Mainstreaming Evaluation: Four Case Studies of Systematic Evaluation Integrated into Organizational Culture and Practices

Amy M. Gullickson
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MAINSTREAMING EVALUATION: FOUR CASE STUDIES OF SYSTEMATIC EVALUATION INTEGRATED INTO ORGANIZATIONAL CULTURE AND PRACTICES

by

Amy M. Gullickson

A Dissertation
Submitted to the Faculty of The Graduate College
in partial fulfillment of the requirements for the Degree of Doctor of Philosophy
Interdisciplinary Ph.D. in Evaluation Advisor: Nicholas Andreadis, M.D.

Western Michigan University Kalamazoo, Michigan December 2010
MAINSTREAMING EVALUATION: FOUR CASE STUDIES OF SYSTEMATIC EVALUATION INTEGRATED INTO ORGANIZATIONAL CULTURE AND PRACTICES

Amy M. Gullickson, Ph.D.

Western Michigan University, 2010

Following a literature review, a researcher generated a descriptive theory of evaluation mainstreaming, the integration of systematic evaluation into the culture, systems, and job responsibilities of organizations. She then explored the validity and generalizability of the theory in the National Science Foundation’s grant-funded Advanced Technological Education Program using mixed methods research. Four centers were chosen based on quantitative survey responses which suggested that the organizations were likely to be mainstreaming evaluation. For each center, the researcher conducted a site visit, interviews, and document review to understand (i) the processes by and extent to which evaluation became part of everyday operations; (ii) the characteristics of the leaders and culture that made the
integration of evaluation possible; and (iii) the organizational capabilities, systems, structures, and practices that have made evaluation sustainable, effective, and useful.

In this dissertation, the researcher presents the descriptive theory as well as the four individual case studies and cross-case analysis through which the theory was explored and refined. Key findings support the existence of three streams and six developmental stages of evaluation within organizations and the importance of (i) leaders who possess characteristics of personal vision and commitment to the truth about current reality; (ii) organizational culture in which staff and partners have shared vision and values; (iii) organizational capabilities such as prioritizing, strategic staffing, team functioning, and creating collaborative external partnerships to listen and learn; and (iv) organizational systems to acquire, analyze, disseminate, and utilize evaluative information. Specific evaluation practices of each center are also presented. Future research should test the descriptive theory of mainstreaming evaluation in broader organizational contexts.
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CHAPTER 1: INTRODUCTION

“Mainstreaming Evaluation” is a descriptive, mixed methods study of organizations that have incorporated the logic and activities of the evaluation discipline into their culture and daily routines. The first chapter begins with a discussion of the difference between everyday evaluation and evaluation as a discipline. A description of mainstreaming evaluation and the associated literature follows. The chapter closes with a presentation of the research questions and contributions and an overview of the rest of the dissertation.

Everyday Evaluation

Evaluation is the determination of the merit, worth or significance of something (Scriven, 1991). As a practice, evaluation has been a part of human life since human life began. Choices of food, hunting, housing, mates, and/or medicines all involved evaluative decisions: determining the merit, value or significance of the options based on a set of criteria, then acting on the choice that best met those criteria. Good choices made species survival possible.

In cases like those listed above, evaluation is informal. The criteria are likely to be implicit. The collection of information on which to base judgments
can be anecdotal or based on assumptions. The move from facts to value judgments can be an intuitive leap. As part of our everyday decision-making process, evaluation is often not systematized nor are its logical steps articulated.

However, more explicit, systematic approaches to evaluation can help improve the results of cooperative efforts. This kind of formal evaluation has been documented for millennia. The Chinese government used a complex system of personnel evaluation as early as 619 BC (Coryn, 2007). Ancient stone chippers left records of improving their craft through evaluation of materials and design. Japanese sword makers had their own cadre of product evaluators; the most distinguished sword evaluators signed the tang next to the sword smith (Scriven, 1991). The systematic process of evaluation is the focus of this dissertation. Thus, throughout this document, evaluation is defined as “The identification, clarification, and application of defensible criteria to determine an evaluation object’s value (worth or merit) in relation to those criteria” (Fitzpatrick, Sanders, & Worthen, 2004, p. 5).

Evaluation as a Professional Discipline

Formal evaluation emerged as a discipline in the modern world in the
1960s and 1970s with the work of Cook and Campbell, among others (Fitzpatrick et al., 2004). Campbell brought the methodology of the hard sciences into the context of the social sciences (Campbell, 1969). They focused on determining the merit of social programs for the purposes of informing policy decisions. In the following years, the scope of evaluation purposes, objects (evaluands), approaches, and activities expanded exponentially. In 1991, Scriven argued for recognizing evaluation as a transdiscipline:

The whole logic of evaluation, its very vocabulary, carries over from field to field in just the way the logic of probability does, or the logic of explanation, or the logics of measurement, statistical inference, or decisions. There is no difference in the way that one goes about establishing – or refuting – an evaluative conclusion concerning malfeasance in a law court, an inferior design in four-wheel drive differentials, bad arguments in a student paper, weaknesses in Linnaean taxonomy, or poor performance in a program (p. 33).

This Logic of Evaluation is the foundation of evaluation as a transdiscipline. Fournier (1995) summarized Scriven’s (1991) explanation of it as:

1. *Establishing criteria of merit.* On what dimensions must the evaluand\(^1\) do well?
2. *Constructing standards.* How well should the evaluand perform?

---

\(^1\) Evaluand is "a generic term for whatever is being evaluated" (Scriven, 1991, p. 139)
3. *Measuring performance and comparing with standards.* How well did the evaluand perform?

4. *Synthesizing and integrating data into a judgment of merit or worth.* What is the merit or worth of the evaluand?

Stake summarized these four steps as “fully describe, fully judge” (1967). This logic can be applied to a variety of evaluands: programs, personnel, performance, products, policies, portfolios, and proposals. The following sections expand the four points of the Logic of Evaluation by defining key terms, and delineating common activities, purposes, and uses.

**Key Definitions**

To fully describe and fully judge an evaluand, an evaluator must understand the following key terms.

**Values**

A value is a deeply held belief, a principle or quality that a person or organization considers intrinsically desirable (Coryn, 2007; Davidson, 2001; Scriven, 1991; Youker, 2006). In organizational evaluation, the values of the organization, program, or stakeholders are the basis for the criteria used to make judgments of merit, worth, or significance. Anyone conducting a formal evaluation must consciously seek out the values in operation, because they are often implicit and undiscussed.
In some cases, the values that are explicit and discussed are not, in fact, the actual values of the person or organization (Argyris, 1993). Therefore, it is critical that a person seeking values on which to build evaluative judgments seek more information than the words of one group about the true values at work. Sources of value include consumers’ needs, ethical and legal standards, the vision of the organization or program, requirements of the funding agency, and political or market circumstances (Scriven, 2006). When espoused values do not seem to match the values on which the program or organization is operating, observation of behavior, examination of budgets and time sheets, and analysis of archival documents can indicate what is truly considered desirable. In other cases, the work an evaluator does to make the values explicit may reveal that the organization or program has values that are intrinsically inconsistent. Whatever the state of the values in operation, it is essential that an evaluation process begin with an accurate and representative set of values. Without that as its base, an evaluation will produce invalid judgments.

Criteria and Indicators

A criterion is an operationalized value, a property or characteristic that
is necessary for an evaluand to be considered “good.” Davidson (2001) defined them as “Dimensions of merit. These are the aspects of an evaluand that define whether it is good or bad and whether it is valuable or not valuable” (p. 239). A list of “criteria of merit” is a list of qualities or attributes that must be present for an evaluand to be defined as valuable. Just as a set of criteria defines an object of value, a set of indicators defines a criterion. An indicator is “A factor, variable, or observation that is empirically connected with the criterion variable; a correlate” (Scriven, 1991, pp. 193-4).

Standards

Constructing standards is the second task in the logic of evaluation. Standards delineate thresholds of performance, demarcating acceptable from unacceptable or excellent from merely good. Standards work in two directions. In the case of formative evaluation (described in Purposes, below), standards serve as a picture of the desired future state of the evaluand; the standard drives current and future performance. In summative evaluation, standards serve to categorize performance for final value judgment; the standard judges the evaluand’s past performance.
Measurement

Measuring performance is the third step in the logic of evaluation. In its most basic sense, measurement is discovering how much of something is present in an evaluand. The objects measured in an evaluand are determined by the delineated criteria. Often, a set of indicators are measured to produce data on each criterion. “Herein lies one of the key problems with insisting that performance be ‘measureable’ – to most people, this implies numerically measured, as opposed to objectively evaluable (quantitatively or qualitatively)” (Davidson, 2001, p. 47).

Purely numerical gauges of performance present several concerns. The first is that the data collected to provide the measurements become the focus of the organization or person being evaluated. “For the measurement determines what one pays attention to. It makes things visible and tangible. The things included in the measurement become relevant; the things omitted are out of sight and out of mind” (Drucker, 1954, pp. 64-5). In other words, what gets measured gets done. The resulting problem is that “…if you measure the wrong thing, you do the wrong thing” (Patton, 2008, p. 172).

Second, measuring only “countable” indicators makes the data susceptible to manipulation. For instance, “[C]ustomer calls can be picked up
quickly and then put on hold almost indefinitely” (Davidson, 2001, p. 47). The measure intended to make an inference between the speed of response to the customer and the quality of service. However, the manipulation of the indicator shows the inference between quantity and quality is invalid. In addition, manipulation of the indicator to produce positive evaluation can have serious consequences. “The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social process it is intended to monitor” (Campbell & Overman, 1988, p. 360). So not only do evaluative judgments based on corrupted indicators lack validity, poorly chosen measures can redirect the effort of the evaluand in different and possibly damaging directions.

A third concern stems from the first two. In an effort to compensate for the fact that some indicators will be corrupted, more indicators are measured. Two common consequences result. While now there are more data, the number of things that have to be measured means that the data collection cannot be done with as much rigor, reducing the quality of the data available for analysis. Another consequence: the increase in indicators to be measured
requires more staff time and financial investment. These resources are
diverted from the work of the organization or program, often to the detriment
of the performance the evaluation is intended to measure (Drucker, 1954;

A fourth and final concern is reductionism (J. R. Sanders, personal
communication, October 30, 2009). Quantitative measures deliberately break
down complex concepts and/or values into simple, countable components.
While this makes “accurate” measurement possible, the sum of the measured
components may not accurately reflect the big picture of the organization or
other phenomena under investigation.

Therefore, a good measure gives information about the quality of the
performance in relation to the criterion it serves. A good measure is not easily
manipulated; therefore, it cannot only be based on counting alone. A good
measure takes more time and input to devise, but the benefit is that a few
good measures will provide better data for less investment over the long
term.

Synthesis of Value Judgment

The fourth step in the logic of evaluation is synthesizing and
integrating data into a judgment of merit or worth. In this step, the data
collected through measurement has been compared with the standards set in
step 2. The performance of the evaluand is thereby “fully described.” Those
factual claims are then combined across the dimensions, components or
criteria into an evaluative conclusion. This grade, rating, ranking or score
represents the merit or worth of the evaluand, thereby rendering it “fully
judged.” The move from performance on standards to the evaluative
conclusion can be done by weighting the criteria by importance, or treating
each criterion as equally important (Coryn, 2007; Davidson, 2001; Scriven,

Purposes

The logic of evaluation provides a map for how formal evaluation is
done. Clearly, the process of conducting a formal evaluation requires the
dedication of time, thought, effort, and resources. The purpose of a specific
evaluation tells why the evaluation effort is made. The three traditional
purposes for conducting an evaluation are summative, formative, and
ascriptive, which have been described as the tripartite taxonomy (Scriven,
1996). A fourth purpose, developmental evaluation, was described by Patton
(1997, 2002, 2008). In the context of mainstreaming evaluation, evaluation activity is typically conducted for summative, formative, and developmental purposes. Those three are briefly summarized below.

**Summative**

Summative evaluations are also called conclusion-oriented. In a summative evaluation, the agreed-upon criteria and standards are applied to data for the sake of making an ultimate decision. The judgment of the overall merit, worth, or significance of the evaluand is intended to offer information to aid in making major, long-term or permanent choices.

For a summative evaluation to be done, something must be completed, although the timing may differ depending on the evaluand. If the evaluand is a program, summative evaluation typically takes place after it is completed and the impacts can be assessed. The information can then be used to judge whether the program should be re-funded, expanded, or discontinued. In the case of a grant proposal, a summative evaluation provides information about the ability the proposers have to carry out research, the adequacy of personnel and other support, and the quality of the work proposed. A judgment about whether or not to fund necessarily happens before the
proposed project starts. If the proposal is funded, then the summative evaluation precedes the actual project. So the same summative evaluation marks the end of the grant-seeking process, but is ex ante (before) the program itself begins. The key to summative evaluation is not the timing of the evaluation, but the ultimate judgment produced, i.e., hire, fire, cancel, fund, expand, etc.

Accountability is a special form of summative evaluation. In this case, the performance of the evaluand on the criteria contributes to the summative judgment of a person's (or persons') performance. Patton (2008) included these two definitions of accountability:

"'Accountability is a state of, or process for, holding someone to account to someone else for something - that is, being required to justify or explain what has been done' (Rogers, 2005)… 'Accountability emphasizes looking back in order to assign praise or blame' (Cronbach et al, 1980)"

Patton listed accountability as commensurate with summative and formative evaluation. However, considering that accountability makes a judgment about performance, it seems to be a better fit as a special case under summative.

Formative

Formative evaluations are for the purpose of improvement of the
evaluand. The agreed-upon criteria and standards are applied to the data to better the performance of the organization, program, or person. Based on those evaluative conclusions, the decision makers can re-allocate resources, or change priorities or processes to improve the outcome of their efforts.

Formative evaluation happens “in process,” during the development or conduct of the activity under investigation. Typically, a formative evaluation is based on a fixed program model, with accompanying criteria and standards.

Developmental

In organizations that are pioneering new approaches or programs, or that operate in highly complex environments characterized by rapid change, developmental evaluation uses the logic of evaluation to support innovation and adaptation. Developmental evaluation is a complexity based, emergent approach in which the evaluator participates with the rest of the team to facilitate learning and bring evaluative thinking to the table from the earliest steps in the process.

Developmental evaluation differs from typical program improvement evaluation (making a program better) in that it involves changing the program model itself as part of innovation and response to changed conditions and
understandings. Developmental evaluation doesn’t render overall judgments of effectiveness (traditional summative evaluation) because the program never becomes a fixed, static and stable intervention. Developmental evaluation supports social innovation and adaptive management. Evaluation processes include asking evaluative questions, applying evaluation logic, and gathering real-time data to guide program, product, and/or organizational development. (Patton, 2008, p. 278)

Therefore, while formative and summative evaluations focus on tweaking and testing a model, developmental evaluation facilitates development of a model or approach that meets the needs of constituent groups. It allows evaluation criteria and standards to evolve as appropriate to match the changes in the conditions and understandings of the evaluand (Patton, 2008).²

Applications

An evaluation moves from purpose through the logic of evaluation to produce evaluative judgments. Both the evaluation process itself and its conclusions can be applied in organizations to create outcomes, as any other program or initiative might. Weiss (1998) suggested a list of possible

² Information for this section also came from Michael Quinn Patton’s presentation at Western Michigan University, October 15, 2009.
evaluation products that could be applied in organizations including findings and recommendations, design, criteria, and measures. Other possible products include learning that occurred from participating in the process of evaluation and archival records or reports that are generated.

The more common term for this application of evaluation products is evaluation “use.”

Use is a core construct in the field of evaluation. Most if not all evaluators strive to have their evaluations used. Many if not most evaluators accept the idea that, at least in part, the merit of their work—the success or failure of their evaluation efforts—can be judged in terms of whether and how an evaluation is used. (Henry & Mark, 2003, pp. 293-4)

The following section outlines the different kinds of use and influence that are present in the literature.

**Instrumental**

Instrumental use was the first way evaluation products were expected to be applied. In the early days of the discipline, formal evaluation was regarded as a summative activity to determine the merit, worth or significance of programs. The value judgments produced by those evaluation studies were intended to provide a basis for decision making. Over the years, evaluators realized that instrumental use of evaluation findings was rare. As
Weiss, Murphy-Graham, and Birkeland (2005) expressed it:

Most studies are not used as the direct basis for decisions. Decision makers pay attention to many things other than the evaluation of program effectiveness. They are interested in the desires of program participants and staff, the support of constituents, the claims of powerful people, the costs of change, the availability of staff with necessary capacities, and so on. Expectations for immediate and direct influence on policy and program are often frustrated. (p. 3)

By 1986, professional evaluators recognized that instrumental use was not the only possible application for evaluation products, and the dimensions of use were expanded to include political or symbolic use and conceptual use (Shulha & Cousins, 1997).

**Political/Symbolic**

The products of evaluation can be used to advocate positions, policies, or programs. When the products of evaluation serve to mobilize support for something, the use is called political or symbolic. Often, evaluation studies are called for and the results used to legitimate a position that is already held (Mohan & Sullivan, 2006; Patton, 2008; Weiss, 1998; Widmer & Neuenschwander, 2004; Wildavsky, 1972).

Weiss and Patton both include “imposed use” as a category under political use. In this case, program staff must use evaluation or its products
because it is prescribed by a higher authority (Patton, 2008; Weiss, 1998). In the context for this dissertation research, evaluation use is imposed; the grant-based centers studied are required by their funding agency to conduct evaluation as part of their activities.

Conceptual

Conceptual use was first defined as grass-roots level program staff members learning from evaluation products (Weiss, 1998) – “lessons learned” kind of use. In cases where political or other circumstances blocked the direct instrumental use of evaluation findings or recommendations, staff could learn from the evaluation and apply those new concepts when the climate was more receptive. By 2005, conceptual use had been expanded to encompass any time evaluation products added to the knowledge base and influenced decisions over the long term as a result. Weiss summarized this broader definition of conceptual use this way: "When evaluation findings percolate into the decision arena in direct and indirect ways, sometimes in the long term, they become new common wisdom" (Weiss et al., 2005, p. 14). This expanded definition encompassed both enlightenment and influence uses.
**Enlightenment**

The concept of enlightenment use is also attributed to Carol Weiss. In her early typology, she considered it the fourth kind of use, after instrumental, symbolic, and conceptual. Enlightenment use is basically conceptual use outside the program that was evaluated, where the lessons contribute to the wider knowledge base and thereby influence decisions. Enlightenment use happens: "When evaluation adds to the accumulation of knowledge, it can contribute to large-scale shifts in thinking—and sometimes, ultimately, to shifts in action...enough cases have been studied to show that the 'enlightenment' kind of use is not a negligible category." (Weiss et al., 2005, p. 14).

**Influence**

Influence as a theory describing the application of evaluation processes and products has been gaining ground over the last several years (Kirkhart, 2000). “The term influence (the capacity or power of persons or things to produce effects on others by intangible or indirect means) is broader than use, creating a framework with which to examine effects that are multidirectional, incremental, unintentional, and noninstrumental, alongside those that are
unidirectional, episodic, intended, and instrumental (which are well presented by the term use)” (Kirkhart, 2000, p. 7)” (Morabito, 2002, pp. 321-2).

Henry and Mark (2003) and Mark and Henry (2004) took Kirkhart’s idea and expanded it into a set of mediators and pathways that described these more subtle paths that evaluation products can travel to create consequences. They used a theory of change approach to map out three levels of analysis (individual, interpersonal, and collective) and four kinds of processes within each level (general influence, cognitive and affective, motivational, and behavioral) (Mark & Henry, 2004).

**Process**

In the 1990s, Patton introduced process use to describe how participating in a formal evaluation could prove useful to the people involved. "Process use occurs when those involved in the evaluation learn from the evaluation process itself or make program changes based on the evaluation process rather than just the evaluation’s findings” (Patton, 2008, p. 156). Process use diverges from the other uses listed here in that it is not focused on use of the products of evaluation, but in the process as a potential change agent. This use also can be the result of learning the basics of
evaluation as a discipline, like learning the logic of evaluation and how to carry it through to an evaluative conclusion. Program or organizational staff who have learned to think evaluatively can apply that new thinking even after the formal evaluation is completed. The results include “increased evaluation capacity, integrating evaluation into the program, goals clarification, conceptualizing the program’s logic model, setting evaluation priorities, improving on outcomes measurement)” (Patton, 2008, p. 156).

Process use may be one of the precursors to mainstreaming evaluation, particularly in cases of imposed use.

Serendipitous

Serendipity as a form of use was published by Leviton (2003), but has not been picked up by the discipline in the literature. Leviton’s argument is that while evaluators often try to declare how their evaluations should be used, there is always the possibility that the user will make connections between the information and current practice that the evaluator could not anticipate. Serendipity can appear:

…in the context of discovering avenues to get information used, get attention, and find champions for the evidence. Yet in a larger sense, serendipity is important because we cannot anticipate completely, what the implications of the work will be
for various policy and program audiences. In many cases (as in the test of flawed assumptions), the audiences cannot anticipate the implications either. (Leviton, 2003, p. 532)

Serendipitous use of evaluation may never become recognized in the evaluation literature, but it is essential for people working in organizations to embrace this attitude toward use. Finding new connections and applications of evaluation methodology and products are key activities in improving organizational performance, and, therefore, mainstreaing evaluation.

Summary

The logic of evaluation can be carried out for a variety of purposes, and its process and products can be applied in a variety of ways. These three components make up the discipline of evaluation (Figure 1).

Mainstreaming Evaluation

The study presented here is concerned with evaluation in the context of organizations. In the case of publicly funded organizations like nonprofits, foundations, and government grant based institutions, evaluation is a common external requirement. Funders expect evaluation to demonstrate the organization’s accountability. Evaluation is typically performed by an outside
consultant for summative purposes, and the findings are used for instrumental or political ends.

In the case of private or publicly owned businesses:

Evaluation of one form or another is a regular activity in organizations, yet few managers or business professionals refer to their work as evaluation. Terms such as benchmarking, assessing, auditing, researching, and reviewing are used fluently within organizational settings, while evaluation is reserved primarily for referring to performance appraisals.
In this context, evaluation, in whatever it guise, is thus, an internal process designed to improve the “bottom line” of a business – the ultimate accountability measure for shareholders and owners. In these organizations, the evaluation activity is conducted regularly by organizational insiders for monitoring and other formative purposes. Approaches like Total Quality Management (Deming, 1986) and Six Sigma (Keller, 2005) are examples of internal formative evaluation to improve business effectiveness.

In the case of organizations that use external quality standards like ISO 9000 (Hoyle, 1998), the evaluation can be both internal formative and external summative. A company may use the standards internally to create a quality system and to assess where changes need to be made in order to achieve certification. An external assessment body or registrar evaluates the organization’s quality system based on the standards and then pronounces a summative judgment. If the organization meets the ISO 9000 standards, then it will be certified and registered as such. The company can then advertise itself with that designation.
Mainstreaming Defined

When an organization is mainstreaming evaluation (Sanders, 2002), it treats evaluation as something more than either external requirement to be satisfied or an internal effort to ensure compliance and performance.

Mainstreaming means

…making evaluation an integral part of an organization’s everyday operations...Mainstreaming is making evaluation a part of the work ethic, the culture, and the job responsibilities of stakeholders at all levels of the organization. (Sanders, 2009, p. 1)

When an organization is mainstreaming evaluation, the logic of evaluation is part of how leaders and staff think about their daily work.

Evaluation activities are conducted for purposes and uses that best serve the organization’s mission (Mayer, 1993) and administration needs. Evaluation is incorporated at every level of the organization (vertical mainstreaming), and across programs and departments through structures and policies (horizontal mainstreaming) (Picciotto, 2002). When evaluation is part of the organizational mainstream it is not quick and dirty or fuzzy (Sanders, 2009; The Joint Committee on Standards for Educational Programs & Sanders, 1994), but rather observes and complies with professional standards.

Mainstreaming evaluation means it has been incorporated into the
organization in sustainable ways under the necessary constraints of cost and human resources, so that the benefits outweigh the cost.

Mainstreaming and Comparable Evaluation Approaches

The discipline of evaluation includes a variety of other approaches that address evaluation in organizations: institutionalizing, capacity building, participatory (including empowerment), evaluative inquiry. The relationship of these approaches to mainstreaming is best represented by von Bertalanffy’s (1995) principle of equifinality, in which “the same final state may be reached from different initial conditions and in different ways” (p. 40). Evaluation mainstreaming, as an ideal final state, can be pursued using the assortment of approaches that suit the context, but the ultimate goal is an organization where evaluation is an owned value in the organizational culture, a continuous activity conducted in a variety of forms and venues, whose process and products are used to improve organizational functioning and effectiveness. Participatory evaluation, evaluative inquiry, institutionalization, and evaluation capacity building can enable evaluation to become mainstreamed, but they are not equivalent to it (Table 1).
Table 1

Comparison of Approaches to Evaluation in Organizations

<table>
<thead>
<tr>
<th>Approach</th>
<th>Timing</th>
<th>Tie to Organizational Culture</th>
<th>Tie to Organizational Development</th>
<th>Relation to Organizational Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainstreamed</td>
<td>Continuous</td>
<td>Owned value; organizational effectiveness driven</td>
<td>Sustainable means to organizational improvement</td>
<td>Necessary for improving organizations</td>
</tr>
<tr>
<td>Institutionalizing</td>
<td>Periodic or episodic</td>
<td>Imposed value with required activities; policy driven</td>
<td>Leads to periodic or episodic organizational review</td>
<td>Necessary but not sufficient for improving organizations</td>
</tr>
<tr>
<td>Building Capacity</td>
<td>Episodic or discrete</td>
<td>Imposed or owned value; program driven</td>
<td>Episodic organizational improvement</td>
<td>Necessary but not sufficient for improving organizations</td>
</tr>
<tr>
<td>Participatory</td>
<td>Periodic, episodic, or discrete</td>
<td>Owned value of participants; program driven</td>
<td>Episodic organizational improvement</td>
<td>Necessary but not sufficient for improving organizations</td>
</tr>
<tr>
<td>Evaluative Inquiry</td>
<td>Range from discrete to continuous</td>
<td>Imposed or owned value; issue, program, or policy driven</td>
<td>Organizational impact depends on the depth and breadth of the inquiry</td>
<td>Necessary but not sufficient for improving organizations</td>
</tr>
</tbody>
</table>

Adapted from (Sanders, 2002)

Mainstreaming Evaluation Research

The published evaluation literature explicitly on mainstreaming is
limited; usually it is discussed in the context of other evaluation approaches.

A literature search of the major evaluation publications (*American Journal of Evaluation, New Directions in Evaluation, Evaluation, Evaluation and Program Planning*) led to only nine articles with evaluation mainstreaming in the title or among the key words (Table 2). Seven of the articles were based on scholarly observation and analysis of the processes and theories of mainstreaming evaluation in organizations. These articles discussed techniques for moving organizations toward mainstreaming, barriers to that movement, and important factors to consider. In three of those seven articles, the author presented case examples from his experience to illustrate mainstreaming efforts (Duignan, 2003; Picciotto, 2002; Sanders, 2003).

Table 2

<table>
<thead>
<tr>
<th>Author/Date</th>
<th>Type</th>
<th>Research</th>
<th>Relationship to Mainstreaming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnette &amp; Wallis, 2003</td>
<td>Theoretical</td>
<td>Reflection on evaluation training needs</td>
<td>Training evaluators as an enabler of mainstreaming</td>
</tr>
<tr>
<td>Duignan, 2003</td>
<td>Theoretical</td>
<td>Reflective summary of 15 years of evaluation</td>
<td>How evaluation has been vertically and horizontally mainstreamed in</td>
</tr>
</tbody>
</table>
Table 2 – Continued

<table>
<thead>
<tr>
<th>Author/Date</th>
<th>Type</th>
<th>Research</th>
<th>Relationship to Mainstreaming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duignan, 2003</td>
<td>work.</td>
<td>New Zealand public health</td>
<td></td>
</tr>
<tr>
<td>Grudens-Schuck,</td>
<td>research – case study</td>
<td>Reflection on an evaluation process</td>
<td>Pros and cons of evaluation enculturation; participatory vs. nonparticipatory process</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picciotto, 2002</td>
<td>theoretical</td>
<td>Reflection on language and implementation</td>
<td>The broader context and specific types of mainstreaming (horizontal and vertical); describes mainstreaming evaluation at the World Bank</td>
</tr>
<tr>
<td>Sanders, 2001</td>
<td>theoretical</td>
<td>Reflection on evaluation in organizations</td>
<td>Creation of values within organizations</td>
</tr>
<tr>
<td>Sanders, 2002</td>
<td>theoretical</td>
<td>Reflection on evaluation in organizations</td>
<td>Defines mainstreaming and outlines indicators</td>
</tr>
<tr>
<td>Sanders, 2003</td>
<td>theoretical</td>
<td>Reflection with one case example as illustration</td>
<td>Mainstreaming as a way for organizations to pursue continuous improvement</td>
</tr>
</tbody>
</table>
Of the nine articles, only two were in-depth case studies on specific mainstreaming efforts (Grudens-Schuck, 2003; Wandersman et al., 2003). Both focused on mainstreaming as a participatory/empowerment approach to evaluation of a specific program, rather than an organization-wide effort to mainstream evaluation vertically and horizontally throughout. In addition, both were primarily reflective efforts by the evaluators rather than objective investigations.

No articles, dissertations, or theses have been published that systematize the characteristics or factors that are essential evidence that an
organization is mainstreaming evaluation. No case studies (comparative or single case) have been published by an outsider examining mainstreaming efforts by organizations. To date, Sanders’ call that evaluators “Compile and publish case histories of organizations that have mainstreamed evaluation in business, education, government, and non-profits” (Sanders, 2003, p. 6), has gone unheeded.

Statement of the Problem

Evaluation is primarily an applied field with a relatively short history as a discipline. The literature base is made up of improvements in methodology, evaluation approaches, and discussions about their value, presentations of findings, conversations about theory, reflections on lessons learned through evaluation practice, and reviews of literature. Published studies of research on evaluation are limited; studies of organization-level mainstreaming of evaluation do not exist. As a result, the need for research on evaluation is acute. Mark and Henry (2004) described it this way:

…regarding research on evaluation, systematic inquiry about the consequences of evaluation is essential in order to establish an empirical basis for the effective practice of evaluation (Shadish et al., 1991). Without an empirical basis that provides evidence about what kinds of evaluation worked in which circumstances to produce which specific outcomes, the field of
evaluation will forever be susceptible to fads, and debates about evaluation approaches will rarely rise above ideology. (p. 51)

With respect to mainstreaming, the need is greater. If these new visions for evaluation are to come to fruition, then the literature needs to give "Exemplars, showcase events, case studies, dissemination strategies and methods, networks, pilot tests, awards -- these are some of the means to create a learning system around the new vision" (Weaver & Merget, 1993, p. 3). Sanders’ (2009) vision for the next 10 years called for “Accumulation of best practices – examples of organizations that are mainstreaming evaluation and are demonstrating improvement because of it…” (p. 2). In this dissertation, the researcher addresses the lack of research on mainstreaming evaluation in the current literature by conducting mixed method case studies of organizations that are mainstreaming evaluation.

Purpose of the Study

The purpose of this dissertation is to document the past evaluation activities, evaluation culture, and the current state of evaluation within a defined sampling frame of Advanced Technological Education (ATE) centers funded by the National Science Foundation (NSF). The researcher selected centers that were likely to be mainstreaming evaluation for participation in
the study. The selection was based on (i) the centers’ responses to a longitudinal survey, (ii) information from the ATE Program Officers, and (iii) willingness to participate. Narrative case studies of the four selected centers were built through review of survey data and documents, site visits and interviews. The case studies then were compared to discover commonalities, differences, and best practices. The result provides evidence of the benefits of mainstreaming evaluation to organizations and contributes to the existing knowledge base on use of evaluation in organizations.

Research Questions

This dissertation is based around five research questions:

1. What should be included in a theory that describes mainstreaming evaluation in organizations?

2. How are the theoretical components and dimensions of the descriptive theory presented in Chapter 2 manifested in organizations that are mainstreaming evaluation?

3. What evaluation history and current practices are found in a sample of organizations that are mainstreaming?

4. What activities, attitudes, or innovations have made it possible to sustainably mainstream evaluation?

5. What benefits or detriments have these organizations experienced as a result of mainstreaming evaluation?
The first question will be answered through a review of literature on evaluation as a discipline, mainstreaming, evaluation in organizations, evaluation approaches, learning organizations, and organizational performance. The descriptive theory generated served as the basis for selecting the case study centers and creating the interview protocols. The final three questions were answered through the review of survey data, documents, interviews, and observations.

Contribution

A study of organizations that are mainstreaming evaluation will improve the knowledge bases of interdisciplinary evaluation and the ATE program. Through this dissertation, the researcher will make the following contributions:

1. A descriptive theory of evaluation mainstreaming in organizations.

2. Descriptions of how mainstreaming actually happened including obstacles, mechanisms, influences, time frame.

3. Steps that have been taken to make evaluation a sustainable part of the organizations' daily operations.

4. Actual benefits organizations have experienced as a result of mainstreaming.

5. A comprehensive picture of how four centers have used evaluation to improve their ATE efforts based on qualitative research.
6. Descriptions of how the four centers mainstreamed evaluation in terms of their internal organization culture and practices.

7. Delineation of any remaining needs four centers might have to maximize mainstreaming for organizational effectiveness.

All of these contributions can be used by organizations interested in improving their effectiveness through use of evaluation, as well as by internal and external evaluators working with organizations. The first contribution makes it possible to identify organizations mainstreaming evaluation for further study and provides the beginning of a checklist of organizations that desire to mainstream evaluation. Contributions 2 and 3 provide insight into how evaluation could be mainstreamed into other organizations in a sustainable manner and solutions to the inevitable obstacles. Contribution 4 provides evidence of the resulting benefits, which evaluation advocates within organizations and external evaluators can use to stimulate interest and commitment to mainstreaming. Contributions 5 and 6 can be used to help both existing and proposed ATE projects and centers integrate evaluation into their daily operations in order to increase their effectiveness. Contributions five through seven can benefit the centers that participate as case study examples by providing them a narrative history of evaluation in
their organization, and areas of potential improvement.

Scope

Four in-depth case studies of Advanced Technological Education Centers define the scope of this dissertation. The centers are educationally affiliated, either through community colleges or four-year universities. All were or are still supported by the National Science Foundation, which mandates regular evaluation as a condition of funding. A single researcher reviewed the literature, survey data and documents and conducted the site visits, observations, and interviews that serve as the evidence base for this document.

Overview of the Dissertation

This dissertation is presented in five chapters with accompanying appendices. In Chapter 1, a background on mainstreaming was presented, the research problem was defined, the research questions were articulated and the intended contributions and scope of the study were outlined. The researcher presents a discussion of relevant literature in Chapter 2, including evaluation as a discipline and evaluation in organizations. In Chapter 3, the Advanced Technological Education context, potential methods for case study
research are reviewed, then the sampling plan and the research process used to compile the narrative case studies are described. The four narrative case studies are presented individually in Chapter 4, which concludes with a cross case analysis of the case study findings. The summary of the study, findings, and ideas for future research are presented in Chapter 5. References for documents cited in the dissertation are given after Chapter 5, with appendices following.

Chapter Summary

Evaluation is both an informal and formal practice. Formal evaluation, also referred to as the transdiscipline or discipline of evaluation, codified the logic of evaluation and added specific purposes and uses for evaluation processes and products. Mainstreaming evaluation means incorporating the logic, purposes, and uses into an organization in sustainable ways to serve both the mission and administration of the enterprise. When an organization is mainstreaming evaluation, members view it as a tool for organizational improvement, and evaluation activities fit seamlessly into daily work. The characteristics of mainstreamed organizations found in the literature, and previous studies on related subjects, are presented in Chapter 2.
CHAPTER 2: LITERATURE REVIEW AND DESCRIPTIVE THEORY

In Chapter 1 a lack of research on mainstreamed evaluation was noted, as were the research questions that will address the problem, and the contributions this study will make to the knowledge base. In Chapter 2 the first research question and contribution will be addressed:

- Research Question: What should be included in a theory that describes mainstreaming evaluation in organizations?
- Contribution: Descriptive theory of mainstreamed evaluation in an organization.

A descriptive theory includes “the full but realistic range of topics that might be considered a complete description…and the likely topic(s) that will be the essence of the description” of the phenomenon to be studied (Yin, 2003, p. 30). The range of topics includes evaluation in organizations, evaluative inquiry, organizational learning, organizational change, mainstreaming, and co-evaluation.

In the first section, the necessary contextual framework for the transdiscipline of evaluation in organizations is laid out. The second section contains a summary of how the literature search was broadened beyond mainstreaming and a description of key ideas related to the topic from that
review. In “Organizational Dimensions,” the researcher proposes a set of characteristics that will be found in organizations that are mainstreaimg evaluation, based on the literature. The final section of this chapter, the researcher summarizes the descriptive theory of mainstreaming evaluation in preparation for the research design presented in Chapter 3.

Evaluation in Organizations

The term **mainstreaming** implies the existence of an entity into which something else is incorporated. In this study, it is the incorporation of the logic of evaluation and its associated activities into an organization. In the context of this dissertation, an **organization** is a purpose driven, open system, that serves as host for the people, systems, structures, activities necessary to achieve its purpose (Andreadis, 2009).

[T]his definition conceptualizes an organization as a physical, social, and purpose-driven entity and provides us a parallel with living, organic systems. Two central characteristics of all living systems are its purposeful behavior and adaptability to changing environments for the purpose of survival. It is this latter feature that stimulates the organism to gather data from its surroundings, reset its goals, alter its form within certain physical limits, and modify its behavior. (p. 6)

By describing organizations as open systems, the definition incorporates the idea that organizations take in information and materials
from their external environment (input), transform it in some way (process), and create a product (output) (Isaac & Michael, 1981). As a purpose-driven entity, the organization conducts this systemic activity toward specific ends. The progress the system is able to make in the direction of its intended outcome is termed “organizational performance.” The appropriateness of an organization’s goals within its environment and its ability to accomplish them within the constraints of available resources determine whether or not the organization continues to exist.

The transdiscipline of evaluation is essential to organizational survival for several reasons. First, it enables the organization to discover the environmental needs it could meet (needs assessment) to remain viable. Second, the logic of evaluation requires delineating what information is important (criteria) and the process for effectively seeking that information (measures), enabling efficient use of resources to get feedback on its performance. Third, by setting thresholds of performance (standards), the organization can use the information collected in the measures to determine progress toward its desired outcome. Fourth, criteria, measures, and standards can be used summatively to determine the merit of inputs,
processes, and products (Stufflebeam, 1999). Finally, the logic of evaluation can be used formatively to monitor and improve inputs, processes, and outputs. An organization that has mainstreamed evaluation engages the logic of evaluation and its related activities as a normal part of tracking and improving organizational performance to ensure its continued existence.

Literature Base

As discussed in Chapter 1, the literature on mainstreaming evaluation is limited. Only nine articles were found, and only two of those were in-depth case studies. Both of those studies were reflections on personal experience with attempting to mainstream evaluation in a program or organization. Thus, in order to better understand mainstreaming, the literature review was enlarged.

First, the bibliographies of the nine articles were reviewed for relevant articles, topics, and authors. A list of related terms was generated and then used to search evaluation specific journals (*The American Journal of Evaluation*, *New Directions in Evaluation*, *Evaluation*, *Evaluation and Program Planning*, *Journal of MultiDisciplinary Evaluation*). The bibliographies of the articles found there were reviewed as well to find further literature. Finally, a search
was conducted in ProQuest, ERIC and the UMI Dissertation and Thesis databases to find relevant research studies and theoretical articles using the terms “evaluation” and “organizations.” The following terms appeared frequently in the early literature reviewed and thus were searched in both the evaluation and broader literature: organizational culture, co-evaluation, organizational learning, evaluative inquiry, organizational change, and organizational readiness for evaluation. Literature on these subjects was found in a variety of disciplines besides evaluation, including management, organizational development, education, engineering, human resources development, psychology, and organizational systems. Across these disciplines, in books, journal articles, dissertations and theses, three topics were found to be closely related to mainstreaming: coevaluation, organizational learning, and evaluative inquiry. The following section offers descriptions of those terms and their relevance to this study.

Coevaluation

Coevaluation is an approach to integrating evaluation closely related to mainstreaming. Mainstreaming was developed by an evaluator, and as a result, easily can be viewed as an external set of requirements that can be
imposed on an organization. In contrast, coevaluation was developed through a particular organization’s two-year study on how to improve its performance. A brief description of the context, process and result of the work that produced the coevaluation approach follows.

"Founded in 1980, Independent Sector is a nonprofit coalition of over 850 corporate, foundation and voluntary organization members with national interest and impact in philanthropy and voluntary action" (Gray, 1998a, before title page). From its inception, Independent Sector has been committed to regular organization-level self-evaluation, as specified in its bylaws. Despite this commitment on the coalition level, evaluation was dubiously regarded by the membership.

Evaluation, as practiced in the past, has typically satisfied neither funding and oversight nor service organizations. It has been focused on past performance and has little apparent value for current and future effectiveness. It is not enough to determine, through evaluation, the number of people who reach specified levels of self-sufficiency, or the number of participants involved in a visual or performing arts event. Yet such measures have been the stuff of which evaluations were made... Discussion of evaluation evokes strong feelings, largely negative, from nonprofit and philanthropic professionals. The term connotes experiences deemed to be little more than 'hoop jumping' or financial accountability requirements of funders or other external overseers. The term also evokes feelings of fear and threat that inhibit total honesty. And even funders -- United
Ways, foundations, governments, etc. -- are frequently less than satisfied that the submitted evaluations reflect meaningful reality. Everyone believes that we should know how we’re doing, but few believe evaluation, as we have known it, provides the answer." (Weaver & Merget, 1993, p. 2)

To address the need for evaluation and the barriers to it, Independent Sector engaged in a two-year study on how to use evaluation as a means to improve effectiveness in nonprofits. Through "six Regional Roundtables, a national forum, and intense study by the [Independent Sector] Leadership/Management Committee and its Subcommittee on Evaluation” (Weaver & Merget, 1993, p. 2), they struggled with intent, use, and the negative connotations associated with the term evaluation. The result was a vision of evaluation as "an important ongoing process that supports the organization striving for excellence in the achievement of its mission. When we speak of evaluation, we mean something valuable and useful to every facet of the organization, not just programs, and to all organizations in the sector” (Gray, 1993, p. ix). The Independent Sector report on this vision, and the follow-up book five years later form the majority of literature on coevaluation, "literally, evaluation together” (Gray, 1998a, p. xviii). As Gray described it, coevaluation is a constructive, continuous, collaborative process to enable organizations to assess effectiveness with their mission and vision
as criteria. It involves three steps: "1. Ask good questions..., 2. Collect the right information..., 3. Share the information and make decisions" (Gray, 1998b, p. 6). Gray (1998b) also elaborated three key points that must be accepted by members of an organization for coevaluation to work:

Coevaluation is the responsibility of everyone in the organization. Everyone gathers information through good questions, shares the information, explores the possibilities, contributes to decisions. Everyone accepts the feedback coevaluation generates as a way of assessing progress, enhancing effectiveness, and continuing to learn, grow and change.

Coevaluation addresses the total system of the organization, its internal effectiveness and external results. At the same time, coevaluation aims for improvement rather than judgment. No one is immune, and not one who is pursuing the organization’s interests is at risk.

Coevaluation invites collaborative relationships within the organization and with external parties such as clients, community members, businesses, government, donors, funders, and other nonprofit associations. All the stakeholders seek jointly to learn how to reach excellence. (p. 5)

Clearly, coevaluation is a synonym for mainstreaming evaluation (Figure 2). However, coevaluation has not emerged in the literature outside of the publications of Independent Sector (Gray 1993, 1998a), which is primarily scholarly observation and analysis. The theories presented in the coevaluation literature will be incorporated into the dimensions and
components synthesized later in this chapter.

Figure 2. Relationship between Coevaluation and Mainstreaming Evaluation

Organizational Learning

In keeping with the open systems definition of an organization, organizational learning is “a process in which organizations or their components adapt to changing environments by generating and selectively adopting organizational routines” (Argyris & Schon, 1996a, p. 189). The learning of individuals within an organization is necessary but not sufficient condition for organizational learning to occur. In order to learn, the organization must be able to respond to past performance and predicted environmental changes as an entity (Jenlink, 1994). In addition, the organization must be able to endure the anxiety and discomfort associated
with “unlearning” the assumptions and habits impeding progress toward its
desired future state (Vince, 2001). How the organization determines what is
worth learning (and unlearning) is an evaluative activity.

...organizational learning is not a value-neutral activity but
proceeds from values, has implications for values, and is subject
to critique in terms of a conception of what is good or right, and
for whom. These implications, which seem obvious once they
are stated, come to light only when organizational learning is
stripped of its normative aura and considered as subject to
evaluation in particular contexts on the basis of particular
criteria of goodness or rightness. In short, we cannot escape the
need to declare what kinds of organizational learning we will
take to be desirable or undesirable and why. (Argyris, 1999, p.
11)

Evaluation is also related to how an organization goes about learning,
summarized through the concepts of single and double loop learning
(Argyris, 1977; Argyris & Schon, 1996a). In single loop learning, the
organization uses the logic of evaluation to create feedback mechanisms that
enable it to adjust its actions based on data from the internal and external
environments (Figure 3).

The logic of evaluation comes into play in the stage (b) of single loop
learning. The criteria and standards serve as operating norms, which are
compared to the collected and measured data. The comparison generates a
picture of the organization’s current state compared to its desired state. A
judgment is synthesized based on the organization’s measured performance and used to determine what action or actions would be appropriate to move the organization closer to its desired state. In this case, evaluation is done for formative purposes.

Figure 3. Argyris’ Single Loop Learning

In double loop learning, the organization moves beyond monitoring and uses the logic of evaluation to assess the operating norms being used (Figure 4). Here, the criteria and standards themselves are put through evaluation’s iterative process. Needs of the organization and environment are investigated. The purpose of the organization is assessed in terms of those needs and other factors impacting the organization both internally and externally. These needs and factors serve as criteria to judge the
appropriateness of the operating criteria and standards (operating norms) in use. Depending on the frequency of this activity and the size of the discrepancy between the new criteria and the old, the resulting organizational actions can vary from minor adjustments to significant changes.

1. Sense/scan/monitor internal and external environments
2. Compare data to operating norms
   2.1 Question appropriateness of operating norms
3. Initiate appropriate action

(Adapted from Morgan, 1997)

Figure 4. Argyris’ Double Loop Learning

Thus, the logic and discipline of evaluation is essential to organizational learning. The organization’s ability to learn is the key to improving organizational performance – and ensuring that the activities the organization is engaged in and the outputs it is producing are worthy
performance. Worthy performance ensures organizational viability. Thus, the mainstreaming of evaluation also serves organizational survival as part of the organization’s effort to learn from its own performance and its environment. An organization that has mainstreamed evaluation has effectively integrated the discipline in service of organizational learning, which in turn serves organizational performance. However, the summative purpose of evaluation means that evaluation is not totally subsumed by organizational learning (Figure 5); sometimes the logic of evaluation is used for making judgments that do not yield learning.

This link between organizational learning and the discipline of evaluation has been explored in the literature by several scholars (Davidson, 2001; Fisher, 1993; Jenlink, 1994; Owen & Lambert, 1995; Preskill, 1994, 2008; Preskill & Torres, 2000; Taut, 2005; Torres & Preskill, 2001). The majority of these contributions are scholarly observation and analysis; only Davidson (2001) and Taut (2005) conducted research studies on the impact of evaluation on organizational learning. Organizational learning has been a topic of interest in a variety of disciplines aside from evaluation. From management to medicine to engineering,
scholars have been exploring how to enable organizations to use learning to adapt appropriately to environmental changes. Organizational learning factors that relate to mainstreaming will be synthesized into the dimensions and components presented later in this chapter.

![Figure 5. Relationship between Organizational Learning and Mainstreaming Evaluation](image)

Evaluative Inquiry

Inquiry is both a process and a cultural orientation that enables learning within an organization. As a process, inquiry facilitates organizational learning in three ways:

- organizational inquiry, instrumental learning that leads to improvement in the performance of organizational tasks
- inquiry through which an organization explores and restructures the values and criteria through which it defines what it means by
improved performance; and

- inquiry through which an organization enhances its capability for learning of types (1) or (2). (Argyris & Schon, 1996a, p. 20)

As a cultural orientation,

[T]he very process of inquiry, individual or collective, is conditioned by membership in a social system that establishes inquiry’s taken-for-granted assumptions... we see organizational learning as a process carried out by members of an organization, working alone or in interaction with one another, within an organizational community of inquiry. Inquiry becomes organizational when individuals inquire on behalf of the organization, within a community of inquiry governed, formally or informally, by the roles and rules of the organization. It follows that individuals may inquire and learn in ways that are connected to and, at times, disconnected from the organization to which they belong. (Argyris & Schon, 1996a, p. 33)

Evaluative inquiry and mainstreaming come to organizations from evaluation as a discipline. Evaluative inquiry as a professional approach came from the intersection of the discipline of evaluation and organizational learning (Preskill & Torres, 1999a, 1999b). The entry point for evaluative inquiry is often evaluation of a program or process. From there, the application of the discipline may be expanded to other aspects of the organization as a means of improving organizational performance. As a result, the literature on evaluative inquiry orients itself in relation to other evaluation approaches, like participatory evaluation, process use, and
Several evaluation scholars have used the term *evaluative inquiry* to make the connection explicit between the type of inquiry described by Argyris and Schön (1996a) and the logic of evaluation. Evaluation theorists have embraced both the process and cultural aspects of inquiry. Cousins, Goh and Clark (2006) referred to the process of evaluative inquiry in organizations as the “systematic application of evaluation logic” (p. 158). Their examples of evaluative inquiry processes include “needs assessment, environmental scanning, program, evaluation and outcome monitoring” (p. 158). Cousins and his colleagues published a review of the literature on evaluative inquiry and culture (Cousins, Goh, Clark, & Lee, 2004). They also published two research studies on the subject, a quantitative scan of evaluative inquiry in school culture (Goh, Cousins, & Elliott, 2006) followed by an in-depth case study of schools that demonstrated high levels of inquiry on the survey (Cousins et al., 2006).

Preskill and Torres (Preskill, 1994, 2008; Preskill & Torres 1999a, 1999b, 2000; Torres, 1994; Torres & Preskill, 2001) have been another set of voices on the culture and processes of evaluative inquiry in organizations. They
describe evaluative inquiry as

[A] kind of public philosophy in which organization members engage in dialogue with clients and other stakeholders about the meaning of what they do and how they do it. In this dialogue, they pay particular attention to the historical, political, and sociological aspects of the objects of inquiry (Schwandt, 1992). (Preskill & Torres, 1999b, p. xx)

In terms of process, they describe evaluative inquiry as an iteration of dialogue, reflection, asking questions, and identifying and clarifying values, beliefs, assumptions and knowledge. Taut (2005) summarized Preskill and Torres’ (1999a) seven steps of evaluative inquiry process, which are presented as an iterative loop in Figure 6.

Preskill and Torres have packaged this approach as an organizational intervention titled *Evaluative Inquiry for Learning in Organizations* (1999b). Part of the package is the Readiness for Organizational Learning from Evaluation (ROLE) instrument. ROLE is a survey designed to assess an organization’s culture, leadership, communication, and systems and structures so that an evaluator can better fit the evaluative inquiry intervention to the organizational context. Both the approach and the instrument have been used in the published literature on evaluative inquiry. Taut (2005) and Kamm (2004) both used the Evaluative Inquiry for Learning in Organizations
Figure 6. Seven Activities of Evaluative Inquiry in Organizations

approach and the ROLE instrument in their dissertations. Graham (2006) and Seiden (2000) adapted the ROLE for their dissertation instruments. The instrument used in Goh, Cousins, and Elliott above (2006), included items from Seiden’s (2000) survey, Organizational Readiness for Evaluation. So while Preskill and Torres have not published any research-oriented studies on evaluative inquiry, their tools and approach have been the basis for advancement in this area of evaluation.

In its ideal state, evaluative inquiry is a close parallel to evaluation
mainstreaming. Characteristics shared between the two include the following:

- integrated into the organization’s work processes
- performed by organization members, not external consultants
- ongoing, not event driven or episodic
- contributes to a culture of inquiry, is culture-bound
- occurs within an infrastructure that values learning and continuous improvement (Preskill & Torres, 1999b)

However, two important differences exist (Figure 7). First, in evaluative inquiry, evaluation activity is internal and formative. Mainstreaming evaluation encompasses those qualities, while striving to balance them appropriately with external and summative evaluation. Second, evaluative inquiry is a method or approach to integrating the logic of evaluation into an organization. As a result, the evaluative inquiry intervention occurs as part of a program or process evaluation and may not spread any farther into the organization than that specific program or issue. An organization that has mainstreamed evaluation demonstrates the use of evaluation throughout the organization’s culture and activities.

Literature Base Summary

In her review of related literature, the researcher found three topics closely related to evaluation mainstreaming: coevaluation, organizational
learning, and evaluative inquiry. Coevaluation and mainstreaming evaluation were deemed to be synonymous; however, coevaluation has gained no traction in the literature in terms of research or articles published by others. Organizational learning does have significant publications associated with it in the literature, and the logic of evaluation is a critical component of that topic. Mainstreaming evaluation is distinct from organizational learning in that it explicitly includes external evaluation for summative purposes, which may not be used for learning. Evaluative inquiry is a strictly internal process in an organization and can be limited to a single program. Therefore it does not encompass the internal, external and cultural aspects of evaluation mainstreaming. The following section uses concepts
from these three topic areas to further delineate a descriptive theory of evaluation mainstreaming.

Organizational Dimensions

In light of the definition of an organization as a living system, dimensions are features of the environment within the system (Andreadis, 2009). Analysis of the literature related to mainstreaming evaluation revealed four relevant features of an organization: culture, leadership, capabilities, and systems and structures. As Figure 8 demonstrates, the organization hosts all four dimensions, with leadership and culture comprising the milieu in which capabilities and systems and structures exist and operate.

All four of these dimensions are interrelated, with close coupling between leadership and culture, and capabilities, systems and structures. The following subsections will define each of these dimensions and discuss the facets of each that relate to mainstreaming evaluation.

Leadership and Culture

The close relationship between leadership and culture presented in Figure 9 was described by Schein (1992) in this way:
I believe that cultures begin with leaders who impose their own values and assumptions on a group. If that group is successful and the assumptions come to be taken for granted, we have then a culture that will define for later generations of members what kinds of leadership are acceptable. The culture now defines leadership. But as the group encounters adaptive difficulties, as its environment changes to the point where some of its assumptions are no longer valid, leadership comes into play once more. Leadership now is the ability to step outside the culture that created the leader and to start evolutionary change processes that are more adaptive. (pp. 1-2)

Examination of the relevant literature bore out this description in several ways. Leadership and a cultural orientation to learning were linked as a single factor in organizational readiness for evaluation according to the factor analysis performed by Seiden (2000). Sanders (2002) described
Figure 9. Relationship between Leadership and Culture in Organizations

Leadership as the final stage of incorporating evaluation as a core value in an organization’s culture. The coevaluation literature also emphasizes the need for leaders to model the cultural values associated with integrating evaluation in order to maximize performance (Gray, 1998b; Merget & Weaver, 1998). The rest of this subsection is composed of definitions of leadership and culture, followed by the specific characteristics found in the literature that are associated with evaluation mainstreaming.

Leadership

Leadership of an organization is primarily defining and defending the entity’s integrity, maintaining its wholeness and coherence as an entity (Friedman, 2007; Gray, 1998b; Selznick, 1957). A leader “is primarily an expert in the promotion and protection of values” (Selznick, 1957, p. 28). As defined in Chapter 1, a value is a deeply held belief, a principle or quality that a person or organization considers intrinsically desirable (Coryn, 2007; Davidson, 2005;
Scriven, 1991; Youker, 2006).

To define the organization, leaders not only articulate and model organizational values, but also create and communicate vision and purpose (Collins, 2001; Gray, 1998b; Owen & Lambert, 1998; Senge, 1990). To defend organizational integrity, leaders work across systems within the organization to improve effectiveness by finding ways to build competence and clarify roles (Owen & Lambert, 1998; Selznick, 1957). Defending integrity also means that leaders simultaneously scan the internal and external environments. They scan the external environment for threats and opportunities (Davidson, 2001). They scan the internal environment to discover structures (physical, mental, and emotional) that previously served the organizational purpose but now have begun to impede organizational performance (Gorman, 2004; Keller, 2005; Owen & Lambert, 1998; Senge, 1990).

Due to the coupled nature of leadership and culture, the activities of leaders listed above have a direct impact on the culture of the organization. Schein (1992) further described the relationship between the two in these words:
...the only thing of real importance that leaders do is to create and manage culture...the unique talent of leaders is their ability to understand and work within culture. If one wishes to distinguish leadership from management or administration, one can argue that leaders create and change cultures, while managers and administrators live within them. (p. 5)

The following section defines the other side of the relationship: culture.

**Culture**

Culture is a dimension attributed to groups. A group is formed when the people in it have spent enough time together to have shared experiences and created common understandings about those experiences. Schein (1992) defined the *culture* of a group as:

…a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. (p. 12)

These shared assumptions include values (what is important), norms (what kind of behavior is acceptable), and practices (how to get things done) (Henri, 2006; Smircich, 1983; Sutherland, 2004; Tsui, Zhang, Wang, Xin, & Wu, 2006). In the vernacular, culture is often referred to as “the way we do things around here” (Burke, 2002). It is an implicit phenomenon; i.e., it operates with or without participants’ conscious knowledge of it.
In the organizational learning literature, these shared assumptions have also been described as mental models. Senge (1990), who popularized the term, described mental models as “…deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action. Very often, we are not consciously aware of our mental modes or the effects they have on our behavior” (p. 8). Mental models are tacit lenses that determine what information is considered important, how that information is interpreted, and appropriate action based on the information and interpretation (Jacobs & Heracleous, 2005; Robinson & Cousins, 2004).

A culture is made up of an assortment of these shared assumptions, each of which developed over time through observation of perceived cause and effect relationships in the life of the organization. As Schein (1992) described it,

When a solution to a problem works repeatedly, it comes to be taken for granted. What was once a hypothesis, supported only by a hunch or a value, comes gradually to be treated as a reality…In fact, if a basic assumption is strongly held in a group, members will find behavior based on any other premise inconceivable. (pp. 21-2)

Thus, the longer the mental model has been in place, the harder it is to see or
change. The significance of this feature of culture in relation to the discipline of evaluation will be further explored in two sections: (1) as a shared vision that establishes the criteria of merit for organizational performance, and (2) as a part of the organizational capabilities dimension.

Characteristics

Two characteristics of leadership and culture are essential to mainstreaming evaluation in an organization. The first is shared vision, as a mental model of the desired future state of the organization. The second is commitment to the truth about performance as one of the organization’s core values. These two characteristics comprise an understanding of the purpose and direction of the organization shared by all members.

Mental Model: Shared Vision

Shared vision is one of Senge’s (1990) five disciplines of a learning organization and, as a result, has been used in a variety of literature on that subject (Davidson, 2001; Ford, Voyer, & Wilkinson, 2000; Kamm, 2004). The idea of organizational vision is cross-disciplinary. Scholarly discussion of its importance and processes involved in generating it can be found in human resources development (Hale, 2007), education (Cousins et al., 2004),
management (Collins & Porras, 1996), organizational change (Burke, 2002), as well as evaluation (Gray, 1998b; Preskill & Torres, 1999b).

Senge (1990) described shared vision as the organizational answer to “What do we want to create?” As he further described it,

A shared vision is not an idea...It is, rather, a force in people’s hearts, a force of impressive power...shared visions are pictures that people throughout an organization carry. They create a sense of commonality that permeates the organization and gives coherence to diverse activities. (p. 206)

Shared vision has been operationalized by other authors. Collins and Porras (1996) described it as the combination of core ideology (core values and core purpose) and an envisioned future. Davidson (2001) separated shared vision into shared purpose, shared identity, and shared intuition.

This picture of the desired future of the organization serves as the primary criterion of merit for any evaluation of performance. As such, it is a key component of mainstreaming evaluation. For if the members of the organization do not have a shared understanding of the future state they are trying to create together, then there is no way to judge progress toward that end.

The task of leadership is to involve individuals within the organization in the process of creating the shared vision. Participation in generating the
vision taps into Lewin’s field theory, which says that people more readily accept forces they perceive as owned rather than imposed (Burke, 2002). Toward this end, leaders can engage in a collaborative process (Gray, 1998b; Preskill & Torres, 1999b) or simply share their personal vision and ask organization members to follow them (Senge, 1990).

**Value: Commitment to the Truth**

The values promoted and protected by organizational leadership and perpetuated by organizational culture are critical to the organization’s ability to incorporate the discipline of evaluation. Collins and Porras (1996) stipulated that any organization will have between three and five core values. In organizations that have mainstreamed evaluation, commitment to the truth is one of those core values.

*Commitment to truth* encompasses two aspects: a clear picture of current reality and continuing effort to improve that picture by surfacing and challenging assumptions that influence that picture. As Senge (1990) described it, “Commitment to the Truth... means a relentless willingness to root out the ways we limit or deceive ourselves from seeing what is, and to continually challenge our theories of why things are the way they are” (p.
Sathe and Davidson (2000) called it *evaluative attitude*, “‘the relentless pursuit of the truth about quality and performance’” (Davidson, 2001, p. 17).

Commitment to the truth is not a casual undertaking. People organize themselves into groups and organize information into assumptions because “the human mind needs cognitive stability” (Schein, 1992, p. 23). Therefore, questioning basic assumptions will release anxiety and defensiveness at both the individual and group levels (Argyris, 1993; Bain, 1998; Schein, 1992). This reaction can take the shape of individual defensive reasoning (Argyris, 1996) and organizational defensive routines (Argyris, 1993). When this commitment is exercised explicitly as evaluation, extreme evaluation anxiety can result (Donaldson, Gooler, & Scriven, 2002). These reactions are automatic and tacit, easily existing as part of organizational culture, often even when leaders claim that is not the case (Argyris, 1999).

With regard to this value, the task of leadership is to consistently ask tough questions, seek negative findings, and learn from mistakes (Merget & Weaver, 1998; Preskill & Torres, 1999b). DiBella called this a “Climate of Openness” in which the organization engages in open communication about problems, errors and lessons rather than hiding them (DiBella, 2001, p. 32).
While Gray (1993; 1998a; 1998b) advocated a cultural environment that is “risk free,” leaders cannot expect that to apply to them. If commitment to truth is to become (or remain) a core value of the organization, then leaders must continually do what is necessary to seek it personally and for the enterprise (Friedman, 2007).

Capabilities, Systems and Structures

Leadership and culture together comprise the atmosphere in which organizational capabilities and its systems and structures exist. Capabilities, systems and structures that are in line with the values of the organization are developed and supported; those that are not in line are not supported. Within that environment, the relationship between capabilities and systems and structures is much the same as that between leadership and culture (Figure 10). People within the organization need to be able to perform in particular ways, and the systems and structures of the organization must support those capabilities. Ability to perform without appropriate support requires extra effort, which means more resources used to generate desired performance. Structures and systems built for capabilities that are not essential consume resources without generating desired performance.
Loops

The literature on learning and evaluation is filled with loops, i.e., iterative processes. The most common in the literature is Argyris’ (Argyris, 1997, 1999; Argyris & Schön, 1996a) single and double loop learning (Cousins et al., 2004; Davidson, 2001; Morgan, 1997; Wijnhoven, 2001), presented in the above section on organizational learning. Other iterative models include Preskill and Torres’ Evaluative Inquiry for Learning in Organizations (1999b), also presented above; Gray’s (1998a) coevaluation process; Haeckel’s (1999) adaptive loop; Korthagen’s (2005) ALACT model for reflection; and Andreadis’ (2009) organizational learning commitment. The last four loops, which are not presented in earlier sections, appear below in Figure 11.

An organization that is mainstreaming evaluation will have an embedded iterative process for acquiring information, interpreting it based
Organizational Learning Commitment (Andreadis, 2009)

Scan environment for relevant data

Assess environmental reality in light of organization’s vision, mission and goals

Make sense of the data

Act on information

Make sense of the data

Act on information

Assess environmental reality in light of organization’s vision, mission and goals

Organizational Learning Commitment (Andreadis, 2009)

Adaptive Loop (Haeckel, 1999)

Sense

Interpret

Decide

Act

Sense

Interpret

Decide

Act

Adaptive Loop (Haeckel, 1999)

Co-evaluation (Gray, 1998a)

Ask questions

Collect information

Share and use information

Co-evaluation (Gray, 1998a)

ALACT Model for Reflection (Korthagen, 2005)

Action

Look back at the action

Creating alternative methods of action

Awareness of essential aspects

ALACT Model for Reflection (Korthagen, 2005)

Figure 11. Comparison of Other Loops in the Literature
on criteria and values, and acting on that interpretation to improve performance. This implies that at every level of the organization, employees and teams have several capabilities. First, they know where to look externally and internally for relevant data. Second, they know what criteria and standards need to be used to make sense of the data they collect. Third, they know how to collect valid and reliable data to use for feedback, monitoring, and formative processes. Fourth, they have the time and ability to reflect on the data to make sense of it in light of the criteria and standards in use. Fifth, they are able to act on their findings and repeat the process. Finally, they also take time periodically to re-evaluate the criteria and standards being used to be sure they are relevant and appropriate.

These capabilities and organizational structures have been described in depth in the learning organization and related literature. An organization that is mainstreaming evaluation will be clear about its use of criteria and standards at every level of the organization. The research described in Chapter 3 will seek to map out these iterative loops in real world organizations for insight into how they are imbedded in the organizational structure and culture and whether or not they contribute to the sustainability
of evaluation use for improved performance.

Internal and External Evaluation

Organizations that have mainstreamed evaluation also employ both external and internal evaluation practices for developmental, formative, and summative purposes. Several presidential strand presenters at the 2001 AEA conference addressed the need to balance external and internal roles as part of mainstreaming. Having both internal and external components provides the organization with checks and balances in a way that only internal evaluation cannot (Davidson, 2001; Williams & Hawkes, 2003).

Organizational Dimensions Summary

Leadership and culture, capabilities and structures are the dimensions in which evaluation mainstreaming presents itself in organizations. Key topics in these dimensions include these:

- shared vision, which serves as organization level values and criteria for evaluative judgments
- commitment to truth, which allows the organization to continually strive to understand current reality more clearly
- iterative loops, which incorporate learning, reflection, and evaluation into the daily routines of organization members
- balance of internal and external evaluation, which contributes checks and balances that support commitment to truth.

The following section describes the components of an organization and how
evaluation contributes to the performance of those subsystems.

Components

An organization provides a host environment for the people, systems, structures, and activities necessary to achieve its purpose. In the previous section, a host environment friendly to evaluation was described as having a shared vision and commitment to truth. An organization with those specific dimensions also has the capabilities and structures. Within that environment four subsystems exist that carry out the work necessary for the organization to pursue its vision: governance, management, work, and people (Andreadis, 2009). It is within and between component subsystems that evaluative activities are conducted. The following section maps the kinds of evaluands that can be found in each subsystem, how the logic of evaluation is likely to be applied, and examples of common evaluation purposes and uses.

Governance

The governance subsystem carries out the leadership functions of the organization (Andreadis, 2009). In a large foundation or business, governance may be carried out by a board of directors. In a smaller private company, the leaders may be the owner or a group of partners. In research centers like the
ones under study in this dissertation, the governance processes are executed by an external advisory committee, in concert with representatives of the funding agency and the project principal investigator.

The governance subsystem performs a significant number of evaluative tasks. It sets the vision and values for the organization, thereby establishing the criteria of merit for evaluation activities (step one of the logic of evaluation). The governance system is also responsible for “double loop” functions that ensure that the existing vision, values and organizational norms are appropriate (needs assessment). It creates, or delegates responsibility for creating, structures to support evaluation activities in the other three subsystems by making policy and apportioning resources. In addition, it carries out evaluation of organizational performance and policies as well as that of senior personnel.

**Management**

The management subsystem is responsible for implementing the directives of the governance subsystem (Andreadis, 2009). With regard to the discipline of evaluation, its primary work is in setting standards and measuring performance against those standards (steps 2 and 3 of the logic of
evaluation). Management focuses on single loop learning activities, establishing feedback systems and monitoring the other two subsystems, work and people. In that capacity, management also includes evaluation of work processes and personnel.

Work

The work subsystem is where inputs are transformed into products or outputs (Andreadis, 2009). In order for this subsystem to function, people need to have the appropriate capabilities, equipment, and organizational structures. Regardless of what the inputs and outputs are, process evaluation is appropriate. Approaches like Six Sigma focus on the process evaluation, with attention to the relational linkages between this subsystem and the other three (Keller, 2005). Output or outcome evaluation may take the form of program or product evaluation. In the work system, evaluation may have either formative or summative purposes and will utilize all the steps of the logic of evaluation. Also within this subsystem, evaluation is carried out at a variety of levels, from entire production processes to individuals who practice “evaluating at your desk” (Gray, 1998b, p. 24).
**People**

The people subsystem is where the word *evaluation* is most commonly used in organizations. It is typically embodied by the human resources department and is concerned with training and development, compensation, and performance management (Andreadis, 2009). Personnel evaluation is the purview of this subsystem, which encompasses all four steps of the logic of evaluation and can be done for both summative and formative purposes. The key to evaluation of the people in the organization is the linkage between the governance and work subsystems. The overall vision and goals of the organization need to be operationalized down to the level of the individual employee so that appropriate criteria, standards, and measures are used to evaluate personnel (Gilbert, 1996; Hale, 2007).

**Chapter Summary**

A descriptive theory of mainstreaming evaluation has been advanced in this chapter. This theory proposes that an organization that has incorporated the logic of evaluation and evaluative activities into its daily routine will exhibit specific characteristics in terms of culture, leadership, capabilities and systems and structures. These characteristics are as follows:
shared vision, commitment to the truth, iterative processes for learning, and embedded internal and external evaluation activities. In addition, evaluation mainstreaming can be tracked on a component level by assessing the ways evaluation is used in governance, management, work, and people subsystems of an organization.

In Chapter 3, the research design and context for exploring this theory in real world organizations are described. The findings of the research are presented in Chapter 4. The conclusions, contributions to the knowledge base, and suggestions for future research appear in Chapter 5.
CHAPTER 3: METHODS AND CONTEXT

In Chapter 2, the researcher presented the dimensions and components of an organization that is mainstreaming evaluation based on a review of the literature, which answered the first research question of the study. Four research questions remain.

2. How are the theoretical components and dimensions of the descriptive theory presented in Chapter 2 manifested in organizations that are mainstreaming evaluation?

3. What evaluation history and current practices are found in a sample of organizations that are mainstreaming?

4. What activities, attitudes, or innovations have made it possible to sustainably mainstream evaluation?

5. What benefits or detriments have these organizations experienced as a result of mainstreaming evaluation?

This chapter describes how the researcher sought answers for those questions. The chapter begins with a discussion of the research methods and rationale behind the selected approach. A brief discussion of the study context follows, including the reasons for the selection. The next sections include a brief discussion of the larger context of the organizations in the population under consideration, the sampling process used to ensure (as much as possible) that the selected organizations were mainstreaming
evaluation, and a brief overview of the organizations chosen for the final
sample. Following that, the research methods are elucidated in detail,
including the data collection process and analytic frameworks. In the final
two sections, the researcher presents the limitations of the study and
summarizes the dissertation thus far.

Research Design

Mainstreaming is a relatively unexplored topic in the professional
evaluation literature. As discussed in Chapter 1, only nine articles were found
in a literature search of the term, most of which focused on scholarly
observation and reflection on mainstreaming in organizations with which the
author was involved. The researcher found no publications of research done
by independent observers comparing organizations engaged in
mainstreaming of evaluation.

To develop a descriptive theory of mainstreaming evaluation, the
researcher expanded the literature search across several disciplines using key
words related to mainstreaming evaluation, as described in Chapter 2:
Literature Base. In addition to providing the basis for the evaluation
mainstreaming organization’s dimensions and characteristics presented in
Chapter 2, the cross-disciplinary literature search identified 17 articles and 13 dissertations that reported research findings on topics related to evaluation mainstreaming. These 30 publications used a variety of research methodologies including qualitative (16), quantitative (8), mixed methods (3), and action research (3). Only six of the studies were conducted by external researchers comparing findings across multiple organizations. Three were particularly applicable to this dissertation because of the research design. The first two were companion articles, which together comprised a mixed methods study on evaluative inquiry in schools. The researchers followed up the initial survey of 41 schools (Goh et al., 2006) with in-depth case studies of the four that scored highest on evaluative inquiry factors (Cousins et al., 2006). The third involved three organizations in different business sectors. The researcher used mixed methods to develop an instrument for measuring organizational learning capacity (Davidson, 2001).

Similar to evaluative inquiry and organizational learning, mainstreaming of evaluation is a complex social phenomenon. As described in Chapter 2: Literature Base, mainstreaming is different from those two areas because it involves the integration of evaluation into the culture and practice
of organizations. The lack of empirical research on evaluation mainstreaming makes a descriptive study an appropriate first step, since the intent is to systematically describe “a situation or area of interest factually and accurately” (Isaac & Michael, 1981, p. 46). Based on an assessment of the literature base, the data sources available to the researcher, and the parameters of the topic under study, the researcher chose a descriptive, mixed methods approach that compares four grant-funded organizations. The details of the research design and the rationale for the research choices follow.

Mixed Methods

Greene (2007) described five purposes for mixing quantitative and qualitative methods: triangulation, complementarity, development, initiation, and expansion. The purposes, the phenomena they investigate, and the desired results are summarized in Table 3. She also categorized four kinds of component research designs for mixed method studies: iteration, blending, embedding or nesting, and mixing for reasons of substance or values.

In this dissertation, the researcher chose an iterative implementation of mixed methods for the purpose of complementarity. Similar to the
Table 3

Types of Mixed Methods

<table>
<thead>
<tr>
<th>Type</th>
<th>Phenomena explored</th>
<th>Purpose</th>
<th>Desired result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangulation</td>
<td>Same</td>
<td>Corroboration, convergence, correspondence</td>
<td>Increased confidence in inferences developed by the study</td>
</tr>
<tr>
<td>Complementarity</td>
<td>Same</td>
<td>Broaden and deepen social understandings</td>
<td>Interpretations and inferences are elaborated, enhanced, deepened and/or broadened</td>
</tr>
<tr>
<td>Development</td>
<td>Same</td>
<td>Results of one method are used to develop the second method</td>
<td>Better understanding of constructs or phenomena based on the strengths of the different methods</td>
</tr>
<tr>
<td>Initiation</td>
<td>Same</td>
<td>Seek paradox, contradiction, divergence</td>
<td>Generate new insights, perspectives and understandings; uncover divergence or dissonance</td>
</tr>
<tr>
<td>Expansion</td>
<td>Different</td>
<td>Explore a variety of constructs related to a subject</td>
<td>Broader understanding of the constructs that influence a subject and how those constructs influence one another.</td>
</tr>
</tbody>
</table>

(Adapted from Greene, 2007)

relationship between Goh, Cousins and Elliott (2006) and Cousins et al. (2006) survey data were used to select a sample for in-depth case study research.

Different from those two studies, the survey used for selection was not
designed specifically for this research, as will be described below in Study Context. The second portion of this dissertation research consisted of qualitative case studies to provide a deeper and broader description of what evaluation mainstreaming looks like in a real world context. A description of the quantitative and qualitative aspects of the study is presented next.

Quantitative Method

The researcher used three years of survey results from a preexisting instrument (described below in Study Context) to select the four sites for case studies and to build a basic understanding of the evaluation practices in those organizations. Survey responses also informed the qualitative portion of the study in two other ways. First, answers to items regarding evaluation activities and practices were used to shape questions in the interview protocols. Second, responses regarding evaluation reports gave the researcher an idea of what kind of documentation was available for review from each of the sample organizations.

Qualitative Method

The researcher chose to use a case study approach for the qualitative component of this study. A case study is an empirical method that
“investigates a contemporary phenomenon within its real-life context” (Yin, 2003, p. 13). The investigation is designed to produce detailed and in-depth information about the concept being studied and also the context in which it is found, because the two are not clearly distinct from each other (Ginsburg & Rhett, 2003; Patton, 2002; Yin, 2003; Yin, 2009). As Stake expressed it, “…the first objective of a case study is to understand the case” (Stake, 2006, p. 2).

A case study handles the wide variety of variables that emerge from studying a context through the use of multiple evidence sources, including documents, physical artifacts, archival records, interviews, and observations. To be scientifically sound, case study research needs to have a clear purpose. Sites need to be selected based on data that indicate they have information to contribute to the theory or conceptual framework under investigation. Case studies are descriptive in nature, and, therefore, an appropriate choice only if behavioral control of the variables in question is not required (Yin 2003, 2009).

The case study approach has a variety of applications. It can be used to explain causal links in situations too complex for survey or experimental research. Case studies can illustrate a concept, intervention, or topic in a real world context. They can also explore a fuzzily defined concept or theory to
inform development of surveys and further research questions (Yin 2003, 2009) (Yin, 2003; Yin, 2009). In addition, case study analysis can suggest effective practices, discern hidden systems and their effect on the context and the concept being studied, and reveal problems with program intervention (Ginsburg & Rhett, 2003). The primary disadvantage of case study research is the large amount of time and resources required to conduct it (Ginsburg & Rhett, 2003; Miles & Huberman, 1994; Yin, 2003, 2009).

A case study can use single or multiple cases. Multiple cases make generalizing findings possible. However, authors differ on the logic that allows this generalization. Qualitative researchers recommend sampling based on the population under study. The sample needs to be purposeful, maximizing diversity on important characteristics within the population so that findings can be generalized back to the population. Theory about what the research expects to find is not required and may not be desirable (Miles & Huberman, 1994; Patton, 2002; Stake, 2006; Strauss & Corbin, 1997).

Yin (2003, 2009) recommended a multiple case approach where generalization is based on theory rather than population sampling method. This theory can be descriptive or hypothesis-based, but it provides a
hypothetical story about why and how events, structure, acts, or attitudes are present in the cases investigated. Cases are selected because they are expected to produce similar results to one another (literal replication) or different results for reasons that can be predicted based on the theory (theoretical replication). Replication of results that support the theory reinforce it and provide insights into ways the theory can be further explored. The generalization in this approach is from the single cases to the theory, rather than from the cases to the population.

Since mainstreaming is a descriptive theoretical construct, the researcher adopted Yin’s (2003, 2009) approach to case studies as the methodology for this dissertation. Rather than using the cases to generalize to the population, cases will be used to support the theory of mainstreaming evaluation in organizations. The descriptive theory, posited in Chapter 2, includes specific characteristics of organizational leadership and culture, capabilities, systems and structures. Since the theory is new, cases were chosen based on predicted literal replication of findings.

A multiple case study can consist of as few as two cases. The greater the number of cases, the less depth of investigation into each and the larger
the amount of resources (people, time, money) required to conduct the study. The researcher chose to use four cases for three reasons. First, while the description of mainstreaming evaluation has been developed from the literature, this study is its first test. Thus, a single case would have provided insufficient evidence of theory replication. Four cases provide ample opportunity for the theory to be replicated. Second, the research was conducted by a single investigator in a six month time frame. With extensive review of archival survey data and documents in addition to two-day site visits, more than four cases would have been unwieldy. Finally, funding was available to conduct four site visits.

Rights of Human Subjects

Both the methods used in this study involve human subjects. As a result, the Western Michigan University Human Subjects Institutional Review Board (HSIRB) was consulted for approval about the survey and the qualitative research components. The survey was conducted under the auspices of Evalua|t|e: The Evaluation Resource Center, and that entity consulted HSIRB with regard to the survey and its other activities. The researcher contacted HSIRB directly with regard to the qualitative case
studies. For both components of the study, the committee determined that HSIRB approval was not needed, because the data gathered was organization-level and not private information about individuals. The memos from HSIRB to Evaluate and the researcher regarding approval are included in Appendix A.

Research Design Summary

Thus, the dissertation research presented here uses both quantitative and qualitative methods to study the phenomenon of mainstreaming evaluation in organizations. The purpose of the study is to generate deeper descriptions of the evaluation purposes, activities, uses, history, and benefits in organizations, thereby complementing the existing knowledge base. An iterative component design used existing longitudinal survey data to generate the study sample and inform the qualitative segment of the study, followed by qualitative case studies on the chosen organizations. The following section describes the context of the organizations in the sampling frame for this study.

Sample

The researcher conducted this study in the context of the National
Science Foundation (NSF) funded Advanced Technological Education (ATE) Centers. The annual ATE Survey, described below, was used to select the study sample for the qualitative research. The section begins with a brief history of NSF and the ATE program and gives the rationale for why this context was chosen for the study. The second section describes the sampling process and gives a description based on survey data of the four centers that participated in the qualitative portion of the research.

Context

The National Science Foundation is an independent government agency created by Congress in 1950. Its purpose is to keep the United States "at the leading edge of discovery in areas from astronomy to geology to zoology." In March 2009, Congress approved NSF’s annual budget of 6.5 billion dollars, the majority of which will fund research in college and universities across America. The Advanced Technological Education (ATE) program serves as one mechanism for disseminating those funds. NSF initiated ATE in the early 1990s as a result of a congressional mandate that the agency create a program to advance the education of science and engineering.

technicians in both undergraduate and secondary schools (Advanced Technological Education, 2006).

Advanced Technological Education

2009 marked the sixteenth year of the ATE program. Every year, new funding proposals are evaluated based on their intention to "demonstrably contribute to the ATE program's central goals: producing more science and engineering technicians to meet workforce demands, and improving the technical skills and the general science, technology, engineering, and mathematics (STEM) preparation of these technicians and the educators who prepare them" (Advanced Technological Education, 2006). To this end, ATE distributes $46 million dollars a year in new and continuation grants to two-year community colleges, four-year colleges, and universities. At these institutions, ATE funds are used to develop technicians in one of more than 15 specific fields like advanced materials (polymers, nanotechnology). Grantees seek to impact technician training through curriculum and faculty professional development, program improvement, targeted research, collaboration, and articulation. The grants are given at two levels: project (smaller grants, limited foci) and center (larger grants, multiple foci).
The researcher chose ATE centers as the focus of the study because they tend to have larger staffs and therefore more “organization” in which to study evaluation mainstreaming. The ATE program funds centers in three categories: regional, national, and resource. National centers focus on fields deemed by NSF as central to maintaining the nation’s ability to compete in a global economy. They focus on comprehensive reform of technological education at the national level. ATE program officers, who supervise the centers on behalf of NSF, expect the centers will create a broad network of academic and industry partners in their technology area to impact both education and the economy. Regional centers are a smaller scale version, focused on a STEM area critical to the economy in their defined geographic area. They are expected to create partnerships as well as education and workforce impacts in their regions. Resource centers are a possible next step after being a national or regional center, although some, like Evalua|t|e, are formed based on ability to provide a specific service to ATE-funded centers. They provide leadership in creating or disseminating educational materials and best practices and serve as mentors to other centers. Of the three funding categories, resource centers work with the largest number and size of
partners, including government agencies, professional associations, academic institutions, and business and industry (Advanced Technological Education, 2010).

Evaluation in ATE

Every federal agency is required to establish clear performance goals and quantitatively track progress toward those goals, per the Government Performance and Results Act enacted in 1993. More recent legislation (Institute for Education Sciences, 2002) requires program evaluation be scientifically valid, adhering to high standards of quality in research design that enable causal inferences through a combination of scientifically valid and reliable methods (Ginsburg & Rhett, 2003). NSF and ATE are subject to these laws and, as a result, make external evaluation for summative purposes part of their funding requirements. In fact, grant proposals are judged in part on the existence of an evaluation plan that is "clearly tied to project outcomes" (Advanced Technological Education, 2006). NSF expects projects and centers to include funds for evaluative activities in their proposal budgets, and recommends that the amount for evaluation be about 10 percent of the total proposed budget.
ATE also is committed to evaluation at the broader program level. Since 2000, ATE has sponsored a variety of activities intended to document the merit of work being conducted under its auspices. In 2001-02 a team of evaluators conducted site visits at eight projects and centers to report on the program’s effectiveness in reaching its stated goals. From 2003-2005 The Evaluation Center at Western Michigan University and the University of Minnesota conducted an evaluation of curriculum materials, which culminated in a large scale quasi-experimental study. In 2008, ATE funded a resource center dedicated to developing evaluation resources for its grantees. This new center, Evalua|t|e, is housed at The Evaluation Center at Western Michigan University.

ATE Annual Survey

In addition to these specific evaluative efforts, ATE also keeps track of its projects and centers through an annual survey that tracks program and evaluation practices. Since 2000, The Evaluation Center at Western Michigan University has designed, conducted, and cached the results of this survey. Projects and centers must have had at least one year of grant funding to be invited to participate. ATE program officers require principal investigators
(PIs) to complete the survey as part of the grant requirements, which has resulted in an average response rate of 96 percent for survey years 2000-2009.

The survey has been redesigned several times over its 10 year existence. Each version has gathered information on the following topics: grantee characteristics, organizational practices, articulation agreements with other education institutions, collaborations with other agencies and institutions, materials development, professional development, and program improvement. The survey was revised for 2007 and has remained basically unchanged through 2009. A copy of the 2009 survey can be found in Appendix B. It has been redesigned again for 2010.

The survey asks for information about the centers’ activities for the previous calendar year, i.e., the 2007 survey reports 2006 activities. It includes a variety of items regarding the evaluation practices of projects and centers. One hundred nineteen projects and 31 centers responded to the 2009 survey (97% response rate). With regard to the ATE program’s evaluation requirement, the vast majority of projects and centers that responded to the survey in 2009 reported contracting with an external evaluator (projects, \( n = 102 \); centers, \( n = 31 \)). Of those, 10 projects and six centers reported using both
internal and external evaluators.

Rationale for ATE as the Research Context

The ATE program was selected as the context for exploring the remaining research questions for four reasons: mandated external evaluation, required level of performance, availability of information, and an existing positive relationship.

Mandated External Evaluation

The literature on evaluation in organizations indicates that an external mandate for evaluation can provide the impetus for evaluation to become a core value of an organization (Katz, Sutherland, & Earl, 2002; Sanders, 2002; Sutherland, 2004). The legislated requirement of external evaluation has caused NSF to incorporate the same requirement in its sponsored programs. As the brief history above described, the ATE program has demonstrated a long standing organizational-level commitment to external evaluation for accountability. The annual survey responses of ATE center personnel indicated that many of them have made evaluation an integral part of their day-to-day operations.
Required Level of Organizational Performance

ATE projects and centers are funded on grants of three to four years in duration. Renewed funding depends on the project’s or center’s performance relative to its stated goals. Those that have been re-funded, therefore, have demonstrated an acceptable level of organizational performance.

Availability of Information

ATE is a government-funded program; thus, a broad array of data is publically available. The ATE webpages at NSF.gov include access to annual solicitations from NSF and descriptive information about projects and centers. The Evaluation Center’s website includes copies of every annual survey, summaries of annual survey findings, and status reports from previous evaluative efforts. Through a formal agreement with the principal investigator for the Evaluate project, the researcher was granted access to 10 years of evaluation survey data and unpublished evaluation research findings from the ATE program. Appendix C contains the confidentiality agreement between the researcher, her committee chair, and the PI of Evaluate.
Existing Positive Relationship

The Evaluation Center and Evaluate have a long-standing, positive relationship with NSF and ATE program officers and principal investigators. The researcher was able to build on this existing relationship to persuade centers to participate in the study. Once the final centers were selected, center leaders and the researcher used the relationship between ATE and The Evaluation Center to facilitate recruitment of interview subjects among partners and program participants.

Sampling Process

To achieve this study’s purpose of exploring evaluation mainstreaming in a real world context, the sites selected to serve as case studies needed to exhibit some evidence of the dimensions and components presented in Chapter 2. The selection process began with annual ATE survey responses collected by the Western Michigan University Evaluation Center from 2000-2009. The initial sample was limited to ATE centers because their larger budgets mean they have more resources available for evaluation activities. (Five percent of $50,000 is much less than 5 percent of $1,000,000.) Personnel from the 31 ATE centers that responded to the 2009 survey formed
the initial sample pool. Once the initial sample pool was delineated, the
selection process used three sources of evidence to choose the four centers for
the research sample: survey responses, recommendations of ATE program
officers, and conversations with principal investigators (PIs) of potential sites.

General Characteristics from Survey Responses

The first round of sample selection was conducted by comparing
centers as respondents across survey years. To be eligible for consideration
for the study, a center had to meet two criteria: had responded to the survey
all three of the last three years (2007-2009 surveys) and had had its NSF
funding renewed at least once. The first criterion relates to ease of use for
sampling. As mentioned above, the survey has had several revisions in its ten
year history. It was redesigned for 2007, and the primary evaluation items
remained unchanged in text and coding through 2009. The consistency made
sorting data on key variables for the next level of the sampling process more
straightforward.

The second criterion is related to organizational performance. A center
that is mainstreaming evaluation should demonstrate at least adequate
organizational performance. ATE centers are closely monitored due to the
size of their funding. Therefore, earning a second grant (or more) from NSF is an indicator of acceptable organizational performance over time. After these two criteria were applied, the sample pool was reduced to 27 centers, with the number of years of survey data ranging from nine to three.

ATE Program Officers

As mentioned above, the survey responses the researcher was using reflected centers’ activities from 2006-2008 (survey years 2007-2009). To get “real time” information about the centers, the researcher solicited information from the ATE program officers. Program officers are NSF employees charged with supervising ATE centers and projects. The researcher e-mailed a description of the study (Appendix D), followed by another e-mail with the initial pool of center candidates (Appendix E) to two long-time ATE program officers. They were asked to consider the list of 27 potential sites and make recommendations for centers to be included (or excluded) from the study based on two criteria: (i) longevity, and (ii) culture and practice of evaluation.

The terms were defined in the e-mail as follows:

Longevity: The centers selected need to be at least 5 years old or, if younger, have been re-funded once by NSF. Longevity is the indicator of effectiveness/success, since NSF does not continue to fund organizations that do not produce results.
Culture and practice of evaluation: Center leadership and staff use evaluation to forward the progress of the ATE center toward its goals, mission, and vision. In a mainstreamed ATE center, evaluation is not just an externally required activity, but an orientation of the leadership and staff toward inquiry and feedback, which is integrated into their daily work. (A. M. Gullickson, personal communication, July 7, 2009)

Based on the feedback from the program officers, seven centers were removed from consideration due to recent changes in leadership, lack of longevity, or other organizational issues that would make them inappropriate for the study. After this step, the sampling pool included 20 potential centers as candidates for the qualitative study. The program officers’ feedback on the remaining 20 centers was recorded for use later in the selection process.

Survey Item Analysis

Next, the researcher compared survey responses on the 2007, 2008 and 2009 surveys from the remaining 20 centers. (The 2009 survey is included in Appendix B.) Three items from “Organizational Practices” (Section 2) were selected as representative of a center’s commitment to evaluation. The items’ text from the 2009 survey is presented in Table 4 below.

Item 1 was selected because needs assessment is a key evaluative activity related to the external scanning capability of mainstreaming. A needs
Table 4

Survey Items Linked to Mainstreaming Evaluation

<table>
<thead>
<tr>
<th>Item</th>
<th>Text</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Did your center gather workforce needs assessment data in 2008?</td>
<td>1 = yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = no</td>
</tr>
<tr>
<td>3a</td>
<td>Did you use a National Committee (National Visiting Committee, National Advisory Board, etc.) in 2008?</td>
<td>1 = yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = no</td>
</tr>
<tr>
<td>10</td>
<td>How useful is the interaction you have with your center’s external evaluator?</td>
<td>2 = not useful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 = minimally useful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 = somewhat useful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 = useful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 = essential</td>
</tr>
</tbody>
</table>

Assessment enables the organization to set appropriate criteria for its work based on feedback from constituent groups. ATE centers are expected to be pioneers in science and technology education; therefore, close attention to stakeholders’ needs is crucial. Committing resources to this valuable activity was determined to be an indicator of mainstreamed evaluation. Seven of the 20 centers responded “yes” to having conducted needs assessment during all three years of the survey.

A second source of data from external scanning was a national visiting
committee (item 3a), a multidisciplinary group of experts from around the country. This group provides expert, external feedback on a center’s past performance and future development. Engaging with a National Visiting Committee involves a commitment of time and resources from both the center and the committee members. Centers who invest in this activity demonstrate a commitment to external feedback that is an indicator of mainstreamed evaluation. Sixteen of the 20 centers responded “yes” to using a national committee of some kind all three years.

Engaging an external evaluator for the sake of independent reporting on center performance is the norm for ATE centers. Seventeen of the 20 centers in the sample had external evaluators, i.e., a person hired specifically to evaluate the grant, who is external to both the ATE center and its host institution. The remaining three had both an external and internal evaluator. Item 10 was chosen because it underscored the usefulness of interactions with the evaluator to the organization and discriminated among centers more effectively. Survey responses from fourteen centers reported interaction with their external evaluator as “useful” or “essential” on all three surveys from 2007-2009.
Based on the ATE program officers’ information about the remaining 20 centers (given earlier in the process) and those centers’ responses on the above survey items, 10 centers were moved to the next level of analysis. The researcher conducted a deeper analysis of the ways these centers sought information to improve their work. To this end, three kinds of survey items were explored in depth – those relating to needs assessment, advisory committees, and evaluation of program activities. Totals for each center on these items were summed across all three survey years. Center staff could specify more than eight different types of needs assessment activities on the survey; the frequency and type were tracked. Centers can also have advisory committees at the regional and local level, so those were analyzed in addition to whether or not they had a National Visiting Committee (NVC). Finally, ATE centers exist to conduct materials development, professional development, and program improvement (or a combination of those activities). An analysis of survey items tracked whether or not those program components had been evaluated in the last three years. As a result of this deeper analysis, one center was removed from the pool because it reported no evaluation of program activities in the last three years. Thus, the researcher
had nine potential centers that could serve as sites for the qualitative portion of the study as she moved into the last phase of sample selection.

Center Principal Investigators

The final step in selecting sites for participation in the dissertation study was conducted at the ATE Principal Investigators’ Conference in Washington, D.C., on October 21-23, 2009. On October 16, 2009, the researcher sent a solicitation e-mail to the PIs of the nine centers being considered for participation in the study. The e-mail included a picture of the researcher and a brief description of the research. The e-mail soliciting center participation in the study can be found in Appendix F. At the conference, the researcher met staff members and/or PIs from six of the nine centers on the final list. After the conference, the researcher followed up with those six via e-mail (Appendix G). Four centers agreed to participate in the descriptive study of mainstreaming evaluation.

The process used to select four centers from the ATE center population that were likely to be mainstreaming evaluation is summarized in Figure 12. In phases A through D, the researcher reduced the number of eligible centers from the original group of 31, based on the criteria and information reported
Responded to the 2007, 2008, and 2009 ATE surveys
ATE Funding renewed at least one time

Consultation with ATE program officers

Reported frequency of meetings with NVC
Reported usefulness of external evaluator
Previous information from program officers

In-depth analysis of survey responses on needs assessment, advisory committees, and evaluations of program activities

Principal Investigators’ Conference and follow-up

<table>
<thead>
<tr>
<th>Phase</th>
<th>Steps</th>
<th>Centers</th>
</tr>
</thead>
</table>
| A     | Responded to the 2007, 2008, and 2009 ATE surveys
        ATE Funding renewed at least one time | 27      |
| B     | Consultation with ATE program officers                               | 20      |
| C     | Reported frequency of meetings with NVC
        Reported usefulness of external evaluator
        Previous information from program officers | 10      |
| D     | In-depth analysis of survey responses on needs assessment, advisory committees, and evaluations of program activities | 9       |
| E     | Principal Investigators’ Conference and follow-up                   | 4       |

Figure 12. Sample Selection Process, Original Population N=31

above. The Centers column presents the number of eligible centers left after the corresponding phase. In the last phase, the final four centers were those whose PIs agreed to participate after meeting and talking with the researcher at the Principal Investigator’s Conference. A brief description of the final four centers is presented in the next section.

Final Sample

The pseudonyms Eng-Tech, IT-Tech, Manu-Tech and Nano-Tech are
used for the four participating centers throughout the dissertation. This upholds the confidentiality agreement between the researcher and Evalua|t|e. Also for that reason, all identifying information has been removed from the case studies presented in Chapter 4.

As described above in the subsection on Advanced Technological Education, ATE distributes more than $46 million dollars annually to community colleges, colleges, and universities to improve the technical skills of the workforce. At the center level, ATE awards grants in three categories: regional, national, and resource. Thus, ATE centers exist in the context of education institutions and industry and have regional, national, or potentially international scope. While these characteristics were not considered in the selection process, the final sample included variation among centers in all three (Table 5). The remainder of this section will summarize the centers’ characteristics with regard to the sample selection criteria.

Longevity was the next selection criterion in Phase A. The researcher used survey responses and feedback from the ATE program officers regarding longevity to choose centers for the study, assuming that centers that do not perform acceptably would not continue to receive grant funds. All
Table 5
Center Characteristics

<table>
<thead>
<tr>
<th>Center</th>
<th>Host</th>
<th>Industry</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>Community College</td>
<td>Marine Engineering</td>
<td>Resource</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Community College</td>
<td>Information and Communication</td>
<td>Regional</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Community College</td>
<td>Manufacturing and Engineering</td>
<td>Regional</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>University</td>
<td>Nano- and Microtechnology</td>
<td>National</td>
</tr>
</tbody>
</table>

centers in the final sample had their grant funding renewed at least once.

Nano-Tech and Eng-Tech, the longest lived centers, have both received multiple ATE grants and had been upgraded in funding category. The number of center grants for each and the number of years they have received center funding is presented in Table 6. All the centers but Nano-Tech were established with ATE grant funds. Nano-Tech was created by the state government and its host university three years before it received its first ATE center grant.

The next criteria for selection were (i) meetings with external advisory committees, (ii) conducting needs assessment, and (iii) interactions with the
Table 6

Longevity Based on ATE Center Grant Funding

<table>
<thead>
<tr>
<th>Center</th>
<th>Number of grants</th>
<th>Years of funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

external evaluator. The four centers met the basic criteria of needs assessment and annual meetings with their external advisory committees. The researcher’s findings from the deeper analysis of survey responses related to those criteria are presented below in Tables 7-10. All four centers in the sample met with an external advisory committee at least annually (Table 7). Nano-Tech became a national center in 2007 (2008 survey data); prior to that it had only a regional advisory committee, commensurate with its regional center status. As a resource center, Eng-Tech’s scope is international, so it does not have regional or local committees.

With regard to needs assessment, personnel from all four centers reviewed reports written by others and obtained work performance data from business, industry, or other sources annually. They also provided more
Table 7
Total Meetings with Advisory Committees from 2007-2009 Survey Responses

<table>
<thead>
<tr>
<th>Center</th>
<th>Advisory Committees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NVC</td>
</tr>
<tr>
<td>Eng-Tech</td>
<td>4</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>3</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>3</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>1</td>
</tr>
</tbody>
</table>

detailed information about their information sources for work performance data, which is summarized in Table 8 below. On all three surveys, every center reported that staff (i) analyzed existing data on workforce needs, (ii) obtained feedback from an advisory committee (see above), (iii) gathered anecdotal information through conversations with business industry representatives, and (iv) obtained feedback from partners and alliances. The centers also got external workforce information from between one and three more additional sources every year.

Interaction with an external evaluator was another key criterion in sample selection. Representatives from all four centers reported interaction with their evaluator was either “useful” or “essential” in the three years of
Table 8

Needs Assessment Information from 2007-2009 Survey Responses

<table>
<thead>
<tr>
<th>Kind of needs assessment</th>
<th>Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eng-Tech</td>
</tr>
<tr>
<td>Conducted own survey</td>
<td>3</td>
</tr>
<tr>
<td>Hired external individual or organization to conduct a survey specifically for your center</td>
<td>0</td>
</tr>
<tr>
<td>Analyzed existing data on workforce needs (i.e. data gathered by business or industry for their own purpose but made available to you)</td>
<td>3</td>
</tr>
<tr>
<td>Conducted focus group(s) with business/industry representatives</td>
<td>3</td>
</tr>
<tr>
<td>Conducted formal interviews with business/industry representatives</td>
<td>3</td>
</tr>
<tr>
<td>Obtained feedback from an advisory committee</td>
<td>3</td>
</tr>
<tr>
<td>Gathered anecdotal information through conversations with business/industry representatives</td>
<td>3</td>
</tr>
<tr>
<td>Obtained feedback from partners and alliances</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
</tr>
</tbody>
</table>

survey data (Table 9). In addition, all responded that they had gotten both a written and oral report from their external evaluator every year (Table 10).
The researcher understood the centers’ responses on these survey items regarding external advisory committees, needs assessment, and interactions with external evaluators as indicators that they were mainstreaming evaluation.

Table 9

<table>
<thead>
<tr>
<th>Center</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>essential</td>
<td>useful</td>
<td>useful</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>essential</td>
<td>essential</td>
<td>essential</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>useful</td>
<td>useful</td>
<td>useful</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>essential</td>
<td>essential</td>
<td>essential</td>
</tr>
</tbody>
</table>

Table 10

<table>
<thead>
<tr>
<th>Center</th>
<th>Written</th>
<th>Oral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

The final criterion to narrow the sample was evaluation of center activities. Centers engage in a variety of activities. The annual survey has
special sections dedicated to getting detailed information about the following
center activities: (i) materials development (curriculum and courses); (ii)
professional development (faculty and educator workshops); and (iii)
program improvement (expansion of courses offered and increased
enrollment, particularly of underrepresented groups). Those sections include
questions about whether or not the center evaluated its efforts in that area.

Table 11 shows the ways each center divided its annual budget among those
three major activities in its 2009 survey responses. For every activity area in
which these four centers spent money, they also evaluated their efforts, which
met the final criterion for mainstreaming evaluation.

Table 11

<table>
<thead>
<tr>
<th>Center</th>
<th>2008 total budget</th>
<th>Materials development</th>
<th>Professional development</th>
<th>Program improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>$400,340</td>
<td>10%</td>
<td>18%</td>
<td>10%</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>$497,316</td>
<td>15%</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>$989,291</td>
<td>0%</td>
<td>12%</td>
<td>40%</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>$1,238,900</td>
<td>10%</td>
<td>23%</td>
<td>26%</td>
</tr>
</tbody>
</table>

The researcher attended the Principal Investigator’s Conference in
October 2009, where she met the PIs from Eng-Tech, Manu-Tech, and IT-Tech
and the Director of Education and Outreach for Nano-Tech. After the conference she coordinated with the PIs and center staff to arrange for two-day site visits to each center. The dates the PIs consented to participate and the site visit dates are presented in Table 12. The following section outlines the methods for collecting and analyzing the data gathered from all four centers in the sample.

Table 12

<table>
<thead>
<tr>
<th>Center</th>
<th>Consent to participate</th>
<th>Site visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>November 25, 2009</td>
<td>February 3-5, 2010</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>October 27, 2009</td>
<td>December 9-11, 2009</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>November 4, 2009</td>
<td>January 6-8, 2010</td>
</tr>
</tbody>
</table>

Procedure

Multiple sources of evidence were used to generate the findings in the qualitative case studies. According to Yin (2009),

…the most important advantage presented by using multiple sources of evidence is the development of converging lines of inquiry, a process of triangulation and corroboration... any case study finding or conclusion is likely to be more convincing and accurate if it is based on several sources of information, following a corroboratory mode. (pp. 115-16)
The data sources for the case studies presented in the next chapter included ATE survey responses (described above), documentation, interviews and observations. The researcher reviewed documentation from both public and private sources. Public sources included a variety of websites including NSF, the U.S. Census Bureau American Fact Finder, community pages for the centers’ home cities and host institutions, as well as those of the individual ATE centers and their partners. Center leaders also gave the researcher access to an array of private data, including reports from external evaluators and advisory committees, data from needs assessment processes, and a sample of evaluation data from program activities. As per the confidentiality agreement with Evalua|t|e, neither public nor private information sources will be cited in the text or bibliography because they contain identifying information.

The primary qualitative data collection process included document review and a two day site visit to each center. Table 13 presents a summary of the site visit dates and activities. The researcher reviewed the centers’ websites and available private documents before the site visits, to begin learning about the centers’ overall strategy, organization, partners, activities,  

---

4 nsf.gov/ate
5 factfinder.census.gov/home/saff/main.html?_lang=en
Table 13

Site Visit Dates and Activities

<table>
<thead>
<tr>
<th>Center</th>
<th>Site visit dates</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>February 3-5, 2010</td>
<td>Observe strategic planning meeting</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>December 9-11, 2009</td>
<td>Visit all three partner colleges, interviews</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>January 6-8, 2010</td>
<td>Single site visit, interviews</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>January 25-27, 2010</td>
<td>Single site visit, interviews</td>
</tr>
</tbody>
</table>

and critical incidents to use in creating interview protocols. During three of the site visits, the researcher spent the majority of her time at the primary center site, interviewing staff and partners. For Eng-Tech, the site visit centered on the leadership staff’s off-site strategic planning meeting. The researcher did get to see the Eng-Tech office and host campus, and interviewed three staff members on site; however, the majority of interviews for Eng-Tech were conducted by phone.

At all four sites, the researcher conducted semistructured interviews with (i) the PI and staff, including part-time and student workers where applicable; (ii) co-PIs who were involved with the day-to-day operations or activities of the center; (iii) partner faculty and administrators from the host
college; (iv) National Visiting Committee and industry advisory committee members; (v) educators from partner colleges; and (vi) people who had participated in center programs. At IT-Tech, the center staff set up interviews for the researcher. At the other three sites, a center staff member sent out a general solicitation letter via e-mail to staff, advisory committee members, partners, and participants asking them to participate in the research. The e-mail Kurt Hinkle, co-PI at Manu-Tech, sent out provided the template for the remaining two centers and is included in Appendix H. The researcher followed up with a personal e-mail to each individual included in the general solicitation to set up an interview date and time. An example personal follow-up, also from Manu-Tech appears in Appendix I. Due to the brevity of the site visits and the geographic dispersal of center staff and partners, more than half the interviews were done via telephone before, during and after the site visit (Table 14). The researcher tracked interview schedules, revision of notes, and validation using Excel spreadsheets.

In addition to interviews, the researcher used the site visits as opportunities to record observations including: (i) the centers’ physical space
Table 14

Centers and Interviews Conducted

<table>
<thead>
<tr>
<th>Center</th>
<th>In person</th>
<th></th>
<th>Telephone</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Interviews</td>
<td>People</td>
<td>Interviews</td>
<td>People</td>
</tr>
<tr>
<td>Eng-Tech</td>
<td>3</td>
<td>3</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>9</td>
<td>13</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>13</td>
<td>18</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Totals</td>
<td>37</td>
<td>46</td>
<td>50</td>
<td>52</td>
</tr>
</tbody>
</table>

and layout, (ii) staff interactions with each other, and (iii) staff interactions with the host school faculty and administrators. Where possible, she also gathered additional documentation from interviewees and public displays at the host and partner colleges. Further details about the information sources for each center are presented in Chapter 4 in the individual case studies, and summarized in the cross case analysis.

Instruments

The data collection process used three primary instruments: the Annual ATE Survey (Appendix B), interview protocols, and document summary forms. The researcher prepared individual protocols for each interview at each site. The first site visit occurred at IT-Tech. The initial
interview protocols were based on the component subsystems model presented at the end of Chapter 2 (governance, management, work, personnel). After the on-site interviews, it was clear to the researcher that the component-based protocol was unsuitable for two reasons. First, the center staff consisted of only two full-time employees and four part-time employees, including the PI. The staff simply was not large enough in number to have role differentiation commensurate with the component portion of the theory. Second, the host college acts as fiscal agent of the ATE center, so the management and personnel subsystems for the center are handled by the host college, making the questions about those subsystems less relevant.

As a result, after the site visit the researcher revised the protocols for phone interviews with IT-Tech partners. Three example protocols from IT-Tech are presented in Appendix J to show the evolution. The researcher continued to refine and adapt the protocols during and between sites, based on the proposed organizational dimensions from Chapter 2 (leadership, culture, capabilities, and systems and structures) and research questions three though five. By the last site, Eng-Tech, she had a set of strong working protocols for staff, host college administrators, partners, and participants.
Two examples of interview protocols for Eng-Tech are included in Appendix K.

With regard to documentation, the researcher collected an array of paper and electronic documents from all four sites. For paper copies and extensive reports, she used a document summary form (Miles & Huberman, 1994). An example from Nano-Tech is presented in Appendix L. For the majority of electronic documents and webpages, content was uploaded directly into the qualitative analysis software.

Data Processing and Analysis

With regard to data analysis in a case study, Yin (2009) suggests three possible strategies: (i) relying on theoretical propositions; (ii) developing a case description, using both quantitative and qualitative data; and (iii) examining rival explanations. Relying on theoretical propositions was chosen as the most appropriate, since the purpose of the study was to generate and test a descriptive theory of evaluation mainstreaming in real world settings. The theoretical propositions described in Chapter 2 were used to analyze the data using this “most preferred strategy” (Yin, 2009, p. 130).

The researcher used MaxQDA software to analyze the qualitative data
gathered from documents, interviews, and observations. The organizational
dimensions from the descriptive theory (research question two), plus research
questions three through five formed the initial coding structure for data
analysis. The qualitative evidence sources are mapped onto the research
questions in Table 15. Additional codes were added for emerging themes
throughout the data analysis, including pattern codes.

In the data analysis, the researcher always reviewed information from
each center as a unit to maintain a clear picture of the individual cases. Using
MaxQDA, the researcher first coded all the interviews from each center. Then
websites and documents were added to the qualitative database, and the
researcher went through the full set of data two more times to refine the
coding system. The final coding system is included in Appendix M. Data
from individual centers were reviewed by code to create the narrative case
studies presented in Chapter 4. The case studies provide a description of how
evaluation mainstreaming happened in real world organizations. Once the
individual analyses were completed, the researcher conducted a cross case
analysis to compare the findings from each and explore whether they
generalized to the descriptive theory of mainstreaming developed in Chapter
Table 15

Research Questions by Evidence Source

<table>
<thead>
<tr>
<th>Research questions</th>
<th>Descriptive theory dimensions</th>
<th>Evidence Source</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Documentation</td>
<td>Interviews</td>
<td>Observations</td>
<td></td>
</tr>
<tr>
<td>2. Descriptive Theory Topics</td>
<td>Leadership and culture</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capabilities</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>3. History and Current State</td>
<td>Mainstreaming history</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaluation purposes and uses</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaluation activities</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sustainment Structures /systems</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Innovations</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Benefits</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>5. Outcomes Detriments</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. The cross case analysis is presented in the final section of Chapter 4.

Study Limitations

This study was based on the assumption that mainstreaming of evaluation is an organizational ideal – an equifinal outcome that may result from a variety of efforts. Since the survey data used to select centers was from an instrument not specifically designed to study mainstreaming evaluation, it
was possible that all the centers would not demonstrate those characteristics. However, even if all four centers are not mainstreaming evaluation, the comparative case study approach will still provide findings that expand the knowledge base about evaluation in organizations.

Validity and Reliability

For descriptive case study research such as this dissertation, construct and external validity apply. In case study research construct validity is upheld by using multiple sources of evidence, establishing a chain of evidence, and having a draft of the case reviewed by key informants (Yin, 2003). This study triangulated data from multiple sources using multiple methods. The researcher established the chain of evidence by using MaxQDA for coding the qualitative data, as described above. Member checks (Miles & Huberman, 1994) at the individual level ensured the accuracy of the information on which the cases were based. Every person that participated in an interview or focus group was given the opportunity to read and respond to the researcher’s notes before the case studies were written. An example of the e-mail sent by the researcher soliciting a review of interview notes is included in Appendix N. In addition, a completed draft of the case study was
sent to the principal investigator of each center for review before the final draft and publication. Interview validation percentages and whether or not the centers reviewed the draft and returned it with comments are included in Table 16.

Table 16

Interview and Case Study Validation

<table>
<thead>
<tr>
<th>Center</th>
<th>Interviews validated</th>
<th>Case reviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>70%</td>
<td>Yes</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>65%</td>
<td>Yes</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>64%</td>
<td>Yes</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>64%</td>
<td>Yes</td>
</tr>
<tr>
<td>Average</td>
<td>65%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

External validity is the domain to which the findings of this study can be generalized (Yin, 2003). The findings of the case studies were intended to generalize to the descriptive theory of mainstreaming. They can be used to formulate future investigations of the phenomena and to suggest possible routes for organizations that wish to mainstream evaluation. The results of this study are not intended to make any judgments or inferences about the state of evaluation in the ATE program.
The reliability of the study was established through a variety of avenues. Measurement error was reduced by using a single researcher, and specific protocols for data collection. Triangulation of multiple data sources through a database created for analyzing the cases also helped to increase reliability (Yin, 2003).

Scope

The ATE Survey was designed and its execution managed by a team of evaluators from The Evaluation Center at Western Michigan University. A single researcher conducted the case study analysis based on that survey data and the four site visits. Funding was acquired for site visit travel and honorariums for participating centers. The data from this study are the property of Evalu|t|e and can be accessed for further analysis with the permission of that project’s principal investigator.

Chapter Summary

In this study a single researcher used an iterative, mixed methods approach for the purpose of developing understanding about mainstreaming evaluation in organizations as a complex social phenomenon (Greene, 2007). Within the context of the NSF ATE program, and through a confidentiality
agreement with Evaluative, she examined data from an existing quantitative instrument to select a sample of four ATE centers for in-depth qualitative case study. The researcher visited all four sites; gathered public and private documentation; and conducted interviews with staff, partners, and activity participants. Multiple sources of data, qualitative coding, and individual and center level member checks ensured validity of the findings (Yin, 2003; Yin, 2009), which are presented in Chapter 4. In Chapter 5, the findings are presented as they pertain to the remaining research questions, and implications for further research are explored.
CHAPTER 4: CASE STUDIES AND CROSS CASE ANALYSIS

This chapter is comprised of an introduction, four organizational case studies, a cross case analysis, and a summary of findings. The names of people and institutions included herein are pseudonyms, as per the researcher’s confidentiality agreement with EvaluATE and study participants. To uphold the agreement of confidentiality, websites, documents, and other sources used to gather information about each center and its context are not named.

Introduction

This introduction includes information about the ATE context and the concept of mainstreaming evaluation. The section on ATE provides background information to help the reader get a feel for the broader context those centers share as a part of the ATE program. The introductory section on mainstreams of evaluation further develops the theory of mainstreaming and will help readers understand the findings presented in the case studies.

ATE Context

Each case described in this chapter is an Advanced Technological Education Center (ATE center) funded by the National Science Foundation
(NSF). ATE grants come with very few specifications about how centers must organize themselves. One specification requires that the center be affiliated with a college or university that acts as fiscal agent. The college receives the grant money, and, as a result, “has primary responsibility for general supervision of all grant activities and for notifying NSF of significant problems relating to research misconduct or administrative matters” (Cooley, 2004, p. 47). Typically, grant staff are employees of the college, referred to herein as “host college.” A brief description of each center’s host college is presented in the context section of the case studies.

Another specification is that the center must have a principal investigator (PI). This individual is designated by the host college and approved by NSF as the primary person responsible for the center’s operation and submission of required reports. He or she takes the lead on the technical and scientific direction of the project and is responsible for “the conduct of the research or educational work, the publication of results, and is expected to provide technical leadership to the project whether or not any salary is provided from grant funds” (Cooley, 2004, p. 47). A center may also have any number of co-principal investigators (co-PIs) who share those
responsibilities. However, the PI has primary accountability for the center’s performance and use of grant funds.

The other two specifications relevant to this study are the National Visiting Committee (NVC), and the evaluation requirement. All centers who receive more than $750,000 in funding from NSF must assemble an NVC, whose job is to advise, assess, and assist the center. NVC members are chosen by the PI, usually in discussion with the ATE program officer. The PI also appoints a chair for the NVC. Membership is usually a mix of industry and education professionals with an interest in the center’s purpose. Typically, a center’s NVC will participate in an annual one or two day meeting with the center staff and selected partners. The center staff send out materials in advance to committee members for preparation. At the meeting, the center leadership and/or staff give a status report to the NVC, discussing priorities, challenges, and achievements. The committee gives advice and feedback on macro- and micro-level issues. After the meeting the NVC produces a formal, written report to which the center leadership provides a written response. Both of those reports are submitted to the ATE program officer. Any exceptions to this typical pattern of having an NVC, its composition, timing,
or other issues will be presented in the individual case studies.

As mentioned in Chapter 3, NSF requires that all centers have an evaluation plan for their work. The type of evidence required is based on the activities specified in the grant proposal and the type of center funded: regional, national, or resource. (Advanced Technological Education, 2006). PIs are expected to include funds for evaluation as part of the overall budget for their center. Most centers contract with an external evaluator who provides this service. This person may be internal to the center, a faculty member at the center’s host college who does not work for the center, or someone external to both the center and the college. The most common type of evaluator among centers, and the kind present in all cases involved in this study, is the third type – an evaluator who is external to the center and the host college. In the four centers sampled, the evaluators have subject matter expertise in one of two broad categories: technology (usually related to the center’s area) or social science (usually related to research with human subjects). In the case descriptions, evaluators are categorized along with the NVC as required external partners. The evaluators’ basic qualifications and their relationships with centers are described in each case study.
NSF, the ATE program, and each of the four centers, like any organization, have a long list of insider language and acronyms. At the beginning of each case study, the researcher has provided a list of pseudonyms and acronyms to assist the reader in following the narrative. Some of the acronyms will appear in more than one case. Those are presented in the list below.

AAS Associate of Applied Science degree
ATE Advanced Technological Education program
NSF National Science Foundation
NVC National Visiting Committee
PI Principal Investigator
STEM Science, Technology, Engineering, and Math

Mainstreaming Evaluation

As described above in Chapters 1 and 2, mainstreaming evaluation in an organization means integrating evaluation into the daily work of staff members. In an organization where evaluation has been mainstreamed, people throughout it evaluate what they do and consider it normal. As described in Chapter 3, the four centers chosen to participate in this study were selected based on survey responses and in-person conversations that indicated they were likely to have integrated evaluation into their culture and
operations in a way that represented mainstreaming.

The variety of evaluative thinking or activities that make up mainstreaming are often not identified as “evaluation.” Particularly in the ATE context, the term *evaluation* tends to refer to summative evaluation, assessing a program’s impact on participants or the workforce. In pursuing the study of mainstreaming evaluation, the researcher had to find ways to ask about evaluative thinking and practices that stretched participants beyond that summative concept.

What evolved over the course of the site visits and the case analyses was the idea of streams of evaluation running through the organization. The idea had its origins in Picciotto’s (2002) discussion of “the mainstream” in an organization being comprised of diverse views and competing beliefs, which, like a river’s undertow, may not be visible from the surface. Within an organization, evaluation can be like a canal running alongside a river, where the two meet occasionally but don’t really exert influence on each other. In organizations that are making evaluation part of their mainstream, evaluation is a current that runs through the whole, influencing the broader body of water like a tributary changes the currents, temperature, and flow rate of a
larger river.

Evaluation in this state of mainstreaming can be further separated into smaller streams that overlap and influence each other the way currents might in a river. Reflection on mainstreaming and analysis of the cases presented in this chapter revealed three streams of evaluation:

1. Strategy and Design. In this stream centers engage in activities that help them understand the needs of their stakeholder groups, set criteria, and create programs to meet those needs. It includes the evaluative steps of articulating criteria, setting standards of performance, and defining success.

2. Continuous Improvement. In this stream, measuring and monitoring processes provide feedback. It uses the criteria and standards of performance created in the strategy and design stream to understand organizational performance. That evaluative information is used to improve processes and performance in relation to center activities.

3. Impact for Judgment. In this stream, the organization seeks evidence of its impact on the target issue or audience. The criteria and standards are synthesized with the measuring and monitoring results to generate evaluative conclusions about performance. These conclusions are used by the center staff, the NVC, external evaluator, and NSF to make decisions about the center, its activities, and programs. They also may be used to reshape criteria and standards, or determine that the kinds of measures being used are incorrect.

An organization that mainstreaems evaluation will have evaluation activities in all three streams, though they might not have started out with
activities or systems for all three. As mentioned in Chapter 1, mainstreaming is an example of equifinality: “a characteristic final state from different initial states and in different ways, based on a dynamic interaction in an open system attaining a steady state” (von Bertalanffy, 1995, p.46). Versions of Figure 13 will be used to illustrate the progression of each stream within an organization from its inception to its current state. In addition, the research conducted in this study will explore and refine their descriptions and definitions.

![Figure 13. Streams of Evaluation](image)

Analysis of the cases in this study further revealed that a center may be at a different developmental stage in each stream of evaluation. In his early writings on mainstreaming, Sanders (2001, 2002) proposed that mainstreaming evaluation takes place in five stages within an organization:

- Awareness – members hear about the importance of evaluation
- Compliance – members conduct or participate in evaluation because it
is required
- Obligation – members feel guilty when evaluation is absent or perfunctory
- Desire – members ask for evaluation
- Leadership – members plan, organize and do evaluation on their own initiative, with organizational capacity and structure to support evaluation evident

This progression is visually depicted in Figure 14. For each case presented in this chapter, the streams and stages terminology will be used to summarize the center’s mainstreaming history and current state.

Outline of Case Studies

Each case study consists of two major sections: a description of the center and a discussion of mainstreaming evaluation at the center. The center descriptions include the organization’s purpose, context, partners, activities,
and staffing. The discussion of mainstreaming evaluation includes a brief summary of the center’s evaluation history and a discussion of the organizational factors that support it and the processes and systems that sustain it. The case studies are not intended to be a full summary or description of all the activities, relationships, and work of these four centers. Rather, each is a synthesis of information from interviews, documents, observations, and websites with the criteria for the study, i.e., how each center uses evaluation, and the organizational factors that influence that use.

Case Study: IT-Tech

The site visit to IT-Tech took place December 9-11, 2009. The researcher was able to personally visit all three of the partner institutions for the center. Before the site visit, the researcher listened in on part of a conference call with the center leadership staff. During the site visit, 15 people were interviewed, seven in person, six in two focus groups, and two by phone. After the site visit, an additional seven people were contacted in six phone interviews, for a total of 17 contacts with 21 people. Participants from 11 of the research contacts reviewed, approved, and returned the interview notes to the researcher for a 65 percent validation rate. Interviewees included: (i) the PI
and two co-PIs; (ii) three grant staff members; (iii) four faculty and one administrator from the host college; (iv) the current external evaluator; (v) three National Visiting Committee members; and (vi) four faculty and three student participants in center activities. Further information for the analysis came from documents, the researcher’s observations, and the center’s website.

Center Description

A variety of IT-Tech staff, partners, and partner organizations are included in this case study. Their pseudonyms, titles, and a description of commonly used acronyms (as applicable) are presented in Tables 17 and 18 to help the reader follow the description of the center and its mainstreaming effort.

Table 17

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northtown College</td>
<td>Host College of IT-Tech</td>
</tr>
<tr>
<td>Vargas Community College</td>
<td>Home college of PI Brunner</td>
</tr>
<tr>
<td>Middle State University</td>
<td>Home university of Co-PI Keller</td>
</tr>
<tr>
<td>Urban Community College</td>
<td>Home college of Co-PI Salazar</td>
</tr>
<tr>
<td>Alexis Brunner</td>
<td>Principal Investigator</td>
</tr>
</tbody>
</table>
Table 17 – Continued

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hattie Silver</td>
<td>Director</td>
</tr>
<tr>
<td>Stephanie Plum</td>
<td>Program Manager</td>
</tr>
<tr>
<td>Dan Keller</td>
<td>Co-PI</td>
</tr>
<tr>
<td>Mario Salazar</td>
<td>Co-PI</td>
</tr>
<tr>
<td>Kelli Tyler</td>
<td>Program Assistant</td>
</tr>
<tr>
<td>Paul Denton</td>
<td>External Evaluator</td>
</tr>
<tr>
<td>Donald Grandon</td>
<td>Director of Engineering, Northtown College</td>
</tr>
<tr>
<td>John Basil</td>
<td>Connections Instructor</td>
</tr>
<tr>
<td>Connections</td>
<td>IT-Tech’s Summer Faculty Development Workshop</td>
</tr>
</tbody>
</table>

Table 18

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Institution/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATE</td>
<td>Advanced Technological Education Program</td>
</tr>
<tr>
<td>BAC</td>
<td>Business Advisory Committee</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>PI</td>
<td>Principal Investigator</td>
</tr>
</tbody>
</table>

Purpose and History

IT-Tech was funded as an ATE Regional Center in 2004 based on the work of two previous ATE project grants. The center was established to
address the need for qualified technicians “who can design, build, test, secure and troubleshoot communication infrastructure and devices in the convergence technology arena, both for enterprise and home markets.” IT-Tech has partnered with education institutions, business, and industry to achieve this mission. As the youngest of the centers in this study, it has received two ATE center grants for a total of approximately $3.5 million. The current grant expires in August 2011. The center engages in activities in pursuit of its four goals: (i) program improvement to meet workforce needs, (ii) professional development for educators, (iii) recruitment of underserved and underrepresented populations into the Information Technology (IT) field, and (iv) capacity building and dissemination.

**Context**

IT-Tech is housed at the main campus of Northtown College, located in an outlying suburb of a large metropolitan area. A county-based community college, it has five campuses, serving 45,000 credit and continuing education students and offers more than 100 degree and certificate programs. The center’s office is located in the classroom building that also houses the IT program and faculty offices. The center occupies a small (12’ x 18’) interior
room with four desks, one each for the full-time center director, full-time program manager and part-time program assistant, and a spare. No cubicles or dividers separate staff members’ work spaces.

The center is deeply engaged with Northtown College, despite the fact that the PI works full-time for another college out of state, and the two full time staff members who are on campus are not faculty, and, in fact, not educators. The center has strong support from the current provost, with whom the PI has a conference call twice a month. The Director of Engineering, who is the program director for the academic program developed by IT-Tech, is an advocate and makes time to attend national conferences with the center staff. In addition, faculty from Northtown interact regularly with the on-site center staff, participating in meetings with industry and professional development workshops.

The IT industry is a growing, dynamic field and a critical contributor to the regional economy of IT-Tech. After an industry downturn in the region in the early 2000s, jobs and community college enrollment in IT are on the rebound. At the time of the research visit, half a million technology jobs existed in the area around Northtown College, with a forecasted need for as
many as 1,400 convergence technicians over the next five years. The IT and communications industry served by IT-Tech is dynamic and fast-moving; technology and knowledge that was cutting edge five years ago is obsolete today. To match that expansion, industry employers are looking for technicians with multiple skill sets including Web development, programming, security, and database design. IT-Tech’s intention is to recruit and equip technicians with that training through a variety of center activities.

Activities

IT-Tech’s activities are all related directly to the center’s goals, which are stated above in the purpose and history section. For curriculum development, the center engages with its Business Advisory Committee (described further in the Partners section below) to create convergence IT courses as well as knowledge and skill guidelines for convergence technicians. An innovative result of this partnership has been the development of two “case based” courses where students solve convergence problems developed by industry experts. To get students into those courses, the center hosts a variety of recruitment events and activities designed to generate interest and rehab the image of IT professionals. Several of these
events are targeted specifically for women and Hispanics.

To facilitate faculty professional development and dissemination of materials, IT-Tech offers two programs. Colleges that sign up for the “Mentored College” program receive a variety of benefits. Mentored Colleges have access to curriculum developed and pilot tested by the center as well as consultation with IT-Tech faculty on utilization of those curriculum resources. Mentored Colleges also receive guidance, in the form of resources and consultation, on how to adapt IT-Tech’s model of operating. IT-Tech staff mentor them on developing a degree and certificate program in convergence technology, which includes determining a need for convergence technicians, establishing a business advisory council, defining skills, addressing a skills gap (typically through curriculum developed by IT-Tech), marketing their program, and recruiting students. In addition, faculty members from Mentored Colleges receive funding to attend the center’s annual professional development conference called “Connections.” Connections is a weeklong event, held at Northtown, where educators can learn about new trends in IT technologies and walk through courses developed by the center with an experienced instructor. Through the Mentored College program and the
Connections event, IT-Tech provides both professional development and materials dissemination.

**Partners**

IT-Tech has positioned itself to meet the continually developing needs of its industry through several external partnerships. First and foremost is its Business Advisory Committee (BAC), a group of more than 70 representatives of small-, middle- and large-scale businesses that operate in the region. A key innovation has been the inclusion of futurists, people who study patterns and trends in both the industry and the broader socioeconomic context. Another regional external partner is InterLink, a regional agency that does workforce forecasting. InterLink provides targeted occupation information to school and college districts based on a labor market survey and other change drivers in society and the economy.

The center also has two ATE-typical external partners, an NVC and an external evaluator. The NVC includes representatives from regional industries, local education entities, and the PI from another ATE center – a common composition for an ATE NVC. The industry representatives are also active participants in IT-Tech’s BAC. Two members are worth special
mention. One represents a worldwide collaboration of colleges and universities involved in IT education. The other is a socioeconomic futurist. This combination allows the NVC to bring a unique external perspective to IT-Tech.

The center’s external evaluator, Paul Denton, is an independent consultant who serves several ATE projects through his firm. He is a subject matter expert in electronics and communications technology, with extensive experience as a community college faculty and administrator. Previously, he was an associate director for an ATE grant at another institution, but now his business provides support services, including evaluation, to technical education programs. He has served as the external evaluator for a variety of ATE projects and centers.

**Current Staffing**

The center’s primary staff consists of both full- and part-time members. The organizational chart for the center’s primary employees is presented in Figure 15. The PI and two co-PIs are all part-time and off-site. The PI, Dr. Alexis Brunner, is the Vice President for Academic Affairs at Vargas Community College, located in a different state than IT-Tech. Brunner has
negotiated with Vargas, Northtown and ATE to continue to serve as PI for IT-Tech.

Both co-PIs are faculty members at postsecondary institutions in the same metro area as IT-Tech. Dan Keller is a senior lecturer and undergraduate advisor at Middle State University, which has created a Bachelor of Arts in Information Technology program through its involvement.
with IT-Tech. Mario Salazar is a faculty member at Urban Community College, located in the city center. Both partner institutions are within a 40-mile radius of Northtown’s campus.

The day-to-day work of the center is handled by three staff members who work on-site in IT-Tech’s tiny main office on Northtown’s campus. The full-time director, Hattie Silver, and full-time program manager, Stephanie Plum, handle the administrative and programmatic work of the center, and are supported by a part-time program assistant, Kelli Tyler. All three are employees of Northtown College.

Due to Brunner’s PI-at-a-distance arrangement, IT-Tech has an unusual supervisory situation. When IT-Tech began, Brunner was a dean at Northtown and Silver’s direct supervisor. Since her departure, Silver reports to Northtown’s Dean of Business, Information and Engineering Technologies. So, while Brunner provides feedback to the dean during Silver’s annual review, she does not have access to personnel information for any of the center staff. As a point of professional courtesy, Silver informs Brunner of sick leave and vacation.

Several members of Northtown’s faculty serve as supplemental staff
for the center. They participate in annual curriculum development meetings with BAC members, are responsible for changing existing courses, and create and pilot test new courses for the program. Some also teach sessions at the Connections conference, based on courses they developed through IT-Tech and taught at the host college.

Mainstreaming Evaluation

As Figure 16 shows, IT-Tech had a strong start in all three streams of evaluation, which can be attributed to Brunner, the PI. Brunner has a personal orientation to needs-based programming accompanied by continuous improvement and external evaluation, which will be further discussed in Leadership and Culture, below. She extended that by hiring a director, Silver, with the same orientation, who had the skills in metrics and project management to create and coordinate data collection as part of everyday operations. Brunner completed the enculturation of evaluation by replacing IT-Tech’s original, summative-oriented external evaluator with someone who supported a more integrated approach to evaluation. Together Brunner, Silver, and the new external evaluator, Paul Denton, set about creating systems and tools to fit the strategic data needs of IT-Tech, including the
capacity for longitudinal and impact data. They have continued to refine them throughout the life of the center.

Figure 16. Streams of Evaluation at IT-Tech

The dark gray color at the left end of the arrows indicates that the organization has been at the leadership stage in terms of commitment and activity in all three streams. The darkening gradient in the Strategy and Design stream represents the center’s advancement to a stage beyond leadership, which is discussed in a special section at the end of this case. In the other two streams, IT-Tech has continued in the leadership stage, so the arrows are the same color throughout.

This section has provided a brief overview of IT-Tech in relation to mainstreaming evaluation. The following sections will describe the center’s leadership and culture in which evaluation is embedded, the staff and organizational capabilities that make evaluation activities possible, and the
systems and structures that make evaluation activities sustainable. The final sections provide an overview of the center’s current processes and activities in the three streams of evaluation.

**Leadership and Culture**

Evaluation mainstreaming has taken place at IT-Tech through the leadership of the PI, Dr. Alexis Brunner. Her experiences in both industry and academia forged a commitment to “data-informed” decision making and an orientation to continuous improvement. Her subject matter expertise in information and communication technology, coupled with her experience in academia, enabled her to create a network of personal connections and organizational systems to collect relevant data for all three streams of evaluation. The following section will describe her background, skills, and personal characteristics as they relate to the mainstreaming of evaluation at IT-Tech.

Brunner’s career has spanned both industry and academia. She held management roles in information technology companies for many years. Brunner credits a supervisor early in her IT career for her management skills and her understanding of the importance of evidence. As she described it,
This all goes back to when I was hired as a token woman manager in an IT program. They threw me into managing a critical project. I had no management experience at all, and I was the only woman, and they hoped I would fail. They gave me the pilot project assuming I wouldn’t pull it off. My boss was intent that it would work, and he showed me how to put the evidence together and he taught me lots of good skills which have carried over through everything I do.

Her business experience provides the basis for her management of IT-Tech.

As PI, Brunner instituted a project management structure for IT-Tech (further described in the Capabilities section) and hired a center director with project management experience. That approach includes the integrated value of using data as a tool for decision making. “The most important thing is to make decisions based on data – not driven by data. Data informed decisions,” Brunner said.

Her experience in academia through her PhD program and as a faculty member also provided knowledge and skills with regard to data and evaluation that she brings to her PI role. She studied Total Quality Management as part of her PhD and encountered the Baldrige National Quality Program when one of her previous community colleges was working toward the Quality Award. At that same college, she learned how to create a good BAC to ensure a close relationship between academic programs and
industry. In her work with grant-funded projects, she learned about summative evaluation, and the importance of providing evidence to stakeholder groups to show impact. In working on grant funded faculty development through Microsoft, she encountered formative evaluation, which influenced her approach to data collection. As Brunner expressed it, “I began to see how getting formative information along the way and using that information to make things better worked much better than waiting until the end.”

Brunner took the step of moving evaluation from a personal value to a part of the organizational culture when she hired the director, Hattie Silver. Ms. Silver was a manager, senior manager and, finally, director of Training and Documentation at a large IT company before coming to IT-Tech. In her previous work, she was involved in ISO 9000 quality audits and government audits and developed quality indexes for the company. She also handled project and program management. While she appreciates the value of data as evidence, she sees evaluation as a key to learning and created IT-Tech’s evaluation systems with that in mind. She said,

My philosophy has always been with assessments, you want to get information to get good decisions – course corrections, new
things on the horizon, problems that need to be addressed. I think it’s all a positive thing – sometimes assessment gets a negative reputation which I don’t agree with. For me, it’s like if you have a lessons learned after an event. What worked, what didn’t, if we did it over how would we do it differently. Our assessments are in that mindset.

The culture was further solidified by replacing the first external evaluator with Denton, who had a more holistic approach to evaluation which matched Brunner’s orientation. As she described her choice of Denton,

I worked with Paul at [another ATE center and in] consulting work – I’d known him a long time. I knew he was good at formulating the right questions, getting good data and giving information that can help us to make decisions.

Not all staff came to IT-Tech with a strong background in data collection and assessment, however. The program manager, Stephanie Plum, was hired for her people skills and brought with her a keen sense of responsibility to stakeholders from her nonprofit experience. Indoctrination into the culture of evaluation came with joining the center. Plum appreciates Brunner’s dedication to learning and improvement for the center and its participating faculty. As Plum put it, “One of Alexis’ real strengths is that she’s not lost that edge, she’s not smug. She’s worried that no one may have learned anything. So it’s a good focus as far as I’m concerned.”

With regard to personal characteristics of the leader that influence
mainstreaming of evaluation, those interviewed for this study described Brunner as smart, visionary, energetic, focused, and sharp. Her commitment to the IT-Tech, as well as her talent for administration, has been demonstrated in her academic career path. While working as the Director of Engineering at Norhtown, she was the founding PI on the initial IT-Tech ATE center grant. Since leaving her post at Norhtown, she has served at two other colleges, at the first as a Dean of Business, Computing and Career Services and now at the second as a vice president. Her arrangement with her current employer, Vargas Community College, Norhtown College, and ATE allows her to continue as PI on the center, which remains at Norhtown College. She works on IT-Tech matters during her lunch breaks and before and after hours; it is not part of her current job description at her home college.

Brunner’s personal commitment to evaluation is clear to the IT-Tech staff. They described her as “results-oriented,” always anxious to ensure that faculty were learning and implementing what they had learned at Connections and other events in their classrooms. Staff members also attributed the existing improvement and evaluation systems to her leadership. Their external evaluator recognizes and appreciates the center’s
commitment to collecting information. “Pretty much everything IT-Tech does gets evaluated, and there’s an appreciation of why it’s important to do it. I can rest assured that anything they do, there will be some data on,” Denton observed.

Brunner’s ability to communicate and collaborate with people from a variety of backgrounds also has been critical in advancing the work of IT-Tech. As the chairman of the BAC expressed it,

Alexis came out of IT… So she brings a good engineering focus. She can relate to people from business, academic and tech perspectives. She brings the ability to work with the engineering staff of a four-year school like Middle State University.

This ability has enabled Brunner to clearly communicate the mission of the center to staff, partners, and participants, through sharing the goals and objectives of IT-Tech. The result is a shared vision of the work of the center among those groups. Therefore, partners and participants see responding to surveys, participating in the BAC, and other data collecting endeavors as an essential part of advancing the center’s goal of training information technology technicians who can meet the needs of industry’s customers. It’s all part of normal operations, according to Brunner: “It has to be implemented as a part of the way you do business, not something you do
once in a while.” Staff, partners, and participants understand that the sharing
of information is essential to the work of the center to which they are
committed.

Sharing information “up” – i.e., with funders and other key
stakeholders – is another of Brunner’s priorities and skills. In terms of the
center’s sustainability, she also knows that different audiences require
different evidence:

We know what kind of information is persuasive to different
stakeholders. NSF, the dean, upper administration need to
know enough to be satisfied and stay out of our way so we can
be creative. I’m very clear about what kind of evidence is
effective to our stakeholder groups – and less is more. Just give
them what they need to know. A few pieces of key data are
valuable. [The Northtown dean] wants numbers because that’s
how he’s reviewed: students, graduates. And for the most part
he gets that.

An industry representative serving on both the BAC and NVC described
Brunner’s knowledge about what data are necessary for specific stakeholder
groups:

There’s a discussion about what data to gather and pay
attention to, some are totally obvious, others take discussion.
They know what they’re looking for. It’s been that way since the
day that I got there. I see a bunch of it from Alexis and Hattie.
They seemed to have a good idea of what they needed to know
to move things through. She had a good idea of what was
needed to get approval from NSF, and that was totally new to
me. I’ve never done that before. She had a clear picture about what was needed to get re-funded.

Thus, as the PI, Brunner has brought a critical set of professional experience, personal characteristics, and skills that played a major role in mainstreaming evaluation at IT-Tech. In the interviews and documents reviewed by the researcher, it is clear that evaluation as a value is deeply embedded into the culture of the organization beyond just the core staff. At IT-Tech, evaluation is part of business as usual. As Brunner summarized it,

We’re always trying to make things better… It’s a matter of how do we get the data to know what we can do to improve. I kind of presumed that everyone was doing what we’re doing. It’s not remarkable or stellar, it’s just the way we do things…If we put on something there is an evaluative piece to it.

The capabilities, systems, and structures necessary to move evaluation from value to practice are described in the next section and further detailed in the three stream sections toward the end of this case study.

Capabilities

Several capabilities, systems, and structures have enabled IT-Tech to sustainably mainstream evaluation. The project management approach translates goals into activities and objectives, which then lead to identification of information sources for all three streams of evaluation. Staff members have
clear roles with regard to those goals, objectives, and information sources and the requisite skill sets to carry out their responsibilities. They have created or appropriated systems and structures that enable them to collect the necessary information from critical sources with a reasonable commitment of time and resources. In addition, the structures they have created foster collaborative relationships with their partners, which forward IT-Tech’s mission.

**Project Management Approach**

Brunner described the project management approach as a map for achieving success. The PI, co-PIs and full-time staff articulate the goals based on information gathered from their external partners, the NVC and BAC. Then they work together to create a document that takes each goal and breaks it down into objectives, with activities and tasks for each. For each activity, the document includes columns for deliverables and evidence of impact, assignment of lead and supporting staff members, budget and other resources, current progress, and scheduled completion.

The project management process and map provide several benefits. Articulating the goals and objectives creates a shared definition of success and thus a shared vision of a desired future. Brunner summed it up this way:
The goals and objectives get everyone on the same page about what success is – mostly the objectives – because you can’t evaluate on a goal level, you have to use objectives. We use goals to create the strategic plan and then monitor the plan to check our progress.

Articulating the goals and objectives also clarifies what falls within the work of the center and what does not. IT-Tech not only resides on the Northtown College campus, but the college also acts as the fiscal agent of the center. As a result, the boundaries between the two entities can become blurred, particularly in areas like recruiting students. Having a document that states the purpose and objectives of IT-Tech as a separate organization enables it to draw boundaries as needed, so the center isn’t drawn into Northtown projects that don’t relate to its purpose.

Another benefit is that the project map links all center activities to the goals of the center, as articulated in its ATE proposal, which keeps the staff on track. Plum, the program manager, described referring to the goals and objectives constantly as they planned activities and put them on the project map, particularly in the early stages of a new grant cycle. Silver, the center’s director agreed, calling the goals “foundational.” However, mapping to the goals is not the end point, but a way to make sure the right things are put in place to achieve the goals. Plum stated, “Within a year and a half to two years
we won’t be [referring back to the goals] as much because they’ll have been built into other processes.” A third benefit of the project management approach is that it requires some thought about what will constitute evidence of success even before staff begin planning an activity. Rather than creating an elaborate evaluation plan in the early stages, having an idea in mind about what evidence to look for enables the staff to be flexible with regard to methods and approaches for evaluation. As Silver described it, starting with the goals,

…leads to other kinds of questions or assessment ideas. We start with a plan about how we’re going to assess our progress and then sometimes we play it by ear, adapting as we go – it’s as much art as science.

Silver and Denton, the external evaluator, work together to create surveys and other instruments to collect data for improvement and evidence of impact based on achieving and documenting success as defined by the goals.

A final benefit of the project management approach is the clear delegation of responsibility and authority for specific tasks on the map. This creates a shared mental model of who is doing what, enabling staff to coordinate their efforts effectively. It also makes clear who is responsible for collecting and analyzing data and who just needs to pay attention to the
results.

Overall, the creation of and continuing attention to the project map creates a shared definition of success and how it will be achieved through objectives and their underlying activities. It provides a platform that transforms IT-Tech’s goals into criteria that are then used to shape evaluation questions and efforts for both formative and summative purposes. The clear delineation of authority and responsibility allows for a coordinated effort toward those goals, which is particularly important for a geographically dispersed center staff. Finally, IT-Tech’s firm goals, flexible approaches, and objectives make it possible for the center to adapt to the changing industry needs, while the structures in place to communicate with industry make it possible to understand what those needs will be.

Roles and Skills

Brunner has recruited staff with diverse backgrounds and skill sets, which are directly reflected in each person’s role in IT-Tech’s operations. In fact, the variety of backgrounds and abilities has made creation of roles and delegation of duties and tasks much easier because leadership on a particular activity often falls directly into a staff member’s skill set. Co-PI Keller
described it as

…sort of natural selection – everyone gravitates to what they’re good at. After a bit of time I know what people are good at and what they like to do and they know that about me as well. So we’re able to distribute the work and it’s not a burden on anyone. We’re willing to do more, but no one has to.

IT-Tech has a strong advantage in having three on-site staff members who do not have faculty or teaching obligations, which frees them up to handle the programmatic and management aspects of the center. All three of the on-site staff came to the center via different career paths. Silver, the director, has a business background and brings expertise in project management and communication. She is responsible for center operations, creating evaluation tools like surveys, analyzing data, compiling and reporting findings to Brunner and the other staff members, as well as overall day-to-day management of the center. Plum, the program director, has years of experience in managing programs for corporate and nonprofit organizations. She handles programmatic activities, recruitment, and logistics for events, and distributes surveys online and at recruitment events. As the designated “people person,” Plum also observes classes and interacts with participants to get informal feedback on center activities. The part-time program assistant, Kelli Tyler, had previous employment in the airline
industry, so she brings a productivity focus and skill set to her support role for the two full-time staff members. All three women agreed that although their roles are clear, they all pitch in to help on whatever is on the docket for the center.

The off-site staff, including the PI and two co-PIs, all have subject matter expertise in IT. Brunner’s role as PI includes overall center leadership and decision making, as well as national networking. Keller, university co-PI, brings curriculum development skills to the table, along with experience and enthusiasm for running high school recruiting events. He takes the lead on youth summer camps and technology experiences. In addition, he worked with Middle State University to create a Bachelor of Arts in Information Technology as a career path for IT engineers and technicians. Salazar, the co-PI at Urban Community College, also brings curriculum development skills. As a Hispanic, he is taking the lead on Hispanic recruitment for IT-Tech.

All staff members share an evaluative skill set that enables mainstreaming and makes it sustainable. As demonstrated by the project management approach, they think in terms of objectives and describe success, thereby converting the center’s goals into criteria for evaluation of potential
and ongoing activities. They do rely heavily on Silver’s ability to create systems for data gathering, collect information and interpret the results. Yet, while not all of them deal directly with evaluation activities and information collection, they are able to understand the results as presented and make changes to the programs based on what they’ve learned from it. These evaluative skills, coupled with clear roles and their diverse backgrounds, combine to make the IT-Tech staff a high functioning team.

**Collaboration**

Building collaborative relationships is another key capability of IT-Tech in mainstreaming evaluation. Through its partnerships with industry and education, the center is able to appropriately direct and improve its efforts, as well as gather data for summative evaluation. The relationship center staff have with the external evaluator, described above, is a typical example of the type of collaboration at IT-Tech. That partnership started with a personal relationship between Brunner and Denton, who met through another ATE center. Another example of a partnership based in a personal relationship is the collaboration between IT-Tech and InterLink. Silver and the executive director of InterLink and have gotten to know each other well,
and, as a result, the executive director participates on the center’s BAC and collaborates on efforts to develop surveys. Survey findings and other information are shared between the two institutions to their mutual benefit.

The choice of partners is critical to the quality of information the center can gain through those relationships. However, with IT-Tech’s regional focus, personal relationships can only go so far. As a result, IT-Tech has taken steps to ensure that partners are chosen wisely. Selection criteria for the types of industries the center seeks for membership on the BAC are posted on its website. In addition, the BAC chair tries to maintain a balanced representation from companies of different sizes. Educational institutions interested in the Mentored College program are selected based on criteria also posted on the website, which are designed to increase the likelihood of positive impact from the relationship.

Once an industry representative or college becomes an IT-Tech partner, the real relationship building begins. The center staff actively solicit information from their partners through the systems and structures described below and the various activities discussed in the three evaluation stream sections. Meeting notes are disseminated to all participants, and pertinent
survey results are shared. Based on that information, the IT-Tech staff make visible changes to the center’s direction, courses, and activities. Members of the BAC and Mentored Colleges who were interviewed said that this dissemination of documentation and results, along with the perceived changes, encouraged them to continue to contribute information. Mentored College representatives who were interviewed also pointed out that the access to methods, materials, and training as part of the collaborative relationship made it a fair trade for them to collect enrollment and other summative data IT-Tech needs for its annual reporting.

IT-Tech also takes collaboration a step further. Rather than creating exclusive relationships between its staff and industry and its staff and educators, it has created venues that enable direct relationships between industry and education. Faculty from both Norhtown and the Mentored Colleges are invited to participate in the BAC conference calls. Mentored Colleges are required to set up their own BAC appropriate for the needs of their region as participants in the program. Faculty at Norhtown College participate in the annual meeting with IT-Tech’s BAC, mapping knowledge and skills to the academic program courses. Mentored Colleges receive
training in that process as well, so that they can use their BACs to shape course work for their own institutions. The flow of information through these collaborative relationships is shown in Figure 17. The size of the arrow indicates the size of the flow of information.

These collaborative relationships, deliberately created based on mutual needs, common purpose, and a shared vision of the future of IT education, have a direct impact on the breadth and type of information available to IT-Tech. For instance, the August 2009 quarterly BAC conference call had 29 participants, including 10 industry representatives (each from different companies) and nine community college faculty representing five colleges from four states. IT-Tech also has a high response rate for event evaluation surveys (during and after events) and e-mail solicitations for information—like training and skill needs. It appears that engagement with the center and the strength of the collaborative relationships increase the number and quality of responses to requests for information. The result is an integration of the three streams of evaluation into the relationships, where partners on both sides pay attention to meeting needs, continuous improvement, and evidence of impact.
As discussed above, all three streams of evaluation are incorporated into the project management approach IT-Tech uses. That approach, coupled with the small staff and the fact that evaluation is a part of the center’s culture, has meant there was no need to create formal evaluation policies at the center. However, staff use a variety of systems and structures to make sure that all three streams are attended to, the evaluation activities can be sustained with the center’s limited budget and staff, and the results of data...
collection are used to inform the work of the center.

**Zoomerang**

One of the primary innovations the center uses to ensure the sustainability of its evaluation practices is Zoomerang. This survey platform enables the staff to create instruments online, and e-mail them directly to the desired respondents. Zoomerang collects the results electronically and instantly creates tables and graphs of responses. Silver used it in her previous job and brought it with her when she came to IT-Tech. She recalled,

> When I came and they were doing a paper survey for Connections – it was such a hassle, and there were fewer numbers of surveys. Automating has allowed us to broaden the scope, more people, more questions – also survey more activities or kinds of things. It’s not time consuming. There’s more consumption of time on building the survey and making sure you’re asking the right question. Then we can spend more time on analyzing the data and what does it mean? Before it was doing all the stuff with numbers that took the time. Two people would take the paper survey, 20 questions, 100 surveys – one person reads and one makes tick marks on a count sheet. That takes a lot of time. We had 105 participants last summer [at Connections]; we couldn’t do it that way.

The ease of use, the instant results, and the reasonable annual subscription price make Zoomerang a key tool in systematizing evaluation at IT-Tech. When asked about the amount of time dedicated to collecting and
analyzing data, Plum and Tyler agreed that they spend less than five percent of their time on it. Silver said she spends more time because she develops surveys. Overall, the three agreed it was manageable because of the online survey tool. Details on how Zoomerang surveys are used for all three streams of evaluation will be presented in the evaluation stream sections of the case study.

**Scheduled Communication**

Scheduled communication that includes evaluation as part of the agenda is another key structure for mainstreaming evaluation at IT-Tech. On the quarterly BAC conference calls, industry trends are a standing agenda item. Part of the two-hour meeting is dedicated to evaluating what’s happening in industry, distinguishing trends from fads to determine what is worth following, and discussing what curriculum or courses need to be developed to address those needs. A five-hour annual meeting of the BAC is dedicated to a review of the knowledge and skills required for IT professionals and how they are presented or need to be presented in current community college courses. Mentored Colleges participate in semiannual meetings – one via conference call and another in person. Part of that time is
dedicated to understanding the needs of the colleges and how IT-Tech can enable them to advance IT education. The core center staff have a biweekly conference call, in which they discuss a variety of evaluative issues, including feedback from event participants, industry trends, student evaluations of courses, and input from participants about topics for future events. In those same meetings, the group discusses whether changes or adjustments need to be made and who will be responsible for getting them done.

**External Requirements**

IT-Tech’s external requirements for evaluation information have also contributed to mainstreaming. The annual meeting of the NVC requires that the center staff prepare presentations that summarize their activities and impacts over the past year. The NVC’s report on IT-Tech and the center’s response provide an opportunity for an external perspective and reflection on it by the center staff. The ATE annual survey requests a variety of information including enrollment numbers, which can then be used to describe program impacts with evidence that Northtown College and the Mentored Colleges find valuable.

The requirement of an external evaluator for the center presented
another opportunity for an evaluation resource. IT-Tech has maximized that opportunity and created a partnership in which Denton is on board with the center management, coordinating effectively with staff on evaluation design, data collection, and analysis. He interacts frequently with Silver to help with the wording of questions, creation of surveys, and matching evaluation to the center goals and objectives. In addition, Denton participates in conference calls with the leadership team and the BAC and attends conferences and meetings.

**Strategy and Design Stream**

This section presents key areas in which IT-Tech engages in collecting information for the purposes of strategy and design. Three areas are highlighted: (i) evaluating the center’s purpose and activities relative to industry trends and job forecasts; (ii) evaluating the academic courses in relation to the knowledge and skills needed to address industry trends; and (iii) evaluating possible faculty development topics for Connections. These are not the only areas in which information is gathered for this evaluation stream; however, those described here represent the innovations and practices that demonstrate the mainstreaming spirit of IT-Tech.
IT-Tech’s Purpose

For evaluating IT-Tech’s purpose, the center taps into industry through the industry representatives on the NVC and BAC as well as its relationship with InterLink. This exchange of information happens primarily through the regular meetings discussed above, with occasional surveys and informal conversations. The focus is on trends and job forecasts with the intent of keeping the center aware of what’s coming, so the staff can adapt their overall purpose and activities accordingly.

Evaluation of trends happens at two levels. First the industry experts use their own criteria to recognize trends in their regular worklife. As one BAC/NVC member described recognizing the wireless and green IT trends, “…when I talk with customers about it I can see that they resonate… You see that reaction a couple times and know that it’s an important topic that’s going to be addressed for a long time.” The second level happens in BAC conference calls. Because those present represent a variety of industries with different customer bases, when several of them mention the same trend, then the BAC discusses whether or not the trend “has legs,” (i.e., is it something to which the IT-Tech needs to pay attention?).
The quarterly BAC meetings enable IT-Tech to get information about possible trends at a pace suitable for the fast moving IT industry – where, for instance, cell phones are now used for taking pictures, surfing the Internet, and sending text messages, rather than just as phones. In addition, collecting data at multiple points throughout the year makes it possible to track ideas across time and thereby identify which are really trends. The process results in a shared mental model among faculty, staff, administration and industry, which allows the center to keep aligned with industry through knowledge of present needs and future trends.

The center’s recent shift in strategic focus provides an example of this evaluative system and its benefits. Silver described the beginning of the process this way:

[The BAC] quarterly meeting has a standing agenda item of industry trends. We go around the virtual room and ask people. Green IT, cloud computing, and information storage management all started popping up there… If it just comes up once we don’t necessarily look for ways to address it, but if we see it at two or three meetings across time, then we know it has some legs as an idea or a trend. So when we heard about green IT for a year, then we started investigating.

According to an NVC/BAC member, Brunner pushed back on green IT with the BAC, saying that it wasn’t related enough to convergence technology
to fit in with the center’s mission. Despite her lack of conviction, the green IT issue was presented to the NVC, which confirmed that it was an important trend for the center to follow. As one BAC/NVC member summarized it, “The futurists...are kind of funny. They said green IT is a fad like the Internet and the World Wide Web.” In the end, Brunner and her staff were persuaded that “green” needed to be incorporated into the center’s mission. As a result, the second grant proposal for the center was written and funded with a focus on “Green IT” added to the existing convergence platform.

**Academic Courses**

The second evaluative purpose within Strategy and Design, after identifying industry trends, is determining what skills and knowledge technicians need to meet industry demands and how academic courses can address those. To this end, IT-Tech taps members of the BAC to determine which skills and knowledge students need to work in the current and future industry environment. Every year, the center uses the PCAL 7 method with the BAC and faculty to facilitate the process. First, the BAC does a job skills validation process, identifying the important skills they require in convergence technicians. They start with an existing list of job skills and
knowledge, to which they add, remove, and/or prioritize items. Next, the faculty and administrators then map those prioritized skills and knowledge to existing course outcomes. When gaps between the two are identified, the group creates a curriculum strategy to address them, which may include updating existing courses with new modules, adding new courses, and/or recommending on-the-job training. According to one faculty member, the map generated by PCAL 7 is also critical to determining the depth at which topics need to be covered. Some can just be mentioned; others need to be “pounded in.” Essentially, the PCAL 7 crosswalk map creates a shared mental model of the skill outcomes expected from courses and the overall skill outcomes of program graduates.

While this process helps to adapt existing courses for better alignment with industry needs, it also has spawned the development of several courses, some of which are so innovative no textbooks exist for them. The two case study classes created out of the PCAL 7 process provide good examples. These courses were designed to give students experience in solving real world problems in the safety of the convergence lab. The courses are based on simulations of Small Office Home Office and the Enterprise network business
situations, developed in partnership with BAC members. Students use the lab to try out different solutions and present their best efforts to a panel of industry representatives for feedback. The simulation projects become part of students’ portfolios, making them more marketable for employment in the industry. One student described the value of the process this way:

Before [coming to Northtown], I worked at a different company. Here I can see it and get my hands on it and play around without worrying about bringing down the whole company. You get the freedom to screw up and not worry about losing your job over it.

The high frequency, strategic interaction with industry that provides the base for both the preceding evaluative activities represents an important shift in the relationship between community college faculty and industry. One Northtown faculty member described the shift in terms of information sources. Prior to IT-Tech, the occasional industry employee taking a class was his primary source of data about what industry was seeking from community college graduates. With the ATE grant, he now gets information directly from a quality source – industry leaders. He said,

By meeting people from industry I can stand up in the classroom and say, “I know John in the business and his people have to know this and be proficient in this,” – and that’s what the students need to be proficient in.
The external evaluator, a veteran of community college education and administration, pointed out that the strategy behind the approach also varies from the typical model of education’s interaction with industry:

This is in contrast to the old [vocational education] model where the teacher gets together for coffee and donuts with local industry representatives and they talk about updating equipment. It’s never anything strategic, it’s just about content. IT-Tech has gotten their BAC to answer immediate skills questions as well as strategy – what kind of skills will you need in the future, where do you see the industry going, what will your company be doing in two years?... [It’s] a new way to conduct relationships with business and industry, beyond donuts.

This approach is so essential to IT-Tech’s operation that it is part of their dissemination to Mentored Colleges, which is further described in the “Disseminating Evaluation Mainstreaming” section toward the end of this case study.

Topics for Connections

Connections is the main faculty professional development event for IT-Tech, held annually on Northtown’s campus. The event includes training in course materials developed through the center and information sessions on topics of interest to faculty. Seven months before the event, the center sends out a survey via Zoomerang to all previous participants in the event, asking
them to rank a list of possible topics in order of their interest. When the results are in, seven months before the event, the director compiles the results, and they are discussed at a biweekly team meeting. The input from possible participants is used to create the learning tracks offered at Connections. The ample lead time allows the staff time to find and vet faculty to teach the courses. The process also raises awareness about the event so potential participants can get it on their calendars and ensure that the topics offered will be in line with their interests.

In the Strategy and Design stream of evaluation, IT-Tech gets information to shape the center’s purpose, the academic courses at Northtown, and the professional development tracks at Connections. The staff use a variety of tools and sources including the BAC, Zoomerang, and PCAL 7. Figure 18 summarizes the evaluative processes and results that are part of IT-Tech’s Strategy and Design Stream.

Continuous Improvement Stream

The program staff at IT-Tech value the information they get from various sources that enables them to continuously improve their activities. As Tyler, the program assistant explained it, “The data that comes in is
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<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
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<tbody>
<tr>
<td>center purpose</td>
<td>EAC, NVC, InterLink</td>
<td>industry trends</td>
<td>Center staff, faculty, and administrators consult with industry representatives at frequent intervals → notes and reports are e-mailed out to participants</td>
<td>• center kept up to date on emerging trends • external partners broaden the center’s imagination about future IT industry scenarios • shared mental model among faculty and industry about future • exposure to this BAC model for mentored colleges</td>
</tr>
<tr>
<td>academic courses</td>
<td>BAC</td>
<td>Knowledge and skills</td>
<td>Job skills validation with industry → PCAL 7 crosswalk conducted with Northtown faculty using that information → crosswalk analyzed to determine gaps between existing academic courses and industry needs → changes made as needed</td>
<td>• skills-course crosswalk map depicts the depth at which skills and topics need to be addressed in specific courses and allows an overview of entire program • faculty able to adapt or create courses based on the map • curricula aligned with industry’s current and future skill needs • faculty engaged with industry • continual adaptation and creation of courses is normal • early advertising for the event • professional development courses offered are based on participants’ needs and interests • seven month lead time allows time for staff to create learning tracks and vet and hire instructors</td>
</tr>
<tr>
<td>Connections topics</td>
<td>participants</td>
<td>Ranked topic choices</td>
<td>survey distributed seven months before Connections → solicits faculty ratings of topic areas for professional development → staff use rankings to choose professional development courses for Connections</td>
<td></td>
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important – it’s our feedback on how we’re doing. Whether it’s a focus group or someone who was at a conference, it’s how we know whether we’re working or not.” The program manager, Plum, agreed, “Information from events helps us decide if there are things we should never do again, and then [which] things are good.” This section presents key areas in which IT-Tech engages in collecting information for the purposes of continuous improvement. Three areas will be highlighted: (i) the Connections event, (ii) Mentored College program, and (iii) academic courses. These are not the only areas in which information is gathered for this evaluation stream; however, those described here represent the innovations and practices that the research participants cited to demonstrate IT-Tech’s mainstreaming of evaluation.

**Connections**

All four of the centers that participated in this study use end of program surveys to improve events the next time around. IT-Tech, with the use of Zoomerang, has added rapid feedback to the Connections event, which enables staff to make improvements to the event during the event. Originally, as Brunner described it, they were using an end of event survey adapted from a training package she had used at another college. However,
adapting the items turned out not to be enough. She recalled:

It was an a-ha moment several years ago. We went through a Connections thinking it was great. We got to the end [of event survey] and a few people had complaints that could have been easily handled if we’d just known about them.

As a result, IT-Tech developed and added an end of day survey on the first and third days of the five-day training event. They call these short surveys “temperature checks” because they include questions about the room temperature, problems with the food, access to handouts, whether the session is delivering what participants expected, and feedback for the instructor.

Silver said, “On a first day survey, we find out that an instructor talks too fast, the room is cold, I didn’t get a spoon at lunch – we’ve gotten all that.”

Using Zoomerang means that the center staff get the results instantaneously, so they can address things like room temperature and catering issues directly. The third day survey is a follow-up to make sure the logistical issues have been addressed, and to see whether the instructors have adapted based on participant feedback. This “just in time” use of survey feedback has enabled IT-Tech to take continuous improvement to a new level, made feasible by the use of the online survey platform.

Also as a regular part of Connections, IT-Tech staff members move in
and out of classrooms throughout the event. This practice not only emphasizes the center’s commitment to making the conference a great experience for participants, but also helps build relationships between center staff, instructors, and participants. Staff members are able to handle quick fixes and make first-hand observations about instructors and any misbehaving participants.

The combination of rapid feedback surveys, staff observations, and the end of program survey proved to be a critical asset at Connections in 2009. IT-Tech contracted with Dr. John Basil to teach programming mobile devices at Connections. Basil is a faculty member at Middle State University and came to IT-Tech based on the recommendation of his colleague, center co-PI Dan Keller. Planning for Basil’s course at Connections revealed a difficulty: Basil wanted to use a Mac platform, which IT-Tech couldn’t support. Once the conference got under way, participants’ Monday survey responses showed that Basil’s teaching style did not meet the needs of his audience - he was used to teaching undergrads, not faculty. On Tuesday, the IT-Tech leadership staff talked with him, showed him the survey feedback, and asked him to adapt if he could. Plum observed his class on Wednesday and talked to his
faculty participants as well. She found out (a) he wasn't adapting very well, and (b) there was a disruptive person in the class. Plum described what happened next:

So he and I talked about it – he was under contract. We had those systems in place with the evaluations, plus my systems of being in the class to observe, and the network with people to get other information. So we sat down on Thursday with him…to see if he was taking this personally, was he going to take it out on the class. What I got was that no, he had a tough situation. After that, Alexis sat down with him on Thursday to give him some coaching on how he could have done things differently. He took that very well and finished teaching the class, but said he would never teach [faculty professional development] again.6

The responses from Basil’s students on the end of program survey provided further diagnostic information for the staff. Basil’s overall instructor ratings were low; however, respondents also indicated that the platform and pre-requisites for the class weren’t clear. As a result, some thought the information conveyed was too difficult, and others were frustrated by the elementary nature of the course. Other comments indicated that the disruptive student had negatively impacted the learning environment for the whole class. The evaluation systems in place, along with the staff’s attention,

6 Dr. Basil has continued to work with IT-Tech on other activities.
reflection, and interpretation led to three lessons for the next Connections event, according to Plum:

1. Instructors need to be briefed on the difference between teaching teachers and teaching students and given some guidance on how to meet the needs of a faculty professional development audience.

2. Course descriptions need to be clear and include the platforms and devices that will be used.

3. It is possible to behave badly enough that your permission to attend Connections will be revoked.

She has made notes on these data-based lessons for use in planning the 2010 Connections event.

The IT-Tech staff and Connections instructors also get feedback for continuous improvement from two other, more traditional, sources: an end of event survey and an individual track survey for participants in each class. Silver compiles the results and distributes them to the center staff and to each instructor. The IT-Tech staff review the survey report and make changes for the following year based on the feedback. Since Silver also provides the information to instructors, those who teach every year have the opportunity to make changes to their courses.

Mentored College Program

With regard to the Mentored College program, IT-Tech has created a
system that enables faculty to learn from one another to improve their IT programs. While IT-Tech offers mentoring, guidelines, and other information to its Mentored Colleges, the center also offers opportunities for the faculty to meet and discuss their challenges, successes, and failures. Twice a year, IT-Tech convenes faculty from the Mentored Colleges, once by phone and once in person. Faculty also gather informally at Connections.

These interactions have created collaborative relationships among faculty from different colleges, who will call each other directly for ideas or to discuss issues. As a result, data for program improvement moves directly among Mentored Colleges, not necessarily mediated by the center. In addition, IT-Tech is moving toward a cascading mentoring system, in which the older Mentored Colleges will support Mentored Colleges of their own. Thus, IT-Tech broadens its reach without increasing its workload.

**Academic Efforts**

As mentioned above in the activities section, Norhtown College offers a convergence IT program. Both faculty and IT-Tech solicit information from students to continuously improve those courses. Students and faculty at Norhtown reported that faculty ask for ideas informally in class and often
include a no-credit test item that asks “‘What one thing would you like to see added?’ on tests to learn how the courses can be improved.

In addition, IT-Tech conducts an independent course feedback survey that gets student demographics and addresses how the students heard about the class, if they had any trouble getting it in their schedule, and asks for any other comments or suggestions. Since the survey is separate from Norhtown’s student evaluations, the center is able to get the specific information it needs to improve recruiting, discover and fix any administrative issues, and give feedback to instructors about ways to improve individual courses.

IT-Tech uses surveys, conferences calls, and in-person events to facilitate gathering information for continuous improvement of its activities. Zoomerang, in particular, has made it possible for the center to fix problems during Connections, rather than having to wait until the next event. Figure 19 summarizes the process for the different evaluation efforts discussed in the Continuous Improvement stream for IT-Tech.

**Impact for Judgment Stream**

In the third stream of evaluation mainstreaming, IT-Tech staff gather
## Continuous Improvement Stream

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<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Connections event</td>
<td>Connections participants &amp; center staff</td>
<td>survey responses, informal conversation, observations</td>
<td>participants fill out surveys at lunch on the first and third days and at the end of the fifth (last) day → staff observe sessions, and engage participants between sessions, look at survey results and make changes to the event in progress → feedback given to faculty → notes made on possible improvements for next year’s event → notes used in planning next event</td>
<td>• staff can find out if faculty are underperforming and follow up with conversation and observation • faculty get feedback in time to make changes • staff can perform quick fixes like handouts and room temperature • structure allows for regular observation of classrooms and instructors, so staff have direct information about instructor performance and participant behavior • the event is improved in process and from year to year</td>
</tr>
<tr>
<td>Mentored College program improvement</td>
<td>Mentored College faculty</td>
<td>needs and ideas for changes</td>
<td>faculty interact at Connections event, semiannual meetings, Facebook and Twitter → needs, suggestions, experiences and best practices shared → faculty create support networks → staff collect information to improve and expand the Mentored College program</td>
<td>• staff collect specific suggestions for improving the program • faculty communicate their program support needs directly to staff • mentored colleges help each other improve their IT programs • creation of cascading mentoring system relieves pressure on center staff</td>
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### Continuous Improvement Stream (continued)

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<th>Source</th>
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<th>Process</th>
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<tr>
<td>academic course</td>
<td>Northtown students and</td>
<td>faculty ask students in class and on tests for ideas about how to</td>
<td>IT-Tech conducts an independent end of course survey of students at in the program → input</td>
<td>• student input is added to the information from the BAC to help faculty improve labs and</td>
</tr>
<tr>
<td>improvement</td>
<td>faculty</td>
<td>is used to make changes in courses and administrative areas</td>
<td>is used to make changes in courses and administrative areas</td>
<td>presentations • changes made to course offerings, course timing, recruiting events •</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>problems with the course calendar within the program can be caught and corrected</td>
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*Figure 19. Continuous Improvement Summary for IT-Tech*
data from a variety of sources about the impact of center activities. For employer satisfaction data, the center relies on anecdotal information from its BAC members, although it continues to explore ways to track students as they enter industry. The center staff have collected more systematic data about its impact on (i) faculty, (ii) prospective students, and (iii) the IT programs at its Mentored Colleges.

The Impact for Judgment stream has an extra level of process than the other two streams because the external evaluator and the NVC have explicit roles in terms of assessment and reporting. The external evaluator, Denton, works with the center director, Silver, to design the instruments used for each group. Silver described the process this way:

What I do at the outset of a year is sit down with Paul and talk about the evaluation criteria on a year by year basis. We both look at the goals, objectives and activities for the grant and put [down] what does success look like.

Denton also brings in the NSF perspective: “So the question for the ATE evaluator is what difference did the ATE money make – what did you do that you wouldn’t have done without the money?”

The impacts that are discovered through the data collection are used to make judgments in three ways. Denton uses the data to write an annual
external evaluation report. The center staff use that report and its own analysis of the data to make decisions about programs that should be changed, continued as is, or terminated. The information, questions, and judgments generated from that data are used in the annual presentation to the NVC. The NVC takes the evaluation report, along with all the information the center gives it to prepare its annual report to NSF.

Faculty

IT-Tech gathers information from Connections participants to determine its impact on faculty. As indicated above in the Continuous Improvement section, participants complete a survey at the end of Connections, giving overall ratings of the event. They also are asked to rate their intention to use what they learned in their home classrooms. IT-Tech uses Zoomerang to follow up with participants at six month intervals after the event. The follow-up surveys ask about the courses taken and what from the courses the faculty are implementing in their classrooms.

This longitudinal tracking has enabled the center to document impact for external reporting and determine which Connections courses are not making the desired impact. Plum described the benefit this way:
Now we can see five years’ worth [of]... specific, aggregate, roll-up data. Like it’s a fun class and everyone loves it, but they don’t go back and implement those classes...[or] they do implement, and they give us specific examples of how that training changed a specific class.

**Partner and Mentored Colleges**

Each year, Silver distributes a form to the three partner colleges and the Mentored Colleges requesting information about courses and programs added as a result of involvement with the center, student demographics, and levels of enrollment in those courses and programs. The center staff analyze the data to check their partners’ institutional progress. The situation with Colville Community College illustrates the benefit of the system.

Colville Community College was one of the original partner colleges on the IT-Tech grant. Over the years, IT-Tech documented that Colville was not meeting its targets in enrollment and academic program development. Further investigation by Silver revealed that the difficulty was institutionally systemic, not personnel based. In early 2009, based on the evidence of underperformance, Colville opted to step down to being a Mentored College program participant, and Middle State University was invited to be a partner.

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7 Northtown, Middle State University, and Urban Community College
institution. Both institutions are doing well in their new roles, and IT-Tech continues to track its impact based on their performance in those roles.

**Prospective Students**

IT-Tech conducts a variety of recruiting events for its convergence program and for Northtown’s IT program. Staff track the number of recruiting events they’ve held for the sake of reporting. However, the center recently added pre-post testing at these events to track the impact the sessions have made on students’ interest in and knowledge about the IT industry. As external evaluator Denton described, the results have been revealing:

Last year we looked at a lot of the student events they did – are they making a difference. Some of the recruitment data told us that they are not really changing anyone’s mind about convergence – the data said students aren't really learning about the career or demonstrating higher interest.

Recruiting is one of the areas of responsibility that gets blurred between Northtown College and IT-Tech. This evidence can be used in future negotiations with Norhtown regarding IT-Tech staff’s level of involvement in this aspect of the college’s work. It also may help both groups reflect on improvements to recruiting practices.
The process map summary of IT-Tech’s efforts in this stream of evaluation is presented in Figure 20. IT-Tech collects data to understand its impact from a variety of sources. The information is used to demonstrate the center’s impact to its stakeholders and to make summative decisions about partners.

Disseminating Evaluation Mainstreaming

IT-Tech disseminates its operational model, in which evaluative activities play an integral part, to its Mentored Colleges. Before a college can participate in the program, the faculty must demonstrate that they have the equipment and resources necessary to support a convergence technology program. If the college has those things in place, then IT-Tech works with the college’s IT faculty to assess their area’s job market to be sure convergence technicians are in demand. Creating a new program or concentration is too time intensive an investment if the industry in the area doesn’t need it. Once the demand is established, then the center works with the faculty to create a BAC of industries in their area, so that the knowledge and skills delivered in courses will match technicians to local industry. The next step is the skills validation, either done either by the college faculty or facilitated by IT-Tech, followed by the PCAL 7 cross-walk mapping to create or modify
<table>
<thead>
<tr>
<th>Impact on...</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT-Tech</td>
<td>NVC, external evaluator, evaluation data, center staff</td>
<td>internal and external perspectives on center performance</td>
<td>NVC and external evaluator function as part of the center team, discussing performance, offering ideas and perspectives from their areas of expertise → leadership staff discusses recommendations from external evaluator and NVC → adjustments made to activities and programs to close performance gaps</td>
<td>external evaluator provides an independent source of information on center performance • evaluator and NVC give independent analyses of performance gaps, possible improvements, and termination/continuation of programs or partnerships • center staff have better information to use for decision making • learning informs future activities and decisions</td>
</tr>
<tr>
<td>faculty</td>
<td>Connections participants</td>
<td>ratings, comments, use of materials</td>
<td>participants fill out surveys at the end of Connections, then at 6 month intervals after the event → center director compiles results → leadership staff analyzes, discuss for program changes → external evaluator uses for reports</td>
<td>• ratings of venue, setup, vendors • ratings of instructors used to make hiring decisions for next year’s event • outcome data for external evaluation and NVC • data on how faculty use what was learned at Connections event • longitudinal tracking of implementation</td>
</tr>
</tbody>
</table>
**Figure 20. Impact for Judgment Summary for IT-Tech**

<table>
<thead>
<tr>
<th>Impact on...</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>colleges</td>
<td>Mentored Colleges</td>
<td>data on enrollment, convergence courses, and programs offered</td>
<td>center director sends a form out to each college → colleges provide requested data → center staff and external evaluator review and analyze</td>
<td>• evidence of IT-Tech’s impact on enrollment at participating colleges • student demographic data for program improvement section of ATE survey • evidence of other impacts to colleges resulting from partnership with center</td>
</tr>
<tr>
<td>students</td>
<td>recruiting event participants</td>
<td>knowledge of and interest in IT careers</td>
<td>students who participate in recruiting events fill out pre- and post-event surveys → center director compiles results → staff and external evaluator use to impact and determine whether to continue these events</td>
<td>• evidence of event impact on students’ understanding of IT industry, and interest in IT careers • summative information for continuing or discontinuing these kind of recruiting events</td>
</tr>
<tr>
<td>overall center performance</td>
<td>NVC, external evaluator</td>
<td>external perspective on center performance</td>
<td>center staff assemble evidence from above sources and external evaluation</td>
<td>• evidence of performance based on data collected by the center and by the external evaluator • documentation of progress toward established goals and objectives • documentation of center activities, strengths, opportunities, and concerns</td>
</tr>
</tbody>
</table>
Faculty at Northtown and the Mentored Colleges recognize these evaluative steps from the Strategy and Design stream as essential to the success of their academic programs. One faculty member from Northtown described it this way:

Now not only do we use the information for developing our classes, but we spread it throughout the country through our mentored colleges... we share our information with them. Some of what we learn here may be localized and wouldn’t work in other states. So those colleges are getting their own industry experts...

Faculty from Mentored Colleges interviewed expressed appreciation for the model and had already experienced benefits from creating BACs. Several discussed how creating their own BAC had led to a focus on specific areas with IT demand in their area, like healthcare and security. As one Mentored College faculty member put it, “It all revolves around the business community. [IT-Tech] is providing us an edge to get students cutting edge training by connecting us with business.” Another said,

The college is required to have a business advisory committee for accreditation. IT-Tech made us realize we needed to build from that existing group and grow into something else... The idea of bringing people in and having a conference call, use the time you meet with them to focus on their interests rather than what the college wants – which is usually “sign off and you can
go back to your life.”

IT-Tech has not disseminated its methods and practices for all three levels of mainstreaming. However, the level of commitment and dissemination in the Strategy and Design stream sets a new standard for the highest level of mainstreaming – Mentor, which is presented visually in Figure 21. Clearly the center has the capability to reach this level in the other two streams as well, as the Mentored Colleges advance their programs.

![Figure 21. Revised Stages of Mainstreaming Evaluation](image_url)

**Figure 21. Revised Stages of Mainstreaming Evaluation**

**IT-Tech Summary**

IT-Tech exemplifies mainstreaming, with evaluation integrated into the organization across all three streams. In terms of the stages of
mainstreaming, the center started at the leadership stage in all three streams and has moved to the mentor stage in Strategy and Design. This can be attributed to the evaluative orientation of the PI, Dr. Alexis Brunner. She brought a personal commitment to all three streams of evaluation and hired staff that shared it. Then they created systems for collecting the information they needed in a sustainable way.

The center uses a variety of evaluative systems, structures, and relationships to advance its work. The maps for project management, skills, and curriculum cross-walks create shared mental models and get partners and staff on the same page about IT-Tech’s purpose and activities. The center’s structured, collaborative partnerships with education and industry create an information-sharing environment that emphasizes learning while continuing to collect summative information. Use of Zoomerang has enabled both longitudinal tracking of participants and rapid feedback for improvement during events.

The staff exemplify an evaluative orientation. Reflection and discussion of evaluative information is part of every center meeting with internal and external partners. The center’s dissemination of the BAC model
to its Mentored Colleges demonstrates a new top stage evaluation mainstreaming: mentoring. IT-Tech is a great example of mainstreaming evaluation and offers a variety of best practices and ideas that can benefit other organizations.

Case Study: Manu-Tech

The researcher conducted the Manu-Tech site visit on January 6-8, 2010. During the site visit, she interviewed 15 people: 12 in person and three via phone. After the site visit, seven more people were contacted by phone, for a total of 22 contacts with 22 people. Fourteen research participants reviewed, approved, and returned the interview notes to the researcher for a 64 percent validation rate. Interviewees included (i) the PI and two co-PIs, (ii) five grant personnel and an administrator from the host college, (iii) four external partners, (iv) the former and current external evaluators, (v) three National Visiting Committee members, and (vi) four participants in center activities. Further information for the analysis came from 45 documents, the researcher’s observations, and a variety of websites, including Manu-Tech’s.
Center Description

A variety of Manu-Tech staff, partners, and partner organizations are included in this case study. Their pseudonyms, titles, and a description of commonly used acronyms (as applicable) are presented in Tables 19 and 20 to help the reader follow the description of the center and its mainstreaming effort.

Table 19

Pseudonyms for People and Institutions in Manu-Tech Case Study

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstate College</td>
<td>Manu-Tech’s host college</td>
</tr>
<tr>
<td>Lawson College</td>
<td>Home college of Manu-Tech’s external evaluators</td>
</tr>
<tr>
<td>Doug Ford</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>Julia Langdon</td>
<td>Co-Principal Investigator</td>
</tr>
<tr>
<td>Kurt Hinkle</td>
<td>Director, Co-Principal Investigator</td>
</tr>
<tr>
<td>Gordon Callan</td>
<td>Industry Outreach Coordinator</td>
</tr>
<tr>
<td>Natalie Green</td>
<td>Administrative Assistant</td>
</tr>
<tr>
<td>Shannon Oliver</td>
<td>Upstate College Faculty</td>
</tr>
<tr>
<td>Adrian Veidt</td>
<td>Dean of SAIT at Upstate College</td>
</tr>
<tr>
<td>Damon Justice</td>
<td>Current External Evaluator</td>
</tr>
<tr>
<td>Parker Randle</td>
<td>Original External Evaluator</td>
</tr>
<tr>
<td>Calvin Ricci</td>
<td>Executive Director, SMI</td>
</tr>
<tr>
<td>Rob Andrews</td>
<td>Chief Technology Officer, SBRT</td>
</tr>
</tbody>
</table>
Table 20

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATE</td>
<td>Advanced Technological Education Program</td>
</tr>
<tr>
<td>PI</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>SAIT</td>
<td>School of Applied and Information Technology</td>
</tr>
<tr>
<td>SMI</td>
<td>State Manufacturing Institute</td>
</tr>
<tr>
<td>SBRT</td>
<td>State Business RoundTable for Education</td>
</tr>
<tr>
<td>SWIB</td>
<td>State Workforce Investment Board</td>
</tr>
</tbody>
</table>

**Purpose and History**

Manu-Tech was established as an ATE Regional Center in 2003 after completion of an ATE planning grant. Its purpose was “to inform and improve manufacturing education through discovery, utilization, and dissemination of intellectual resources” (nsf.gov 2003 award abstract). The mission was refined when the center was re-funded in 2008; Manu-Tech’s current purpose is “to develop educational initiatives that meet the technical and engineering technology needs of [the state’s] manufacturers while improving the industry image.” The center has partnered with a variety of state business and industry organizations and education institutions in pursuit of this mission. Over its seven-year history, Manu-Tech has received
two ATE center grants for a total of approximately $5 million; the current
grant expires in September 2011.

**Context**

Manu-Tech is housed at the main campus Upstate College, a county-based community college located in a suburb of a large metropolitan area in the East. Upstate has 3 campuses, serving approximately 68,000 credit and continuing education students. It offers more than 180 degree and certificate programs. On Upstate’s main campus, Manu-Tech’s home is a suite of offices in the same building with the college human resources and information/welcome centers. The suite includes separate offices for the PI, each co-PI, and the part-time industry outreach coordinator, plus a common entrance space where the part-time secretary has her desk. The center director’s office (8’ x 12’) also doubles as their conference room since it has space for a small table, which seats four, and the white board.

The staff of Manu-Tech have a collegial relationship with the Upstate College’s administrators despite challenging circumstances. Just after Manu-Tech was first funded as an ATE center, the college decided to eliminate several manufacturing programs. The decision was based on manufacturing
cutbacks in the area and low enrollment in the programs. Consequently, Manu-Tech had the money and expertise to develop industry-relevant courses in manufacturing technology, but there were no faculty to teach the classes. As a result, the center has conducted additional noncredit industry training workshops through continuing education.

The Dean of the School of Applied and Information Technology, Adrian Veidt, is responsible for oversight of the center and is committed to reinvigorating the manufacturing curriculum at Upstate. He recognizes the potential for Manu-Tech to drive enrollment by changing the perception of industry in the state. Thus, the administration at Upstate has clear expectations for the center in regard to increasing enrollment in manufacturing and engineering programs. The center staff is under pressure to provide data that prove they are making that kind of impact, despite the fact that those programs were cut and are now being rebuilt.

As an industry, manufacturing is struggling in Manu-Tech’s home state. It has been slow to change, has experienced significant downsizing in the recent past, and is perceived as a “dirty job” despite the move toward automated production. The state has manufacturing companies of all sizes,
from international to “mom and pop shops,” that contribute 20 percent of the total state revenue. When they are hiring, manufacturers are looking for technicians willing to do shift work and who possess higher level technical skills—but they haven’t been hiring that often in the last year.

The relationship between industry and education has been a pull system; i.e., the health of the manufacturing industry and its demand for employees drives enrollment in technical degree programs. However, due to continued cutbacks in manufacturing jobs, there has not been much pull for the last several years. Enrollments dropped sharply in the early 2000s and have risen only slightly since. Individuals interviewed who had connections to industry expressed concern that when the system needs technicians, they won’t be available because it will take too long for the community colleges to respond to the need.

Two areas that have been growing are lean and green manufacturing. Lean manufacturing is a systemic approach to removing waste from a company’s processes. It involves analyzing everything from work spaces, to personnel training, to inventory to find places where resources are being invested in ways that do not yield value for the customer. Those areas are
called waste, and a lean program helps the organization reduce them to zero, making the organization more economically sustainable. The green manufacturing idea builds on lean, adding practices that make the company environmentally sustainable. Both these movements in the industry have provided an area of growth and opportunity that Manu-Tech is exploring.

Activities

Manu-Tech conducts activities for the manufacturing industry in three main areas: curriculum development, professional development, and image rehabilitation. Their efforts also include creating articulation agreements between high schools, community colleges, and four year colleges and universities to enable students to progress smoothly from one to another in STEM programs. Manu-Tech funds and facilitates curriculum development for a variety of audiences. They have facilitated DACUM (Developing A Curriculum) processes for four degree programs within the Associate of Applied Science (AAS) in Manufacturing and Engineering Technology degree at Upstate and its partner colleges. Following the DACUMs, faculty at Upstate and Manu-Tech’s four partner colleges develop and pilot the required courses. Course development has a focus on innovative delivery
including hybrid and online courses and the virtual classroom. The center also funds curriculum development for teacher training in support of Project Lead the Way and FischerTechnik. These two programs use hands-on activities to interest students, as early as elementary school, in STEM.

Manu-Tech also provides professional development for educators and industry professionals. Secondary and post secondary educators can receive funding to attend conferences, visit other ATE centers, and conduct Learning Projects. The center’s Learning Project program is a mini-grant process. Interested educators apply for funding to take students on field trips to industry, develop curriculum based on new software or manufacturing equipment, create strategic plans for STEM programs, or add STEM topics and activities to existing programs.

Manu-Tech also conducts professional development opportunities for educators and industry professionals. Secondary and postsecondary educators can receive funding to attend conferences, visit other ATE centers, and conduct Learning Projects. The center’s Learning Project program is a minigrant process. Interested educators apply for funding to take students on field trips to industry, develop curriculum based on new software or
manufacturing equipment, create strategic plans for STEM programs, or add
STEM topics and activities to existing programs. Manu-Tech also conducts
professional development workshops for educators and industry
professionals on lean and lean to green topics.

Manu-Tech’s biggest challenge is the rehabilitation of the
manufacturing industry’s image in the state. The efforts with Project Lead the
Way and FischerTechnik, described above, serve that purpose. In addition,
Manu-Tech financially supports the Society of Engineers on Upstate’s campus
and provides personnel support to various STEM-oriented programs
including FIRST Robotics,8 Skills USA,9 and ACE Mentoring.10 The center has
also partnered with a state level industry consortium on the Careers website
and is working with them to develop a careers campaign.

Partners

Manu-Tech works with a variety of in-state partners to pursue its
goals. One of those partners is the State Business RoundTable for Education

8 A national organization that hosts competitions for grades K-12, in which kids build robots
to complete tasks. (www.usfirst.org)
9 A national organization that hosts competitions for secondary and postsecondary students
in manufacturing technical skills (skillsusa.org/index.shtml)
10 A national organization promoting high school students’ interest in architecture,
manufacturing and engineering through mentors and scholarships (acementor.org)
(SBRT), a statewide consortium of business and industry representatives interested in improving the quality and reach of STEM education. SBRT focuses on under-represented groups including African-Americans and Hispanics. SBRT promotes STEM careers through its website and in-classroom presentations, which encourage students to take advanced math and science courses. SBRT’s Chief Technology Officer, Rob Andrews, partners with Manu-Tech in two efforts: the Careers website and the industry image campaign.

The center also gets information about industry needs in the state from a variety of sources. Manu-Tech assisted the State Workforce Investment Board (SWIB) with aerospace and advanced manufacturing industry initiatives by collecting data and writing reports. Through this relationship, the center has access to SWIB’s recent reports on industry needs. The State Manufacturing Institute (SMI) Executive Director, Calvin Ricci, has been a close partner of Manu-Tech since it began. SMI provides forums and conferences, conducts surveys, and participates in statewide efforts to develop industry and create connections between industry and education. Manu-Tech also interacts with a variety of county- and state-level
manufacturing associations that provide an interface for businesses to share ideas and resources with the intention of improving production and the economy.

Upstate College and four area community colleges serve as Manu-Tech’s educational partners. All have close ties with technical high schools in their geographic areas, which make them obvious choices to participate in the center’s efforts to reinvigorate manufacturing education. As mentioned above, faculty at Upstate and the partner colleges are funded by the center to develop curriculum for the AAS degree program and other projects.

Manu-Tech also has the ATE required external partners. Its current NVC has 10 members, six from industry, two other NSF ATE center PIs, and two from educational institutions. The center has had two external evaluators, both PhD sociologists and faculty at nearby Lawson College. The first, Dr. Parker Randle, was the director of a graduate student research and evaluation center at Lawson. For most of his tenure as external evaluator, his graduate students handled the evaluation work for the center. When the graduate center was disbanded, Randle took over the evaluation himself. When Manu-Tech sought a grant renewal, Randle helped the staff design the
data plan and then, over the first year of the new grant, handed the external evaluation off to his colleague, Dr. Damon Justice, who is the Manu-Tech’s current external evaluator.

**Current Staffing**

Manu-Tech has three full-time and two part-time staff, all of whom are on-site at the center office on the Upstate campus (Figure 22). The PI, Mr. Doug Ford, and co-PI, Mr. Kurt Hinkle, are full-time. The other co-PI, Ms. Julia Langdon, is considered full-time, although she has some administrative responsibilities for Upstate. Ford and Langdon were employees of Upstate prior to the creation of Manu-Tech, and both have been with the center since its inception. Ford has always been full-time. Langdon began at 20 percent time, while also serving as an administrator for both credit and noncredit programs at Upstate. In 2007, shortly after Hinkle came on board, he and Ford asked Langdon to come to work for Manu-Tech full time. Since then, she has been three-quarter time at the center and quarter time at Upstate.

Ms. Natalie Green, a 35 year employee of Upstate College, serves as part-time administrative support to the center. She has been with Manu-Tech for three and a half years. Mr. Gordon Callan, a veteran human resources
manager in the steel industry, works part time for the Manu-Tech as their industry outreach coordinator, and has done so since shortly after the center was funded.

Mainstreaming Evaluation

The stream arrows depicted in Figure 23 are a visual representation of Manu-Tech’s mainstreaming development over its six year history.

Mainstreaming at Manu-Tech began with Ford and Langdon, who are view data as essential for creating improvement and documenting activities. (Hinkle affectionately referred to the two of them as “data freaks.”) NSF’s evaluation requirements added to the mix. Ford said, “About the time I came into NSF was when they started to do more pushing on evaluation. So it was clear we should do something about it.” To do something about it, Manu-
Tech contracted with Randle as their external evaluator.

Randle used a project management model with evaluation milestones and implementation audits, including quarterly meetings to check progress. While other organizations he had worked with had difficulty articulating goals and milestones, Manu-Tech adopted the process easily. “I felt that Ford, the PI, was very simpatico...We had a good response from [Manu-Tech], it fit very well with their mentality, ‘We want to know if we’re doing a good job’ – is how they were thinking about things,” Randle said. In fact, evaluation became habituated enough that Randle decided they no longer needed quarterly meetings. When the time came to write the grant renewal, Randle recalled, “The whole evaluation orientation, culture and structure and everything was in place. It was just a routine part of the planning...” Langdon agreed, “All of us brought some of the capabilities with us. As
we’ve worked with outside evaluators and discussed some things with them, we’ve gotten better... It’s part of our every day conversation.”

Manu-Tech has been pushed by its NVC and by NSF to continue to develop in the Impact for Judgment Stream. At the insistence of the NVC, they incorporated metrics in their websites and at events to measure participation, and impact of curriculum development activities. With the 2008 grant, the Manu-Tech leadership team heeded NSF’s request for more in-depth impact data. Together with Randle, they created a plan for a quasi-experimental evaluation of the impact of three programs (ACE Mentoring, FIRST Robotics and SkillsUSA) on students in their county. In Strategy and Design, Manu-Tech started at the desire stage. Ford and Langdon had the interest in and personal networks to provide evaluative information in this stream. As the center has matured, all three leadership staff members have participated in planning and organizing efforts to get information to shape the center’s activities. The addition of the Guiding Principles, discussed in Systems and Structures below, has added structure to support this evaluative stream, putting Manu-Tech at the leadership stage.

In Continuous Improvement, the center started out at the leadership
stage and remained there. Staff shared the desire and the skill sets to create tools and collect data to use for improvement from the outset. Working with Randle as their external evaluator enabled them to create systems and improve their tools to make getting that information a sustainable process.

In Impact for Judgment, NSF had the evaluation requirement for the center, and Langdon and Ford understood the importance of documenting their activities in compliance with that requirement. Through the influence of Randle, the NVC, and NSF, Manu-Tech has advanced to the leadership stage with its foray into quasi-experimental design, in addition to the other impact measures in place. In this stream in particular, the center is poised to be a mentor to other organizations.

Manu-Tech’s current evaluator, Damon Justice, summed up the center’s enculturation of evaluation with these words:

I only know based on my interactions and I’d say it’s top notch. I’ve done evaluation for others who do it just because it’s required. Manu-Tech uses data to evaluate its effectiveness, they want to know if their dollars are making a return on investment for ATE, bringing students and skills into the industry. There’s very little compromise on that. First of all, in terms of describing my role as external evaluator, it was articulated very clearly, we’re in contact weekly and that reinforces it. The data I collect they use. They actively document what they do. And they’re timely, too. I’ve been involved with organizations that assemble
information retrospectively. With Manu-Tech they have the data, and if you ask for it they can give it to you right then, and that’s always a key sign.

Leadership and Culture

The leadership and culture of Manu-Tech is intimately tied to the center’s leadership staff. Both Ford and Langdon were long-term employees of Upstate College when the idea for an ATE center was hatched. Ford was involved as a co-PI on the NSF planning grant; he and Langdon played key roles in drafting the original Manu-Tech proposal. When NSF funded Manu-Tech in 2003, Ford remained as a co-PI, and Langdon had no official role in the center, continuing to direct Upstate’s continuing education efforts. Then Upstate decided to cut its manufacturing programs, and the original PI, a member of the manufacturing faculty, retired. Ford stepped into the PI role, and brought Langdon on as co-PI, though her time commitment was limited.

Together, the two of them, with the later addition of Hinkle, have striven to lead Manu-Tech forward within the sometimes difficult context of Upstate College and their state’s manufacturing industry. The following

____________________________

11 Caveat: at the time of the research visit, the PI had been out on medical leave for over a month. The researcher did do a face to face interview with him, but that was more interaction than he’d had with his staff since his leave began. Since the research visit was limited to a one-time event, there is no way to determine the effect the situation had on the data collected.
paragraphs describe the development of the leaders and the organization’s culture with respect to mainstreaming evaluation. It is not intended to be a full history or description of Manu-Tech or its staff.

**Doug Ford, Principal Investigator**

Before becoming co-PI of Manu-Tech, Ford served many years as the director of Upstate’s DACUM (Developing A Curriculum) Center. Through that experience, he developed a significant network of personal connections in industry to help him understand industry needs for technical education. As PI, his knowledge of industry and academia has enabled him to move the center forward despite the contextual difficulties at Upstate and in manufacturing. He also has used the role to continue to build and strengthen his network and is frequently out and about as the public face of the center, judging at competitions like FIRST Robotics as well as working on committees with industry and government partners. His curiosity and connections have enabled him to continually generate ideas for activities that can help the center reach its goals of developing educational initiatives that meet industry needs, while also improving the manufacturing and engineering industry image.
Colleagues describe him as “an idea guy.” The executive director of the State Manufacturing Institute called him “the smartest guy I know in community college.” Those who were interviewed for this study consider him to have intimate knowledge of what NSF is looking for in proposals, activities, and evaluation evidence, making him an excellent proposal and report writer.

Ford has been able to adapt his ideas to work in the context of Upstate, while growing the college’s understanding of its role in manufacturing and engineering education, which it had previously abandoned. As he summarized it, “I’ve been working in the field for years... I don’t have an academic background, but I know about what the needs are relative to manufacturing, and how you temper that into what the college will tolerate and afford.” In both his personal data gathering activities and those conducted by the center, he continually seeks to document trends for the sake of both the center and the college. He also uses evaluation data from center activities to test his hypotheses about the activities that will be the most effective methods for achieving the center’s goals. When asked why Manu-Tech has so much evaluation incorporated into its daily activities, he
responded, “...my learning style demands that – what data do we need to have to improve? ... [plus,] we’ve learned that we need to have some basis for decisions that we make. So if we have the data to support it, we get to do some things we want to do.”

Julia Langdon, Co-PI

Langdon brings her own expertise and network of connections to the center’s leadership. Before Upstate College, she coordinated the evaluation of technology programs for the state department of education, which enabled her to create a statewide network of contacts in education and industry. Langdon also did post-master’s work in curriculum, so she is skilled at putting proposals and projects into objective form. Her experiences in curriculum and evaluation have given Langdon a significant skill set for moving from ideas to execution and evaluation, which makes her an excellent counterpart to Ford as “the idea guy.” Together she and Ford established a culture passionate about manufacturing and engineering, keen to connect with industry, and focused on reaching measurable goals. She described her personal commitment to evaluation with a story about a prospective job.

Because of my work, I just think [evaluation has] always been part of me. I turned down a job with a private company that
was doing some training because I asked, “How about your evaluation?” He said, “We don’t evaluate. If they don’t come back we know we didn’t do it right.” That’s not the kind of organization I want to work with. How do you make things better? You do it by evaluating how you’ve done.

The industry members on their NVC recognize Ford and Langdon’s commitment to industry needs, and using data for evaluation and learning at Manu-Tech. One of them described their influence this way:

The strength of the leadership at Manu-Tech has been that they are very willing to go out and find out the information and adapt their program to whatever feedback they get. I dealt with a lot of these programs who think they have a good idea, and you get that idea whether you like it or not. With this group, at Manu-Tech, both Julia and Doug are very good at going out, soliciting information and doing something with it. I learned that three years ago, after the first committee review. We made a lot of suggestions about how to get feedback, how to measure results and they put that into effect almost immediately. By the time we came back for the next year’s meeting, we learned very quickly that they had heard what we said and they put it in place.

Kurt Hinkle, Center Director and Co-PI

The final piece of the leadership trifecta is Manu-Tech’s Director. According to Veidt (Dean of SAIT), to whom the center reports, Hinkle’s predecessors were lacking. “This is the third director I’ve had in there running that [center]. The first two weren’t here long – didn’t have that sense of vision, urgency and ability to create buzz,” he said. Ford described the
culture at Manu-Tech as “healthier and better than it has been” since Hinkle took over as Director in 2007.

As a former principle of a technical high school, Hinkle is experienced in managing staff and budgets, and evaluating personnel. It is his habit to use mission, goals and objectives to create a shared mental model among staff. As an instructor for 20 years at Upstate, he is familiar with the college’s administration and culture, as well as the challenges of educating students for technical careers and the bureaucracy that comes with it. When he came on board at Manu-Tech among the first things he did was to sit down with Ford to figure out roles and responsibilities. “Doug and I agreed that he had so much more understanding of NSF and I didn’t care to understand NSF, working with the deans and college was more my interest. It’s a nice balance,” Hinkle reported. Ford agreed,

Kurt is director, has administrative responsibility. I like it, I don’t have to deal with budget and the administrative details at the college. It turns me loose to do other things, the creative stuff – and Kurt likes it. The way we have it structured allows us to make joint decisions about hiring – it’s a good team effort. Who we bring on, why we bring them on. Final responsibility is shared by Kurt and I and he gets to do all the paperwork. Didn’t work so well with the last guy, but works well with Kurt.

One of their first joint decisions, based on their discussions of their
roles and Manu-Tech’s goals, was that they needed Langdon full-time. “The missing link was we needed someone who knew the college programs, state and community better, who has implemented curriculum and knows how it gets done in the classroom. Julia was the perfect match,” Hinkle said. Once the three of them were in place with roles established, Hinkle led them in learning to work as a cohesive team. “We looked at each other’s learning and management styles... We all know what we can do – and how we behave. It would not be fun to be here sometimes when we meet – but we hash it out. We did a self- Myers-Briggs [to better understand each other’s personalities].”

Since the leadership team has such different backgrounds and very specific areas of responsibility, helping them stay focused on the center’s goals is also one of Hinkle’s tasks. He has employed two specific strategies to keep everyone on the same page, which are described in more detail in the Systems and Structures section below. The first is a white board on the wall in his office on which team members write down ideas and problems as they come up. The second strategy is a set of guiding principles for the center, questions that serve as high level criteria for choosing courses of action based on how they connect to Manu-Tech’s goals.
When it comes down to whether or not something is working, the whole team, including the external evaluator, gets in on the discussion. Together they determine what kind of information will be collected, who will be responsible for getting the information, and discuss survey responses and findings. Any action that needs to be taken as a result is assigned to a specific person.

Through the leadership of Ford, Langdon and Hinkle, evaluation has been embedded into the culture of Manu-Tech. All three are committed to seeking data for the three evaluation streams. The goals, objectives, and guiding principles serve as criteria to ensure their activities are aligned with their purpose. Each staff person then uses his or her experience and skills appropriately to get and analyze data that forwards the work of the center. Langdon summarized evaluation at Manu-Tech as “part of our everyday conversation.”

The mainstreaming of evaluation into Manu-Tech’s culture has been enhanced by the attitudes of part-time center staff, as well as the faculty and administration members with which the center interacts at Upstate. Callan, the part-time industry outreach coordinator, asked the researcher to be sure
to talk to the PI about any outliers, even if they weren’t included in the report.

“Call Doug and talk to him about it,” he said. “That’s important because we want to get better.”

Several faculty members are involved in designing programs and writing curriculum. In their interviews, they discussed the importance of evaluating their product. One faculty member’s response when asked how she got interested in evaluation exemplifies the general attitude, “It’s just logical – you want to see if what you’re doing is effective. That’s doing an evaluation, and then you use it to improve whatever it is you’re doing.” The dean who supervises Manu-Tech also requires evaluation as part of Hinkle’s reporting. “I’m a person who knows you can’t fix something unless you can measure it. I have Kurt do an evaluative process for me, which is a matrix on goals and objectives and I keep him to task on that.”

The center also has begun to pass on the habit of evaluation through the Learning Projects program. Applicants are required to provide a description of expected outcomes and deliverables that will result from their proposed project. The application also asks them to think about measurement and impact in the planning of the project. “Consider: How will you measure
your success? How many students will you impact as a result?” This information provides a way for Manu-Tech staff to determine when funded projects are completed and which kinds of projects create the most impact for the investment. In addition, it encourages Learning Project participants to think evaluatively.

Manu-Tech’s original external evaluator, Randle, summed up the center’s leadership and culture with regard to evaluation with the following analogy and description:

I don’t see it as a crisis model, where all of a sudden something is all terrible and needs to be fixed; thank God we have an evaluator. I think because it was built into the process all along... It was a routine operational thing. It was more like steering the car, you’re constantly steering to make sure it doesn’t go off the road. It’s not like the wheels fell off or it went into a spin. You have to go around the corners where the corners are, stop at the stop lights. I would say it was pretty routine... Manu-Tech didn’t worry about interrupting time with clients for collecting data. “We’ll collect the data, it’ll be great. We can use it to figure out whether we want to do another workshop like this” or whatever. Even when it wasn’t part of the evaluation, they would be doing that kind of thing. They would be talking to people trying to figure out what they wanted. If you are in that mode, evaluation is a tool to accomplish what you already want to accomplish rather than an added burden that you somehow have to deal with. I think that orientation is the most important thing.
Capabilities

The staff at Manu-Tech have several capabilities that are key to mainstreaming evaluation in the organization. They include (i) establishing roles and responsibilities, (ii) translating goals into objectives, (iii) functioning as a team, (iv) prioritizing evaluation information needs, (iv) collaborating with partners to get information, and (v) designing systems and structures to support evaluation. Each capability is further described below.

Roles and Responsibilities

As discussed above in Leadership and Culture, Manu-Tech’s staff and partners have designated roles with regard to information and evaluation. The role of Callan and Ricci (SMI) includes external scanning for ideas and trends on the leading edge of industry. Ford assists with that and, along with Hinkle and Langdon, moves the center from ideas to action based on Manu-Tech’s goals and guiding principles. Hinkle facilitates that process. As activities are designed based on those ideas, the current external evaluator, Justice, helps the team figure out how to measure impacts, design instruments, and collect data. Langdon, in particular, spends time on data collection for center activities and amassing data from the host and partner
colleges needed for reporting. Both Hinkle and Ford use that data for reporting – Hinkle to Upstate and Ford to NSF. Green, in her administrative support role, compiles evaluation data from workshops and makes sure historical reports and information are accessible.

**Translating Goals into Objectives**

Manu-Tech’s leadership has demonstrated the capability to translate goals into sets of objectives. In this key step, they break the big ideas down into smaller tasks and activities where progress can be measured. Using the guiding principles and Randle’s Planning, Implementation, and Evaluation approach (further described in Systems and Structures below), Ford, Langdon, and Hinkle ensure that their actions will indeed forward the center toward its mission. Once the alignment between mission and actions has been established, then the roles and responsibilities capability enables the leadership to assign specific objectives to staff. These two capabilities, creating aligned objectives and assigning responsibility, make generating a complete picture of the center’s activities and impacts an easy next step. “We each have a direct area of responsibility we report on, and then when you put it all together you can see what we’ve done with each goal and each
objective,” Hinkle said. The 2008 NVC report provides evidence of that. In it, each goal is listed with its working objectives, personnel assigned to lead, and identified metrics for each.

**Team**

The articulation of roles and responsibilities for objectives contributes to Manu-Tech’s ability to function as a cohesive team. The teamwork capability makes the most of the staff’s varied backgrounds, channeling their individual skills into actions that coordinate to achieve the center’s purpose. In interviews with the leadership staff, they referred to themselves as a team and discussed the difficulty of having a team member out on medical leave. External partners also have observed the cohesiveness among the staff. Justice, the current external evaluator said, “They are all about their mission, and they are on it... Whenever I’m at Manu-Tech things are smooth – everyone has their roles and responsibilities.” As an industry member of the NVC described the Manu-Tech staff:

I’m just impressed with them...These people are having a good time together, they talk together, listen to each other. It’s nice to be a part of that. There’s no one person saying, “I have the right idea and you’re wrong.” They bounce a lot of ideas off each other, while the [NVC] is sitting there, they have a lot of open discussions – it’s apparent they work well as a team... I think the
combination really works. Obviously it’s personalities and experience and everything else. The bottom line is, it’s the team, whether they did a good job of putting it together or got lucky I don’t know, but that whole group works really well together as a team.

Prioritization

The fourth capability with regard to mainstreaming evaluation demonstrated by Manu-Tech is prioritization. Center staff take time to assess what kind of data is important and devote their time and evaluation resources to collecting and analyzing that information. They base their decisions partly on stakeholder requirements, partly on what they need to uphold their commitment to excellence, and partly on analytical and intuitive curiosity. Both NSF and Upstate have reporting requirements, including enrollment and other impact information. The center’s commitment to improving its offerings means it also needs performance information. The impact data can be the most expensive to collect in terms of time and money, so Manu-Tech has chosen to focus its impact evaluation on the places where it is spending the most money – robotics competitions and the website. When it comes to prioritizing impact questions to be answered, timing and the depth of detail required for a decision are key issues. Ford asks himself and the leadership team, “Is it time to answer that question? Do we need to take what
we know and move it up a notch in terms of detail?”

**Networking and Collaborative Relationships**

Another capability of Manu-Tech with regard to mainstreaming evaluation is collaborating with partners. The center uses these relationships to expand its reach in terms of activities and information gathering. Manu-Tech’s response to the 2008 NVC report summarized the benefits, “Connecting to professional societies and trade organizations continues to be a focus and has resulted in assistance in identifying emerging technologies and topics, marketing programs, additional faculty members, and guest presentations to classes.”

Collaborations at Manu-Tech seem to center around personal relationships and interactions, rather than formal committees. As mentioned previously, Ford, Langdon, Hinkle and Callan all have extensive personal networks in industry, academia, or both. The center’s close relationship with Calvin Ricci, Executive Director of the State Manufacturing Institute (SMI), adds his personal network in industry and government to the mix.

The center uses its informal relationships with industry to gather data about trends and spread the word about training programs the colleges are
developing to meet industry needs. They also use that network to bring
industry and academe together by inviting industry representatives to
participate on the advisory committees of the academic programs connected
to the center. A faculty member described how the center’s web of
connections had impacted him and his program:

Manu-Tech [has] gotten me students. I don’t know how they do it. Like [multinational manufacturing company], I don’t know how they got in there to let them know we have this program here. Next thing I know we have a boatload of students from there, who are doing online courses.... They are getting the word out that we have the training, and they know how to get through the back door. Same thing with Constellation Energy – Julia asked if they could come to my advisory board. How the heck did they get in there? ... They’ve got the word out and they have the respect of companies and the [state] government. They get the word out to places I would never think of – like a bakery that does its own machining, and the U.S. Mint. I’ve made contacts and they’ve sent students all through contact with Manu-Tech.

This dense web of personal networks and diverse experience also enables staff to interact effectively with industry. It is the leverage that enables the center to accomplish its goals using limited resources. One NVC industry representative summarized it this way:

Part of their success is that their backgrounds are a mix of academics and industry. I love academia but it is a different world. People who work in industry have a sense of urgency. So the staff has that mixture of background [that] helps them have
the skills and capabilities, and gives them the sense of urgency about getting things done within a time frame. They have the ability to network, to pull together the right resources. It’s always a question of right resources at the right place at the right time. All come from varied backgrounds so they can tap into the networks they’ve built over time. They are good at compelling those resources – that are rarely direct resources – to achieving the results they are trying to achieve; they do a lot with a little.

Manu-Tech also engages in a few, more formal partnerships. The staff works with the State Business RoundTable for Education (SBRT) on a career website and recently partnered with SBRT’s Chief Technology Officer, Rob Andrews, to design a manufacturing marketing campaign. SBRT’s commitment to increasing the number of students interested in STEM makes them an excellent collaborator for Manu-Tech. Manu-Tech’s connections with education and industry, and its willingness to get involved with rehabilitating manufacturing’s image have made the center an excellent collaborator for SBRT. Andrews described Manu-Tech as the partner they’d been looking for:

The industry has long had an image problem. We’d tried dealing with three different groups to try to deal with that before but it was dead ends. It’s a fractured community – we were very happy to start working with [Manu-Tech] because the other manufacturing centers just weren’t there… I see them as successful [in creating a coordinated effort] in an area that is really hard to work – manufacturing – because of the disparate
interests in an industry that’s changed so much.

Through their partnership with MBRT, Manu-Tech has gained valuable information for its marketing strategy. SBRT’s access to classrooms has given the center a channel to get its manufacturing career message directly to students. In addition, the tracking mechanisms added to the Careers website enable Manu-Tech to gather information about its impact on students’ career interests.

Manu-Tech also engages in more formal partnerships with faculty at Upstate and its four partner colleges. The center contracts with faculty to develop curriculum for the AAS programs developed through the DACUM process. Those faculty members design and pilot test courses, using traditional, online, and hybrid delivery methods in an effort to draw in students to low enrolled programs. To that end, Manu-Tech pays for classroom release time and funds travel to conferences and other colleges developing similar programs. Manu-Tech staff also go out to the partner colleges to sit in on program advisory committee meetings and to coordinate with faculty about the center’s needs and the colleges’ needs. Langdon described the center’s side of the partnership this way:

Every program has an advisory committee – so Kurt and I try to
go to those so we can be sure that the courses are meeting the needs of industry… This next meeting we’re not there to sell, we’re there to listen to what their needs are. We don’t have a campus up there, so we’re trying to figure out what we can do to serve their needs. We adapt depending on the kind of information we need from them.

In return for access to the Manu-Tech’s expertise, network, and funds, partner faculty provide enrollment and other data for Manu-Tech’s annual reports.

The center also funds faculty at Upstate to develop and pilot test curriculum for external professional development programs. Project Lead the Way and FischerTechnik are classroom interventions designed to increase students’ interest in STEM subjects. Two Upstate faculty members are engaged in improving the ways in which middle and high school teachers are trained to use those resources.

Getting the work of the center done through partnerships and informal relationships requires a significant amount of coordinating. Partners interviewed said that the center staff’s vision and passion draw people into collaboration. As one NVC member expressed it:

You want to work with industry to provide a workforce that meets industry needs… [through] living wage jobs with benefits. If we can put all these pieces of the puzzle together everyone wins. They convey that, they convey the passion about what they’re doing and it becomes contagious.
Disseminating clarity on purpose and tasks is a challenge in such a diffuse network, but necessary to keep collaborators engaged. According to Andrews (SBRT), Manu-Tech has learned how to communicate effectively with industry:

Universally, the private sector really wants data. If the public sector makes data the focal point of how you talk and work in partnership, it makes the conversation so much more successful. Outcome measures, not just process – we’re there with businesses. We lead everything with data, every meeting, and I see Manu-Tech doing that more so over the years and that keeps people at the table... I don’t know if it’s solely because they are focused on data but it’s a big part of it – they’ve connected organizations around a topic – they’ve helped people who’ve been speaking past each other for a long time come together and focus on the customer.

Purpose and tasks seem to be less clear for collaborators on the academic side, however. Faculty collaborators expressed a need for better coordination of the curriculum development efforts. One said this:

Sometimes people are working on the same stuff, it would be better if it were more collaborative than individual. With electronics we have it split up and so not much overlap. Sometimes I’m working on something and [a faculty member at a different partner college] is working on the same thing; and we have to try and piece it together from what we’ve both done, or throw it out and start over.

Another commented,

They’ve been very open and encouraging with learning. The
weak point is that I don’t know what’s all available – I don’t always know the questions to ask – like I developed a course and told them about it and they said, “We have that already.”

Manu-Tech’s recent engagement with robotics competitions seems to have potential, but faculty aren’t really sure where it’s going or what is expected of them. A faculty member described the situation this way: “Doug wants Upstate to support schools in robotic competitions – like FIRST, VEX, other things like that... he seems to be pressing forward. I don’t know where that’s at. I don’t know where his next progression is on that.”

Overall, however, Manu-Tech’s use of personal connections and formal partnerships has enabled the center to engage in a broad range of activities related to its purpose. The staff collects data from those partners and activities to shape strategy, demonstrate impact, and make decisions about which activities should be continued or discontinued. The industry members on the NVC are also pleased by how Manu-Tech interacts with the committee. One member summarized it like this: “They listen well. They are trying to respond to customers; they’re not trying to drive their product onto their customers. And it’s impressive how they interact with their partners; it’s almost like going to a party every time you go to these [NVC meetings].” The flow of information among Manu-Tech and its partners is depicted in Figure
24, below. The size of the arrow indicates the amount of information, and the direction indicates the movement from one group to another.

*Figure 24. Information Flow in Manu-Tech’s Collaborative Relationships*

**Designing Systems and Structures**

As the next section will demonstrate, Manu-Tech has been successful at designing systems and structures to support evaluation. This capability is built on the individual skill sets of the leadership team and has been complemented by the external evaluators. The two groups share responsibility for designing instruments, collecting data, and performing analysis.
Systems and Structures

Manu-Tech has made evaluation a sustainable part of its operations. This section describes the systems and structures that have made that possible. These include (i) the Planning-Implementation-Evaluation strategy, (ii) the center’s guiding principles, and (iii) Kurt Hinkle’s white board. Manu-Tech may have other overall structures to sustain evaluative activity that did not present themselves in the course of this study.

Planning-Implementation-Evaluation

Randle, the original external evaluator, was accustomed to working with nonprofit organizations that didn’t know how to think about their programs in terms of goals, objectives, and measurable outcomes. So he developed what he calls the PIE approach – Planning, Implementation, Evaluation. Randle summarized the PIE strategy as, “You make a plan, you try to work the plan, see whether it’s working, and then revise the plan if necessary.” The approach was an easy fit for Manu-Tech’s staff, which already had project management orientations. “We took their basic management strategy and turned it into an evaluation process rather than simply record keeping – as well as adding the other elements like designing
questionnaires to assess different things,” Randle recounted.

In the planning phase they use a Gantt chart to map goals, objectives, personnel responsible, tasks, milestones, and expected outcomes. To keep the center on track during implementation, Randle used a quarterly audit. Every three months Randle and/or his graduate students would put together a short report summarizing the center’s activities and evaluation results. Then the evaluators would sit down for a meeting with the staff to discuss the results and make adjustments as needed. The quarterly report also could be given to NSF, Upstate or the NVC as evidence of Manu-Tech’s efforts.

With the new grant in 2008, the frequency of implementation audits was reduced because the center staff were managing implementation well. As Randle remembers it,

When Manu-Tech was getting off the ground it was good to have the conferences, a stop-look-and-listen kind of a thing. After a while, that was not so key. I really felt the amount of effort being put into the quarterly meetings was detracting from the ability of the evaluation to do some other things that started to take up more time and effort. It might have gone down to semi-annual so we could focus on doing the other parts of evaluation…

The center staff, however, have added their own annual in-house review to the implementation process so they can reflect on the past year. Langdon
explained, “We have a day-long retreat where we talk about what got done and what didn’t during the past year, and whether what didn’t get done was important enough that it needs to get done this year. Sometimes we bring in a facilitator to help us with that.”

For the evaluation portion of the PIE approach, the instruments were designed as the center’s programmatic activities evolved. Originally, Randle and his graduate students did the designing. Since the evaluation and research center at Randle’s college was dissolved, he, Justice, and the center staff have been designing the instruments and evaluation processes. They use a 360° approach, creating documentation and evaluation processes for all the different Manu-Tech activities from articulation agreements to workshops. Survey questions are matched to the specifics of the activity. The specificity is what makes the surveys useful, according to Langdon. “We want the evaluations to be as specific as possible to what we’re doing. Not like the college’s course evaluations, which are the same for every course, and thus not helpful. We don’t do it that way,” she reported. However, they do include a set of items on surveys that are the same across all the center’s activities, to track overall impact. In addition to the formal reporting from the external
evaluator, the staff usually will have an informal discussion about event results. After events, the paper surveys are collected and someone on staff – either the person in charge of it, or Green, the administrative assistant – creates a summary sheet of all the survey responses. The leadership staff discuss them over lunch or at meetings and adapt as necessary.

**Guiding Principles**

Manu-Tech developed guiding principles based on the advice of another ATE PI, who also serves as the chairperson of Manu-Tech’s NVC. The guiding principles are a set of questions and statements based on the center’s goals and objectives. The seven guiding principles questions are as follows:

1. Does this improve the numbers and skills of manufacturing and engineering technicians?
2. Does this contribute to a more positive image of manufacturing and engineering technology as viable and desirable career options?
3. Does this improve the technical and instructional skills of our secondary and post-secondary faculty?
4. Does this enhance our ability to build meaningful partnerships among our educational, industry and government stakeholders?
5. Does this increase Manu-Tech’s leadership in manufacturing and engineering technology in the state?
6. Does this complement and enhance our ability to improve student success by providing resources, opportunities and access to educational programs?
7. Does this enhance our capacity and sustainability as a resource for innovative, creative and valued products and services for our student, industry and educational customers?
The leadership staff ask these questions whenever they are considering adding something to their plate. Hinkle explained:

If you can answer yes to them then you know [the activity] connects to the goals and objectives of the center. The more we talked about it and worked together, we realized we needed to know if things connected – maybe it will work or not, but we’ve been able to narrow down what connects and what doesn’t.

Andrews (SBRT) agreed that it has helped keep the partnership with Manu-Tech focused. “Manu-Tech puts those goals and objectives before partners before they do anything else. Kurt and I use them as our guiding posts – it’s very smart, keeps you from doing whatever pops up. I would say it’s a good coordinated effort,” he said. The guiding principles serve as a key set of criteria for the overall center operation, making sure that time and resources are invested only in activities that forward the purpose of Manu-Tech. The ways the center gets information to answer the guiding principles questions will be discussed in the Strategy and Design section, below.

**White Board**

The white board is used for two different evaluation activities: figuring out what the center needs to be doing and improving what’s already going on. Langdon described how it works:
In Kurt’s office there’s a huge white board – any of us, when we think of something that we all need to talk about together, will go in and write it on the board. Then we use that to make a meeting agenda. After we discuss it, then there’s usually an action step – it’s assigned to someone to take care of.

Hinkle agreed that the white board is a key resource for the team in its process. “We use the board in here – to start ideas and play with them; that’s what’s been missing without Doug here [out on medical leave]. Things start one way and end up completely different, ways I never would have imagined,” he explained. The board is in Hinkle’s office, which also happens to have the only table in Manu-Tech’s office suite big enough for the leadership team to sit together. As a result, whenever they lunch or meet, they are in the presence of the ideas on the whiteboard. Thus, those ideas, problems, and challenges become part of the daily conversation at the center, as well as being included in meeting agendas.

The PIE approach, guiding principles, and white board provide the contextual systems and structures that have helped make evaluation sustainable for Manu-Tech. Within this broader framework, the center conducts a variety of activities in each of the main streams of evaluation. The following sections highlight some of Manu-Tech’s evaluative work in Strategy and Design, Continuous Improvement, and Impact for Judgment.
**Strategy and Design**

Manu-Tech engages in a variety of evaluative activities in the Strategy and Design stream. Four areas are highlighted in this section: (i) center purpose and activities, (ii) Learning Projects, (iii) academic programs, and (iv) the Careers Campaign.

**Center Purpose and Activities**

To shape its purpose and future direction, Manu-Tech gets information about industry needs in three primary ways: commissioned studies, the personal networks of staff members, and partnerships with other agencies in the state. Upstate’s SAIT commissioned two studies, one in 2003 and another in 2009. Both consisted of interviews and focus groups, with a summary report delivered to Dean Veidt. Callan conducted the 2003 study, which led to his becoming part of the Manu-Tech staff. In the 2009 study, the Manu-Tech leadership and Veidt assisted Callan by conducting some interviews with industry representatives. Both studies documented important trends in the state’s manufacturing industry and revealed possible future directions for Manu-Tech and Upstate.

The center also maximizes the staff members’ connections with
industry to get industry representatives for DACUMs and to participate in advisory boards for their host and partner colleges’ programs. Manu-Tech’s involvement with SMI and various competitions has helped expand those networks. Through those connections the leadership staff have been asked to participate on various task forces and committees. That work, in turn, has led to further data collection on trends, and also has given staff access to the data collected by government and other organizations.

Manu-Tech’s formal and informal partnerships have also been a good source of information for adapting the center’s strategy and designing programs that meet industry and educational needs. Connections with other ATE centers and educational institutions have exposed the staff to different methods for pedagogy and delivery, such as systems approaches to teaching electronics, online and hybrid courses, FabLabs, and virtual classrooms. Work with SBRT led to exploring ways to improve manufacturing’s image through a website directed at teens seeking career information. The center’s NVC also serves as a source and sounding board for evaluating strategies and ideas.

An episode from early in Manu-Tech’s history offers a clear example of the center using information from industry and education to revise its overall
strategy and program design. The original grant proposal devoted a large part of the center’s resources to developing training for Profibus, a specific manufacturing technology. As Ford recalled,

Originally we had money to support Profibus technology, based on the input of faculty and some industries in the area who said they were going to commit to it. Our NVC was skeptical, so we did further research with both the original industry people who said they would support it and some other industry folks. The outcome was it would only be put in a new plant – and there are not likely to be any of those in [our state]. So we listened to that information and made a switch.

Langdon mentioned the episode as well. “In the original grant we were going to do something because we’d had interest from a couple manufacturers on a specific technology. By the time we got the grant, that technology was no longer of interest to the manufacturers, so we changed our plan,” she recalled. Resources for that training development were channeled into creating lean and lean-to-green workshops in which industry and education expressed interest.

Learning Projects

As described above in the Activities section, Learning Projects are mini-grants given by Manu-Tech to secondary and post-secondary educators. In order to be funded, a Learning Project must serve one of two purposes (i)
increase manufacturing and engineering awareness for students or (ii)

enhance educators’ manufacturing and engineering technical knowledge and

skills. Langdon has primary responsibility for supervising the program.

The existence of the Learning Projects program is a reflection of Manu-

Tech’s adaptation to stakeholder needs. The original intent for the funds was

professional development workshops for faculty on emerging technologies.

The center intended to poll faculty and create workshops based on their

preferences. The NVC was skeptical about the practicality of the approach. As

an NVC member recalled:

It just didn’t sound like it would be a very effective thing – besides, getting people to do more than regular professional
development is not easy during the academic year. So we asked a lot of questions about how they were going to do that, the
investment, how they would prioritize the requests that came in, and all that kind of stuff.

Manu-Tech staff did poll faculty and run a Web2 workshop as a result. In the end, however, they scrapped the idea and created the Learning Projects

program in its place.

The Learning Project application process also serves as a Strategy and

Design evaluative tool for two reasons. First, it requires educators to

formulate a clear proposal about what they intend to do with the grant
money. This enables Manu-Tech staff to choose projects that fit the intent of the program. Second, the application requires the proposer to state the Learning Project’s objectives and deliverables. In this way, the educator has created the basis for an evaluation of the project before it is even funded. The evaluation may be as simple as the delivery of course materials created by the grantee. In cases of workshops and camps supported by the program, Langdon and Hinkle go out and observe classroom and other activities. Manu-Tech caches the deliverables so they can serve as resources for other teachers, and publishes a list of funded projects on its website to help others design Learning Project proposals.

In this particular project, Manu-Tech is mentoring others in mainstreaming evaluation at the project level. Both the application itself and Langdon’s work with applicants encourage evaluative thinking in terms of project design and outcome evaluation. The following section is an excerpt from the application, which explicitly asks for goals and deliverables.

**Learning Project Description:** Describe the project giving information such as: 1) the goal/objectives of what you wish to accomplish; 2) start and end date; 3) who will participate; and 4) when and where activities will be held.

**Outcome or Deliverables:** Describe what you will provide Manu-Tech as a result of your project. (Final report, curriculum,
lesson plans etc. Consider: How will you measure your success? How many students will you impact as a result?)

Learning Project participants interviewed for this study reported that Langdon worked closely with them to revise their proposals and to develop objectives and deliverables. Through requiring the evaluation component and Langdon’s one-on-one work with applicants, the Learning Project program is disseminating the basics of mainstreaming evaluation to its participants.

**Academic Programs**

Shortly after Manu-Tech received its first grant, Upstate College cut back its manufacturing training programs. Manu-Tech has used information gathered about trends and needs in industry to help Upstate and the center’s other four partner colleges rebuild those programs. Ford has conducted four DACUMs with industry representatives, based on the kinds of jobs and training that research and their personal networks revealed as needs. Faculty at Upstate and the partner colleges used the results of those DACUM processes to design courses.

The courses also have been designed to incorporate the needs of students. Some manufacturing classes are done as hybrids, with students coming to campus only for hands-on work in the machine shop. Being able to
listen to lectures and taking tests online reduces the students’ travel time and, in some cases, enables the course to be compressed into a shorter time period, which was an industry request. The decreased time commitment for students boosted enrollment enough to get the classes offered; low enrollment had previously prevented some courses from being pilot tested. The faculty design the courses to be delivered online as much as possible and then pilot test them with students to see which format is the best for their constituent group: traditional, online, or hybrid. Faculty teaching the courses also interact with Manu-Tech staff to tweak the content to better match student and industry needs, based on their own program advisory boards.

**Careers Campaign**

One of Manu-Tech’s overarching goals is to improve the image of manufacturing in its home state. The staff have explored various ways to achieve that goal, the most recent of which is the development of a careers campaign for elementary and secondary students as well as incumbent workers. Through the staff’s networks and the center’s partnership with SBRT, they discovered the need to educate students about careers in the manufacturing and engineering industry. Then they went out to industry,
professional societies, and trade organizations to find out what kind of public relations efforts those groups would support. They had completed a design process for the careers campaign, with SBRT’s Andrews as the facilitator. He described the campaign and his work with Manu-Tech to develop it:

They haven’t finalized the plan, but they’re putting some very common messages together that any of their colleges could use to sell any of their programs to appeal to people – K-12 student or incumbent workers or people trying to re-enter the workforce about what tech careers are out there... I personally worked with them facilitating – what do we want to achieve? How much can we spend? [My job was first] keeping them from getting ripped off and then tapping into our membership companies to participate.

At the time of the research visit, the campaign was still being finalized.

This section is not a comprehensive picture of all Manu-Tech’s evaluative activities with regard to Strategy and Design. However, the overview and examples were intended to give the reader a basic understanding of how the center has integrated this stream of evaluation into their daily operations. Manu-Tech’s evaluative activities in the Strategy and Design stream are summarized below in Figure 25.

**Continuous Improvement**

Manu-Tech does most of its work with or through other organizations.

As a result, the research found only two activities in which it conducts
### Strategy & Design Stream

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Projects</td>
<td>applicants</td>
<td>project proposals</td>
<td>center staff and consultants get information using personal networks and periodic targeted research → information is compiled and analyzed by PI, in conversation with leadership staff → ideas for strategies and activities generated → go or no-go decisions made based on guiding principles, feedback from NVC → educators fill out Learning Project application which requires a list of activities and deliverables → Langdon works with applicants on proposal drafts to help them create feasible, fundable projects with articulated, measurable objectives → center staff use proposals to evaluate Learning Projects</td>
<td>• increasing clarity about the center's purpose and activities that will forward it • evidence of industry needs encouraged host college to revamp, create, or reinstate industry programs • decision to move from specific technology training to workshops and supporting manufacturing competitions • creation of lean and green workshops • evidence of poor image of manufacturing impacting ability to hire qualified employees • switch from emerging technology workshops for faculty to mini grant based Learning Projects • creates a built-in evaluation system for grantee and center • creates a contract about deliverables to be given to the center upon completion of the project • deliverables create a resource at the center for curriculum and ideas for educators • educators get practice thinking evaluatively and aligning goals, objectives, measures, and deliverables</td>
</tr>
<tr>
<td>Subject</td>
<td>Source</td>
<td>Input</td>
<td>Process</td>
<td>Results</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>academic programs</td>
<td>industry representatives, center staff, faculty</td>
<td>knowledge and skill needs of employers</td>
<td>center conducts DACUM for programs → faculty write curriculum for courses → center staff recruits industry representatives for academic program advisory committees</td>
<td>• detailed map of knowledge and skills required by industry • courses created based on those needs • increased interaction between industry and academia on program advisory committees</td>
</tr>
<tr>
<td>careers campaign</td>
<td>industry, SBRT</td>
<td>focusing, designing, and marketing careers campaign</td>
<td>staff held focus groups with industry, asked for input on the kind of careers campaign they'd be willing to support → center worked with SBRT to learn how to create and disseminate information about manufacturing careers to students</td>
<td>• concept supported by stakeholders • feasible design process • marketing campaign for manufacturing careers</td>
</tr>
</tbody>
</table>

*Figure 25. Strategy and Design Summary for Manu-Tech*
evaluation for Continuous Improvement: workshops and Learning Projects.

In this section, the evaluative processes that enable Continuous Improvement within those two activities are described. A figure summarizing those processes is presented at the end of the section.

**Workshops**

Manu-Tech developed workshops for industry and educators based on feedback from its stakeholders. For the current workshops, the center used Callan, the industry outreach consultant, and hired another outside consultant to design and conduct training on lean and lean-to-green concepts.

At the end of every workshop, participants are asked to provide feedback, either via paper surveys or through a group discussion. Staff members make sure that evaluation feedback about the events is always collected. Langdon summarized it:

> Sometimes the night before an event I’m here writing up those evaluation questions... Even if we don’t do a formal [evaluation], always at the end of the day we’ll at least to a flip chart with plusses and minuses to see what they liked and what they didn’t. And sometimes you get more information that way than you do with paper and pencil.

Someone on staff compiles all participant responses into a single
document, which the leadership staff reviews to see what changes need to be made. Feedback has led to incorporating more hands-on activities, using different instructors, and changing the length of workshops. For example, “Harnessing the Power of Green” was originally offered as a full day workshop. Langdon and Greene both remembered adapting the length based on participant feedback:

When they ask for more hands on, we definitely take that to heart and make changes. Like “Harnessing the Power of Green” was a full day – we looked at the evaluations and people said, “This was good, but it could be shorter.” So we used that information to decide what should be done and then offered it as a half day seminar the next time. (Langdon)

“Harnessing The Power of Green,” we did it first as an all day workshop. The feedback was that that it was too long, so now they are a little more than a half day. (Green)

Learning Projects

Manu-Tech’s original Learning Project program offered faculty the chance to do internships, externships, or job shadowing and then write a report or lesson plan based on that experience. However, the program wasn’t getting very many applicants. As a result, the possibilities for Learning Projects were expanded. One long time participant described the changes he has seen over time with the program:
They’ve expanded their definition of what would be good or acceptable to them. Four or five years ago when they started this, it was job shadowing. The instructor would go out and job shadow at a company and write a brief report about what they found or what they saw, or something of that nature, and that was it. They’d have a report, the instructor would have job shadowed and had the company verify the person spent two weeks on the job. I don’t know how much bang for the buck that gave anybody, so they’ve expanded to try and get more curriculum development activities like I was doing.

Funded projects in the last year included field trips for teachers into industry, funding for subject matter experts to work at STEM-related camps, course and curriculum development, software training and upgrades, development of STEM initiatives for community colleges, and industry certifications for faculty. In the 2009-2010 school year, Manu-Tech funded 14 Learning Projects.

“We went from giving away $3,000 one year to $35,000 now. And I get thank you notes from teachers – the word is getting out. We’re getting many new ideas,” Langdon said.

Manu-Tech’s efforts highlighted in this section are summarized in Figure 26. Although Manu-Tech does not engage in a lot of direct activities, its attention to Continuous Improvement is paying dividends for the center, workshop participants, and faculty. As the center chooses new activities for strategic engagement, this existing orientation to the Continuous
### Continuous Improvement Stream

<table>
<thead>
<tr>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>participants, staff, external evaluators</td>
<td>debriefing and survey responses, observations, quarterly reviews</td>
<td>staff engage with participants through an end of workshop debrief or survey → responses compiled into single document for staff → staff conduct after-action review of event to see what can be improved for next time → also discussed in quarterly updates from evaluator</td>
<td>• rapid feedback on workshop results • staff can tweak workshops without waiting for annual evaluation report • workshops adjusted in terms of length and content to meet future participants' needs</td>
</tr>
<tr>
<td>grantees, staff</td>
<td>applications, grant agreements and project deliverables</td>
<td>proposals, goals, and deliverables are collected → staff discuss and fund a variety of activities → deliverables provide evidence of the impact generated by different activities → evidence used to make decisions about what kinds of projects will be funded in the future</td>
<td>• broadening of types of projects funded • increased participation and variety • grateful faculty spread the word about the program leading to more diverse participants and projects • successful use of center funds up from $3,000 to $35,000</td>
</tr>
</tbody>
</table>

*Figure 26. Continuous Improvement Summary for Manu-Tech*
Improvement stream will serve it well. The staff also could consider how they might work with partner organizations like FIRST Robotics to help create or improve systems to get information for continuous improvement.

**Impact for Judgment Stream**

The Impact for Judgment stream is an area of particular strength for Manu-Tech. From the center’s earliest days, the staff has kept excellent documentation of all its activities and accomplishments, from workshops given to articulation agreements and academic programs created. The following section summarizes the evaluative activity in six areas of impact: (i) Manu-Tech itself, (ii) competition and mentoring program participants, (iii) Careers website users, (iv) academic programs, (v) Learning Projects, and (vi) workshop participants.

**Manu-Tech**

At Manu-Tech, the Impact for Judgment stream is being used to inform the center’s evaluative activities in the Strategy and Design stream. As described above, the center has tried a variety of approaches to meet its goals, several of which have not been successful due to contextual and other factors. An incident from Manu-Tech’s history provides a clear illustration of how the
center used impact evaluation to decide the fate of one such approach. In its early days, the center contracted with a local museum to develop a manufacturing competition and curriculum to support it. After two years, the center used its network of teachers to test what the museum had developed.

Ford recounted their reactions:

We tested their stuff with schools )sic) who said, “This is pretty silly.” Presented it to faculty who said it wasn’t sophisticated, organized or structured enough to make sense of it. Their materials did not produce good classroom learning. It was clear folks were not interested in this.

As a result, Manu-Tech terminated its relationship with the museum and began investing in the existing FIRST Robotics competitions instead.

While the center was ramping up its involvement with FIRST Robotics, NSF was expanding its desired evaluation data beyond program enrollments. According to Ford and Randle, when Manu-Tech drafted its second ATE grant proposal, NSF pushed the center staff to learn about the ways in which Manu-Tech’s activities were impacting different groups. This created a quandary for the center because the center budget wasn’t designed for such an emphasis on evaluation. As Randle described it,

There was a lot of push back, with a specific focus on behavioral outcomes, which is really difficult without a target audience. Something like a drug abuse prevention program for youth in
the school, it’s easy to know who the targets are and assess them at the beginning and the end. But this kind of thing, who are you affecting? Are you affecting all manufacturers in the state? Cooperative organizations? How are you doing it? Who are you targeting? It’s a much more difficult type of evaluation and the funds they provide are not much more than what would be provided for assessing a program like [drug abuse prevention]. So the scope increases at least an order of magnitude but the funding increases only incrementally. It’s difficult to find behavioral things you can evaluate with that kind of a budget. NSF shifted and the budgets went up a little bit, but if you were really going to be out and interview all the manufacturers…Plus, the program funds aren’t that large – you’d have to dump some serious money if you want to change manufacturing climate in the whole state. They’re not providing that kind of money. They’re creating/seeding places that will catch on and grow beyond NSF… That’s my perception. The constraints on conducting the programs make constraints on conducting the evaluation.

Despite the budget constraints, Ford was interested in discovering what kinds of programs create real changes in students’ attitudes toward STEM courses and careers. Thus, rather than developing another set of activities, he decided Manu-Tech should dedicate its resources to targeted research that would answer those questions. Ford described his decision making process thusly:

To get the kind of data NSF wants, it would take more money targeted to research and evaluation, and that creates a dilemma. I could use that money to get more kids in the program, or spend some to do targeted research…I’ve decided to see if I can get some information that’s useful to NSF… I’m doing what I suggested to [our ATE Program Officer] – to do targeted research within centers to find out whether specific activities are
working… So it will be informative for us and for other schools that are doing similar work.

The center’s NVC agreed. This was included in its 2009 report:

The research project on the impact of robotic activities on students going into technical programs could produce some interesting data. The NVC thinks it is important to identify those participants new to STEM activities and their pursuit of STEM education and/or career pathways to determine if these activities are good recruiting tools.

At the time of the research visit, Manu-Tech was moving forward with its targeted research agenda. The results of the next two impact evaluation activities described in the following segments will be used, not only to determine Manu-Tech’s future actions as an ATE center, but also will be disseminated to both NSF and other schools engaged in competitions and mentoring. Thus, these impact evaluations have the opportunity to encompass a broader scope of influence than just Manu-Tech’s Strategy and Design.

**Student Participants in Competitions and Mentoring Program**

Manu-Tech has chosen three programs to investigate with a three-year, longitudinal evaluation: FIRST Robotics, Skills USA, and ACE Mentoring. The study employs a quasi-experimental design to assess the impact of participation in these activities on students. The center received permission
from a county public school district to access student information data for
comparisons with nonparticipants. Justice, the current external evaluator, is
leading the effort. In addition to designing survey instruments, he is handling
the processes to make sure the study meets the human subjects research
requirements for the county schools involved.

The basic question is one of return on investment, according to Ford.
He wants to know if “the expenditures of time and dollars resulted in
meaningful changes in grades, STEM enrollments, career decisions, [and]
educational program choices.” Pre- and post-participation data will be
gathered from students, their parents, and teachers to see if the activities have
made a difference in the courses they take and the kinds of careers in which
they are interested.

Careers Website Users

Manu-Tech partners with SBRT in the Careers website. As part of the
targeted research effort, the partners have added metrics to the website to
track how that investment is impacting students in their career decisions.

Andrews, described the metrics this way:

Our metrics are about what do they know, what’s their attitude,
and behavior toward it... So we have aggregate data – how
many kids look at the website, how many create accounts, what their career goals are, what they are looking for. If a student thinks of themselves (sic) as a builder or problem solver, then we want to show them that a Manu-Tech career is an option and what kind of choices they need to make to get there.

This kind of tracking has already impressed one of the center’s NVC members. She described the process from request for data to data delivery:

…in 2008 we remarked about their affiliation with [Careers website] and recommended continuing that partnership. We [asked] can you explore ways to assess the impact and effectiveness of that? This year they presented the website statistics. They instituted web statistics so they could look at before and after – how many students viewed the manufacturing examples when they posted them.

**Academic Programs**

While Manu-Tech is engaged in these larger scale impact evaluations, it also has maintained its ability to report on enrollment and program data. Upstate College has an Institutional Research Office, and Langdon has worked with them to configure the data so she can get what she needs for annual NSF reporting:

Our institutional research people have set up things for Manu-Tech so I can go in and see how many students of what kind are in Manu-Tech classes. And if we have an update, I can ask them to change what I can access to answer those questions. I can track students through their coursework. We usually report two kinds of numbers: unduplicated – students enrolled, and duplicated – the courses they’ve taken. We like to report not just
totals but also by program, how many were enrolled. We look at that from year to year.

Getting enrollment data from other colleges is more difficult. Since there is no state community college network, faculty at each partner college must negotiate with their administration to get access to the data for their school. One partner college faculty member described his frustrations with the data gathering aspect of working with Manu-Tech:

That’s probably one of the hardest things, is just [collecting] data. It’s the hardest thing to gather even though it should be easier... we’ve gotten better at how we do it. We had a little NSF grant at [our college] in the early 2000s, and it was terrible trying to get data. Now we use a relational database for the whole college and I have scripts written for it but it’s still time consuming because I have 30 classes to pull and have to do them one at a time.

Information gathered from Upstate and its partner colleges is used to demonstrate impact in enrollment, ethnic diversity, outreach contacts with high school students, and articulation agreements.

Learning Project Participants

To evaluate the impact of the Learning Projects, Manu-Tech staff use the processes that have been built into each funded project during the application process. For interactive projects, Langdon and Hinkle may go out to the site, observe the activity, and talk with participants. With curriculum
development based on industry interaction, they may require a statement from the industry partner that the faculty member spent time on-site. In addition, the faculty members engaged in curriculum development do not receive their grant stipend until they have delivered the materials they promised. The deliverables and impact data are compiled and used for several purposes. Impact data are used in external reporting. The list of funded projects is posted on the Manu-Tech website to give ideas to future applicants. Copies of materials developed are cached at the center for use by other faculty. Participants also tend to expand the impact of program and the range of future applicants by talking with their colleagues about what they’ve learned through their projects.

**Workshop Participants**

At the end of every Manu-Tech workshop, either using a formal paper and pencil survey or a group process, staff get a variety of information including specific ratings of the content, instructor, applicability of the information, and the participants’ intended use of the information. The paper surveys contain common questions across all events, which make cumulative tracking of center performance possible. Manu-Tech’s evaluative activities in
the Impact for Judgment stream reported herein are summarized in Figure 27.

Manu-Tech Summary

In terms of its evaluation history, Manu-Tech has moved from simple project management and documentation to mainstreaming evaluation. Through its partnership with Randle, evaluation was embedded into its existing project management with the PIE approach. Interactions with the NVC encouraged Manu-Tech to move from enrollment to performance data for impact evaluation.

Manu-Tech’s PI, leadership, and part-time staff, and collaborators are committed to evaluation. As a result of their combined efforts and the partnership with the NVC and external evaluators, all three streams of evaluation have been embedded at the center. In the Strategy and Design stream, the staff is continually engaged in seeking information about industry trends to shape the center’s activities. Manu-Tech has less activity in the Learning and Improvement stream because it is not running very many center specific activities. The leaders have chosen to invest significant resources in Impact for Performance evaluation to understand the broader impacts of the activities they conduct and sponsor.
Manu-Tech leadership desires external partners with activities that have a high return on investment → NVC and NSF seeking more rigorous evidence that ATE programs are making a difference in STEM initiatives → targeted research on website, student competitions, and mentoring addresses both → results will be used to shape future center direction and activities

- staff take the opportunity to increase resources devoted to research on STEM initiatives and their impact
- quasi-experimental design study to determine impact of noncenter activities on STEM areas
- tracking of career website's impact on students' educational and career choices

students and teachers create registration profiles → website automatically tracks time spent on the site, gathers information about knowledge, attitudes, behaviors, and career goals → SBRT and center review the data

- evidence of students who visit the website for external reporting
- information about relationship between students' activity on that website and choosing STEM careers
<table>
<thead>
<tr>
<th>Impact on...</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>student participants</td>
<td>ACE Mentoring, FIRST Robotics, Skills USA</td>
<td>parent, participant, and teacher surveys</td>
<td>design quasi-experimental study → complete HSIRB with school districts → collect data from program(s)</td>
<td>• impact of participation on student grades, STEM enrollments, career decisions, educational program choices</td>
</tr>
<tr>
<td>county school students</td>
<td>participants and student data from public schools</td>
<td></td>
<td>participants → compare participants to nonparticipants based on courses taken, grades, etc.</td>
<td></td>
</tr>
<tr>
<td>academic programs</td>
<td>Upstate’s office of institutional research, partner colleges</td>
<td>enrollment data from center-related courses</td>
<td>Upstate and partner colleges keep track of enrollment numbers → Langdon assembles into formal reports, uses to complete ATE survey</td>
<td>• Impact data for NSF ATE reporting • strategic data readily available for Upstate administrators to present to stakeholders</td>
</tr>
</tbody>
</table>
Figure 27. Impact for Judgment Summary for Manu-Tech
The practice of evaluation is a core part of Manu-Tech’s culture. Evaluation is used in all three streams to benefit the center, its host and partner colleges, and industry partners. The overall benefits include data to support strategic choices, improve programs, document activities, and demonstrate the impacts made through investment of center funds.

Case Study: Nano-Tech

The researcher visited Nano-Tech from January 25-27, 2010. During that period, 18 people were interviewed in person through 13 interviews and one focus group. Two were interviewed by phone during the site visit, and another 13 were contacted in 10 phone interviews before and after the visit for a total of 25 contacts with 31 people. Sixteen research participants reviewed, approved, and returned interview notes to the researcher for a 64 percent validation rate. Interviewees included: (i) the PI and three co-PIs; (ii) 16 staff members, including administrative support, program and technical staff; (iii) the two current external evaluators; (iv) four industry partners; and (v) five faculty from partner colleges who participated in center activities.

Further information for the analysis came from 39 documents, the researcher’s observations, and 25 different websites, including the center’s.
Center Description

A variety of Nano-Tech staff, partners, and partner organizations are included in this case study. Their pseudonyms, titles, and a description of commonly used acronyms (as applicable) are presented in Tables 21 and 22 to help the reader follow the description of the center and its mainstreaming effort.

Table 21

Pseudonyms for People and Institutions in Nano-Tech Case Study

<table>
<thead>
<tr>
<th>Person/Institution</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hilltop University</td>
<td>Nano-Tech’s Host University</td>
</tr>
<tr>
<td>Scott Franklin</td>
<td>PI</td>
</tr>
<tr>
<td>Hans Pierson</td>
<td>Co-PI, Managing Director</td>
</tr>
<tr>
<td>Richard Grayson</td>
<td>Director of Education and Outreach</td>
</tr>
<tr>
<td>Arwynn Kennedy</td>
<td>Co-PI, Alumni</td>
</tr>
<tr>
<td>Ben Marshall</td>
<td>Co-PI, Materials Dissemination</td>
</tr>
<tr>
<td>Jake Nelson</td>
<td>Capstone Instructor</td>
</tr>
<tr>
<td>Denise Lawton</td>
<td>Administrative Assistant</td>
</tr>
<tr>
<td>Pepper Potts</td>
<td>Administrative Support Assistant</td>
</tr>
<tr>
<td>Sarah Crandall</td>
<td>Part-time Administrative Support</td>
</tr>
<tr>
<td>Anja Berry</td>
<td>Education Coordinator</td>
</tr>
</tbody>
</table>
Table 21 - Continued

<table>
<thead>
<tr>
<th>Person/Institution</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logan Jackson</td>
<td>Outreach Coordinator</td>
</tr>
<tr>
<td>Reed Stark</td>
<td>Research Assistant</td>
</tr>
<tr>
<td>Arthur Lazlo</td>
<td>Current External Evaluator</td>
</tr>
<tr>
<td>Samuel Lewis</td>
<td>Current External Evaluator</td>
</tr>
<tr>
<td>Belinda Fenwick</td>
<td>NFM Educational Partner</td>
</tr>
<tr>
<td>Gavin Allen</td>
<td>NFM Educational Partner</td>
</tr>
<tr>
<td>Blaine Taylor</td>
<td>Technical Expert</td>
</tr>
</tbody>
</table>

Table 22

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Institution/Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMTE</td>
<td>Advance Materials Technological Education ATE Center, Ben Marshall is the PI</td>
</tr>
<tr>
<td>ATE</td>
<td>Advanced Technological Education Program</td>
</tr>
<tr>
<td>HUCNE</td>
<td>Hilltop University Center for Nanotechnology Education</td>
</tr>
<tr>
<td>IRB</td>
<td>Institutional Review Board</td>
</tr>
<tr>
<td>NFM</td>
<td>Nanotechnology Fabrication and Manufacturing Partnership</td>
</tr>
</tbody>
</table>
Table 22 – Continued

Acronyms in Nano-Tech Case Study

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Institution/Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>Principal Investigator</td>
</tr>
</tbody>
</table>

Purpose and History

The Hilltop University Center for Nanotechnology\textsuperscript{12} Education (HUCNE) was created in 1998, inaugurated by the governor and funded by its home state’s Department of Community and Economic Development to help meet the growing need for skilled nanofabrication workers. In 2001, HUCNE was awarded an ATE Regional Center grant “to meet the increased demand in [the state] and nationally for associate degree-level workers in the field of nanofabrication, including semiconductor manufacturing” (nsf.gov center award abstract). In 2004 the center’s leadership received an ATE planning grant to explore the possibility of becoming an ATE National Center, which was subsequently funded in 2008. At the time of this study, the center had two ATE grants running concurrently as it completed the transition from regional to national center. The regional center grant, funded

\textsuperscript{12} A nano-meter is one billionth of a meter. In nanotechnology, the physical properties of a substance can be described and manipulated at the nano-scale to create materials, devices, and systems with new and unique properties. Nanotechnology has applications in a variety of fields including medicine, nutrition, energy, and electronics.
at $1.7 million for five years ends in August 2010. The national center grant, funded at $3.7 million continues through August 2011. In its nine year history with the ATE program, Nano-Tech has received more than $8 million in NSF funds designated for ATE centers. For the sake of simplicity, the pseudonym Nano-Tech will be used throughout this case study to refer to HUCNE and the regional and national ATE centers it houses.

**Context**

Nano-Tech is located at Hilltop University, a state land grant research university in a small, rural town where the total university enrollment exceeds the city’s resident population. Hilltop University has 20 satellite sites around the state and one international campus, offering 8 associate, 150 baccalaureate, and more than 170 graduate degrees. The main campus serves more than 45,000 undergraduate and graduate students annually.

Near its main campus, Hilltop University has a research park where Nano-Tech resides in two separate buildings. The main center is in an office building and includes two separate suites of offices, a conference room, and a classroom. The PI, Dr. Scott Franklin, and senior program and administrative support staff are housed there. The offices for the remaining program staff
and the center’s lab space are a quarter mile down the street in a research building. The building in between Nano-Tech’s offices houses start-up companies, including two run by the PI, Dr. Franklin.

The center leadership is embedded in Hilltop University’s culture and administration. Franklin has been on the university faculty for 39 years and holds an endowed chair position in the engineering department. Nano-Tech’s Managing Director, Dr. Hans Pierson, is the Director of Research Program Development in the Office of the Vice President for Research at Hilltop. In addition, the center’s full-time administrative assistant, Ms. Denise Lawton, has a long tenure at the university, where she gained experience in a variety of offices and roles.

The state government has been a strong supporter of the center in the past, providing seminal funding and continuing financial support of community college students in the center’s capstone semester. Recent economic changes have reduced that support, which has meant a reduction in staff and programs for the center. The nano industry in the state is strong, however, with a variety of sizes of companies from small local to giant international (e.g., GE). These companies use nanotechnology in a variety of
settings from solar energy to mobile phones. Therefore, the need for nanotechnicians who can operate across a broad spectrum of manufacturing contexts continues to grow, despite the economic situation.

**Activities**

Nano-Tech operates on the basic premise that equipment for nanotechnology is inaccessible to community colleges due to price. Therefore, the center has designed its activities to (i) give a broad range of students access to nanotechnology, (ii) teach educators about nanotechnology applications, and (iii) help educators incorporate nanotechnology into their courses appropriately. Nano-Tech’s capstone semester, which it has offered three times a year, forms the platform for most of these efforts. The capstone semester integrates six courses (18 credits), including classroom and lab work, designed to give participants hands-on experience with nanotechnology equipment. Community college and university students come to Hilltop from approximately 30 institutions all over the state to take the courses. Until 2010, state government funding for the capstone meant participating students received a stipend for room and board and paid the tuition of their home college, even though the courses are offered through Hilltop. Due to the
economic crisis, the state has had to scale back funding, so Nano-Tech will offer the capstone only twice in 2010-2011.

Nano-Tech has used the materials and approaches developed for the capstone to launch a variety of other activities. The center disseminates nanotechnology curriculum modules developed for the capstone and conducts professional development workshops and webinars based on those concepts. Center staff engage in outreach activities with community colleges and high schools to promote awareness of the capstone and educate students and teachers about nanotechnology applications. In the past, the center spent the summer hosting three-day camps for high school students; however that program was terminated after summer 2009. Nano-Tech also hosts an annual career fair and has created an alumni website to connect capstone graduates with potential employers.

Nano-Tech’s most recent activity allows educators from around the world to access the center’s equipment and expertise. In coordination with center staff, educators develop experiments in their classrooms, send in their samples and then run the Nano-Tech lab equipment remotely via the Web to get the results. This project was being set up for pilot testing at the time of the
research visit.

**Partners**

At its inception, before there was even a capstone semester, Nano-Tech founded a partnership with education and industry, the Nanotechnology Fabrication and Manufacturing (NFM) partnership. It includes an industry advisory board with representatives from companies of various sizes, from local to international. Industry participants represent companies that have hired capstone graduates. Educational participants are faculty representing the variety of community colleges that send students to the capstone.

With regard to the ATE required external partners, Nano-Tech is in a different situation than the other three centers included in this study. At the time of the researcher’s visit, Nano-Tech was transitioning from a regional ATE center to a national ATE center. The regional center grant, which runs through 2010, has its own separate staff and NVC. The national center grant began in 2008, giving Nano-Tech two years to make the transition before the regional grant funding was completed. At the time of the research visit, the committee membership for the national center’s NVC had not been established. However, crossover between the regional center and Nano-Tech
is evident: two NVC members from the regional center (Ben Marshall and Arwynn Kennedy) serve as co-PIs on the national grant. Therefore, in this case study, any mention of the NVC will refer to the regional center’s NVC, since that group has been serving in that advisory capacity for Nano-Tech since 2001.

With the creation of a national center, Nano-Tech hired two external evaluators, Mr. Arthur Lazlo and Dr. Samuel Lewis. Lazlo is a retired company vice president and 30-year veteran of the aerospace industry. Dr. Lewis is a retired professor with subject matter expertise in technology education. Individually and as a team, they serve as evaluators and consultants for several ATE projects and centers.

**Staffing**

Nano-Tech has the largest staff of all the centers involved in this study. Overall center leadership includes the PI, Franklin, and four co-PIs, three of whom are at different educational institutions. Franklin and co-PI Pierson have other responsibilities at Hilltop, and thus work with the center part-time. The work of running the center and its activities on a day-to-day basis falls on the seven full-time and nine part-time staff members. Mr. Richard
Grayson, Director of Education and Outreach, is full-time and manages Nano-Tech’s daily operations. At the time of the research visit, the other full-time staff could be broken into two groups: program and support. The program staff included Mr. Logan Jackson, Outreach Coordinator; Ms. Anja Berry, Education Coordinator; Mr. Jake Nelson, Capstone Instructor; and Mr. Reed Stark, Lab Coordinator. Support staff included Administrative Assistant Lawton (mentioned above), Ms. Pepper Potts, Administrative Support Assistant, and Sarah Crandall, Part-Time Administrative Support. The six teaching assistants for the capstone semester comprise the remaining part-time staff members. The staff configuration of Nano-Tech is presented in Figure 28, below.

Mainstreaming Evaluation

Nano-Tech’s mainstreaming of evaluation is embedded in the history of the center. When Franklin founded the center in 1998, he was personally committed to strategically aligning the center with the needs of industry and community colleges. He created the Nanotechnology Fabrication and Manufacturing (NFM) partnership, which served as a venue for learning about those needs. Due to Franklin’s leadership and the NFM partnership,
Figure 28. Nano-Tech Organization Chart
Nano-Tech started at the leadership stage in the Strategy and Design stream. The partnership has continued to serve as a key resource for strategic information and is a model that Nano-Tech could disseminate in its role as a national center. The recent development of the remote access program and Berry’s commitment to designing experiences that meet the needs of each customer demonstrates how deeply that commitment to evaluation is within the center. Thus, the gradient of the Strategy and Design arrow in Figure 29 shows Nano-Tech starting and continuing at the leadership stage.

*Figure 29. Streams of Evaluation at Nano-Tech*

With regard to Continuous Improvement, the center initially moved from the desire for feedback to creating actual surveys and systems for collecting that feedback. The step to leadership happened when Franklin hired Richard Grayson as the Director of Education and Outreach. Grayson took the data that were being generated from surveys and created a system to
consolidate and share that information with the rest of the staff. All the staff interviewed, down to the teaching assistants, said that they expect evaluation feedback and use it to improve their performance.

Neither Franklin nor co-PI Pierson were particularly interested in the Impact for Judgment stream of evaluation when Nano-Tech began. In his interview, Pierson said:

….we resisted outcome-based evaluation. In fact, in traditional resident instruction higher education, we do not track our students after they graduate except for alumni donations. When the state funds workforce development, it requires tracking of graduates. We don’t participate in those programs. So a program like ATE that wants outcome-based tracking, community colleges might be more in that space, but a research institution like Hilltop, that’s just not something we do.

The center created an impact evaluation system as a matter of compliance with the ATE grant requirements. As Franklin put it:

…the formal surveying with evaluators... the formal system came out of NSF forcing it on me. I’d never thought about it before that – so we started doing it and then discovered we liked it and it was really useful. It’s nice when their requirements are useful.

In the journey beyond compliance in the Impact for Judgment stream, Nano-Tech had help from staff member Karl Davis. Nano-Tech hired Davis, a retired community college executive, in its early years to facilitate
partnerships with community colleges. He served as a resource for evaluation of educational programs and helped Nano-Tech build in impact evaluation.

The center’s previous evaluators did most of the instrument development and surveying, and presented reports to the staff and the NVC. The center’s interest in and use of those reports placed Nano-Tech at the “desire” stage of evaluation mainstreaming.

With the creation of a national center ATE center at Nano-Tech, two factors contributed to move the center from desire to its current stage of leadership. First, the center leadership hired two new external evaluators, Lazlo and Lewis, who have a more strategic, partnership-oriented approach. Second, the national center leadership included two new co-PIs, who previously had been NVC members. Co-PI Ben Marshall is the PI at another ATE center and responsible for coordinating Nano-Tech’s materials dissemination. Co-PI Dr. Arwynn Kennedy is a retired community college professor. She was a co-PI on an ATE nanotechnology center at her community college, which has partnered with Nano-Tech since 2002. Kennedy coordinates Nano-Tech’s alumni tracking and networking efforts. Through the influence of the external evaluators and co-PIs, staff have
become more involved in planning and creating systems for obtaining evaluation data. As a result, the center could be a great mentor to other institutions in the Impact for Judgment stream of evaluation.

Nano-Tech started at different stages in each stream of evaluation within the organization, based on skills, interest and perceived usefulness of the information generated by each. Over time, through NSF requirements, staff skills, and experience with all three streams, the center has moved to the leadership stream in all three stages. In addition, the center staff have the knowledge, skills, and systems in place to be able to mentor other organizations that wish to integrate evaluation into their own operations. The following sections will explore the organizational factors, capabilities, systems, and structures that enable and sustain the mainstreaming of evaluation at Nano-Tech.

**Leadership and Culture**

Nano-Tech’s PI, Dr. Scott Franklin, is a subject matter expert in nanotechnology, with extensive experience in both academia and research and development for industry. Hilltop University has been Franklin’s home for more than 40 years. He received his undergraduate degree there, and
returned as a faculty member in 1968 after he earned his PhD in Engineering at another institution in the same state. He became a full professor in 1978 and a distinguished professor in 1985; in 2000, Hilltop awarded him an endowed faculty chair position.

Franklin’s research and development for industry springs directly out of his work as a distinguished professor and researcher in semiconductor physics. He cofounded two nanotechnology companies, and according to his biography on the Hilltop website, personally holds 29 patents in his research areas, many of which are licensed to industry. In addition, Franklin is a founding member of the National Nanotechnology Infrastructure Network (NNIN). NNIN is an NSF-funded partnership among 14 universities that provides research opportunities and support through their nanotechnology laboratories.

Nano-Tech’s staff, industry, and education partners, and external evaluators interviewed for this study unanimously described Franklin as intelligent, visionary, and driven, as well as collaborative and personable. Through his long history with Hilltop and his work with industry and start-ups, he has a broad personal network to draw on when looking for new
directions for Nano-Tech. This combination of personal characteristics and connections means he knows what kind of information he needs, where to look for it, and how to listen and sort through what he hears to find it.

Belinda Fenwick, a longtime educational partner, described Franklin this way:

Scott is very visionary, but as visionary as he is, he always takes the time to truly listen to what people have to say. And that’s a really neat part of that leadership. He is assessing, from his perspective, weighing the comments he hears and suggestions. And he seeks people out for that, too – I’ve noticed in the partner meetings, people he knows have certain strengths, he’ll direct questions to them... He’s a nice man, and very brilliant. He’s very smart but good with people, too.

In addition to being brilliant and personable, Franklin also can explain nanotechnology in ways that make sense to the uninitiated. From evaluations of Nano-Tech workshops, participants commented that they enjoyed his presentation style and found him engaging, organized, and easy to follow and understand. This skill has been key in spreading the idea of nanotechnology education beyond the university to community colleges.

Franklin’s vision for Nano-Tech is to improve the education of nanotechnologists by creating strong collaborations between research universities and community colleges. On a basic level, he believes the
collaboration is important because community colleges drive the economy by providing technicians essential to the workforce. “Those institutions...breathe life into our country,” he said. In nanotechnology, however, the collaboration is critical because the equipment is prohibitively expensive for community colleges, and universities are able to provide both access and expertise. In Franklin’s words:

I really believe that the community colleges and technical colleges need the help of research universities... Somebody told me once that he read three articles and made three courses in nanotechnology. It seems better to have practitioners, researchers at universities create the curriculum and do the dissemination. Nanotechnology is fast moving and the envelope is driven by universities, so it makes sense to have them involved in educational infrastructure. I believe in resource sharing, developing materials, making modules available to them that can be used in seminars.

Franklin has demonstrated that commitment to collaboration with community colleges in several ways. In the early days of Nano-Tech, he established the Nanotechnology Fabrication and Manufacturing (NFM) partnership with community college educators and industry representatives. He worked with them to create the capstone held at Nano-Tech, where students from all over the state can spend a semester learning about nanotechnology and working with the equipment in the lab. Recently, Nano-
Tech purchased a $500,000 Field Emission Scanning Electron Microscope (FE-SEM) strictly for educational use. A frequent lecturer for Nano-Tech, who is also an employee at one of Franklin’s start-up companies, explained the significance of that purchase:

The faculty members at Hilltop didn’t understand why that kind of high level of microscope is needed for education purposes. So what they think is, for research, that kind of high performance microscope is crucial, but for educational purposes, simple demonstrations on how it works and things like that would be good enough... Dr. Franklin said he wanted the FE-SEM to have the highest priority for education and since there are a lot of partner institutes in the U.S. and internationally, he wants it available 24 hours [a day]. If he opened it to researchers and if someone else wanted to use it for education then it would be conflict. In a sense, even though that is a very expensive tool, he purchased it for education purpose only and did not open it to the research purpose.

The FE-SEM purchase clearly demonstrates Franklin’s commitment to nanotechnology education, and not just research.

Franklin is not only committed to collaborating with educators, he is committed to training students for successful careers. Nanotechnology graduates can work in a variety of industries, but they need an adaptable skill set, because employment in the manufacturing sector is constantly in flux as jobs go overseas. As Franklin put it:

We’re not training for industry, we’re training for a student’s
career. The way I feel about it, a student can go out and work for Company A for a year and they move to China. The student needs to have tools they can shop around to other companies.

Franklin described an example where 16 capstone graduates had gone to work for a large company with a manufacturing site in the state. When the company decided to close the plant and offered its employees the chance to relocate to another state, all the capstone graduates declined. Instead, they got jobs with different companies in the same city. Franklin summed that up as evidence of a good nanotechnology education. “And that’s being highly successful – preparing students for a lifetime of flexibility and a base to build on,” he said.

A critical part of Franklin’s vision for Nano-Tech is excellence. “I want to make sure we’re doing the best job we can; it’s that simple. I take pride in what I’m doing, research, teaching, center activities,” he explained. Evaluation is a critical part of achieving that excellence, even though it requires resources above and beyond what’s spent on the program or product. When asked how he makes evaluation sustainable at Nano-Tech, Franklin said:

We just try to budget it in. I can understand the push back, it costs money, it takes time; but to me you have a product and if you have it, you have to find out how it’s being received, so you
have to ask... I believe [evaluation] helps us produce a better product. I think it’s necessary in all these programs. I think it’s very important that NSF makes sure the evaluations are done in a correct way and objectively.

In pursuit of excellence and his vision for Nano-Tech, Franklin needed colleagues with different skill sets than his. Therefore, he found two partners to round out the center’s leadership staff, Co-PI and Managing Director Hans Pierson, and Director of Education and Outreach, Richard Grayson. Each of the three has a clear role in the center’s leadership. When asked how he created the roles for Pierson and Grayson, Franklin responded:

Consciously, I don’t like writing proposals; Hans is good at it. I don’t pay attention to funders or politics and Hans is very good at that. I’m a researcher and a teacher so I don’t have time to run things on a daily basis; and Rich had that kind of background in industry, engineering and MBA, so that’s worked out well. They’re conscious decisions.

Both Pierson and Grayson are committed to excellence and have subject matter expertise in areas that Franklin needs to support his vision for nanotechnician education. Pierson is the Director of Research Program Development for Hilltop University’s Office of the Vice President for Research. He has been involved with the center for 10 years and served as PI on the planning grant for the national ATE center. Currently, 35 percent of his time is dedicated to Nano-Tech. Grayson, an engineer with an MBA, joined
the staff in 2005 as Nano-Tech began expanding to operate on a national level. They both share Franklin’s personal characteristics of being “smart, but good with people.”

Besides adding leaders who are committed to excellence, Franklin has further ensured it will be a part of Nano-Tech’s culture by hiring for that trait and then setting improvement toward excellence as one of their performance criteria. When asked if he hired people who are improvement-oriented, Franklin said:

I hire for it. I look for people who aren’t asleep at the throttle. You can hire somebody to do a job, or you can hire someone to do a job and make it bigger and better. And you get a critical mass of people like that and they know it’s how they’re being evaluated and how their raises are determined. You hire for it and then it builds on itself? Exactly.

Based on interviews with Nano-Tech staff, Franklin has hit the mark.

In individual interviews with the researcher, every single member of the staff discussed how they use feedback to improve their work and improve the overall products of Nano-Tech. When asked if getting feedback felt like extra work, Logan Jackson, the Outreach Coordinator, gave an answer that exemplified the staff’s attitude toward getting feedback from capstone students and workshop participants: “It always helped me know how to
improve the next time… It’s not a waste of time; it helps me do my job.”

In addition, the staff share the relational skills that Franklin, Grayson and Pierson exemplify. Grayson said this about the staff:

Every one of them has good interpersonal skills… I think they relate well with people. They do want to make sure that the people who use our program, that go through our programs or events, that it’s positive. They have a desire to do what they’re doing well and not be wasting time.

The shared traits, good interpersonal and technical skills, commitment to excellence, and desire to create a positive experience for participants have had the added benefit of making it easy to create a group that functions as a team. Franklin deliberately uses team language to describe his staff. He said:

Teams are very important. We have a staff meeting and we call it a team meeting. You hear it mentioned in the literature, but it’s very important that people understand that this is a team that thinks it can win the super bowl and you better play as hard as you can every time. So that’s the kind of attitude we try to engender.

Throughout the research visit, staff at all levels who were interviewed referred to themselves as a team. They described solving a variety of problems with ease and fluidity, from covering the same amount of work with fewer staff due to budget cuts, adapting capstone labs and lectures when equipment breaks down, and figuring out how to get the equipment fixed.
Stark, the lab coordinator, described how weekly meetings are a great venue for open communication and problem solving. He described an incident that happened just before the research visit, and how the team handled it:

We meet weekly; everybody’s input is asked for. “How do you solve that problem?” Rich is a good mediator for that, encouraging open discussion and conflict resolution for whatever the conflict might be. For example, this week we had a tool that went offline that the graduate students needed for research. Anja, as lab manager, was given the task of diagnosing it, which was taking a little longer because of beginning of semester stuff that she also had to get done. Jake said he could look at it and have a friend who works on it in industry help. I offered to cover lecture, and we had the problem taken care of before lunch. We make it look easy.

The teaching assistants (TAs) agreed that the communication and problem solving was just as fluid with labs. Two described how they work together to help Stark with preparing samples if he needs it. They also feel comfortable asking Stark or any of the other technical staff for help preparing to lead a group of students through a new lab experience. One said:

There’s like a lot of open lines – the communication here is really good, really fluid. You’re not afraid. It’s not like if you ask Anja a question you’ll get in trouble; she’s not going to say, “I’m not the person that does that.” It’s a network of information; even though people have roles, they’ll answer your question.

A comment from Jackson summarizes how Franklin’s vision of the NanoTech team has come to fruition:
Everyone within our group wants to get better… It’s a team environment. Anja, Reed and I work together well. Rich, Denise, Sarah and Pepper work together, too. We have an open door policy where anyone can offer assistance to anyone else. If I come to the end of a project like the bulletin, I’ll see if anyone else needs help. Everyone is easily approachable; there’s no one I’d be afraid to ask for help or see if I could help them out, too.

Franklin’s leadership at Nano-Tech is based in his vision, expertise, and personal characteristics. By selecting staff who are passionate about his vision, have complementary areas of expertise, and are skilled at personal interaction, he has created a culture that reflects his leadership. The staff also share his commitment to excellence; thus, evaluation is part of everyday business as well as in meetings among staff and with partners. As a team, they are pursuing Franklin’s vision to develop excellence in nanotechnology education and disseminate it as widely and effectively as possible. Blaine Taylor, who has been involved with Nano-Tech in a variety of capacities as a technical expert, summarized the center’s culture from his point of view:

They’re always trying to improve what they’re doing. That’s an important way to do it, to use evaluation to show where you’re weaknesses are. Everything I was involved with, we definitely used the input and actually make changes to try to improve it. Some of the things you know didn’t go well, so you don’t need the feedback to know you need to improve it. I’d say every activity [and] workshop they’ll do evaluations and things; and in that respect I’d say it’s part of the culture that they’re going to do that.
Thus, the leadership and culture of Nano-Tech form the value basis of evaluation mainstreaming. The next sections highlight some of the organizational/staff capabilities that have made evaluative activities possible and the organizational systems and structures that have made getting evaluation information sustainable.

Capabilities

The researcher found several capabilities at Nano-Tech that have enabled mainstreaming of evaluation. They include (i) hiring staff for their skills and shaping their roles and responsibilities in relation to both the goals of the center and evaluation of progress toward those goals, (ii) prioritizing evaluation activities, (iii) creating collaborative relationships, and (iv) developing systems to handle feedback. These are certainly not all the capabilities Nano-Tech and the staff possess, but they seemed to be the most critical in relation to making it possible to gather information and learn from evaluative activities.

Skills → Roles → Goals → Evaluation Responsibility

The staff at Nano-Tech were brought in to the center based on their subject matter expertise and accompanying skill sets: Pierson for finding
funding opportunities and writing grants, Grayson for management, the
program and instructional staff for their technical knowledge of and ability to
teach nanotechnology concepts, the administrative staff for their support
skills. The program and instructional staff’s areas of technical expertise also
reflect the breadth of nanotechnology applications and broaden the group’s
approach to teaching and problem solving. As Stark described it,
“…everyone’s got a different background – Anja physics; Logan, chemistry;
me, biology – [with our] diverse backgrounds everyone has a different
viewpoint, everyone has opinions from different directions.”

The roles each person fills on the team are based on their expertise. The
leadership team (Franklin, Pierson, and Grayson) seeks information about
industry trends, and evaluates them in light of Nano-Tech’s vision for career-
prepared technicians. Pierson’s role is to look for funding opportunities that
converge with the center’s vision and industry trends. As he described the
process:

We are always listening to the government, the funding source,
trying to understand what are their priorities, hot buttons. We’re trying to match those two things – market needs and
funding sources. I don’t think it’s highly structured. You come
away from – you always have a list of needs, you know. Right
now we’re hot on remote access. You’re looking for
opportunities to develop a capability to address that need. Suddenly you’re thinking about remote access and a couple funding opportunities come along that are standard – NSF programs, that we already know about and maybe we’ll hit. Then someone says, “The Obama administration wants to fund things in Russia,” and we already have partners there, so maybe we can do remote access in Russia, and NSF will support that. You have to morph – like when we started with remote access we weren’t thinking about Russia, but then that opportunity came up. We have a general idea about where we need to go and then look for opportunities to make that happen.

Once the idea and funding are in place, Grayson coordinates staff and resources to meet the goals. As he described his role:

I wear a lot of hats. I guess I would be the coordinator of activities we have going on for the center. I’m not a nanotechnology field expert; I have the engineering background so I can understand it. My expertise is pulling people together to achieve the goals of the center. I use the resources we’ve got to systematically approach hitting [goals] we have set, basically in discussion with Scott and Hans. We have a new initiative, and I try to figure out how it fits and how we’re going to do it with regard to the other things we are doing.

Grayson works with the program team (Berry, Jackson, and Stark) to design program activities and continuously develop them. Once the programs are in place, staff members carry out their assigned responsibilities within each. Due to the recent state funding cuts, this often means working simultaneously on multiple Nano-Tech programs, particularly for Berry and Jackson. At the time of the research visit, Berry was developing remote access, teaching in
capstone labs and workshops, and learning how to manage the new website.

Jackson also was teaching in capstone labs and workshops while organizing outreach events and recruiting visits and putting together Nano-Tech’s news bulletin. (Neither of those lists is comprehensive!) Berry summarized the way the roles serve Nano-Tech operations like this:

Pepper and Sarah are recent hires and though they replaced other people, having that resource to collect and disseminate information helps a lot. It gives the technical staff the time to continue doing their job. We have Dr. Franklin, who is a true visionary. He’s got years of experience and knowledge, he plows a clear path, he knows what he wants and asks that we make it happen. And then Hans Pierson, who really is just – his expertise is grant writing and evaluation, I think, is critical. Differences in roles? Rich’s role is to communicate Dr. Franklin’s needs to us. And we as an engineering team have to figure out how to make that happen. More of a brainstorming session – you go to Dr. Franklin when you have results. That’s why Dr. Franklin employs us, to think through the hurdles and the struggles and then make it happen.

The “staffing for expertise” also has extended to Nano-Tech’s choice of partners, including the external evaluators and co-PIs. Two of the co-PIs have extensive experience at other ATE centers and served on previous Nano-Tech NVCs. Co-PI Ben Marshall is the PI of another ATE center, AMTE. Co-PI Arwynn Kennedy is a retired community college professor, and former co-PI for another ATE center dealing with nanotechnology. At Nano-Tech,
Marshall is responsible for materials dissemination and Kennedy for creating alumni resources and the alumni network.

Lazlo and Lewis were the evaluators on Kennedy’s ATE grant. Pierson, who is on the NVC for Kennedy’s ATE center, met Lazlo and Lewis through that connection. He admired the quality of their work and recruited them to serve as Nano-Tech’s external evaluators. According to the 2009 evaluation report, Lazlo and Lewis have been involved since the beginning of the national center grant, helping to create an evaluation plan based on Nano-Tech’s 10 goals and its proposed activities to reach those goals. The plan includes assessment questions and benchmarks for each goal. According to Grayson, this is the first time the staff has been involved in planning for impact evaluation.

We’re doing more in the proactive evaluation, whereas in the past we did more passive. [We’re] more proactive about external evaluation – not of what we do, but creating an evaluation plan. Before, it was more we engaged the evaluators, they did surveys and talked to our customers – we got great evaluations. But it wasn’t as proactive as we are now. Why the change? It’s the way [Lazlo and Lewis] do it. Not conscious on our part – how would we know? And not the fault of the evaluators before. We weren’t holding back on them; they were parts of meetings and then they went away, and we checked that box.

Co-PIs Marshall and Kennedy also pushed the staff deeper into
thinking about impact evaluation. As experienced leaders on other ATE grants, they both understand NSF’s requirement for external evaluation and how to build that into their work. Kennedy explained how they handled it at the center where she was co-PI:

I know NSF requires an annual evaluation, through Western Michigan, and I know they try to have us embed those findings in our annual report. The one thing that can be troublesome in evaluation is when it gets tedious to the point that it doesn’t really apply. When it’s practical and you go to the source of where the action is happening it becomes very, very helpful...If you know up front what the expectations are, it’s so much easier to deal with than going back and trying to collect it at the end. When we had our initial center meetings, we spent a lot of time developing how we would measure each goal quantitatively and qualitatively – each member has the chart and they know what exact numbers and kinds of qualitative measures are expected; so when I write the annual report, its not nearly as difficult because people have known what kind of data to collect along the way.

Marshall concurred. When asked about his motivation to build evaluation into the Nano-Tech activities for which he is responsible, he said:

It’s more from our own experience, that any funding agency is extremely desirous of knowing impact of what you’ve done beyond the fact you’ve done it. We want to make it easier for us to write our annual report. I’d rather say, “Our web seminar yielded these impact results.” We’re trying to make it easier for us, by bringing evaluation in at the front end. It seems the right way to do it. Our task is curriculum development and dissemination, and to build evaluation in from the beginning just makes a huge amount of sense.
Marshall brings that impact question into his various areas of responsibility related to Nano-Tech activities. For instance, he got the staff thinking about how to evaluate their Web-based materials dissemination process while it was still in the design stage. “We’ve tried to build evaluation into everything we’ve set up for them. We’re not trying to take over the evaluation world, but we’re working with the evaluators to set it up, to build it into every single thing,” he explained.

The more proactive stance to evaluation as related to staff members’ areas of responsibility has been most clearly demonstrated by Berry, the education coordinator. She is the primary staff person responsible for developing the remote access project and at the time of the research visit was organizing a pilot study and working with the external evaluators to determine how to measure impact. Lazlo said, “Anja is setting up a pilot for this spring, setting up with 5 faculties around the country, and working with us about what information to collect.” Berry described the effort this way:

It’s one of the first projects [where] I’m taking a look at evaluation before the project, starting with a pre-participation survey. I’ll be putting together an individual plan for each participant and their associated students, or whoever they are using to participate... There will be a pre-participation survey for the individual group plans, then scheduling test sessions
and experiments – a lot of interaction between those two making sure they are supported in whatever way they need, so I hope there will be feedback from them about that…With each of the individual plans I’ll be figuring out the best way to gauge the efficacy of the experiment – different for each – maybe a survey, group project, [it] could be a number of different ways.

The efforts of Marshall and Berry exemplify Nano-Tech’s critical capability of involving people with the key skills and expertise the center needs, giving them clear roles and responsibilities in relation to the center’s goals and then making evaluation part of that responsibility.

Prioritizing

Like any organization, Nano-Tech has limited time and resources. In order to make getting feedback feasible, leadership staff prioritize the expenditure of time and resources on evaluation in ways that best serve the center’s goals. They have set up systems to stay in touch with their partners and focus extra time and effort on developing systems for new programs and activities. Grayson commented, “It’s a tough balance. It’s the most critical things – those are the ones where we say, ‘How will we get feedback?’”

One of the critical things the center is focusing on is feedback and impact from the remote access program. They want to track the center’s impact on student learning in the remote access project; therefore, the staff are
completing the Institutional Review Board (IRB) process (see Systems and Structures, below), which increases the time and effort for setting up the evaluation systems. However, the leadership staff deemed that extra effort worth it due to the high potential the remote access program has for helping Nano-Tech meet its goals. Grayson summed it up:

[Getting information on student learning is] a critical thing we’re doing – we won’t do it for everything we do. We think there’s some strong promise for [remote access]. We don’t know if it will take off, but it’s logical that it might take off. There’s a lot of work going on in that area...

The ability of Nano-Tech’s staff to prioritize its activities and evaluative efforts based on meeting the center’s goals is a key capability in mainstreaming evaluation.

Collaborative Relationships

Nano-Tech is founded on the capability to create collaborative relationships. When the center was inaugurated in 1998 by the governor, Franklin moved immediately to create the Nanotechnology Fabrication and Manufacturing (NFM) partnership, a collaborative effort between industry and education to equip technologists for the nanotechnology workforce. In those early days, it was Franklin’s status, connections, and commitment that
made the partnership possible. As one industry member of the NFM described:

...at the beginning it was less formalized. Scott is pretty well known, certainly from the companies that work with Hilltop. He has experience with start-up companies, spin-offs of Hilltop. He has a lot of experience networking with folks. He’s a social person and a very intelligent person, and has a fairly large network from that.

Franklin used his personal influence to get people involved in the partnership, and together the NFM built the courses for the capstone semester, which Nano-Tech first offered in spring 1999. The contributions of both industry and academia were critical in that effort, which enabled the courses to meet the skill needs of industry and the instructional needs of community college students. An educator who participated in the development described the process this way:

We had an industry committee, then the folks they engaged at Hilltop University who were curriculum developers, not technical folks. So we had a team of content folks, and industry folks, and we all had some of our own ideas. The other part was also what kind of students might we get, what would their skill sets be, would they benefit from certain courses before they came, what could they take to be prepared. I helped prepare them with the demographic and type of students coming out of community colleges, that they would be different from engineering students at Hilltop. These students are more tactile and kinesthetic learners than theoretical ones. So they adjusted the curriculum in large measure to recognize they’d see
students with learning styles that weren’t quite like what they’re used to. That was a wise thing early on.

Since those early networking and development efforts, the NFM partnership and the capstone have been built on six core concepts. The NFM is (1) a statewide education and workforce development activity reaching every corner of the state, which is (2) truly a joint effort mandated to bring nanotechnology education to secondary schools, postsecondary schools, industry and the general public. The partnership is (3) based on sharing of the research and education resources of Hilltop University, using (4) a broad approach to nanotechnology that is not focused on any single industry. The capstone semester at Nano-Tech (5) admits associate and baccalaureate degree students based on their achievement of skill-set requirements at their home college rather than specific course prerequisite requirements. Finally, (6) all students admitted to the capstone pay the tuition rates of their home college. The capstone is able to offer tuition “equity” through funding support from the state.

Nano-Tech has continued to bring industry, educators, and the center staff together regularly around the vision of quality education in nanotechnology for the workforce. At the NFM semiannual meetings, the
agenda begins with a short presentation by Franklin reiterating the purpose and vision of Nano-Tech and the NFM partnership. This presentation reinforces the shared vision of the group and sets the tone for the collaborative work to be done. Gavin Allen, a longtime educational partner described the vision as the foundation of the NFM:

It is all about one goal. The real issue is this: Our visions are the same, what we want to do is the same. That’s why the collaborative works; we have shared vision on where this program is heading and those things line up. That’s the key to this. That’s why it works.

Meeting agendas forward that vision with presentations, panels, and facilitated discussions. Through those activities, the center staff report on their activities and seek the input of both industry and educators to improve the capstone and other efforts. The vision is also forwarded at Nano-Tech’s annual career fair where educators, industry, current students, and capstone graduates can network and learn about different companies using nanotechnology in the state.

Within the NFM partnership, Nano-Tech has established an industry advisory committee. This group meets annually to review the capstone courses and skill sets and update them as necessary to keep up with industry trends. A member of that group described Nano-Tech and its interaction with
industry this way:

If you look in the sciences in graduate programs, most are training scientists to be academicians... This center, while focused on science and engineering education, really is focused on training individuals to enter into industry, for a wide variety of industries... so it’s in a sweet spot for industry to have a say in what goes on, unlike a typical graduate program at a university level. I look at it as unique in that way – they are focusing in that area and they want that feedback from industry to help guide the program...So rather than saying, “This is what I think and this is what it will be,” both [Rich and Scott] have the attitude, “We really need industry here to help us guide this whole thing.” At the end, when they look at their metrics, it’s how well their students are received, how is their employment success compared to other students, how well are they received where they go, how well do they do in those companies. I think their success rate is pretty high. A lot of that comes down to leadership quality of being engaging and really trying to listen to what industrial folks are saying.

Nano-Tech staff continue to increase the number of industry sources to which they listen. When a company hires a capstone graduate, Nano-Tech invites them to join the partnership and the advisory committee.

Center staff also invest time and energy in maintaining relationships with existing partner companies. On the industry side of the NFM, Grayson is the primary staff person making the effort. Another industry collaborator described his experience with Grayson:

Rich is just a very friendly guy – he sends an e-mail here and there, and since we have so many [capstone] graduates, they
know Rich. It’s a friendly relationship with Nano-Tech... There have been multiple people at [my company] that Rich has continued the relationship with, as we’ve grown and roles have changed and different people have changed responsibilities. Rich has managed to continue to know who to talk to. He stays in with [my company], even as his original contacts have changed...

This collaborator met Grayson when he called to see if the company was interested in participating in the annual career fair. The collaborator recalled, “The guy Rich had usually contacted forwarded my information to Rich, and I went up and presented.”

Collaboration with educators is another key part of the NFM partnership. Educators receive funding from Nano-Tech to attend professional development workshops, are invited to the industry advisory board meetings, host center recruiters at their colleges, use curriculum developed at the center in their courses, and send students to the capstone. They provide enrollment data for center evaluation reports, pipeline information to give the center an idea of how many students are intending to attend the capstone, and contact information for students to help with alumni tracking. At least one partner college has pursued and received NSF funding in the nanotechnology area. Franklin wrote a letter of support that Dr. Gavin Allen is certain positively influenced that process. As he described it:
I went to Dr. Franklin, told him I wanted to write [an NSF grant] and asked for his help to articulate who we really are and what we really do to NSF. When I asked him that, he said, “Sure.” He and Dr. Pierson, our experts from here, and I, we went to NSF, told them what we’re doing here and what we need from this program. One year down the road from that we have $600,000 from NSF to do this. I tried to get it from NSF before, but without success. This was the first grant in the history of [my college] from NSF – they never knew us before. Not only did we get the 2008 grant, we wrote another one in 2009 and we got that too. Before that, I wrote 15 grants to NSF alone; they didn’t take me seriously. These are things you can’t replace or buy or say.

Besides classroom and funding support, the opportunity to be in the same room, in conversation with industry representatives has been another benefit for faculty members involved in the partnership. Not only does industry interaction help the faculty adjust their courses, the interaction with faculty from other colleges is valuable as well. Belinda Fenwick, a long time educational partner, described the benefits:

In our area, the last time we met, we had five to six industry partners who were able to attend, folks from Hilltop came out, and then we had three local community colleges in the partnership come out. It really gave a good exchange. When we have [had] partner meetings at Hilltop, it gave the community colleges a chance to get together and dialogue about what we’re doing, pick each other’s brains, talk about best practices – that was of tremendous value to us.

According to the partners interviewed, the collaborative relationships
between Nano-Tech and the participants in the NFM partnership are based in the center’s leadership and culture. Over time, the partners have seen that the staff value their input and adapt the center’s work based on it. As Fenwick said, “When you know your feedback is helping to drive the process then it makes you want to provide input and the piece they need for evaluation.” In addition, partners reported that Nano-Tech actively tends the relationship through communication, thus demonstrating its commitment to a participatory model of organizing. As one educational partner said:

They were also proactive in sending people out to visit their constituents, to say, “Here’s what’s coming,” and “What do you think?” They valued people’s continued commitment that way, instead of sitting on an academic chair, and saying we have the money and if you want it, good luck. I think that was always part of the culture. They were open to realizing it would be much stronger if it was participatory and it would be a success as a result. They’ve been proactive over the years in getting information to folks as well as asking for it.

When asked what it was about Nano-Tech that made this kind of deeply collaborative partnership possible, Allen said:

[The] fundamental reason is the people – Dr. Franklin is a person whom you can work with. He is truly a leader; he not only does work, he interacts well with people, he’s pretty supportive and easy to work with – and his group has been similarly so. If anybody else was doing it I don’t know how it would go. It is about the person and persons who are involved in it.
Nano-Tech’s organizational-level capability to build collaborative relationships has been key to its continuing development. Franklin and his staff get information from partners for all three streams of evaluation, and the partners are happy to contribute because they know the center will use the information in service of their shared vision for nanotechnologist education. The flow of information is depicted in Figure 30.

Developing Systems to Handle Feedback

The depth of the partnership has made a significant amount of information available to Nano-Tech. For its long-running programs like the capstone and workshops, Nano-Tech has extensive evaluation feedback systems in place; every activity has an evaluation component. One of the difficulties that comes with this comprehensive feedback system is that Nano-Tech obtains a lot of information. This means the staff have had to develop ways to handle all that information. Berry described the one process for caching data from existing programs, “… now we have a folder on a shared network drive that has the surveys for different projects and the evaluation material is in that project folder. The folder has the actual survey and the collected data.” Grayson also wanted staff to be able to review the
feedback individually, so he created a system to get information compiled and shared with staff (discussed in Systems and Structures, below).

The center’s information systems also are capable of dealing with two other challenges that come with feedback: lack of specificity and negative comments. With regard to the capability to get specific feedback, Nano-Tech has added features to its surveys that specifically ask for it and tell how it will be used. An example was found at the top of an end of program survey for

Figure 30. Information Flow in Nano-Tech’s Collaborative Relationships
the center’s Train the Trainer workshops. The text reads:

Thank you for participating... Your input and evaluation is extremely critical to the future success of these workshops, and will help to shape the structure/format of future Train the Trainer workshops. Please take a few moments to help us improve this offering by giving us the feedback that we need. Please be honest..... we can take it! (The more specific the better.)

Other features that increase specificity include the frequency and content of the workshop surveys. Participants are asked to complete surveys at the end of each day, and those surveys have sections for comments on every presentation and every presenter. As will be discussed below in Continuous Improvement, staff use those comments to improve their performance.

The capstone evaluation surveys, however, lack the capability for specificity in relation to the TAs’ performance. If students complain about a specific TA, lab coordinator Reed Stark will e-mail that individual, but the results that are circulated don’t differentiate between the TAs with regard to performance. In the focus group discussion, the TAs expressed some frustration about that. One said:

We get a big sheet at the end of the semester with all the comments people have written. We got things like, “Most TAs didn’t write enough comments” – they weren’t specific at all. They told us problems, but not who had the problems.
The lack of specific feedback to particular TAs has made it hard for them to know what they need to do individually to improve.

The capability to handle negative feedback appropriately is important in an organization that asks for honest input from participants. As Stark said about students’ capstone evaluations, “The problem with that stuff, all the negative things come through, not it was great that somebody came in on a Friday to answer my questions.” With regard to the workshop feedback, Grayson’s system shares all feedback with all staff, which has the potential to share one person’s negative feedback with the entire group. As a result, Grayson reviews all the feedback before it goes out. If there are harsh comments directed at a particular staff member, Grayson removes them before circulating the evaluation compilation because the practice is “not meant to shame someone,” he said. His other solution to dealing with negative feedback is to keep a broad perspective, which includes other sources of information besides participant comments. As Grayson described it:

Sometimes it’s difficult not to react to one negative piece of information. And I’m probably pretty good at sorting. Others might say we need to re-invent the program – a student might come in and complain about an instructor. And I’ll say this guy
has taught 600 students. We need to not have knee-jerk reactions. We have to be careful not to redesign stuff that doesn’t need to be re-designed because there’s plenty of work already.

Capabilities Summary

Nano-Tech demonstrates several capabilities critical to mainstreaming evaluation. The staff are subject matter experts, with clear roles and responsibilities related to the center’s goals. They are getting involved in creating feedback systems within their areas of responsibility. The leadership prioritizes information-gathering activity to keep it feasible within time and budget constraints. Nano-Tech’s modus operandi is based on collaborative relationships, as evidenced by the NFM partnership. Those relationships generate important information that the center uses to adapt itself in pursuit of its goals. Finally, Nano-Tech has exercised the capability to create systems that get useful feedback (i.e., specific) and handle negative feedback in a constructive manner. The systems and structures the center has in place to sustain evaluation mainstreaming are further discussed next.

Systems and Structures

Nano-Tech staff have created three overarching systems and structures that have made evaluative activities a sustainable part of the center. They
include (i) scheduled communication, (ii) dissemination of evaluation results, and (iii) compliance with the IRB. All three are maintained by staff as a part of upholding the center’s commitment to excellence in pursuit of the vision of quality nanotechnologist education.

**Scheduled Communication**

Nano-Tech has a structured system to ensure communication among staff members and with external partners, and evaluative activities are integrated into that. The program staff meet weekly, and post-event evaluations are included on the agenda as appropriate. The team engages in group problem solving regarding the capstone courses and labs. They design changes based on feedback, discussion, and observation and assign responsibility for implementation.

The lab TAs also meet weekly, a practice established by Stark, their supervisor. One longtime TA remarked on the change:

> It’s been improved over the years – when I started out there was (sic) no TA meetings – because Reed wasn’t in charge then, it wasn’t that organized. Ever since he came, we have a mandatory weekly meeting, to improve the quality of the lab, for next week, and see what’s coming two weeks ahead of us. It’s look ahead time every week.

Evaluation is also part of the center’s interaction with its off-site staff
and partners. There are monthly conference calls between the on-site center staff and Marshall and Kennedy, the external co-PIs. Marshall and Kennedy extend the evaluation conversation in their twice-yearly meetings with their national committees for materials dissemination and alumni, respectively.

The NFM partner meetings also include evaluation. The NFM meets at least twice a year and, as the 2007 and 2008 meeting agendas demonstrated, part of the time is dedicated to continuous improvement issues. Nano-Tech staff solicit information about student and partner recruitment strategies, talk about survey results, and seek better ways to communicate and serve the needs of partners. They also look for assistance in identifying new companies for the advisory committee and finding past graduates.

**Dissemination of Evaluation Survey Responses**

When Grayson arrived at Nano-Tech in 2005, the surveys for activities were already in place, but in order to review the responses, staff had to look at all the individual surveys. So, he enlisted the administrative staff to compile all the responses into a single document. He recalled,

> When I first came, nobody was doing that [typing up survey responses onto a summary sheet] and I couldn’t handle all that individual survey data. I can’t compile and sort through that. I might focus on the one that is negative. I did have them compile
that work – which I think people were thankful for...I send out everybody’s feedback to everybody – there was a discussion about whether or not we should do it that way. But it’s just faster to send it to everyone... everyone can learn from everyone else’s feedback. Then we modify our workshop based on that.

A frequent lecturer at the workshops talked about the amount of data that need to be compiled after a workshop and the significance of the undertaking to get the compilations done. He said:

For example, for the Education and Train the Trainer workshops, they have workshop participants fill out day-by-day, activity-by-activity evaluation... There are multiple pages for every single workshop. Afterwards Pepper or Rich compile and send it out to everyone who participated. That was a big thing that they did.

Nano-Tech has the advantage of two full-time and one part-time administrative support staff who share the work of compiling all that survey data so it can be disseminated to staff. Sarah Crandall, who is part-time administrative support, reads the responses as she compiles them; and since her desk is right outside the conference room in the main Nano-Tech office, she hears it when program staff discuss the surveys on their way in and out of meetings. She said:

[The compilation] goes out in e-mail to everybody; that’s pretty much how they make improvements on the workshops, based on feedback from these surveys. I think they read it, because I’ll
hear them talking about it, especially if someone said something they didn’t like. But mostly they’re all good comments; people love them.

Staff members also are grateful for Potts and Crandall’s work creating the compilations. Berry summed it up saying, “It would be harder if we were responsible for collecting the evaluation data – but Pepper and Sarah collect and compile the information, making it more easy to digest.”

Grayson also circulates a hard copy of the compilation and program staff are required to sign off on it agreeing that they reviewed it. Individual staff members and lecturers who were interviewed unanimously agreed that they used the evaluation information disseminated in the compiled format to adapt their presentations for the next workshop. Logan Jackson, Outreach Coordinator, talked about how he uses the compiled survey responses to improve his sections of the workshop:

I read my section [of the survey] about five times to make sure that I am doing the best I can for the parts I have in assisting with the workshop – making sure that the way I presented things made sense to the participants. I use it more for self-improvement than anything... I think [the survey] is nice because it breaks it down, every agenda item. Looking where someone didn’t enjoy something, maybe I need to put more in or take material out or describe things better.

The survey responses also are discussed in program staff meetings, but the
depth of discussion varies. Potts, the administrative support assistant said, “We don’t elaborately go into it unless there is a problem. We discuss... one or two things of how we think it went. It’s not at all the whole meeting time.”

**Institutional Review Board (IRB)**

Nano-Tech is located at a four-year research university, and perhaps for that reason, has an acute sensitivity to the rights of human subjects involved in evaluation and research about the center. Like most four year research institutions, Hilltop University has a committee that reviews all research proposals and their accompanying protocols and instruments. This committee, the IRB, ensures that the participants’ rights and welfare are protected in any research conducted under the name of Hilltop University. If the research falls under IRB parameters, then those conducting the research must take extra steps to document how participants’ rights were protected.

For instance, a researcher might use IRB-approved confidentiality agreements, which outline how the information obtained will be used. At the beginning of each interview with a participant, the researcher would read through the agreement, and then both the researcher and participant would sign and date it. The researcher then keeps the documents on file in a secure
location. In cases where the information collected will not endanger the participant’s rights, the study may be declared exempt by the IRB, and then the IRB’s approval of the study and the requisite documentation is not required.

The broader institutional requirement of attention to subject’s rights has meant that Nano-Tech needed to develop center-level capabilities to deal with the step in conducting research and evaluation with their participants. Denise Lawton, the administrative assistant, is the center’s liaison with the IRB. She reviews surveys in the design stage to make sure questions appropriately protect the rights of participants, and she handles submissions to the IRB. Often, she sends things to them just to assure that IRB approval is not needed. “Pretty much anything we like to send to them to see if we need approval – I like to get that paper that says we don’t need IRB,” she remarked.

Currently, Nano-Tech is involved in IRB review for two different evaluation projects that involve obtaining information from students. The first is determining the impact of materials disseminated on the website. The center wants to understand the impact those materials are having on student
learning. The second project involves understanding the impact on students who participate in remote access projects. In collaboration with Lazlo and Lewis, the Nano-Tech staff are developing pre-post evaluations to determine what kind of learning results from remote access experiences. Nano-Tech uses the IRB to be sure the center is respecting students’ rights in its evaluation research.

**Systems and Structure Summary**

Nano-Tech staff have experienced a variety of benefits from the evaluation systems and structures they have in place. Scheduled communication has provided a regular influx of information for design, improvement, and understanding of impact. The system created for disseminating that information has made it possible for staff to digest and use it effectively. The compliance with IRB has protected the rights of evaluation participants. The major advantage of systematizing, however, is that it reduces the amount of time staff spend on the logistics that come with getting and using information. When asked about how much time she spent dealing with evaluation issues, Berry’s response reflected those of the other program and technical staff. “It’s not a huge amount of time. We can edit a survey
more easily than re-create; things are already running themselves,” she explained. The following three sections describe the specific tools and systems Nano-Tech currently has in place for getting and using evaluation in each of the three streams.

**Strategy and Design Stream**

Strategy and Design has been an area of strength for Nano-Tech since its inception in 1998. The center has continued to seek information to develop its overall strategy, adapt its professional development offerings, create new programs, and develop the capstone semester. The following section describes the processes in which the center engages in this stream of evaluation.

**Center Strategy and Approaches**

Nano-Tech staff want the center’s strategy and program design to align with industry and education needs. They seek feedback from the NVC and the NFM partnership to ensure that is the case. The following two brief illustrations describe how the center has adapted its overall approach and activities to meet the needs of its stakeholders.

When asked about adapting strategy based on feedback, several study
participants mentioned Nano-Tech’s approach to materials dissemination.

One of Nano-Tech’s main goals is dissemination of the various materials it has developed for teaching nanotechnology. For the national center, the staff was already set up to disseminate via CD-ROM, as they had done in the past. However, Ben Marshall, the co-PI for materials dissemination, urged the leadership staff to consider using Web-based dissemination instead.

Although it meant extra work to be sure copyright issues were handled appropriately, Nano-Tech made the switch. Marshall recalled the process:

> No one was dictating, it was collaboration... They felt that intellectual property issues constrained them to CD. The curriculum development and other committees said maybe take out material that was copyrighted by others and switch to electronic form. It took quite an effort, but they saw the rationale for doing it and made the change. It's a perfect example of the way a project like this goes or should go.

The resulting online dissemination strategy took extra work and resources to set up, but Franklin is pleased with the result. He said:

> We put money into developing the website; it wasn’t cheap, but it saves us – we don’t have to mail out CDs or print them. In today’s world it gives easier access to the materials, it gives ways to track statistics in ways we would have never had.

Tracking is possible because the website requires users to register in order to download materials. This extra step gives the center the option to follow up
later to see if and how the materials were used, for both improvement and impact purposes.

The second example of Nano-Tech using feedback to adapt its overall strategies involves the NFM partnership. Since its early years, the center asked the NFM partners to come to the Hilltop campus for partner meetings. When participation levels began to wane, the staff brought the issue to the NVC. Co-PI Kennedy, who was an NVC member at the time, recalled the NVC’s response to the issue:

At one NVC they were struggling getting feedback from industry, because people were so busy. So we suggested they go out to industry, rather than expecting industry to come to them. So they have meetings throughout the state – that has proved to be enormously helpful.

As the May 2007 NFM partnership meeting notes demonstrate, Nano-Tech heeded that advice and held meetings at three different locations across the state. The practice has continued since, with some variation, enabling educational and industry partners to participate in the meetings with less travel time commitment.

Thus, in the Strategy and Design stream, Nano-Tech has adapted its materials dissemination and method of interacting with partners. The refinements came as the result of feedback from two groups concerned with
the overall Strategy and Design of the center itself, the NVC and NFM partnership. The following sections highlight areas in which Nano-Tech gets feedback from specific groups to address the strategy and design of specific programs and activities.

**Workshops**

Nano-Tech staff use the faculty applications for workshops in several ways to make sure participants have an excellent professional development experience. Nano-Tech offers a range of workshops from introductory to advanced levels. When applications come in, they are reviewed to make sure that the applicant’s level of knowledge and experience with teaching nanotechnology is commensurate with the level of the content in the workshop for which they’ve applied. Pepper Potts described the process this way:

> I contact them to say they’re in or that they would be better off in another workshop we are offering. Specifically, with the educators’ workshop, we try to make sure that nobody too advanced is at the introductory workshop and no one too new is at the Educators’ workshop.

Also, administrative staff follow-up with registrants to be sure they have made appropriate travel and hotel arrangements. Lawton said:
We try to follow up with them after they’re registered, making sure everyone who is registered has a room at the hotel; if not, then I’ll send an e-mail to double check. Sometimes they’ve forgotten to make a reservation – or the hotel forgot to put them in the block of rooms for the conference. Taking care of those details ahead of time is easier on us, so we know how many things we need to have to be prepared.

Once attendees have been selected and confirmed their plans to participate, their applications are distributed to the staff members who will present lectures and conduct the lab experiences. Those staff members look at basic background data on who is coming in for the workshop, and adapt their presentations accordingly. The explanation offered by Anja Berry, the education coordinator, of how she uses the information, exemplifies the typical process among workshop staffers:

We get their name and school, so we know what level they’re at, roughly, what ratio of secondary to post-secondary [teachers], and geographically where they’re coming from. I don’t change my content based on that per se; I try to tailor my presentations to the person coming with the least amount of experience. And sometimes I get feedback that it was too basic for people who’ve been in the field for years, but that’s ok.

By attending to participants’ skill levels through selection and tailoring presentations, Nano-Tech staff have used evaluation to create workshop experiences that are more likely to meet the needs of their customers.
Remote Access

The remote access project is a new development for Nano-Tech and, in that respect, is itself a reflection of the center’s continual evolution to meet educational needs. With the purchase of the FE-SEM for strictly educational purposes, the center staff started brainstorming different ways to use it to benefit partners who couldn’t come to Hilltop’s campus. Grayson, the director of education and outreach, described the process of developing the remote access program:

Sometimes it comes from us saying we need to do something, like the remote access. Like it was a cool one-time event, but no meat, no student learning. They might learn from a lab – so let’s see if it will work to make our labs remote friendly…we listen to the needs of the people we’re working with – like people using the remote access, in that case. We have conversations with people, try to integrate that to come up with a product.

Now that the remote access “product” has taken shape, Education Coordinator Berry has taken the lead. Together with the external evaluators, Lazlo and Lewis, she designed a pre-participation survey for educators interested in using the center’s remote access capabilities. Using the survey, she will create a remote access experience that falls within Nano-Tech’s capabilities and meets the needs of the educator and the faculty or students they have participating. At the time of the research visit, she had completed
one remote access project with a college in Queensland, Australia, and had a pilot study set up with five different colleges around the country. Lazlo and Lewis discussed how she was working with them to determine what information she needed to collect. “[She’s] finding out what goes in at both ends. What do participants need to learn as receivers? And Hilltop, what do we need to learn as senders; how can we do that most effectively?” Berry’s efforts to shape participants’ remote access experiences to meet their specific needs is a great example of the leadership stage of the Strategy and Design stream of evaluation at Nano-Tech.

Capstone

The capstone semester was designed in collaboration with the NFM partners. Nano-Tech first offered it in spring 1999, when the center was relatively new, and two years before it received NSF funding. The original capstone courses focused on electronics and semiconductors. Every year since the capstone was created, the center has met with the NFM industry advisory board to discuss the skill sets and material being taught in those courses. Those conversations are key to the evolution of the capstone, according to Franklin. “If we find out that something about our courses industry doesn’t
like, we change it. In the industry advisory committee every year, we go over everything we’re teaching in every course,” he said. Industry advisory board participants understood that their input was critical to keeping Nano-Tech current with industry needs. As one summarized it, “That was the idea, to keep the Hilltop program dynamic, to make sure they were producing students that had the skills that industry in [the state] wanted.”

An industry partner gave a specific example of changes the center has made in the capstone based on industry feedback. He described how industries in the state have expressed the need for technicians with skills in dispersing nanomaterials, rather than just measuring amounts already present in other materials. He said:

In [the state] a lot of the members are more materials oriented – like PPG, Bayer, Alcoa, GE (we have a member of GE on the board) – they are materials focused companies. So one of the things that has come up over and over is more of a focus on how to take nanomaterials and disperse them into other materials. Originally that wasn’t a major focus area... It’s been incrementally becoming a larger portion of it, but we’re trying to say that it needs to be a more defined and organized part of the program... I think they’ve listened and have tried to incorporate that more and more over time.

In addition to changes in the use of nanotechnology, the field also has expanded to include disciplines like physics, biology, and chemistry. Over its
history, Nano-Tech has adapted the capstone courses accordingly. A longtime NFM educational partner, Belinda Fenwick, described the progression as she has observed it:

“When the program first started, because of the nature of where nano was coming out of, there was more focus on electronics and electronics manufacturing industry. That was one of the driving forces in the early days of the program. Since then, and this is based on feedback from partners and industry, that focus has shifted, definitely not electronics based, but more broad based science focus, chemistry and physics majors. They started incorporating biology – from the nature of things, biotech companies using nanotechnology, pharmaceutical companies. They really have adjusted their program to the changing and expanding nature of how nanotechnology is being used in industry.

Educational partners like Fenwick reported using the information from industry to adapt the capstone prerequisite courses they teach at their community colleges as well.

In terms of Strategy and Design, Nano-Tech has also benefited from the NFM partnership with educators. Partner faculty review recruiting materials and consult on the design of courses in the capstone as well as the materials disseminated on the website to be sure they are commensurate with community college students’ needs and learning styles. Faculty members also provide estimates of the number of students they have desiring to attend the
capstone semester, to give Nano-Tech leaders an idea of demand and help them staff appropriately. One faculty partner described how talking to him gives Nano-Tech an advantage:

A big part of feedback they are interested in getting is the estimate of demand, or number of students who might be scheduling the capstone. They see applications once the student applies, but I see students who are thinking about it and trying to assess whether they want to come. So I’ll give a seat-of-the-pants estimate, like I think we’ll have four students for summer, so it gives them some sense of how the demand is aggregating for a semester so they can plan.

Awareness of students in the pipeline became particularly important when the state cut funding for the program in 2009. Nano-Tech needed to cancel one of the three capstone semesters for 2010 and consulted with the education partners about it. As a result of feedback from their partners, they cancelled the fall capstone in 2010. One education partner recalled the process and how it impacted one student in particular:

[Nano-Tech] surveyed all the partners to see how many students were in the pipeline. They were going to cancel spring… I had a student who was registering for spring. We registered him for summer, but then in about a week [Nano-Tech] changed their mind…They absolutely said, “We were going to cancel, but then partners said, ‘We have students who need it.’ So we decided to run it anyway.” My student was very happy about that.

The last capstone area in which Nano-Tech uses evaluation for
Strategy and Design is in selecting students and placing them in appropriate groups. The instructional staff use the applications, which include information from the student and a sponsoring faculty member, to screen out students that lack the appropriate set of personal characteristics or prerequisite skills. Once a student is accepted into the capstone, the staff use the applications to place the student in a work group for the semester. The groups are specifically designed to be cross-disciplinary, so one student experienced in biology, chemistry, physics, or electronics is placed in each. The design ensures that the group will have all the skills they need to complete the group projects that are part of the capstone semester.

Overall, Nano-Tech shows a clear commitment to evaluation for Strategy and Design. Its efforts to keep the center up to date with trends in nanotechnology, offer excellent workshop and remote access opportunities based on participants’ needs, and its continual adaptation of the capstone semester provide evidence of that commitment. The processes in this evaluation stream highlighted above are summarized in Figure 31 below.

**Continuous Improvement Stream**

Nano-Tech is dedicated to Continuous Improvement, as its current
### Strategy & Design Stream

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>center strategy and approaches</td>
<td>NVC and NFM industry advisory committee</td>
<td>industry trends, ideas for increasing clarity and participation</td>
<td>advisory committees provide ideas, insights, and trend information → center staff discuss, filter, and integrate them</td>
<td>• materials disseminated online, rather than by CD-ROM • center staff go out into the state to meet NFM partners, rather than expecting them to come to the host college</td>
</tr>
<tr>
<td>workshops applications and participants</td>
<td>knowledge and skill levels</td>
<td>interested educators fill out an application for the workshop they would like to attend → support staff get the applications → workshop staff review the applications for skills and knowledge → support staff contact over- or under-qualified applicants to redirect them to a more appropriate workshop → staff use applications to match the level of lecture content to incoming participants</td>
<td>teachers or researchers interested in remote access contact the center → remote access coordinator sends out survey → person planning the remote access lesson fills out the survey → center staff figures out how to meet the educational and/or research needs of the group via remote access</td>
<td>• applicants attend workshops that are a better fit for their skill set • staff have information to help them prepare lectures and labs at an appropriate level of difficulty for the workshop group</td>
</tr>
<tr>
<td>remote access organizers/participants</td>
<td>specific task(s) or lessons to be done via remote access</td>
<td></td>
<td></td>
<td>• remote access experiences designed to meet the specific needs of each participating group • establishes initial contact which allows follow-up on learning outcomes for students</td>
</tr>
</tbody>
</table>
### Strategy & Design Stream (continued)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFM industry advisory committee, NFM partner colleges, capstone applicants</td>
<td>capstone courses revised as necessary to match industry needs and trends • course catalogue description of capstone revised • annual revision of knowledge and skills set for nanotechnologists • industry information available to colleges that participate in the capstone to adapt their prerequisite courses • capstone courses designed more hands-on, kinesthetic for community college students • curriculum materials disseminated are commensurate with community college students' needs • recruiting materials are reviewed by faculty who deal with target population daily • ongoing estimates of demand help the center plan for materials, teaching assistants, and funding • estimates allowed the center to choose which semester to drop the capstone while still meeting partners' needs • application screens out students who do not have the appropriate set of personal characteristics or prerequisite skills • staff create cross-discipline work groups of students in biology, chemistry, physics, electronics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>industry trends, educational approaches, recruiting, student demand for course, incoming student skills</td>
<td>center staff get input about trends and educational approaches from industry representatives and educators • capstone staff select or adapt lectures and labs to fit needs • capstone staff e-mail industry trends to partner colleges • partner college faculty report the estimated number of their students who will be attending the capstone each semester • students and their supervising faculty provide information about the students' core skills and personal characteristics on application • center staff use applications to select students and place them in cross-disciplinary groups for projects</td>
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</table>
activities in this stream demonstrate. As Administrative Assistant Denise Lawton expressed it:

> Everything we do, workshops, class, we always survey anybody that comes through for ideas and suggestions about what they liked, what they didn’t, and how to make it better. Down to travel, how can we make it easier for them to get here and make it easier for them when they’re here, too.

The following section presents some of Nano-Tech’s continuous improvement efforts. This is not a complete list, but rather reflects those areas that staff and partners discussed with the researcher. The efforts include improving (i) workshops, (ii) the website, and (iii) capstone semester.

**Workshops**

As mentioned above in Strategy and Design, Nano-Tech staff conduct several workshops for participants with different levels of skill and experience. In every workshop, paper surveys are administered at the end of each day, requesting responses for every agenda item and every presenter. Participants are asked to give comments as well as overall quantitative ratings. Based on the researcher’s review of several workshop survey compilations, participants took the opportunity seriously. For instance, on the compilation from the November 2009 three-day Educators Workshop,
between 15 and 19 participants\textsuperscript{13} gave comments in every section for every
day. The education partners interviewed concurred that they were surveyed
after events. One who has attended workshops at Nano-Tech said, “Certainly,
when I went through the training workshops there was a questionnaire, and
they wanted comprehensive feedback.”

Staff use the feedback to improve their presentations for the next
workshop and to revise the overall workshop agendas accordingly. Berry’s
comments about the workshop feedback elegantly summarized those offered
by the rest of the staff. She said, “[Participants] critique every session
throughout the workshop; that’s quite beneficial. I learn what works and
doesn’t work and I adapt my presentation accordingly. I’ve never given the
exact same presentation twice, probably.”

Nano-Tech’s Train the Trainer workshop series provides a clear
example of how staff adapted the workshop agenda based on participant
feedback. Franklin designed the format for the first of the three workshops in
the series. According to the agenda for the week, programming ran from 8:30

\textsuperscript{13} The compilations do not include the number of total participants. However, the end of
event quantitative items had a maximum of 20 responses. If 20 is used as the total number of
participants, the response rate for the qualitative section of the daily surveys is very high.
a.m. or 9:00 a.m. to 9:00 p.m. Monday through Thursday, with a half-day on
Friday. Participants spent Monday through Wednesday noon in lectures with
Franklin and Jake Nelson, the capstone instructor, going through the
PowerPoint slides for the first two capstone courses. From lunch Wednesday
until the end of the workshop at noon on Friday, participants were hands-on
in the lab with Stark, Berry, and another staff member.

Before the first workshop, program staff were concerned that the
lecture followed by all labs format was not the best option. However, since it
was Franklin’s project, the staff did not push back. They ran the first one
using that format and then used the participants’ feedback to adapt. Blaine
Taylor, a technical expert for Nano-Tech, discussed the evolution of Train the
Trainer workshop:

Dr Franklin came and did [lecture] for two days, then two days
of 4 labs each day – and we heard what we thought we would –
people don’t want to do the PowerPoints, people come and
want to do the hands-on... So we knew we had to change for
the second and third one. We alternated [lecture and labs] in the
second and it worked pretty well, and for the third we decided
to shorten it by a day, because we heard from the evaluations
that if you’re teaching courses in the college level, you should
be able to put together PowerPoints without having someone go
through it slide by slide. So there was definitely some push
back, but eventually it changed to be the more workable way.

When asked why program staff didn’t bring their concerns to Franklin
before the workshop, the essence of the responses was respect for Franklin and the hierarchical organizational system at Nano-Tech. Program staff understand that it is their job to carry out Franklin’s plans, because as PI he has the ultimate decision-making responsibility. If his plans aren’t practical, they attribute that to his visionary nature and his high expectations. As Berry put it, “…he’s a visionary…Dr. Franklin shoots for the stars and I think that’s important. It’s funny the level people can attain when they might not think they can at first. He pushes us and I respect him for that.”

Program staff also know that Franklin trusts them to carry out the plan and then adapt it as necessary to make it work. So within their group, the conversation is more informal and fluid, and focused on improvement. Grayson described the process this way: “The operational staff digests the feedback and makes the changes necessary – Scott then may course correct if he thinks we went in the wrong direction.” The ultimate result with the Train the Trainer workshop was a dramatic revision of the agenda based on participant feedback, and the evolution of a workable template for future Train the Trainer events.
Website

Nano-Tech staff used two approaches to get data to improve their materials dissemination website. The first is simply including contact information for center staff on the website, along with messages that encourage users to ask questions and offer suggestions. The second is a targeted research project developed by Ben Marshall and the external evaluators, Lazlo and Lewis.

The website was set up in summer 2009. In early September, 2009, the external evaluators surveyed website users, contacting them via their registration information. The goal was to understand how effective the website was as a system for disseminating materials. “So we asked how they found the materials, how friendly and usable, how accessible, how organized the website was,” Lewis said. Grayson described the survey and the use of results this way:

We’re going out to our customers, surveying the people who went through [the website]. We get those surveys and start with ease of access, use, did you use the materials and how was it for you, and what’s the impact… We’ll adjust – like the ease of use, were there issues?… Also feedback on the materials – [like] “You spelled immersion wrong.”

Marshall and his own ATE center staff will use the survey results to adapt the
website in terms of accessibility. Nelson and the capstone technical staff will use the survey feedback to make adjustments in the materials.

**Capstone**

Instructional staff have created systems to get information for continuous improvement of the capstone semester. Jake Nelson, the capstone instructor, is responsible for lectures and course notes. He said:

I spend a lot of time with the students during the semester and they say, “I don’t know how to do this,” or “I took the course and I don’t understand,” so we can go back and re-do things. I take the suggestions and put them into print; I take the feedback from the students and correct the course.

Nelson uses student feedback, as well as input from other technical experts associated with the center, to adapt the lecture notes, which are also part of the package disseminated on the Nano-Tech website. Therefore, his continuous improvement efforts benefit not only his capstone students, but also the students whose faculty get their materials from the center.

A variety of program staff and TAs teach the lab portion of the capstone semester. The staff who were interviewed and who teach in labs reported they also engage in conversations with students in the lab to check their understanding and to see if any topics need to be addressed again. As a
part of their homework assignments, students are required to report how
their work or the labs could be improved. Stark added this feature, and has
used student feedback to adapt the labs:

Specifically for assignments, I require them...to list their errors,
or how they could improve on their reports, or how the lab
could be improved. Real good students will say, “Maybe the
flow of the lab can be altered this way.” I’ve used that to
develop flow charts, where responsibility can be delegated
during a lab project, and where things can be done at the same
time.

Stark and Nelson also adapt the exams based on discussion between
the two of them and feedback from students about clarity. On every exam,
students are able to write questions they have for the instructors on the back
of the exam. Stark explained:

With the exams students take, we let them write any questions
they have on the back of the exams. So sometimes exam
questions will turn out not to be clear and students will tell us
that on the back of the test. Teamwork is huge. Jake and I go
back and forth, take out errors or ambiguity on exam questions.
If we see that people are still having trouble answering what
we’re asking, then I re-write the question for the next exam...

The capstone consists of six separate courses, which the students take
two at a time over the 16-week semester. At the end of each course block, the
students get class time to fill out an evaluation of the two courses (six credits)
they just finished. Since the first two evaluations occur at the 6 week and 11
week mark, staff are able to use the information to improve the capstone for students that are currently taking it. The final evaluations happen at the end of the course, so changes can only be made for the next group of capstone students.

Nano-Tech staff is committed to getting and using information for continuous improvement. Their efforts to improve the workshops, capstone courses, and website illustrate that commitment. The process maps for continuous improvement in each of those areas are presented below in Figure 32.

**Impact for Judgment Stream**

The research revealed that Nano-Tech gets information from a variety of sources about the impact of its activities. The staff seek to understand their impact on (i) their capstone graduates and, through them, on the workforce; (ii) professional development workshop participants; (iii) website users; and (iv) webinar participants. This list and the following descriptions are not intended to be comprehensive, but rather a representation of how those interviewed described Nano-Tech’s efforts in this stream of evaluation.
## Continuous Improvement Stream

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>workshops</td>
<td>participants,</td>
<td>end of each day and end of program surveys</td>
<td>participants fill out a survey at the end of each workshop day and at the end of the workshop → administrative staff enter individual participant’s survey responses and compile into report → the report is circulated among the staff, who sign off that they have seen it → results and potential improvements discussed at next weekly meeting → changes implemented</td>
<td>• change of lecture/lab format for Train the Trainer, shortened by a day • feedback for lecturers about performance • staff adapt their lecture style, content to improve clarity</td>
</tr>
<tr>
<td>website</td>
<td>users</td>
<td>ease of use, errors, clarifications</td>
<td>website provides contact information for center staff → users provide information about website ease of use, with downloaded materials, ask for help or clarification, point out typos and other errors → webmaster makes adjustments based on feedback</td>
<td>• changes to website - reducing number of &quot;clicks&quot; to access material • corrections made to curricular materials • assistance given to educators using materials</td>
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</tbody>
</table>
### Continuous Improvement Stream (continued)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>capstone</td>
<td>students, staff</td>
<td>conversations in lab and lecture, end of course evaluations</td>
<td>in class and labs, instructors talk with students to probe their understanding of the material, answer additional questions, find out what skills or knowledge need to be reiterated → staff meet weekly and discuss educational and equipment issues → students make notes on exams about ambiguous or unclear items → capstone instructional staff review and adapt exams → students fill out course evaluations at the end of each pair of courses → compiled results given to instructors and lab TAs</td>
<td>• continual adaptation of courses in progress to adapt to equipment failures (common) • real-time course corrections, re-presentation of materials as needed • e-mails to TAs regarding underperformance • improvements in flow of lab exercises • creation of different examples for concepts • alteration of exam items to improve clarity • corrections of typos in the lab notes • changes in lecture notes and course materials • improvements in labs and lecture presentations</td>
</tr>
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</table>
Capstone Graduates/Workforce

The primary way that Nano-Tech understands the impact of its capstone semester is through the careers of its alumni, on whom they endeavor to keep an up-to-date database. The database is used to track graduates throughout their careers to learn about the capstone semester’s impact on its graduates and their employers. They get information to update the database from a variety of sources, including industry, educators, the website, and the students themselves.

Nano-Tech keeps track of companies that hire program alumni and invites them to participate on the NFM industry advisory board. One of the educational partners described the center’s attention to tracking alumni this way:

Almost every company that hires a nano-grad also sits on the advisory board. So there’s a good relationship there. They really track that too; they know every company in [the state] that’s hired their graduates. They care about their graduates – something you don’t often see. Usually they slap a degree on students and say, “Get a job.” They really track them. They can name you all the companies that have hired graduates; they have a lot of data on what percentage of students get hired and where.

Employers’ participation on the industry advisory board gives staff a chance to get anecdotal information about how their graduates are performing in the
workforce.

The center’s NFM education partners also provide information about capstone alumni. Students spend one and a half to two years at another college or community college before coming to Hilltop for the capstone experience. As a result, they tend to have stronger interpersonal relationships with their home college faculty (who have to sign off on their application) than they do with the capstone staff. Those faculty members are often able to provide information to Nano-Tech from graduates who keep in touch. Another education partner described how the center uses his network with students to get information about capstone alumni:

They ask us about alumni contacts, how they’re doing job wise, any placement issues. So to the extent that I’m aware of those things I try to pass that on. That’s mostly anecdotal; I don’t do formal studies on that, I’m just trying collect information...They track the alumni as best they can, but sometimes people don’t respond or they have a bad address and so forth. So sometimes we have better reconnaissance on those things.

The latest development to keep the graduate database current is the institution of the Alumni Network, under the leadership of co-PI Kennedy. She described the challenge of tracking graduates in an industry where they don’t have common job titles. “Because this area is so new, there is not a common job title name – it’s not like being an interior designer. So we’ve
shared graduate information to identify 100 different names of jobs these students are getting,” she explained. This makes keeping in touch with alumni even more important, since they would be hard to find using a job title search in industry. The Alumni Network webpages provide a variety of resources for graduates on job searching, mentors, and connecting with other graduates as well as professional societies. Students can create personal profiles that can be viewed by employers and can also use the services of Nano-Tech’s Alumni Network career specialist. Those personal profiles enable Nano-Tech to track graduates and get important outcome information about the kind of jobs and companies in which alumni are employed.

Nano-Tech uses the database for two primary purposes. First, the contact information enables the center to conduct a biannual survey of alumni to find out where they are working and in what kinds of jobs. The results give the center data on impact for its evaluation reporting. Second, the center also uses the database when employers contact them looking for job candidates. All four industry partners interviewed discussed using Nano-Tech for that kind of information. One industry partner from a relatively small firm expressed how the center has given them access to high quality candidates,
with the specific skill set they need at his company. He reported:

Before I would put it on our website and we would get candidates with no experience whatever, or people who are trained in electronics, which is not quite the skill set we need... Now I call Rich or Logan and say, “Hey I need some candidates.” I got a dozen of them in a couple days... What’s nice about it is that it gives us an “in” to a bigger population. There’s a lot of people from community colleges all over [the state] who come to this program that we never would find otherwise. They’re probably not looking at our website, and would never know who we are, if they live on the other side of the state. It gives us a bigger and better pool of candidates... With the nanofab capstone background, there is more confidence that the candidates chosen will perform successfully. That’s why, not only do we have a bigger pool, we have a lot higher confidence in people who went to this program, especially if they talk about how they like it and the things they’ve done. We feel that they will be able to be much more successful.

Based on the researcher’s observations and review of the website and other materials, this service is not advertised as part of the alumni network offerings. However, the ability to connect employers with job seekers could be a powerful incentive for students to keep their contact information current with Nano-Tech. Thus, the database serves to track graduates for the sake of impact, but also enables the center to serve both graduates and industry by connecting potential workers with workforce needs.
Workshop Faculty Participants

For every workshop they conduct, Nano-Tech staff use an end of event survey to get information about the impact on participants. The researcher reviewed compiled survey responses from two different events, one Educators workshop and one session of the Train the Trainer series. For both events, the overall survey included both quantitative and qualitative items, with high response rates from participants on both types. Items like helpfulness of materials, instructors’ knowledge of the subject matter, and whether or not the workshop met the participants’ expectations were similar between the surveys. This allows the center to document those outcomes across events for more efficient reporting.

Besides being used for external reports, the comments on the surveys provide a source of endorsements for Nano-Tech programs. Logan Jackson, the outreach coordinator, always looks through the survey response compilations for content he can use in the center’s regular news bulletin:

I use quotes from that for the newsletter…I’ll call people who responded to the survey and talk with them about their participation and ask if it’s ok if I quote or feature them. People usually don’t push back on that, they are happy to be featured and quoted and have their picture – they enjoy us telling people what they did and that it was really good.
As an added benefit, the Educators workshop surveys also ask participants to answer specific questions about what they would need to implement nanotechnology education at their home institutions, including access to tools. Those questions help the center predict implementation outcomes. Responses can also be used for Nano-Tech program design in terms of finding ways to help educators overcome obstacles through external funding for professional development and course adaptation to remote access to equipment.

**Website Users**

Co-PI Ben Marshall has been charged with creating ways to disseminate the nanotechnology education materials Nano-Tech has developed and refined in its long history. As discussed above, when planning the website, impact data was part of Marshall’s plan. “[When] we chose the content management system, the electronic system we use, the highest requirement was being able to track people, who they were, what they were doing, what they were downloading. That set up the evaluation steps,” he explained.

Those early efforts have already paid dividends in terms of evaluation
data. As mentioned above, the tracking data were used to get improvement information about the website and the materials in September 2009. In December 2009, Lazlo and Lewis used the tracking system to send surveys to 170 users who had downloaded materials. Fifty users responded, 26 of whom had used the materials. The survey asked a variety of questions about the context in and purpose for which the materials were used. The evaluators also followed up with three respondents by phone to learn more about their use of the materials. The next step will be looking at student learning, according to Grayson.

**Webinar Participants**

AMTE, co-PI Ben Marshall’s ATE center, also runs the webinars for Nano-Tech, which were added as part of the national materials dissemination effort. Berry described how Nano-Tech has benefitted from AMTE’s experience with webinars. She said, “The webinars, we relied on AMTE for their expertise because they’ve been doing them for years… The evaluation at the end of the webinar is part of their package.”

The researcher participated in a webinar in January before her site visit to Nano-Tech. During the webinar, the staff took participants “live” to the
Nano-Tech website and showed the various places where visitors can give feedback about how they use the materials they download from the site. At the conclusion of the webinar, there was a short online feedback survey asking for responses including information about the webinar’s value, potential impact on students, and ideas for implementation.

As the above section illustrates, Nano-Tech is engaged in a variety of activities in this stream of evaluation. Those processes are summarized in Figure 33, below. By seeking to understand and document the impact of its work, the center has been able to demonstrate how its efforts have positively benefitted its partners and participants.

Nano-Tech Summary

Nanotechnology is a rapidly evolving field that is becoming increasingly important in manufacturing. Nano-Tech has positioned itself to provide a broad-based, quality education for nanotechnologists through the vision and effort of PI Franklin and his capable staff. The leadership and culture of the center is built on its commitment to excellence, and mainstreaming evaluation has augmented that commitment.

The center demonstrates capabilities in organizing staff for evaluation,
<table>
<thead>
<tr>
<th>Impact on...</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>capstone graduates and workforce</td>
<td>industry, graduates, education partners</td>
<td>where graduates are working and types of jobs</td>
<td>education partners help the center find alumni → alumni register on website → center conducts a biannual survey of alumni → industry partners report on alumni they employ and give basic performance information</td>
<td>• resource for industry seeking employees • contact information for tracking graduates enables follow-up on how capstone experience has impacted their careers • employment information helps build database of job titles for capstone graduates • employers of capstone graduates recruited for industry advisory board</td>
</tr>
<tr>
<td>workshop faculty participants</td>
<td>participant post event surveys</td>
<td>learning outcomes, potential obstacles, ideas for classroom implementation</td>
<td>workshop participants fill out surveys at end of day and end of event → responses from all participants compiled into a single document for each event → compilation document shared with staff and external evaluators</td>
<td>• quotes and comments used for center newsletter and other marketing materials • participant self-reported learning outcomes for external evaluation reports</td>
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</tbody>
</table>
### Impact for Judgment Stream (continued)

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<tr>
<th>Impact on...</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>website users</td>
<td>tracking data, follow-up surveys, and interviews with users</td>
<td>use of materials</td>
<td>users must register to download materials → web system automatically caches who downloads what → external evaluators survey those who downloaded to learn about use and impact → follow up interviews conducted with a few survey respondents</td>
<td>• quantitative data on number of downloads • demographic and educational information about users • outcome data on materials use • information on how they found out about the materials</td>
</tr>
<tr>
<td>webinar participants</td>
<td>participant post-event surveys</td>
<td>satisfaction, intent to implement and recommend to others</td>
<td>webinar participants fill out end of event survey → responses compiled electronically and shared with AMTE and Nano-Tech staff</td>
<td>• quotes and comments used for webinar and other marketing materials • faculty intention to implement outcome data for external evaluation reports • overall ratings of the value of the information presented (relevance) • overall ratings of impact the information will have on students and colleagues of the participant (impact)</td>
</tr>
<tr>
<td>capstone semester</td>
<td>capstone students</td>
<td>learning outcomes, quality ratings of materials and staff performance</td>
<td>students fill out evaluations for each set of two courses → responses compiled into a single document → compilation disseminated to instructional staff, including TAs</td>
<td>• performance feedback for TAs and staff • overall ratings of the quality of materials, value of the information • student’s self-assessment of their enthusiasm, level of challenge of the course work, and level of satisfaction with the capstone experience • strengths of the capstone</td>
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</tbody>
</table>

*Figure 33. Impact for Judgment Summary for Nano-Tech*
as well as prioritizing, and systematizing getting and using evaluation information. The relational basis of its partnerships through NFM have given staff access to information to help meet the needs of the center’s partners through both program design and improvement. The resulting benefits of evaluation mainstreaming to Nano-Tech include continuous improvement of programs and materials, evolution of the capstone semester to match the changing landscape of nanotechnology in industry, evidence for funders (demonstrated by the move from regional to national level), cutting edge materials dissemination via the website, and contact information for following up to get impact information. The ultimate benefit, however, is well-trained technicians available to meet industry demands.

Case Study: Eng-Tech

The researcher visited Eng-Tech February 3-5, 2010, where she attended the center’s two-day strategic planning meeting. As a result, the majority of interviews were conducted via phone. Three people were interviewed in person during the site visit, and 20 were interviewed via phone for a total of 23 contacts. Sixteen of the 23 research participants reviewed, approved, and returned the interview notes for a 70 percent
validation rate. Interviewees included (i) the PI and co-PI; (ii) six grant staff members; (iii) an administrator from the host college; (iv) the current and former external evaluators; (v) three National Visiting Committee members; and (vi) four faculty (two from partner colleges), two industry representatives, and three students who participated in center activities. Further information for the analysis came from 28 documents, the researcher’s observations, and the center’s two websites.

Center Description

A variety of Eng-Tech staff, partners, and partner organizations are included in this case study. Their pseudonyms, titles, and a description of commonly used acronyms (as applicable) are presented in Tables 23 and 24 to help the reader follow the description of the center and its mainstreaming effort.

Purpose and History

After an ATE planning grant in 1994, Eng-Tech received its NSF ATE National Center of Excellence grant in 1997. Its purpose was to “improve marine technical education and increase the number of highly skilled technical professionals who enter ocean-related occupations.” Since its
Table 23

Pseudonyms for People and Institutions in Eng-Tech Case Study

<table>
<thead>
<tr>
<th>Person</th>
<th>Title</th>
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<tbody>
<tr>
<td>Coastal College</td>
<td>Eng-Tech’s host college</td>
</tr>
<tr>
<td>Diana Prince</td>
<td>PI, Director</td>
</tr>
<tr>
<td>Jaime Sommers</td>
<td>co-PI, Associate Director</td>
</tr>
<tr>
<td>Talia Danvers</td>
<td>Internship Coordinator and Education Specialist</td>
</tr>
<tr>
<td>Emma Peel</td>
<td>Faculty Development and Summer Institute Coordinator</td>
</tr>
<tr>
<td>Jay Garrick</td>
<td>Coastal College Dean, Senior Advisor, Eng-Tech Liaison</td>
</tr>
<tr>
<td>Selina Kyle</td>
<td>Administrative Assistant</td>
</tr>
<tr>
<td>Steve Austin</td>
<td>Head Rules Judge and Technical Manager, RoSV Competition</td>
</tr>
<tr>
<td>David Banner</td>
<td>RoSV Technical Support</td>
</tr>
<tr>
<td>Laurie Jupiter</td>
<td>Current External Evaluator</td>
</tr>
<tr>
<td>Tom West</td>
<td>Original External Evaluator</td>
</tr>
<tr>
<td>Sara Pezzini</td>
<td>NVC member</td>
</tr>
<tr>
<td>Dallas Martin</td>
<td>NVC member, Chair of OTS RoSV Committee</td>
</tr>
<tr>
<td>Tyrone Namor</td>
<td>Summer Institute Instructor</td>
</tr>
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Table 23 – Continued

Pseudonyms for People and Institutions in Eng-Tech Case Study

<table>
<thead>
<tr>
<th>Person</th>
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<tbody>
<tr>
<td>John Clayton</td>
<td>RoSV team mentor, Summer Institute Instructor</td>
</tr>
<tr>
<td>Colleen Lassiter</td>
<td>Internship Coordinator, 2005-2009</td>
</tr>
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</table>

Table 24

Acronyms in Eng-Tech Case Study

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Institution/Activity</th>
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<tbody>
<tr>
<td>ECOS</td>
<td>Educational Centers for Ocean Science</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>OTS</td>
<td>Ocean Technology Society</td>
</tr>
<tr>
<td>RoSV</td>
<td>Remote-operated Submersible Vehicle</td>
</tr>
<tr>
<td>UNOLS</td>
<td>University-National Oceanographic Laboratory System</td>
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inception, Eng-Tech has supported, enhanced, and expanded marine technology education in high schools, community colleges, and universities. Over its 13 year history, the center’s purpose has remained constant, although its ATE designation has changed. In 2003, Eng-Tech became an ATE National Resource Center and received its current grant in 2007 with that designation.
To date, the center has received four ATE center grants totaling approximately $8.5 million. The current grant expires in April 2011.

**Context**

Eng-Tech resides in a small, affluent town on the coast. The community is home to a variety of marine industries and research institutes, as well as military and international graduate schools. The campus of the city’s only community college serves as Eng-Tech’s home base. Coastal College offers more than 70 associate degree and certificate programs to approximately 14,000 students per year. The center occupies a single 25’ x 50’ space adjacent to an auditorium in the heart of the campus, where the PI, Diana Prince, and co-PI, Jaime Sommers, have cubicles and the part-time support staff person has a desk.

Eng-Tech currently has a limited relationship with Coastal College, although that has not always been the case. In past incarnations, the center ran multiple concurrent grants with a large staff who were employed by Coastal. The current staff is primarily part-time consultants, with only Prince and Sommers as full-time employees of the college. Neither is a faculty member, although the college has a marine science and technology
Coastal’s administrative situation also has contributed to the relationship between the college and Eng-Tech. The college has had nine presidents in the past 30 years, creating limited administrative continuity and shifting levels of enthusiasm about the center. The current president of four years has been an advocate for the center. Dr. Jay Garrick, the current Dean of Instructional Planning, has been a continuous source of support for Eng-Tech in Coastal’s administration since the center’s inception. He served as the PI on two of Eng-Tech’s four grants and is now a senior advisor for the center and liaison between the center and the college. Another factor in the level of administrative support relates to Coastal’s size. As a small community college, Coastal does not have a grants office; therefore, the center staff handle grant submittals and budgeting.

The marine industry context also has changed over the course of Eng-Tech’s existence. In terms of the national economy, the industry’s contribution has held steady at 20 percent, but the skills required for marine technologists have expanded considerably. Previously, technicians needed to understand specific oceanographic equipment and electronics. Now they
need to be multidisciplinary, able to work with electronics, IT, communications, engineering, oceanography, marine biology, remote sensing, and geology in a variety of contexts and combinations. Marine technologists’ jobs vary widely, depending on geographic location and whether the work is for education/research or industry. Demographically, the field is predominantly white males.

The marine science community in the United States is geographically dispersed on the coasts and the Great Lakes. However, the community comes together through a variety of government agencies and professional associations, including the National Oceanic and Atmospheric Administration (NOAA), the Ocean Technology Society (OTS), and the Centers of Excellence for Ocean Sciences Education (CEOSE). Eng-Tech has positioned itself among those agencies as a key link between industry and education.

Across the U.S. more than 240 postsecondary schools and research centers offer programs in marine science and technology. The current economic situation is placing them at risk, due to the expense of the equipment and the multidisciplinary expertise required for faculty to keep
current with the industry. Eng-Tech’s home state is one that has been hit hardest by the economic downturn. While this is not affecting the center’s current funding, it is impacting the center’s educational partners in the region.

**Activities**

As an ATE Resource Center, Eng-Tech engages in a variety of activities with students, educators, and industry, intended to fulfill the center’s goal of increasing the number of skilled marine technicians in the workforce. In terms of participants, the annual Remote-operated Submersible Vehicle (RoSV) Competition is Eng-Tech’s largest activity. Middle school through college-age students build remote operated underwater vehicles and “fly” them in swimming pools in one of 16 regional competitions throughout the U.S. and internationally. Competitors prepare an RoSV, poster, 20-page technical report, and 15-minute group presentation. Marine industry professionals judge performance in all four categories based on strict criteria that are available online to competitors before the events. Regional winners receive invitations to the annual international competition, which is held in a different location each year. Eng-Tech offers a career expo and tours of the
facility hosting the event as part of the international competition.

Eng-Tech also offers a variety of professional development activities including training on Geographic Information Systems (GIS), ocean drifters, and how to build an RoSV like those used in the competition. The opportunities range from one- to two-day workshops around the country to week-long workshops like the Summer Institute held at Coastal College. Eng-Tech provides funding for faculty to attend the on-site training and creates and distributes underwater vehicle kits for instructors to use in their classrooms.

Eng-Tech also provides resources for students and educators. The center coordinates at-sea internships for students and connects students and faculty with industry through its two websites. One website allows alumni of Eng-Tech programs to register, post resumes, and read job announcements. The other describes more than 50 marine careers, and gives the list of education organizations that provide the necessary training for those careers. With regard to resources specifically for educators, the PI conducts workforce studies and creates knowledge and skill guidelines based on those industry needs. Those knowledge and skill guidelines are disseminated to educators,
along with modules for classroom teaching. After 10 years of development, the center will publish a marine technology textbook this fall.

**Partners**

Eng-Tech has developed a variety of external partnerships that further its mission as an ATE resource center. The Ocean Technology Society (OTS) has provided the center a variety of connections throughout the years. As a professional, paid membership organization, OTS provides a common forum for academia, government and industry to exchange ideas and information. Eng-Tech has been closely involved with OTS since the center’s inception; Co-PI Sommers is currently on the board. In addition, OTS cosponsors the RoSV competition and has a standing committee dedicated to that effort. OTS’ RoSV Committee chairperson, Dallas Martin, serves on Eng-Tech’s NVC.

The center has also built relationships with a variety of companies and individuals in the marine industry. Industry representatives participate in most aspects of the center’s work, from the RoSV competition to developing the knowledge and skill guidelines. The Eng-Tech website lists 24 industry partner organizations who have signed a Memorandum of Agreement with the center.
Eng-Tech also has developed relationships with academic institutions. The University-National Oceanographic Laboratory System (UNOLS) is a key partner in Eng-Tech’s internship program. The center places interns on the fleet of 21 marine vessels UNOLS operates at 16 institutions. Through UNOLS, the center is connected to 61 academic institutions in addition to the interns’ community colleges. The center’s academic connections also include its partner colleges, which are located all over the country. Although the Eng-Tech has not engaged these colleges often on a strategic level, it has provided funding for partner college faculty to attend workshops. Eng-Tech looks to these partner colleges to forward the center’s mission of a well-trained marine workforce and to provide enrollment and impact data for the center’s external evaluation reporting.

Eng-Tech also works with the requisite ATE partners: an NVC, and an external evaluator. The NVC is a group of 10 representatives, five from industry, two from education, two from OTS, one from a government agency, and an ATE liaison. Based on interviews, the members are passionate about marine science and innovative education. The criteria for selection to the NVC roster have changed over time due to center needs. In the past, Eng-
Tech looked to the NVC to help define its strategic focus. The current NVC roster is intended to help the center access funding and other resources.

The Eng-Tech staff treat the current external evaluator, Ms. Laurie Jupiter, as part of the center leadership. She attends strategic planning meetings and center events and works closely with staff members to develop instruments. As a Master of Public Administration, she has extensive experience in project management, from needs assessment to outcome evaluation. In addition, she brings knowledge of social networking and access to informational databases that are critical for Eng-Tech’s strategic next step – longitudinal tracking of students.

**Staffing**

The organization chart for the main staff is presented in Figure 34. Eng-Tech’s leadership staff includes PI Prince, co-PI Sommers, the Internship Coordinator, Ms. Talia Danvers, and the Faculty Development and Summer Institute Coordinator, Ms. Emma Peel. As mentioned above, Prince and Sommers are full-time employees of Coastal College, and operate out of the Eng-Tech office on campus. Danvers and Peel work part time for Eng-Tech and live across the country from Coastal College.
Figure 34. Eng-Tech Organization Chart
The center also employs a variety of part time support staff both on and off site. Three people have part-time roles for Eng-Tech on the Coastal College campus. Ms. Selina Kyle, a Coastal student, is the administrative support staff person, handling office tasks and database management. She has been with the center for three years. A Coastal College graduate, Mr. Steve Austin, serves as the technical manager and head rules judge for the RoSV competition and as educational and technical support for the summer institutes. He also teaches part-time at the community college. The third support staff member on campus is the automotive lab technician at Coastal, Mr. David Banner. He provides technical support for all the center’s RoSV activities, while teaching and mentoring in the Coastal RoSV team. Off-site, Eng-Tech also employs part-time contractors for Web design, publishing, teaching faculty development, and RoSV competition development and support. Teaching staff for the Summer Institute are included because they plan and debrief that experience as a team with Sommers, Peel, Austin, and Banner.

Mainstreaming Evaluation

The Eng-Tech mainstreaming story begins with its original external
evaluator, Tom West. West brought experience with traditional summative evaluation, but also insisted on being part of the strategic planning process.

As he described his approach,

I work with... all my clients, not as an arm’s length evaluator, but as a participant in their strategic planning, so that I can bring evaluation feedback from a third party with no horse in the race to those discussions. I find that is the most valuable thing an evaluator can do for these projects and centers.

West’s developmental approach to evaluation helped the Eng-Tech staff articulate goals for the center and figure out how to track progress, all while giving the leaders the necessary information to report to NSF and the center’s NVC. Prince, who was originally Eng-Tech’s curriculum and industry manager, praised West for his work in the early years of the center:

The type of evaluation he did for us was helpful – formative evaluation with lots of dialogue. He interviewed and talked to a lot of people, influenced what we did in earlier years. In the first six years, the evaluation was just essential.... In Tom we had someone who knew what NSF wanted, what to evaluate, what to tell the NVC.

In their interviews, Sommers, Danvers, Jupiter, and a longtime NVC member, Dr. Sara Pezzini, all cited West’s involvement as a key factor in the
development of the center overall, as well as the enculturation of evaluation and the creation of existing systems and instruments. Pizzini described his impact on Eng-Tech this way:

For a number of years they had Tom West as their evaluator, and he was probably almost brutally honest with them about things that were working or not and adjustments that needed to be made. I think that when you say “Why has Eng-Tech evolved into what it is today?” I’d say the fortunate partnership with Tom as their evaluator – I’ve seen him over the years. He cares passionately about Eng-Tech and the people of Eng-Tech – he’s an evaluator independent of their operation, but he’s not detached. He wanted Eng-Tech to be successful. Sometimes he said things that were painful to hear, and they listened and made changes.

West partnered with Eng-Tech for its first 12 years, and retired in 2009 when the current external evaluator, Laurie Jupiter, came on board.

A visual representation of Eng-Tech’s move through the stages of mainstreaming evaluation is presented in Figure 35. Eng-Tech was strong in Strategy and Design from its inception. Prince was a leader in curriculum development, making connections between industry and educational materials through needs assessments and workforce studies. Through her attention to the needs of industry and education, she realized that the diversity of the marine industry meant that developing curriculum would not
serve stakeholders well in the long term. Instead, Eng-Tech has created knowledge and skill guidelines, and facilitated partnerships between faculty and educators. As she described it,

Marine technology is so highly varied depending on the requirements of the industry and access to technology... We’ve spent more time trying to understand workforce needs, then training faculty so they know what the workforce needs. We facilitate partnerships with industry and let [faculty] implement it as it works for them.

![Figure 35. Streams of Evaluation at Eng-Tech](image)

Over the life of the center, the leadership aspect of Strategy and Design evaluation has expanded to include the whole center staff. As the section on Eng-Tech’s current Strategy and Design processes will describe below, all members on the current staff exercise leadership in this area. They have honed their skills in matching center offerings to the needs of their audience. Thus, in this stream Eng-Tech has moved from desire on the part of most of the staff, with leadership provided by Prince, to leadership exhibited by all
staff members. The slight darkening of the gradient in the Strategy and
Design arrow in Figure 35 depicts this progression from desire to leadership.

In the Continuous Improvement stream, the combination of the center
staff’s desire to improve and the expertise of the external evaluators moved
Eng-Tech from the desire stage to the leadership stage. West helped Eng-Tech
build surveys and other processes to get feedback for continuous
improvement. He also offered his own perspectives, informally, about what
the center could modify. Starting in 2009, with a mature roster of activities in
place, the staff began seeking out the new evaluator, Jupiter, to make changes
and additions to existing instruments and develop new ones. All staff
interviewed agreed that Jupiter helps them develop better instruments and
get better information. Danvers, the Internship Coordinator, summed up the
benefits of the partnership this way:

If we didn’t have an evaluator to help me write the surveys,
it would be really hard. But because we have [Jupiter] to
take my draft of what I think I want to ask and fix it for me,
it’s not that bad.

The combination of the staff initiative to refine existing instruments and
develop new ones, combined with the external evaluator’s expertise puts
Eng-Tech at the leadership stage of mainstreaming in this stream. The
historical progression is depicted by the darkening gradient in the Continuous Improvement arrow in Figure 35.

At Eng-Tech, the third stream, Impact for Judgment, began with compliance. As the external evaluator, West understood the kind of evidence NSF required to increase Eng-Tech’s chances of being funded. So he helped them create systems to generate that kind of data. The data generated by these systems also has been used for Continuous Improvement, since staff review the impacts of activities to look for performance gaps to address. At the time of the research visit, the staff and Jupiter were working together to give the impact evaluation system a refresher. Surveys are being re-vamped so that different age levels within the same program are asking the same questions, and unused questions are being removed. Staff are adding new questions to address developing impact issues, such as what factors are preventing faculty from implementing what they learned at Eng-Tech workshops. Staff partner with Jupiter in this work as well. Jupiter’s role also includes exploring ways to track program participants longitudinally. In this stream as well, Eng-Tech is at the leadership stage. The progression from compliance to leadership is depicted in the Impact for Judgment arrow in
Mainstreaming evaluation is a combination of staffs’ attitudes and values as well as organizational capabilities and systems. Eng-Tech has reached a point where those factors place the center at the leadership stage overall. In fact, the Eng-Tech staff could mentor other organizations in mainstreaming, if they so chose. The following sections will outline and give examples to illustrate the leadership and culture of the center in which the evaluation values are founded, the capabilities that make evaluative activities possible, and the systems that make it sustainable. The last three sections highlight Eng-Tech’s current processes in each of the three streams of evaluation.

**Leadership and Culture**

The current center PI, Diana Prince, has been with Eng-Tech from its start in 1993. She began as the curriculum and industry manager, one of five co-PIs. While the center produced results in its early history, there was a significant amount of conflict among staff. All of the other co-PIs left the grant within the center’s first three years. The first PI was gone within four, leaving Prince as the only original leadership staff member. In 2000, Dr. Jay Garrick,
the dean at Coastal College responsible for grant programs, took the helm at Eng-Tech. Due to his other responsibilities at the college, Garrick took a more part-time, strategic and advisory role as PI. During his tenure, Prince continued in her co-PI role, working full-time at the center. She gradually took on more and more of the leadership, eventually serving as strategic leader and day-to-day center manager. With the urging of Eng-Tech’s NVC, when Eng-Tech’s NSF grant was up for renewal in 2007, Prince became the PI.

Prince is a subject matter expert in marine and earth science, with one master’s degree in Geography/Geographic Information Systems (GIS) and another in Marine Science/Geological Oceanography. She has extensive experience in both marine industry and marine education. Her knowledge of those contexts has enabled savvy adaptation of the center’s products and processes to the needs of each group. As she described it,

I’ve done some detailed curriculum development, but our audience is highly diverse. The way to get the most utility is to assess industry needs and document emerging trends and occupations – those that are new or changing. Once we have those ideas, then we conduct focus groups and develop the knowledge and skill guidelines. We’ve deliberately not called them standards, because when people hear standards they think certifications, which means we’re telling them
what to do, which nobody likes. So instead we define the occupations in detail to facilitate interaction between workforce and education.

In addition to conducting workforce studies, Prince has continued to build her network of connections and stay abreast of trends in industry and education. As Dr. Sara Pizzini, a longtime NVC member observed, “Diana really knows the landscape, knows who’s doing what where. She’s out and about an awful lot.”

Prince believes that for Eng-Tech to continue serving industry and education, the center must pursue excellence. She has striven to build a reputation for herself and Eng-Tech as national experts, and views evaluation as essential in striving to be the best in marine technologist education. She described her attitude toward evaluation this way:

We can’t be afraid of weaknesses – if our true goal is to make something that is the best. You have to put yourself out there, be vulnerable, expose yourself to criticism. It’s a healthy process. You have to face it, and understand that information will make you stronger and better. If you embrace that attitude, then evaluation is the best tool for that process.

From the researcher’s observations at the strategic planning meeting and the comments made by interviewees, Prince’s attention to vision, excellence, and evaluation are just part of how she operates. An industry
partner said, “What motivates Diana is that she really wants to succeed, she
wants what she’s doing to be the best thing it can be.” Danvers, the current
part-time Internship Coordinator and a former full-time staff member,
described Prince’s leadership this way:

Diana is good at seeing the big picture, and seeing what we
have to do to continue funding. She is very good at making
sure we’re remembering our existence is based on continued
funding and that [it] is more likely we’ll get funding if we
show we’re doing what we set out to do and doing it well. In
staff meetings and phone conversations, she consistently
makes sure we take a step back, and think about the bigger
picture of what we’re trying to do. In our weekly meetings
when I was full-time, there was always the conversation,
“What does the feedback say and what can we do about it?”
Sometimes there weren’t straightforward answers, but there
was always the continued conversation.

Prince also thinks strategically about what the center needs to continue
its success. She has revamped the NVC from a group selected for their ability
to give guidance and focus, to members who can help Eng-Tech access
funding and other resources. With regard to activities, she uses her industry
and education connections to find those that will forward the center’s
mission. Then she defines what success will look like in those activities. Eng-
Tech’s new Ocean Drifters program provides an example.

Prince learned about Ocean Drifters through her contacts with
industry and education and knew it was a good direction for the center because of the increasing importance of ocean observing in the marine science community. In the midst of developing a pilot program with partner faculty and organizations, Prince created a document that outlined the expected impacts for each group of stakeholders and participants and the key results that would define success. The document has been used to guide and shape the dissemination and refinement of the Ocean Drifters project for Eng-Tech and its partners in the effort.

The drifter project exemplifies Prince’s vision of what it means to be an ATE center.

You should get money only if you provide something of value – unique, entrepreneurial, innovative, cutting edge. We want to write grant proposals that reviewers say, “Oh my God, we have to fund this!” That’s why our proposals are successful – we believe in what we’re doing, we’re excited about it, and it’s a lot of fun. If it’s not fun, then it’s way too much work.”

Based on this vision, Prince knows she needs staff members with passion for marine technologist education, commitment to excellence, and the ability to work in an entrepreneurial environment. She describes her approach to staffing this way:
I look for people who are truly passionate – who are driven and want things to be really good. People who are able to engage in self-reflection and external reflection for improvement because we are all in it together and we want to make things as good as they can be. Sometimes people just want to get things done. In our situation, it’s about how can you deal with ambiguity and defining the nebulous. We are trying out new things, new ideas. So the conversation will go like this: “I’ll give instructions, but I’ve never done the thing I’m asking you to do. So you might have to do it over three times before we get it right. Will you be OK with that?” It’s been hard with new staff – I have to be explicit about that process. I thrive off it, but some people don’t. Some people can’t stand to redo things. To think there’s gonna be some right answer – that’s not how we work.

With passionate, driven people on board and clear areas of responsibility designated, Prince stated she is happy to share the spotlight:

Everyone has their own responsibilities, but we also support each other. When people see us at work, they often assume someone else is in charge, and not me – and I think that’s tremendous. It’s important to let people shine and be good at what they’re good at.

Prince’s relationship with Jaime Sommers, the current ATE co-PI, clearly demonstrates that team orientation. Sommers joined Eng-Tech as a staff member in the late 1990s and became a co-PI on the 2003 ATE grant. Other than Prince, she is the longest term member of the center staff. Sommers and Prince have worked together so long and so closely that quite often in interviews people referred to them together when asked about the
Eng-Tech’s leadership and culture related to evaluation. In the rest of the case study, the reader will find a variety of quotes that mention Sommers and Prince as a unit, i.e., “Jaime and Diana” or “Diana and Jaime.”

The combined skills of Prince and Sommers have enabled Eng-Tech to take on bigger and better projects, like the marine technology education textbook and the International RoSV Competition, and now a grant from another branch of NSF seeking to increase STEM interest among middle school students. Sommers is excited about the possibilities of the center, and her role in shaping those choices:

At this point the center leadership has really evolved too, with Diana at the helm and just the two of us based in [city]; we really sit down and talk and try to mold the center and have the strategic types of discussions. We try to figure out where we need to go, where we need to be... Really setting the direction, and that’s exciting. It’s challenging – because of soft money. So it can be challenging and frustrating, but we also have tremendous freedom to do things we really enjoy so it makes it all worth it.

Eng-Tech’s culture of entrepreneurialism, commitment to excellence, and expertise in marine technologist education has been cemented with the hiring of the other members of the current leadership staff. Emma Peel (Summer Institute Coordinator) and Talia Danvers (Internship Coordinator)
coordinate with Prince and Sommers to handle the day-to-day work of the center. Sommers, Peel and Danvers each have backgrounds in different aspects of marine technology education, and they bring their expertise to bear on their areas of responsibility. Plus, striving for excellence is just part of their natures. Each of them readily admits to being a perfectionist. At the strategic planning meeting, they continually joked about being a group of women Type A overachievers. As Sommers expressed it:

A lot of it is our personalities. It’s funny that we’re all women, all very driven... We want to do our best. It’s part of our psyche – it’s sort of normal operations for us... We want to know if something’s not working right so we can address it.

Danvers concurred, “I don’t know how to do anything halfway – so maybe some of it comes from internal drive – you want to do the best you can do.”

Laurie Jupiter, the current external evaluator observed: “In terms of personality, this is a highly internally motivated group. Everyone is dedicated to the organization, and as long as there’s a little direction from Jaime and Diana, everyone pretty much runs with it.”

Other external partners also recognize that attention to improvement and evaluation as a key part of the Eng-Tech’s culture. Pizzini put it this way:
Diana and Jaime and the other people that are involved at Eng-Tech really valued meaningful evaluation data and feedback. It was part of their loop: being critical of themselves, having the evaluator help them identify strengths and weaknesses, and where to best invest their resources. Even if it wasn’t always what they wanted to hear, they heeded that advice.

Their original external evaluator, Tom West, concurred, “…it’s absolutely reflex action – they just do it, it comes with the dinner, as it were.” A professional development participant and RoSV competition mentor agreed that Eng-Tech is always seeking feedback. He said:

I’ve filled out a survey every time I’ve done anything with them, that’s for sure. At every competition, students fill them out. I’ve filled them out after every summer institute. They’re pretty comprehensive, five- to six-page surveys…

Even when systems are in place for getting feedback and each staff person has a personal orientation to perfection, functioning together as a team is not a given in a group of Type A overachievers. Several factors have combined to make Eng-Tech a high functioning team. First, Prince and Sommers set the standard with their collegial relationship. Second, based on interviews with the staff, center partners who work closely with the staff, and the researcher’s observations Eng-Tech’s leadership operates in an “ego-free” zone. This team-oriented, ego-free zone enables the staff to listen and get the
right things done. When asked what makes the center staff so willing to listen
to stakeholder needs and ideas, Clayton, a long time RoSV mentor and
Summer Institute instructor said:

They understand this is bigger than all of us individually
could ever do. They get it. It’s hard to quantify it. There’s no
egos. I’ve not seen an ego-centric (sic) person involved ever –
it’s quite the opposite. A lot of competitions it’s about the
director – it’s all, “Here’s the director and all the great things
they’re doing.” In this case it’s the opposite, it’s, “Look at the
great things the center is doing – oh, by the way it’s run by
these people over here.” Lack of ego enables them to go out
and connect with people, and let people know they’re
interested in what they have to say for real – not just
listening and then saying, “We’ll do what we want to do.”
Certainly by the number of years they’ve been doing it
they’ve earned the right to have some ego behind them, but
they don’t even show it... Eng-Tech has a quiet
professionalism.

Peel, the Summer Institute Coordinator and newest addition to the
center leadership, added respect for each other and for an individual’s
expertise as other factors in Eng-Tech’s ability to function as a team. She
described it with the following example:

[We have] really strong personalities, obviously everybody
Type A overachievers; however, it’s being able to
understand and recognize who the person is in leadership at
that given moment and falling in behind. Even though the
chain of command is clearly Diana, Jaime, and then
everybody else... [At the Summer Institute] let’s say
something really screwed up – and that’s happened – Jaime would never walk in and call me on it – she would wait until the end of the day. And we’d discuss it off to the side… A participant or attendee, a student, or a family would never have any notion that I wasn’t in charge of that. And whatever the situation was, I would be told what it was and I would still be the one to handle it…. It’s really recognizing that that thing – internship, summer workshop, or whatever – is that person’s area of expertise.

This respect for others’ expertise extends not only to the center’s leadership staff and external partners, but also to Selina Kyle, the part-time administrative assistant. When she runs into problems with the center’s website or has an idea for improving her area of responsibility, they take her seriously. She said, “I love my bosses [Diana and Jaime]. When I tell them I have a concern they don’t see it as, ‘What do you know?’ They know I deal with the website and what’s not working.”

The final factor that makes it possible for these driven women to work in concert is their sense of shared vision. All of them are committed to marine science and to advancing technologist education in the field to the best of their ability within their areas of expertise and responsibility. Peel summed it up this way:

Even though you may be an overachiever, you recognize that you can’t do it all, and you know the person doing it is
fully capable, and you trust they’re functioning for the greater good of the institution, and if you support them in that task you’re supporting the greater good of the whole thing. Why would you undermine that? …they are relying on you as one of the legs of the table to support the same mission they’re supporting.

As demonstrated throughout the above section, evaluation is embedded as a value in the leadership and culture of Eng-Tech. The PI and leadership staff are personally committed to it as an essential tool in pursuit of perfection. They enact this commitment through developing relationships with partners and creating systems that generate feedback on trends and center performance. The organizational culture also has additional factors that facilitate getting and using evaluation information for the benefit of Eng-Tech and its stakeholders. The respect for others’ expertise, focus on relationships, passionate commitment to marine technology education, and ego-free pursuit of a shared vision of excellence combine to create an environment where evaluation is truly integrated into the daily life of the center.

Capabilities

The researcher identified several capabilities of Eng-Tech that facilitate the mainstreaming of evaluation. They include (i) staffing, (ii) focus on vision,
(iii) entrepreneurship (iv) prioritizing evaluation information needs, (iv) roles, and (v) collaborative relationships. Each capability is further described below.

**Staffing**

Eng-Tech’s staffing has undergone several strategic changes over the center’s history. In the early days, most of the staff were full-time employees of Coastal College. As the center grew, became more entrepreneurial and acquired multiple concurrent grants from different funders, it was clear some people were not up to the challenge of bringing in soft money. At one point, Eng-Tech had eight concurrent grants, and Prince was the PI on most of them. A dip in funding created the opportunity to pare down the staff size. Prince took it, and moved the center to more part-time and contract employees. As Prince described the current staffing situation:

> We have lots of good people who are willing to work part time because they love what they do and they like the flexibility… The whole team is reliable. We spent a long time experimenting, and this allows us to expand and contract as needed… it allows us to take advantage of opportunities.

Having a small, flexible staff, most of whom are part-timers, means that Eng-Tech can adapt to changes in grant funding, and thus follow where vision
and opportunities lead. Careful selection of staff members who share the commitment to excellence and passion for marine technologist education reinforces the organizational culture and keeps the center productive.

**Focus on Vision**

Eng-Tech is driven by its staff’s vision to be the national expert in marine technology education. They use this vision as the selection criterion for determining what goals and supporting activities will help them toward their vision. The vision also keeps them focused on industry trends and needs as a critical component of their work. For each new ATE grant, Eng-Tech has articulated goals and activities that serve the vision. Some have worked, and some haven’t. Both staff and external partners said that when something doesn’t work, it’s a focus on the vision that gets them back on track. Garrick summed it up:

It’s a learning experience basically…Knowing that you’re going in a certain direction – even if it doesn’t go quickly our how you thought, you just reset and ask, “Now what do we do to get there?” … we have these things we need to do, we try them and we evaluate, it’s just something we constantly do. Whenever we were drifting off course, we could say, “Nope, that didn’t work,” and we could go back to the core mission again.
Entrepreneurialism

In order for Eng-Tech to achieve its vision, the capability to focus on it is not enough by itself. The center staff also must (i) keep up with trends in education and industry; (ii) be aware of staff strengths, skills, and center resources; (iii) know its existing systems and relationships; and (vi) be aware of funding opportunities. An idea for a new direction or a new activity may come from any of those sources. Spotting the opportunities where vision, trends, strengths, systems, relationships and funding converge is a key capability the researcher has termed “entrepreneurialism.”

Pizzini’s description of how the staff handle recommendations and suggestions made by the NVC illustrates the entrepreneurialism capability of Eng-Tech:

They’ll remember advice you gave them several years ago – and say, “We finally found a time and place to do that thing you recommended.” You’re thinking, “What did I recommend three years ago?” They listen well, they remember these things. Even if they put them on the back burner because it’s not the right time, they have the uncanny ability to dig it out later and use it.

The RoSV competition was born out of this kind of entrepreneurial convergence. OTS has a standing committee on RoSVs; they approached Eng-
Tech looking for better ways to connect with students. Sommers and Martin, the OTS RoSV committee chair, hatched the idea of the competition as a way for OTS to reach students, increase awareness of marine industry careers, and develop the necessary skills. It was a match of OTS’ needs and Sommers’ background with RoSVs and marine education. The result has been a rousing success, according to Martin. “I’ve been in the business 43 years and I’ve never seen anything as successful, that’s touched so many kids and done so much good as that program,” he said. Eng-Tech more recently demonstrated its entrepreneurial capability with the Ocean Drifters project.

**Prioritization of Information Gathering**

Once the Eng-Tech’s activities have been set, based on the vision and entrepreneurial savvy, then the center prioritizes the kind of information it needs for improvement and demonstrating impact to stakeholders. Prince makes sure that any evaluative activity is producing useful information. In a discussion with the leadership staff at the strategic planning meeting, she said:

The funders we have now are not asking those questions – so we don’t want to add the questions unless they are addressing our specific issues. What we’re already trying to get from people in terms of the evaluation questions we get
is already unmanageable... We have to prioritize who we follow, we can’t long term track everyone. Students have to be our focus, finding successes.

Staff members embrace this prioritization in their areas of responsibility as well. As discussed next, they work with Jupiter to revise instruments to get information that is important to stakeholders and remove items that don’t serve that need.

Roles

The Eng-Tech staff have clear areas of responsibility with regard to the center’s activities. Within those areas of responsibility, each leadership staff member also has the power to work directly with the external evaluator to shape instruments for improvement and outcome data. Since the leadership staff members are all perfectionists, they make use of that power and collaborate with Jupiter to revise existing instruments and create new ones. The combination puts their knowledge of the program areas and important improvement and impact issues together with Jupiter’s subject matter expertise in designing instruments.

Danvers worked with Jupiter to revise the surveys used at the end of the internship program. As she described the process,
We mapped out what we needed to know and then figured out what to ask. Some of the questions we asked we don’t ask anymore because we weren’t doing anything with the data. Now it’s aimed at the goals of the program, making sure we’re doing what we said we would in the program, and making sure we are placing the right students.

Danvers also worked with Jupiter to design a process to discover what obstacles prevent community college students from participating in Eng-Tech’s internships.

After reviewing the end of event survey for the Summer Institute in preparation for the NVC meeting, Peel talked with Jupiter about adding an item to figure out what obstacles are preventing participants from implementing what they learned. She thinks that information would help the NVC understand the factors preventing implementation and enable Eng-Tech to include ways to overcome those obstacles in its next grant proposal.

Sommers described how the process works for her with the RoSV surveys:

Laurie really brings a fresh eye and fresh look. I have to run the program and I know that evaluation is important – and I’m not an evaluator, so I really look towards her to say, “We can’t ask that. We should ask that.” We have fantastic discussions about how to word things, what to word things, what do we want to get at. It’s really encouraging, because part of those discussions I contribute, but she’s inevitably the
one who has to build the tool and get the mechanism in place.

As the examples from Danvers, Peel and Sommers illustrate, empowering staff to work directly with the evaluator has produced quality instruments that get the information staff need to demonstrate impact and make improvements.

Collaborative Relationships

Eng-Tech excels at building collaborative relationships with its partners. This overall capability is based in the staff’s ability to listen and act on what they hear. (The staff’s characteristics of lack of ego and commitment to excellence appear closely related to this capability to listen and respond appropriately.) The following quote from John Clayton, a marine educator, longtime RoSV team mentor, and a recent addition to the Summer Institute faculty, summarizes what many partners expressed:

…it’s a willingness to listen to others. A lot of academic areas get into the thing where they have the feeling, “We’re the experts; we know what to do. We’ll listen to what you want, but we know the best way to do it.” It’s hard to convince some people that it’s being done a better way outside of academia. Eng-Tech has the openness to bring experts in and listen to what they have to say. It’s that close coupling with industry brings it all together.
The partnership with West, the original external evaluator, helped establish that habit of listening to others. He was closely involved with Eng-Tech, working with them on organization-level strategies to get feedback from external and internal sources. The close relationship between the center and external evaluator has continued with Jupiter. Her role is slightly different from West’s because Eng-Tech is in a different stage, developmentally. Rather than organization-level strategy, Jupiter’s focus is on revising and streamlining instruments and systems, as well as figuring out how to track student participants. However, the external evaluator continues to be an essential part of the Eng-Tech team. Prince described Jupiter’s role this way:

We hired [Jupiter] because our needs are very different now – longitudinal tracking, social networking, database access to give us the ability to help us sort and find important information… We bring our “external evaluator” to staff meetings because the evaluation is for us to improve… I like treating the evaluator as an integral part of the team. If you do that, your work builds on your work and makes your work stronger!

Eng-Tech also creates integrated, collaborative relationships with its other partners in industry and education. External collaborators are intertwined into center activities creating organic connections between
students, educators, and industry rather than relying on scheduled systems for interaction and getting information (although they have those as well). They use these relationships to build the capacity of the center in terms of the quality and reach of their activities and influence.

The relationships are visible in every aspect of Eng-Tech’s operations. Prince serves as PI on workforce study grants with co-PIs from Educational Centers for Ocean Science (ECOS), OTS, and multiple education institutions. Industry experts are intertwined throughout the RoSV competition, from design to judging competitors at the regional and international levels, which adds value for participants. One longtime industry partner who serves as a judge at the RoSV competitions gave this reason for his continued involvement:

With any volunteer activity you’ve got to decide, “Do I have time for this,” and Eng-Tech continually wins out because I am impressed by the way they handle it. I feel like they listen to my advice and appreciate it... Even though we live in the era of Facebook and social networking where everyone feels like it’s very easy to build relationships, I think the skill of building and maintaining a relationship of high value, in a professional sense, is still hard to come up with. I think [Prince and Sommers] are both very good at it.

Faculty members who engage with Eng-Tech for faculty development and
through the RoSV completion described how the staff take time to listen and answer questions – from both faculty and students. One said, “They have a lot of stuff to do, a lot of work to do, but they’ve always been personable. It’s more than just a job with them.”

With a foundation in listening and personal relationships, partners are happy to provide information on trends, enrollment, or impact when Eng-Tech staff ask. Close partners in particular agreed that they understand how important their feedback is to the center. Several interviewees from both education and industry described how they had been brought into activity they cared about, involved in the process, and then asked for feedback. They were happy to give it because it was something they cared about, had knowledge of, and they knew their input would be considered carefully.

Figure 36 gives a visual representation of the flow of information through these collaborative relationships. The size of the arrow indicates the amount of evaluative information exchanged in that direction. As described above, Eng-Tech facilitates the exchange of information among industry, education, students, and the center itself. The exchange benefits all parties involved.
Figure 36. Information Flow in Eng-Tech’s Collaborative Relationships

Systems and Structures

The staff at Eng-Tech use several kinds of systems and structures to make meeting their evaluation information needs a sustainable part of the center’s operation. These include (i) piggybacking on national conferences, (ii) building evaluation in early, (iii) empowering staff members, (iv) information source-specific strategies, (v) SurveyMonkey, and (vi) use of rewards. Eng-Tech may have other overall structures to sustain evaluative activity that did not present themselves in the course of this study.
**Piggybacking**

Eng-Tech’s remote location is a budgetary challenge when it comes to bringing the center staff and partners together for input on workforce studies or exploring new trends and possibilities. Although the center’s hometown has an airport, it is expensive to get a direct flight, and it also adds several hours’ travel time. In addition, as a national center, Eng-Tech’s partners are geographically dispersed, so getting a number of them together involves travel for almost everyone. Rather than always going out to individual partner organizations or bringing groups in to Eng-Tech, the center arranges meetings before or after industry or association gatherings – when everyone is already traveling. Invited partners can then simply extend their stay a day or two for the center meeting.

**Build Evaluation in Early**

Eng-Tech is in the habit of building evaluation into projects early on in their development. The staff and current external evaluator agree that it takes extra time and energy to do it that way. As Jupiter explained it,

…evaluation done well does take time and energy to set up. You have to make sure that you are asking the right questions in the way that will give you useful data, that you’re asking in a way that is understandable. Ideally, it’s
set up at the beginning of the project, which is when people have the least amount of time to spend on something on this. It’s a true investment of time and energy.

Peel concurred, “[it’s] a little bit more time-consuming... It takes some serious planning.” However, the energy invested in creating systems early means that only small changes need to be made once the program is up and running. Danvers said, “Up front it was challenging, but now it’s easily maintainable.” Jupiter agreed, “Because I inherited a good system, it’s not as burdensome. The system is already set up, it doesn’t have to be that much energy [invested] compared to the payoff.”

Information Source-Specific Strategies

Eng-Tech staff work with a variety of stakeholders and run activities of widely differing sizes in diverse locations on various timelines throughout the year. They have created their feedback systems to get the data they need from these diverse sources. For the regional RoSV competitions, they use both online and paper surveys, since not all sites have computer access. For the internship program, the online surveys are perfect, since interns and mentors are spread across the country and everyone has Internet access, even on the ships. The Summer Institute uses online surveys for the end of event and
follow-ups, but also uses personal interaction. With only 20 participants at a
time, staff can engage them more personally and adapt institute activities to
specific needs or interests of the group while the institute is in progress.

For getting information from partners, staff use a combination of face-
to-face meetings and occasional short surveys with specific questions. Taking
time to respond to Eng-Tech isn’t a burden because they are smart about it,
according to Clayton:

They make it so easy. If you do continuous feedback, you
don’t need to ask for much feedback when you ask. You ask
very pointed simple questions... If you wait so long in
between sampling it becomes a monstrous task. The smaller,
more frequent sampling makes it possible to make changes
to problems. And it’s, “We blew it,” or “We didn’t think of
that” – then they can adapt before the next one happens.

A Summer Institute participant agreed about his experience with Eng-Tech’s
follow-up surveys:

The questions were specific when they asked. It wasn’t
expansive – it was four to five questions. You know how
some questionnaires go on and on, this wasn’t one of them.
So I could answer in a succinct manner and move on.

This approach enables the center staff to get the information they need, and
the size of contribution is manageable for partners to fit into their schedules.
Survey Monkey

Eng-Tech uses SurveyMonkey for much of its data-gathering activities. At the time of the research visit, the center had 46 surveys in the system. SurveyMonkey automatically compiles results, consolidates comments, and instantly creates summary reports that can be viewed online by staff. The instruments created on SurveyMonkey also are printed out for use at events with no Internet access. Then Kyle, the administrative assistant, creates individual entries on SurveyMonkey for each paper respondent so all the responses – electronic and paper – can be analyzed together. This is particularly helpful for compiling overall results from the regional RoSV competitions and the internship surveys.

Rewards for Evaluation

The Eng-Tech staff are motivated to get information from their sources. As a result, they have instituted systems to reward participants for completing evaluations and informational surveys. For the recent survey of community college students regarding internships, respondents got a laser pen. For the RoSV competitions, the rewards vary from lunch tickets to prize drawings to the official competition patch. Peel explained that at her regional
competition, nobody gets a lunch ticket – not parents, students, or mentors – until they’ve completed the evaluation.

As part of registering to participate in the RoSV competitions, students are also required to register on Eng-Tech’s AlumniWeb. Educators who participate in Eng-Tech activities also are encouraged to register. The reward is that AlumniWeb members can post resumes online and view job announcements from Eng-Tech’s partners.

Payment is the motivation to fulfill the evaluation requirement for interns. As part of the program, interns receive a stipend from Eng-Tech for their work on the ships. However, before they get paid, they must complete their internship journal or blog, turn in a two- to three-page report on their experience, create a PowerPoint presentation, and fill out the end of internship evaluation. Danvers said, “I don’t pay them their stipend until they have completed all paperwork.”

The reward system is effective for generating feedback. Sommers reported, “The benefits are, look at our numbers – when you have 85-95 percent [response rates], the percentages we get back from our summer institutes and internships and competition surveys, you know if what you’re
doing is right…” The high return rate ensures that Eng-Tech is getting a good sample of information for both making decisions about improvements and demonstrating impact.

The six overall systems and strategies described above have made evaluation sustainable at Eng-Tech. Within this broader framework, the center conducts a variety of activities in each of the main streams of evaluation. The following sections highlight some of Eng-Tech’s evaluative work in Strategy and Design, Continuous Improvement, and Impact for Judgment.

Strategy and Design Stream

After 13 years as an ATE center, Eng-Tech has a well-established purpose and set of program activities. Staff continue to use their personal networks, professional associations, and Eng-Tech’s activity-related industry committees to get current information on trends, emerging jobs, and workforce skill and knowledge needs for marine technicians. However, the majority of their efforts in the Strategy and Design stream of evaluation tend toward using information to design quality experiences for participants in their activities. The following section highlights staff efforts in evaluating the
center direction and designing (i) knowledge and skill guidelines, (ii) missions for the ROS competition, (iii) RoSV competition rules and score sheets, (iv) the Summer Institutes, (v) internships, and (vi) Eng-Tech’s new website.

**Center Direction**

Since Eng-Tech’s inception, its purpose has been to continually improve marine technical education, thereby increasing the number of highly skilled professionals in ocean-related occupations. The center staff use feedback from their personal networks, workforce studies, and interactions with professional associations to understand trends in the marine industry. The collaborative relationships described above are key in this effort. Once they’ve gathered that information, the staff map out how Eng-Tech can use it to advance technologist education. “We try to take it all in, and then also try to be extremely realistic about what we can do… knowing what we have in place, [and] the staff we have,” Sommers explained.

The result is continuing innovation in center activities, the latest of which is the Ocean Drifter project, described above. One partner college faculty member, who helped draft the original center proposal, described the
benefits of evaluation for the center’s direction:

I would say the benefit I can see is the evolution of the organization. Obviously, they are paying attention to the feedback they are getting. The organization has grown proactively as a result... We now have the international RoSV competition, internships for students, workshops available, this wasn’t there years ago. It’s because of the feedback it has grown.

Knowledge and Skill Guidelines

In the early days of Eng-Tech, Prince conducted workforce studies and DACUM (Developing A Curriculum) processes to create courses and modules. However, attention to the increasing diversity of the workforce and the national reach of the center showed that specific curriculum was not the best way for Eng-Tech to serve its stakeholders. Instead, Prince and her colleagues shifted to knowledge and skill guidelines. The guidelines are created through Prince’s continued workforce study efforts, which she leads in partnership with staff from a variety of education institutions, government agencies, and professional societies. Eng-Tech staff document and share those results with the center’s partners, and through its website. The published knowledge and skill guidelines serve as criteria that educators throughout the country can use to determine what needs to be taught in their marine
technologist courses. They are also used to shape the center’s professional development workshops and the Summer Institute. In this way, Prince’s evaluative efforts in Strategy and Design benefit not only Eng-Tech, but also the marine science and technology community as a whole.

RoSV Competition Missions

Eng-Tech’s annual RoSV competition is built around a set of tasks that each team must guide their remote-operated submersible vehicle to complete. Every year, the center staff design a new set, or “mission,” for each level of competitors, from secondary to university students. The Eng-Tech staff responsible for the RoSV competition take fidelity to real world scenarios seriously. As staffer Steve Austin described:

The number one thing we focus on with the missions is that they are real world. An underwater obstacle course is nice but RoSVs don’t do it. So we try to make the missions realistic, and we get feedback from industry to make sure that’s true.

Thus, they create the missions at the international competition based on actual work conducted by RoSVs at the competition’s host institution. The center convenes a panel of industry experts, educators, and representatives from the host site to brainstorm ideas for possible missions. Then Sommers
and Austin design the missions and send them out to the panel to check the
details. The process can take several iterations, with the panel giving
feedback, ideas, and tweaks to make the missions more realistic.

The 2010 RoSV competition, held in Hawaii, provides an example of
the iterative process. The mission scenarios were designed around the tasks
RoSVs conduct at the marine center hosting the event. Feedback from the
industry panel helped the Eng-Tech team decide how much sample the RoSV
needed to collect from a simulated bacterial mat, based on actual field
experience. Austin recalled, “One of the scientists advised us that you don’t
want to take too much or you’ll destroy the bacterial mat and it won’t grow,
but you have to get enough for the scientist’s sample.” The specific
parameters were incorporated into the mission, creating an experience for
competitors with high fidelity to the kind of work they can do as marine
technologists in the workforce.

**RoSV Competition Rules and Score Sheets**

The annual RoSV competition is a complex event. Two levels of
participating teams, Ranger (advanced) and Explorer (beginners), compete in
four areas: mission, poster, technical report and group presentation. Industry
experts are brought in to serve as judges at the regional and international competition for both levels on all four areas. To ensure reliability and fairness in assessing performance as well as the safety of participants, Eng-Tech has designed safety guidelines, rules and detailed score sheets. These are reassessed annually by the RoSV “Supreme Court,” a panel of industry experts that works together with Eng-Tech’s RoSV staff, Austin, in particular.

The Supreme Court is made up of industry experts with experience judging at the RoSV competitions. They handle changes to the safety guidelines and rules and make judgments on rule questions that come up before and during the contest. Competition participants appreciate the importance Eng-Tech places on answering rule questions and addressing changes. One mentor said, “They have an online thing where they take questions for upcoming RoSV competitions... Steve takes care of moderating that. Usually within three to four days if my kids post a question on there they get something back.” Clayton gave a more dramatic example of Eng-Tech’s attention to adapting rules based on feedback. He described this incident with his college’s RoSV team:

One year everyone was walking around the pool in flip-flops and I didn’t think anything about it. Then one of my
guys dropped the RoSV on his toe and cut it open. Since then, no open-toed shoes on the [pool] deck. That’s a no-brainer, why didn’t we think about that? Any type of issue, they think about it, they put it to their panel and [it] gets incorporated.

It’s clear the score sheets for the various aspects of the competition have gone through multiple iterations as well. There are two sets of separate score sheets for all four parts of the competition posted on the Eng-Tech website – one set for each level of competitors. The sheets are clear, specific checklists with a spot for scoring in process and an overall worksheet to compile scores at the end.

The score sheets are for the judges’ use during the competition. However, because Eng-Tech makes them available on the website, savvy teams can see how to prioritize development of their competition deliverables to get the most points. The score sheets also define what kinds of activities will get a team penalized or earn bonus points. For example, teams can be penalized for a mentor who exercised more than an advisory role in the presentation or for overuse of off the shelf systems in the RoSV design. Teams can get bonus points for things like correct grammar and extra effort to overcome obstacles. In addition, a team can be disqualified by the judges if they don’t pass the initial poolside safety check of their equipment. Eng-
Tech’s attention to the competition rules and criteria, as exemplified by Web forum, supreme court and detailed score sheets, are a great example of evaluative activities for design.

**Summer Institute**

Eng-Tech’s Summer Institute staff are committed to making the Summer Institute professional development a worthwhile experience for participating faculty. They employ a variety of tools and information sources to design an excellent experience. For topics and course material, Summer Institute staff use their personal research and networks to gather information about what’s “new and hot” in RoSV technology throughout the year. Then they meet several times via phone conference to prioritize the topics and skills, lay out lesson plans, and determine the kinds of technology that will be used by participants to build RoSVs. The institute takes a lot of design planning, according to Banner:

> The summer institute lasts about a week – we meet several times before, and discuss what will we do, our priorities, what needs to be taught. Jaime and Steve work on getting the schedule lined up. Then we get feedback from the teachers, to see if the amount of time is adequate for their section.

The Summer Institute is further developed with help from applicants.
Eng-Tech staff modify the application based on the intended curriculum for the year’s event. It asks for information about the faculty member’s background with RoSVs, their previous professional development experience, their desired outcomes from participation, and a description of their home institution. In addition, applicants are asked to rate their skill level in a variety of areas related to building and operating an RoSV. Applicants then rate their knowledge and skill in each on a one to five scale (1. willing to learn – 5. able to teach others). The two sets of information are used in three ways to design the Summer Institute experience, all of which were the result of staff’s experience and reflection on previous institutes.

First, the information about the applicant’s background, intent for use, and home institution is used by the center staff and the Summer Institute faculty to narrow the field of 50 applicants to 20 who will be issued invitations. The selection criteria are based on two categories: who will benefit the most, and who will be able to spread the RoSV program to new school systems or underrepresented groups. All the faculty and staff involved with teaching sessions at the institute review the applicants and submit a list of their 10-20 top candidates. This screening step weeds out applicants who
are just looking for a trip to Eng-Tech’s scenic location and not prepared to use what they learn to forward marine technologist education – something that happened before the process was instituted. It also helps to ensure that the entire group is on about the same level of experience with RoSVs, so that participants are not bored or in over their heads.

Second, invitees who commit to attending are placed in work groups based on the self-ratings of their knowledge and skills they provided on the application. The groups work together during the week to build and fly an RoSV on a mission. Using the self-ratings, center staff rank the people with the highest skills in each area and make sure each group has someone with skills in each of area. That way, each member has something to contribute and also can learn from the others in his or her group. When asked if the screening process made more work, David Banner, who works as technical support for the institute said:

Sure, but in the end it makes the workshop a whole lot better, more effective, and everyone came out of the workshop feeling better... the workshop flows smoother, you don’t see a team that’s way ahead of everybody and bored, or way behind everybody and comes out depressed and disappointed that they didn’t do as well. We build a computer system and if there’s no one on the team that can program, and they can’t finish it, then it’s frustrating on the
last day when the RoSVs are in the pool and theirs doesn’t work. When you’re sitting at the pool and yours isn’t in the water, that’s just not a happy place.

The third and final way the application is used to design an excellent experience for Summer Institute participants is in making room assignments. Participants come from all over the country for the weeklong institute, working from 8 am to 9 pm every day in classes and building their RoSVs.

Peel, the Summer Institute Coordinator, is a three-time veteran of the Institute. She knows that in midst of the intensity of that experience, little inconveniences can loom large. As a result, she created an algorithm that puts participants in rooms with someone from their same time zone who is not a member of their RoSV team. She explained:

I also worked really hard to match lifestyle things, so people from the same time zone were roommates, so when you both wake up at 4 am it’s ok... [This way] it’s great; if you hate the people on your team, you can talk to your roommate; or if you hate your roommate, you only have to sleep there and you’re with different people all day in the lab, and that’s important.

Peel also made changes to the meals, housing, and other logistical issues based on her experience. Her design changes, implemented in 2009, yielded the highest satisfaction ratings from participants of any Summer Institute conducted by Eng-Tech. Jupiter said, “In fact, the immediate feedback
surveys, the satisfaction with logistics shot up after she took the reins. They were already high, but then they went extremely high.” Clearly, the staff’s attention to design of the Summer Institute’s content, participants, group configuration, and logistics ensures a top notch development experience for faculty.

Internships

For Eng-Tech’s internship program, an excellent experience needs to be designed, not only for students, but also for the partner organizations that host the interns. In the early 2000s, the center was having difficulty getting berths on University-National Oceanographic Laboratory System (UNOLS) ships for interns, even though Eng-Tech had NSF funds to support the program. Danvers, who was the full-time staff member in charge of the program at the time, remembers her frustration with the situation. She recounted, “…it was like pulling teeth to get ships to give me berthing space.” A staff member from a UNOLS station recalled how the marine technologists on her ships resisted taking on interns:

They were frustrated, and when it would be time to get ready for interns, I’d try to drum up some enthusiasm, [saying,] “Hey, summer’s coming up!” And they would groan... So, in the beginning it was horrible for the mentors.
I was constantly trying to cheer them up and motivate them to help the students learn.

When Danvers left the Eng-Tech staff in late 2005, the problem had not been resolved. It took a lot of honest conversation between her successor, Colleen Lassiter, and the UNOLS host offices to figure out what wasn’t working. The problem turned out to be twofold: (i) interns weren’t applying for jobs on the ships after their internships, and (ii) some interns did not have the necessary skills and knowledge to contribute positively to the ship’s operation. Once the root causes of the UNOLS office’s dissatisfaction were sorted out, Eng-Tech staff took steps to address it and design a better internship experience for students and mentors.

First, to address the issue of interns not applying for jobs on the ships, Eng-Tech changed its selection criteria and process. University students were using the internship opportunity as a stepping stone to graduate school, rather than to a marine technologist career. In response, the center staff added a section in the application that asked students to discuss their reasons for wanting to do the internship and their future career goals. Center staff now give priority to applicants from community colleges who are interested in marine technical careers. In addition, students who have graduated are
eligible for the internship program; before it was limited to current students.

While participants have to sign up for credit in order to have health insurance, they can have completed a degree program. Danvers explained,

We started taking students who had recently graduated who were in the job market, and that made a huge improvement. So students do the summer after they graduate and use it as a way to get into the workforce. It made a big difference.

These two changes have successfully addressed the lack of applicants for jobs from the intern pool.

The second set of changes regarded the issue with unprepared or underprepared interns. Lassiter consulted with folks from UNOLS who worked closely with the interns to create a preinternship quiz. It is distributed online through SurveyMonkey to students who have been chosen for an internship experience. It asks them questions about common terms and technology used on the UNOLS fleet. A poor quiz score does not disqualify a student for internship, but it does allow Eng-Tech to give students additional reading or research to do before the internship if they don’t score well. Even for the students who pass, the quiz helps them understand the shipboard context and work environment. One intern explained it this way:

I think it was helpful in that it gave me an idea of what I
would be up against. I don’t think it was completely inclusive of what I needed to know or what I would be learning, but it pointed me in the right direction of what would be expected of me.

Another student reported that the quiz actually helped him solve a problem with a major piece of equipment essential to completing the science crew’s mission for the cruise. He described staying up for 24 hours, working with another crew member to get the Conductivity, Temperature, and Depth Sensor (CTD)\(^{14}\) operational. They got it fixed and reassembled an hour before it had to be deployed. He recalled the quiz helping him figure out how to handle the problem:

Some of the electrical stuff [from the quiz] I actually applied, because the CTD problem was electrical with the power supplies. I don’t remember what the question was on the quiz, it was something that had to do with electricity on the ships and knowing what the equipment is and what it does.

The design adjustments explained above resulted in the UNOLS hosts getting better candidates and, thus, a better experience for everyone on

\(^{14}\) The CTD is the primary tool for determining essential physical properties of sea water. It gives scientists a precise and comprehensive charting of the distribution and variation of water temperature, salinity, and density that helps to understand how the oceans affect life. (http://www.whoi.edu/instruments/viewInstrument.do?id=1003)
involved in the internship. As one UNOLS staff member explained, he gets to choose from a small set of qualified applicants who are eager to learn from the mentors and are helpful on the ship. He reported, “Everyone gets to feel useful. With good candidates, we’ve gotten more done.” A UNOLS staffer who participated in the quiz design process said that mentors and students were more satisfied with the experience now. “Once we got better at selecting the students – the difference was like night and day. Their evaluations at the end were all coming out in the high range,” she said.

**Website**

Eng-Tech’s website provides resources for students, teachers, and activity participants. In January 2008, the center embarked on a redesign and restructuring process with it. According to Eng-Tech’s 2009 annual report, the new website would integrate wikis, social networking, and online collaborative learning to “serve the needs of an increasingly technically savvy audience.” At the time the annual report was written, the redesign had been completed and was ready for implementation. Rather than trust that the redesign would serve its intended purpose, Prince and the webmaster made time to observe students using it. As Prince described it,
The webmaster and I are doing usability testing with students – it’s in person, watching students use the website... Students didn’t use it at all the way we thought they would; we’ve learned a lot by watching...It needs to be totally redone based on what we’ve learned there.

Although the usability evaluation and resulting revisions have pushed back the launch of the new site, changes made based on it will ensure a design that serves the center as its users more effectively.

The previous sections have described a variety of ways Eng-Tech uses data collection and evaluation to shape the strategy of the center and the design of its programs. While this is not a complete list of all the ways the center uses evaluation for Strategy and Design, it gives the reader a sense of the intensity and commitment Eng-Tech has to this stream. The evaluative processes presented above are summarized in Figure 37.

Continuous Improvement Stream

Eng-Tech staff conduct evaluative activities for Continuous Improvement in several areas: the RoSV competitions, workshops and internship program. They also have created a feedback loop for Continuous Improvement that includes RoSV competitors and the industry experts who judge entries. This section describes those evaluative processes.
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<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>center direction</td>
<td>industry, agencies, educational partners, NVC</td>
<td>industry trends, ideas for partnerships, funding and other resources</td>
<td>center staff are engaged at various levels with industry, education, and professional associations → ongoing conversations with those networks</td>
<td>• center leaders aware of trends in industry and opportunities that fit with center's mission • center's work refined to meet marine science industry and education needs</td>
</tr>
<tr>
<td>knowledge and skill guidelines</td>
<td>industry and agencies</td>
<td>emerging trends and jobs in marine industry</td>
<td>PI along with other center partners conducts workforce studies every 2-3 years → data collected through interviews and focus groups → early findings are reviewed and refined through conversation with education and industry partners</td>
<td>• provides industry trend information to educational partners • updated knowledge and skill guidelines that meet current and future industry needs</td>
</tr>
<tr>
<td>RoSV missions</td>
<td>panel of industry representatives, RoSV host</td>
<td>RoSV tasks in the host organization's context</td>
<td>center staff consult with marine technologists and host organization to sketch ROV mission → staff develop the sketches into full missions for the different levels of competitors → draft missions presented to original group and changes made until missions are finalized</td>
<td>• fidelity to real life work of ROVs in terms of tasks, challenges, and equipment • connected to the context of the international ROV competition</td>
</tr>
<tr>
<td>Subject</td>
<td>Source</td>
<td>Input</td>
<td>Process</td>
<td>Results</td>
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<tr>
<td>RoSV rules and score sheets</td>
<td>RoSV judges, participants</td>
<td>questions, clarifications, observations</td>
<td>previous year's rules and score sheets reviewed annually → students ask questions about rules on center Web forum → center staff converse with RoSV &quot;Supreme Court&quot; regarding possible improvements based on observations, questions, and clarifications → rules and score sheets revised accordingly, questions answered via website</td>
<td>• rules and safety checklist improved annually for clarity, coverage • increased safety for participants • refined score sheets for each division and competition component</td>
</tr>
<tr>
<td>Summer Institute</td>
<td>applicants, institute faculty, center staff</td>
<td>staff knowledge, participant applications and pretests</td>
<td>individual staff members conduct research and document trends in RoSVs → Summer Institute staff phone conference about trends to be included in courses → applicants rate their skill level and describe how they will use the training → instructors use applications to rate applicants for inclusion → staff use skill level ratings to place participants in appropriate institutes and work groups within the sessions → Coordinator uses an algorithm to make sure that roommates are from the same time zone but in different work groups</td>
<td>• equipment, computer programming, and RoSV components used in the institute match industry trends and RoSV competition needs in terms of price, quality, and availability • session content adapted to participants' intended uses • participants at similar point in RoSV experience are grouped in introductory, moderate, and advanced sessions • participants aren't with the same people all the time • people with similar jet lag issues room together • groups balanced with different members experienced in programming, soldering, electronics, etc., for successful building and flying an RoSV • institute participants have cutting edge training to implement with their RoSV teams and in their classrooms</td>
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</table>
**Strategy & Design Stream (continued)**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internships</td>
<td>applicants, intern hosts</td>
<td>applicants' education, knowledge and interests; host’s berths and projects available</td>
<td>application asks for information about students' interests, career goals, knowledge, and skills → intern hosts provide information about the kinds of projects on their vessels with available berth space → Internship Coordinator creates a short list of candidates for each host → hosts choose interns → interns complete a quiz to prepare for internship</td>
<td>• students not interested in technical careers are screened out • information helps match applicants with intern sites • quiz ensures interns have necessary vocabulary and basic knowledge to be an asset on a vessel</td>
</tr>
<tr>
<td>new website</td>
<td>PI, webmaster, students</td>
<td>usability testing</td>
<td>site redesigned based on feedback from center staff → PI and webmaster observe students using the beta version of the new website → PI and webmaster discuss observations and needed adaptations</td>
<td>• website designed to facilitate use based on students' needs and interaction with the site</td>
</tr>
</tbody>
</table>

*Figure 37. Strategy and Design Summary for Eng-Tech*
RoSV Competitions

Eng-Tech has put systems in place to continually improve the management infrastructure of the RoSV competitions. In the past year, staff have been developing a handbook for regional coordinators. They also have regularly scheduled conference calls with that group to coordinate and address emerging issues.

The center also has systems in place to continually improve competition logistics. Students and team mentors who attend the RoSV competitions have the opportunity to fill out a survey about the experience. Part of the survey asks about the competition logistics – hotels, food, etc. A multiyear team mentor reported:

They do feedback forms each year, for teachers and kids. They do evaluation of several things – one is nuts and bolts of running it, quality of food, rooms. That’s important. If the kids don’t like rooms or food, it could destroy the atmosphere of the place.

Eng-Tech staff use the survey responses to make changes in vendors and hotel accommodations for the next year.

RoSV Team Performance

Eng-Tech has expanded its feedback systems for continuous
improvement beyond just the organizational staff and programs. At the RoSV competitions, industry experts judge the students’ performance in each category. Students get to interact directly and indirectly with the judges during the competition. After the competition, Eng-Tech staff send out the judges’ scores and comments to each team. This is another opportunity for all students to see their efforts in light of real world industry requirements. Team mentors really value that interaction. Clayton, an RoSV mentor said:

> Everything the students submit is judged by industry professionals and we get the paperwork back with their raw comments, like “We would have liked to see this.” “Why did you put that in there?” “That was a great idea.” Their comments are directly on what the students did…You can’t ask for a better thing than when someone from industry takes time to come to the competition and says, “Change this,” or “Good job on this.”

Another mentor told the researcher how his students make changes for the next year based on the judges’ feedback:

> They give us feedback from the judges; we can see the judging sheets two months after the competition, but that’s in time to plan for the next year. Last year our presentation was a lot different than the year before because of the feedback. The kids see the feedback and make the decisions about what to change. We’ll be doing it differently again this year for the same reason.

By bringing industry experts into the competition as judges and then
forwarding their scores and comments to the individual teams, Eng-Tech has expanded the Continuous Improvement stream beyond the center’s core staff. The center is making it possible for students to learn and improve their work directly based on current industry standards and information.

**Summer Institute and Workshops**

Eng-Tech staff have created several evaluative systems to get feedback for Continuous Improvement at their RoSV Summer Institute and other workshops. The first is on a staff-program level. Before an event, the staff sit down together and review the comments and evaluations from the previous year, to ensure that the improvements they deemed important have been made.

Eng-Tech’s Continuous Improvement efforts continue during the week-long Summer Institute. Center staff are on hand in the classrooms to observe lectures. They give feedback (outside of class) to the instructors to help them improve their lectures to meet the needs of participants. Martin, an OTS colleague and annual member of the Summer Institute faculty recalled:

I have this canned lecture I’ve been doing for many years about the history of the RoSV industry, why do they exist, what do they do, what did we do before we had them. A few years ago they told me I was spending too much time on
history and not enough on the latest technology and advances and the future directions of the industry. So I took some off the front end and added on to the back end.

The staff also engage in conversation with participants during the week to make sure the content and activities are meeting their needs. Staff are willing and able to adapt the content on the fly based on participants’ requests. One educator who had attended multiple workshops reported:

I know on the second [institute I attended], for more advanced [educators], they spent a lot of time talking to us individually... Even as we went through, if you had an area you really wanted to get into, they would split up and go on the fly. Some guys really wanted to get into programming and Tyrone wrote three different programming exercises during the week to adapt what we were doing to the people that were there, which I thought was really good... I’ve been teaching 34 years and these were the most responsive, interactive workshops I’ve been at.

A participant in the GIS workshop confirmed that the ongoing conversation between participants and center staff happened at more than just the Summer Institute. When asked if he had the chance to give feedback to staff during the workshop, he said:

Absolutely. It’s more in the dialogue you have with the teachers – with Diana in my case, with the GIS training. As you’re plugging along, she has an itinerary of what to cover, but there’s always flexibility. So if we want to expand on one part, they will shorten some other part to do more of what
the group is interested in. They are a really flexible group – if you say, “I want to spend more time on this,” they are completely open to doing that.

The center staff’s willingness to engage in continuous dialogue with participants and their skill and flexibility in adapting on the fly enable them to excel at meeting participant needs in professional development.

The third process for Continuous Improvement with regard to faculty professional development happens after the Summer Institute and workshops. The Eng-Tech staff who are involved sit down again and process the event. Banner said, “After the teaching, we get together and talk about what we need to do next time. Those notes get set aside and we talk about them in the premeeting the next year.” This includes talking with one another about how to improve their teaching. Austin shared an example about a staff member who was lecturing over participants’ heads and how the team handled it:

Tyrone is a very elegant programmer, but he does some complex things to make it run smoother, when it could be done in a way that’s easier for teachers to understand. So who says to Tyrone, “You’ve gotta dumb that down a little”? One of the nice things, we’re all friends, so we talk about how to tone it down, that certain people are getting left behind. Who actually does it? It could be anyone that says it – Jamie, Emma, me, John. I like to think we’re not saying you have to
do it. In that example, Tyrone did recognize some people were falling behind and not getting it. He’ll maybe be able to change things for this summer.

Eng-Tech’s feedback systems get information from staff, participants, lecturers, and industry to improve its professional development efforts. Several long-term benefits result from this focus on Continuous Improvement. They include better processes for the workshops and building RoSVs, improved content, and participants who have skills they can take back to their classrooms. Austin summarized it, “…the more feedback we get the better it becomes. We’re always improving.”

**Internship Program**

Eng-Tech staff also have created two systems for improving the internship program. The first system is the end of internship surveys for mentors and interns. The student survey includes questions about the students’ expectations, academic preparation, and any suggestions for how their coursework, the internship, or the Eng-Tech staff’s efforts in coordinating the internship could be improved. The mentor survey includes items about the sufficiency of Eng-Tech’s support of the internship and asks for suggestions about how to improve the program. The internship
The internship coordinator reads the survey responses, makes changes to the program, and forwards comments about academic preparation to Eng-Tech’s partner colleges.

The second system for improving the internship program revolves around lack of participation by underrepresented groups like African-Americans and Latinos. Looking at demographic information from previous interns, Eng-Tech staff realized individuals from those groups rarely applied or accepted positions. As a result, when they wrote their most recent grant, they included funds to conduct a study to figure out what was preventing their participation. Prince described the effort, “We’ve discovered that asking what doesn’t work is more eye-opening than asking what does. We’re learning about the obstacles that prevent students from applying for these internship opportunities.”

The study began with a presentation and survey of community college students at a nearby partner college. The internship coordinator then conducted focus groups based on students’ survey responses. Danvers reported a key finding: “Students in the focus group said they had a fear of the unknown. The minority students had a much bigger fear of the unknown,
and they wouldn’t apply for it because they couldn’t visualize the internship.”

The center staff have taken multiple actions based on those findings already. Eng-Tech’s internship webpage has been adapted to include descriptions of internship life in both English and Spanish. Additional videos, pictures and blogs from previous interns on the site also help describe the experience for potential candidates. Danvers developed a PowerPoint presentation that can be given by other staff and partners to explain the internship program to community college students. Together with Jupiter, she further refined the postpresentation survey so that they can continue to learn about barriers to participation even when the staff are not doing the presentations themselves. Students who complete the survey get a laser pointer pen.

This section has described some of Eng-Tech’s evaluative activities in Continuous Improvement that have enabled learning for the center staff and RoSV competitors. The process maps for the Continuous Improvement activities described herein are summarized below in Figure 38. The information included herein was deemed the best representatives of Eng-
## Continuous Improvement Stream

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>RoSV international competition</td>
<td>participants, staff</td>
<td>survey responses, observations</td>
<td>students and mentors complete a post-competition survey → UCV staff conduct an after action review where they discuss survey responses and recommendations → notes made about changes to be instituted for next year's event. Teams fly RoSVs in the pool, make a public presentation, do a poster, and write a technical report → in each area, judges give scores and comments → students and mentors get to interact with the judges at the competition → score sheets forwarded by the center to the teams two months after the competition.</td>
<td>• tweaking of mission parameters for next year's competition • logistic considerations and improvements (food, lodging, associated activities) • students and mentors get direct feedback from industry experts on their performance • teams use the information to make changes for the next year's competition.</td>
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### Continuous Improvement Stream (continued)

<table>
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<tr>
<th>Subject</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
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</table>
| Summer Institute      | participants, observers, staff| participant needs, observations, survey responses                     | before: review last year's notes to make recommended changes and additions.  
during: observers sit in on sessions, staff engage in informal conversations with participants about their instructional needs.  
ongoing conversation among staff to adapt and improve sessions based on feedback.  
after: participants fill out survey, staff conduct after action review and make notes about their observations and participant recommendations for next session/year. | • Immediate changes in course inclusions,  
adding or changing components based on participants' needs.  
improvements for next day's class.  
next year's approaches.  
improvements for next year in terms of recruiting, creating groups, topics, teaching approaches. |
| Internship program    | marine technology students    | barriers to participation                                             | focus groups with students to discover what enables or prevents participation in the internship program.  
coordinator and external evaluator design survey to get information from a broader sample of students.  
information used to adapt website and internship marketing. | • Focus group findings used to develop survey.  
resources in Spanish, photos, video links, journals, and blogs added to website.  
changes to recruiting materials and presentations. |

*Figure 38. Continuous Improvement Summary for Eng-Tech*
Tech’s efforts in this area, because they have provided a variety of positive improvements in the center’s programs.

Impact for Judgment Stream

Eng-Tech engages in a variety of evaluative activities in the Impact for Judgment stream. Staff efforts provide information that is used by the center, its partners and funders to understand its impact on various areas. These groups include (i) RoSV student competitors, (ii) faculty, (iii) interns, and (iv) workforce and marine education programs.

Students in RoSV competitions

At the RoSV competitions, students and mentors fill out surveys to help Eng-Tech staff understand the impact of the activity on participants. One team mentor described the survey he fills out at the RoSV competitions:

…there is a feedback form at the competition – ½ open-ended questions, with places to write stuff in. The stuff they ask is more about their ATE requirements, how you heard about it, how many people affected, do you use it in courses at your school, how many students impacted – the focus is on fulfilling the requirements of the grant… I think they do that and do a great job.

The survey has evolved since the first RoSV competition. Sommers recalled the surveys were an afterthought originally, because the event was so
logistically complex. West helped them build a better RoSV survey, which was used through 2009. Then, with a new external evaluator and a new grant to extend the RoSV competition to middle school students, the survey has been overhauled. While it still asks the impact questions, Jupiter has revised the items to a lower reading level, so the same survey can be used for middle school through adult respondents. In addition, the survey is also used at all the regional competitions, which had not always been the case. The revision has enabled the center to track impact for all levels together; plus it means there is only one instrument to disseminate and update for all regional and international competitions.

Faculty

The staff also gathers information about Eng-Tech’s impact on faculty through the Summer Institute and workshops. Participants fill out a survey at the end of the professional development experience. Staff, or the external evaluator, follow up three to four months after the event, when teachers are back to their regular schedules, to find out what they’ve been able to use in their classrooms. Faculty participants who were interviewed attested to that model. One who attended the weeklong ROV training said, “The follow-up
afterward, we got an e-mail that asked how we were using this in the classroom. It was obvious that was a primary objective – to document how we hoped to use the skills in the classroom…”

With the launch of the Ocean Drifters project, the staff has expanded their efforts to get impact information to help them further develop the program for the center and its education partners. One interviewee described the expanded feedback process Eng-Tech used after his two faculty members who participated in the drifter workshop had built and deployed drifters with their students:

Eng-Tech facilitated an online conference where people chatted in and out about what they found rewarding and frustrating about their drifter build and deployment. They aren’t experts, but they got NOAA and other organizations who are experts involved and they were always available to handle our questions and concerns.

By making the ocean drifters impact conversation a public dialogue, Eng-Tech staff facilitated a way for faculty to share their experiences with the project with one another, not just the center. Involving NOAA and other agencies enabled the impact of the project to continue expanding. Thus, the center’s efforts to understand the impact and improve the project benefited the drifter participants in process, rather than waiting for Eng-Tech to
disseminate findings.

**Interns**

The impact of the internship program is tracked through postinternship surveys, the intern’s deliverables, and the mentor’s evaluation of the student via survey. The survey responses provide the program impact data needed for external reporting. However, Eng-Tech staff has taken the impact conversation a step further. By requiring the intern to document his or her experience, both the center and the intern have a resource they can use in the future. Eng-Tech uses the photos, videos and e-mails to create resources for prospective interns that show them what an internship is like. Some interns interviewed said they used their internship journal and report for writing school reports, updating their resumes, and helping them tell the story of their internship to others.

Eng-Tech also gives mentors the opportunity to share their evaluations with the intern, which opens another channel for feedback and impact between interns and their mentors. Mentors have the option to share their evaluation directly with the student or have Danvers forward the evaluation to them. One intern described the process as very valuable: “The review stuff
was good…It was helpful in giving me a general idea of things I needed to work on.” Another described how she experienced the evaluation process:

Talia sent files to [my mentor] for him to fill out and evaluate me – it was a comprehensive list of any way you could evaluate an intern. It was like 300 points. Every question asked about my performance. Like a one through five scale... I think it was sent to him after I had flown home. But he e-mailed it to me. So we didn’t get to discuss it, but I got to see what he filled out.

A third talked about how his mentor used the evaluation to shape his experience from beginning to end:

There was a checklist thing that the mentor has to fill out afterwards and before the cruise we went over it. It was a breakdown of what the cruise was about... So we went through that and what I would be doing collecting the samples and stuff... We set up an outline beforehand of my responsibilities on the ship, and afterward we went back through and talked about how well I did on those. We sat down with the form and went over it together... Afterwards, Talia forwarded to me what [my mentor] had put for my final evaluation. It was cool. Obviously, I heard what [my mentor] told me about how she thought I did, and the stuff she wrote down, but the stuff she put on the Eng-Tech one wasn’t what she said to my face, so it was cool to get to read it. It was pretty much the same... Then there’s a spot for comments and I got an incredibly flattering recommendation from her.

Thus, the impact evaluation process for the internship program has several benefits. First and foremost, it enables Eng-Tech staff to collect the
information they need to demonstrate impact to their funders. Second, the way they’ve designed the system creates opportunities for involved parties to participate in the feedback loop. Third, the high response rate makes their evidence compelling to prospective hosts as well as their external stakeholders. Since it is a requirement for interns and they don’t get paid their stipend until they deliver, their response rate is 100 percent. Danvers also personally follows up with each mentor until they have completed their surveys. Danvers believes that the evidence of success has made her job easier:

> It also makes my job easier in the long term because I can show them the numbers. I’m not just saying, “Do this because it will make you feel good.” I’m saying, “Look, here are the numbers. Everyone who had an intern last year loved it, said they want another one, and said it made their job easier. Why would you not take one?”

Workforce and Education – AlumniWeb

Documenting Eng-Tech’s long-term influence on people who have participated in its programs has been a challenge. Garrick recalled:

> ...with students one of the difficult things was to figure out how we impacted them...we didn’t have that built in as much throughout the years. I think it would have been a good idea to resolve that earlier in the process...Tom [West] worked with us on that, too; that was something we knew
we needed to do more of... It was a struggle – it takes more resources and effort, especially with a grant like ours that has such a large geographic range.

One of Eng-Tech’s responses to the tracking challenge was to create AlumniWeb, an online database and resource for participants in center activities. The current online registration form for AlumniWeb asks for first name, last name, date of birth, mailing address, phone, and e-mail. The form works for educators and students, with options for education level and current occupation, intended career plans, awards/honors, and information about new curriculum or courses taught as a result of Eng-Tech experience.

The center asks its workshop, Summer Institute, and RoSV competition faculty to register, and it is an eligibility requirement for students to participate in RoSV competitions. All the information is kept confidential by Eng-Tech, unless the registrant allows it to be shared with potential employers.

Eng-Tech continues to explore other ways to learn about its impact. In 2009, Jupiter conducted a student tracking pilot study for the center. She chose RoSV students who had only enrollment forms on file with Eng-Tech and tried to find them using a variety of external databases. The goal was to discover how cost-effective it would be to track down “nonsuccess” stories,
since students who continue to be involved with Eng-Tech activities are easier to track. The answer: tracking “nonsuccess” students was really difficult, and not cost-effective. As a result, Jupiter added the date of birth item to the AlumniWeb application to make it easier to search national databases for “lost” participants who do not stay in touch with the center through AlumniWeb or e-mail.

Eng-Tech’s efforts in the Impact for Judgment stream of evaluation have taken evaluation beyond just providing evidence for funders. Staff have expanded the feedback loops so that participants, mentors and interns are included and can benefit from the information. In addition, they continue to engage in creative ways to track participants long term. Figure 39 presents a summary of Eng-Tech’s Impact for Judgment evaluative processes.

Eng-Tech Summary

As the above case description shows, Eng-Tech exemplifies mainstreaming evaluation in its leadership, culture, capabilities, structures, systems, and ongoing evaluative activities. PI Prince is personally committed to excellence and sees evaluation as an essential part of that pursuit. Her leadership staff of “Type A overachievers” shares that commitment and, as a
<table>
<thead>
<tr>
<th>Impact on...</th>
<th>Source</th>
<th>Input</th>
<th>Process</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>students</td>
<td>students, mentors, and parents</td>
<td>surveys</td>
<td>students, mentors, and parents fill out survey → staff and external evaluator analyze data</td>
<td>• Information on students’ interests, coursework and college plans • Outcome data for external evaluation and NVC</td>
</tr>
<tr>
<td>faculty</td>
<td>Summer Institute and workshop participants</td>
<td>end of event and follow-up surveys</td>
<td>participants fill out survey on last day of institute → center sends out a follow-up survey on implementation 3-4 months after event → in the ocean drifter project case, the center facilitated a conference call among participants to discuss impacts and obstacles → staff and external evaluator analyze data, use for reporting</td>
<td>• Learning outcome information for external evaluation and NVC • Information for future institutes on venue, food, hotel, etc. • Ratings of instructors and content for future institutes • Comments used for marketing, website • Information about what lessons from professional development are being implemented in classrooms • Facilitated conversations about implementation makes impact information available to participants before any impact reports are generated</td>
</tr>
<tr>
<td>Impact on...</td>
<td>Source</td>
<td>Input</td>
<td>Process</td>
<td>Results</td>
</tr>
<tr>
<td>-------------</td>
<td>--------</td>
<td>-------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>interns</td>
<td>interns and mentors</td>
<td>e-mails, blogs, final report, PowerPoint, plus evaluations from intern and mentor</td>
<td>students journal, e-mail, and blog during internship → at end, students submit a 2-3 page paper, PowerPoint, and a completed evaluation → mentors also complete an evaluation of intern and internship program → internship coordinator reviews data → external evaluator uses data in reports</td>
<td>• learning outcome information for external evaluation and NVC • photos used for marketing, website, etc. • powerpoint used for recruiting • learning outcome information for external evaluation and NVC • ratings of mentors for future intern placement • information about students’ academic preparation and how it impacted internship performance</td>
</tr>
<tr>
<td>workforce and education</td>
<td>all Eng-Tech activity participants</td>
<td>AlumniWeb</td>
<td>participants asked to register on AlumniWeb → then tracking and follow-up by center staff → pilot study tracking hard to find former student participants</td>
<td>• participants get access to career information, ability to post resumes • center gets ability to track and follow up with participants to see how their experience with Eng-Tech has impacted their careers or teaching • pilot study proved adding date of birth to survey demographics would make database tracking possible and is MUCH more cost-effective than trying to track down former participants using name and former address</td>
</tr>
</tbody>
</table>

Figure 39. Impact for Judgment Summary for Eng-Tech
result, evaluation is deeply embedded in the organizational culture.

Evaluation in all three streams is part of all Eng-Tech meetings. It is also part of the center’s strategy and daily operations. With the help of the previous and current external evaluators, staff have invested time up front to develop evaluation systems that are specific to their various activities. For new programs or activities they budget extra time and resources to figure out how to get the necessary information efficiently and effectively. Once a program or activity is up and running, then the staff and external evaluator can adapt that plan as needed to gather data. The early planning and systematization of evaluation has made it a sustainable part of the center’s activities.

Eng-Tech’s strong collaborative relationships throughout the marine education and industry community also benefit the center in terms of evaluation information. The relational connections keep staff up to date on industry trends. The collaborations facilitate direct engagement between industry, educators and students through the RoSV competitions, creating a flow of information that benefits the center as well as the participants. The staff’s commitment to supporting professional development both financially and through providing excellent workshops means that faculty are glad to
answer questions about implementation and impact. The personal relationships staff members have created with industry partners means that when they ask someone for information or help, they get it.

At least partly due to its attention to evaluation, Eng-Tech has become recognized as a leading institution in marine science education. Its programs are continuously improved in process and content. The center has evidence (both qualitative and quantitative) of impact available for funders and for use by partners and host institutions to inform their conversations with government and other funders about industry trends and program successes. They’ve also broadened the evaluation conversation so that faculty, students, mentors and industry experts can engage in direct conversations about performance and potential for improvement. Despite the challenges of budgeting time and resources and the personal challenges of hearing difficult evaluation feedback, Eng-Tech has persevered in creating and maintaining a culture of evaluation that benefits the center and its participants and partners.

Cross Case Analysis

As stated in Chapter 3, all prospective centers for this study were first contacted via e-mail on October 16, 2009, prior to the ATE Principal
Investigator’s Conference. The researcher met staff members and/or the PI for each of the four centers during the conference, October 21-23, 2009, and followed up via e-mail the following week. From that point on, the researcher engaged in conversation with personnel from each participating center to set up the site visits, determine who should be interviewed, and negotiate documents to be reviewed. Other important contact dates for each center are summarized in Table 25.

Table 25

<table>
<thead>
<tr>
<th>Center</th>
<th>Site visit</th>
<th>First interview</th>
<th>Last interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>February 3-5, 2010</td>
<td>November 25, 2009</td>
<td>March 29, 2010</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>December 9-11, 2009</td>
<td>December 9, 2009</td>
<td>January 18, 2010</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>January 6-8, 2010</td>
<td>January 6, 2010</td>
<td>May 17, 2010</td>
</tr>
</tbody>
</table>

Data gathered for this study came from three primary sources: interviews, documents and webpages. The majority of documents were given to the researcher by center staff; some were acquired by the researcher during site visits. The webpages analyzed included each center’s official website(s) and those of external partner organizations, the U.S census and local sources
for information about each center’s context, and the websites of the host
colleges. A summary of those external information sources for each site is
presented in Table 26. Observations by the researcher were also included in
the data analysis.

Table 26

<table>
<thead>
<tr>
<th>Information Sources</th>
<th>Interviews</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contacts</td>
<td>People</td>
</tr>
<tr>
<td>Eng-Tech</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>25</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>97</td>
</tr>
</tbody>
</table>

Center Descriptions

The following section compares the four centers on purpose, history,
host institution, industry contexts, activities, partners, and staff
configurations.

Purpose and History

Though each works with a different industry, all four centers exist to
serve the basic purpose of the ATE program: to prepare “well-qualified
science and engineering technicians for existing and emerging advanced
technological fields as well as preparing effective teachers for these fields.”

Each center followed a different path to becoming an ATE center. Eng-Tech got a planning grant in 1994 to explore creating a national center and was funded at that level in 1997. The other projects had a more gradual progression. IT-Tech completed two project grants before being funded as a regional ATE Center. Manu-Tech received a planning grant in 2001 for a regional center and was funded at that level in 2003. Nano-Tech’s university nanotechnology center preexisted the first funding as an ATE Regional Center in 2001. In 2003 the university center got a planning grant to explore becoming a national center, began to transition to that status in 2005, and got funding at that level in 2008. The summary comparison of the purpose and history of the ATE-funded centers in Figure 27 represents center level grants only, not planning grants.

**Host Institution Context**

The four participating centers are located in geographically disparate areas of the country, two in rural and two in suburban areas. Eng-Tech is located in the smallest community, which also has the highest per capita

---

Table 27

Center Purpose and ATE History

<table>
<thead>
<tr>
<th>Center</th>
<th>Industry</th>
<th>Existed before ATE grant</th>
<th>Age in years</th>
<th>Funding category</th>
<th>Annual funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>Marine Engineering</td>
<td>No</td>
<td>13</td>
<td>Resource</td>
<td>$400,340</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Information and Communication</td>
<td>No</td>
<td>6</td>
<td>Regional</td>
<td>$497,316</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Manufacturing and Engineering</td>
<td>No</td>
<td>7</td>
<td>Regional</td>
<td>$989,291</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Nano- and Microtechnology</td>
<td>Yes</td>
<td>12</td>
<td>National</td>
<td>$1,238,900</td>
</tr>
</tbody>
</table>

Income. IT-Tech is in an outlying suburb where the population has doubled in past 10 years. Manu-Tech’s suburban location is bordered by a state park, so it has a more rural feel despite being 10 minutes from a major international airport. Nano-Tech’s hometown has the smallest per capita income, probably due to the fact that the university students outnumber the local residents.

Important features of the locale of each center are compared in Table 28.

Three of the four centers are located at community colleges, the other is at a major land grant university. Host institutions also varied by enrollment and number of campuses; the numbers included in Table 29 are from 2009.
Table 28

Center Locale Comparison\textsuperscript{16}

<table>
<thead>
<tr>
<th>Center</th>
<th>U.S. region</th>
<th>Milieu</th>
<th>Population</th>
<th>Family households</th>
<th>Per capita income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>West</td>
<td>Rural</td>
<td>29,669</td>
<td>74%</td>
<td>$59,572</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Southwest</td>
<td>Suburban</td>
<td>97,740</td>
<td>81%</td>
<td>$36,880</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>East</td>
<td>Suburban</td>
<td>44,473</td>
<td>56%</td>
<td>$30,405</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>East</td>
<td>Rural</td>
<td>38,866</td>
<td>29%</td>
<td>$13,890</td>
</tr>
</tbody>
</table>

reports. The enrollment numbers presented in Table 29 for Nano-Tech represent all 21 of the university’s campuses. Nano-Tech is located in the technology park of the primary university campus, which had a total enrollment of just over 45,000 graduate and undergraduate students in 2009. The enrollment figures for the community colleges represent the sum of both degree and nondegree students at all campuses.

The centers also differ in the relationships they have with their host institutions. Both Nano-Tech and IT-Tech seem to work in partnership with their hosts. Manu-Tech’s relationship with its host has a more supervisee/supervisor sense. Eng-Tech, the longest lived of the centers in the

\textsuperscript{16} Data for each city from http://factfinder.census.gov/home/saff/main.html?\_lang=en
Table 29

Host Institution Comparison

<table>
<thead>
<tr>
<th>Center</th>
<th>Host</th>
<th>Type</th>
<th>Campuses</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>Coastal</td>
<td>Community college</td>
<td>1</td>
<td>14,000</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Northtown</td>
<td>Community college</td>
<td>5</td>
<td>45,000</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Upstate</td>
<td>Community college</td>
<td>3</td>
<td>68,000</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Hilltop</td>
<td>Land grant university</td>
<td>21</td>
<td>94,000</td>
</tr>
</tbody>
</table>

study, has a very limited relationship with its host college. Further
description of the centers’ relationships and roles is presented below.

Nano-Tech’s leadership is embedded in the history and culture of the
host institution, Hilltop University. The PI, Dr. Scott Franklin, is a 39-year
faculty member of the host univeristy, and one of the co-PIs serves as a
director in the Office of the Vice President for Research. The center’s program
staff interact with the college through these two leaders, but have limited
direct communication with the university administration. The center operates
in partnership with the university, working to promote human and economic
development. Nano-Tech is not expected to boost enrollment, but rather to
use its resources to generate and disseminate knowledge that benefits industry and education alike.

The PI and full-time staff of IT-Tech engage with their community college administration frequently, meeting with the provost twice a month and keeping the supervising dean and director apprised of center activities. This has helped maintain open communication between the two entities, since Dr. Alexis Brunner, the PI, is currently working at a college in another state and the two full-time staff members on-site have administrative roles and are not educators. The relationship is further strengthened by Northtown College’s current Director of Engineering, who makes time to attend conferences with the center staff. The administration sees the presence of the center and its engagement with industry and education as having a positive impact on the entire college. As the Director of Engineering put it, “a rising tide raises all ships.”

The relationship between Manu-Tech and Upstate College, its host, has a supervisory feel to it. Although PI Doug Ford does not interact much with the college administrators, the center director, Kurt Hinkle, reports regularly to the Dean of the School of Applied and Information Technology. The dean
has high expectations of the center and its ability to contribute positively to enrollment at the college and the image of manufacturing in the state through its work with industry and education organizations. He has charged the center with exploring how to make itself sustainable beyond ATE funding.

Eng-Tech shares physical space with its host, Coastal College, but has a very limited relationship with the college. The two entities communicate through interactions between the current PI, Diana Prince, and the former PI, Dr. Jay Garrick, who is Coastal’s Dean of Instructional Planning and Eng-Tech’s liaison. The practical disconnection was a conscious choice made earlier in the center’s history by Eng-Tech’s leaders, in consultation with the NVC. They thought the center could not serve the enrollment expectations of the college and still effectively pursue its mission to become a national leader in marine technologist education.

Summary details of the relationships of the centers with their hosts are presented in Table 30. The percentages for indirect funds for each are from their most recent ATE survey responses, and reflect their current grants. The indirect amounts are included to give some indication of the level of administrative support each center receives from its host institution.
<table>
<thead>
<tr>
<th>Center</th>
<th>PI is faculty</th>
<th>Relationship</th>
<th>Expectations</th>
<th>Primary supporter</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>No</td>
<td>Minimal contact, primary supporter serves as liaison</td>
<td>None.</td>
<td>Dean, Instructional Planning</td>
<td>8%</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>No</td>
<td>close relational ties, full time staff have frequent contact with multiple levels of the college administration</td>
<td>Presence will positively impact enrollment and influence other departments/programs</td>
<td>Dean, Academic Affairs, Business of Information and Engineering Technologies; Program Director, Engineering</td>
<td>10%</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>No</td>
<td>Regular supervisory contact, center director reports to college dean, center supports the college</td>
<td>Drive enrollment, transform image of manufacturing industry</td>
<td>Dean, School of Applied and Information Technology</td>
<td>6%</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Yes</td>
<td>Embedded, faculty member and university administrator lead center</td>
<td>Advance the field, serve smaller education institutions through resource sharing</td>
<td>Director of Research Program Development, OVPR office; Endowed Chair in Engineering Department</td>
<td>45%</td>
</tr>
</tbody>
</table>
Industry and Economic Context

The impact the 2008-2010 economic downturn has had on these four centers is related to their products and their relationships with industry and educational partners. Eng-Tech seemed to be least affected by the economic downturn, likely because of its looser connection to industry and community colleges. As a national center since its inception, the center’s industry customer base has always been the entire marine industry, rather than the needs of companies in its geographical region. As a resource center, Eng-Tech used this broad and diverse base of information to create activities and resources for educators, rather than academic curriculum. The combination of these two factors means that the center has been less affected by fluctuations in community college enrollments and demand for technicians in specific sectors of the marine industry. Any economic impacts are more likely to be felt through changes in sponsorships for the RoSV competition and in the participation of industry partners in the center’s activities.

Nano-Tech is similar to Eng-Tech in the breadth of its industrial base. Nanotechnology is an expanding field in a variety of industries, and Nano-Tech has continued to widen its base of industry customers accordingly. In
contrast to Eng-Tech, Nano-Tech operates its own education program, which produces graduates intended to meet the demand for nanotechnicians. Rather than focusing on the needs of one specific industry, Nano-Tech is committed to giving students a broad base of skills that are transferrable. Thus, the economic impact of some manufacturers moving overseas or out of state has had limited effect on the demand for capstone graduates. The impact of the economic downturn on Nano-Tech’s state government, however, has reduced the funding for the capstone semester and, thus, reduced the number of times it can be offered per year. So in Nano-Tech’s case, the impact of the economy has been felt because of the center’s reliance on the state government for funding, rather than its relationship to industry.

IT-Tech is located in a regional telecommunications corridor and has created a close relationship with that industry. After a downturn in the early 2000s, the IT industry is on the rebound. Currently, there are more than half a million jobs available in the region, and that number is predicted to grow in the future. IT-Tech is directly engaged in creating academic courses to train technicians for those jobs. Since the industry is growing, the close customer relationship between industry and education has not negatively affected the
center, despite the broader economic situation. By cultivating relationships with a job forecasting agency and futurists, the center can get forewarning of changes in the industry situation. This gives the staff more lead time to adapt its programs appropriately. However, the close coupling and lack of diversity in its academic programs and customer base could create difficulties if there is an unanticipated drop in industry demand.

The economic downturn had the largest effect on Manu-Tech. Like IT-Tech, Manu-Tech was focused on creating curriculum that would lead to graduates who could meet industry demands. Manu-Tech is closely coupled to the manufacturing industry which, unlike telecommunications, has experienced significant losses. The linear relationship between industry, the community colleges, and Manu-Tech meant that cuts in manufacturing resulted in cuts in programs and faculty at the community colleges, which in turn meant fewer staff to teach and fewer programs in which to offer the curriculum Manu-Tech was creating. In response, the center is becoming more research and resource oriented, though it still contracts with faculty to develop specific courses for manufacturing and engineering curricula.
Activities

In service of the ATE purpose, centers conduct a variety of activities intended to improve technician education. Some are direct educational interventions with students, such as recruiting, internships, competitions, and Web-based services, like career exploration, information, and assistance. Others are indirect activities in which centers leverage their resources to reach a larger group of students than they could contact directly. Examples of these indirect activities include creating or improving knowledge and skill guidelines, curriculum materials, educational programs, conducting professional development for faculty, and supporting other organizations’ efforts. A comparison of centers by activities is presented in Table 31.

Partners

All four centers have developed a variety of partnerships with industry, education, and professional associations related to their STEM area. As described in the individual case studies, these partnerships are critical to the overall strategy and performance of each center. Two of those partnerships, the NVC, and external evaluators will be described here. The other kinds of partner relationships will be discussed below in the section on
Table 31

Center Activities

<table>
<thead>
<tr>
<th>Center</th>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>RoSV Competition • hands-on workshops with students • alumni and marine career websites</td>
<td>Knowledge and skill guidelines • textbook • summer institutes and workshops with educators</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Recruiting events</td>
<td>Connections event • Mentored Colleges • dissemination of courses and curriculum modules</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Judge FIRST Robotics competitions</td>
<td>Faculty and industry training • curriculum, course and program development • Learning Projects • support for FIRST Robotics, Society of Engineers, and SBRT career website</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Capstone semester • recruiting visits • alumni and career website • remote access</td>
<td>Faculty training workshops • dissemination of courses and modules</td>
</tr>
</tbody>
</table>

collaborative relationships.

All four centers have an NVC, as per the ATE requirement. Nano-Tech was in the process of forming an NVC for its national center, but had had one in place since 2001 for its regional center. IT-Tech, Manu-Tech and Nano-Tech each have NVC members who are PIs or co-PIs from other ATE centers. At IT-Tech and Manu-Tech a PI from another center is the NVC chair, which has
helped both centers in terms of articulating a purpose and getting renewed ATE funding. At Manu-Tech, staff attributed their creation and use of guiding principles to one of the other PIs on their NVC. At IT-Tech, another NVC member said, “Alexis had a clear picture about what was needed to get re-funded. [The other ATE PI] had done it before as well and gave her a lot of advice about what she needed to do to be successful.” Nano-Tech has taken that partnership with other centers a step beyond NVC members by making two of its ATE partners co-PIs on its national center grant.

In terms of membership, all four centers have a mix of representatives from industry and education related to their disciplines on their NVCs. The NVC members are geographically related to the expected reach of the center. IT-Tech and Manu-Tech have representatives from businesses and schools in their regions. Nano-Tech’s leaders are in the process of figuring out who to include as they expand from a regional to national committee composition. Eng-Tech, which began as a national center, has the widest range of participants. Its NVC members come from national and international societies and research programs. IT-Tech has expanded its NVC to include a futurist, which has helped staff anticipate changes in the IT industry and plan their
center strategy accordingly.

To fulfill the ATE evaluation requirement, all four centers have hired external experts. Despite the range of ages of the participating centers, each has changed evaluators once. The tenure of previous and current evaluators, and the level of engagement each center had with its evaluator, varied from traditional to a closer, partnership relationship (Table 32).

Table 32

<table>
<thead>
<tr>
<th>Center</th>
<th>Past</th>
<th>Tenure (years)</th>
<th>Current</th>
<th>Tenure (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>Partner</td>
<td>12</td>
<td>Partner</td>
<td>1</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Traditional</td>
<td>1</td>
<td>Partner</td>
<td>5</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Partner</td>
<td>5</td>
<td>Traditional</td>
<td>2</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Traditional</td>
<td>7</td>
<td>Partner</td>
<td>2</td>
</tr>
</tbody>
</table>

In a traditional relationship, the external evaluator is truly external to the center. He or she designs the instruments (perhaps in consultation with the center staff), attends some events to observe, handles data collection, and writes a report. In all four centers studied here, the relationship with at least one of their external evaluators was something more than the traditional. In a partner relationship, the external evaluator may participate in strategic
conversations with the center staff, help create systems for project management and feedback, and work closely with staff to develop instruments and data collection systems.

When the external evaluator is a partner, the relationship is much closer and more interactive, which could cause concern about loss of independence and therefore a concern about the objectivity of the external evaluator’s findings. The researcher’s interview protocols did not include questions about the perceived objectivity of the external evaluators who functioned as partners, since the relationship itself was revealed through this study. However, objectivity seemed to be related to the combination of the center staff’s commitment to the truth and the external evaluator as partner who speaks the truth. This relationship could be investigated in a future study.

ATE does not have any requirements about external evaluator qualifications. Although the interview protocol for this study did not include any questions for the external evaluator about his or her training in evaluation, the researcher found that the current evaluators for each center come from diverse backgrounds (Table 33). Jupiter (Eng-Tech) is a principal
investigator for a social and economic sciences research center, with a strong background in program evaluation and grant writing. Denton (IT-Tech) is an ABD in a Doctor of Education program, with an extensive history in industry and technical education. A former associate director of an ATE center, he now runs a consulting practice assisting community colleges and technical high schools. Justice (Manu-Tech) is an assistant professor of Sociology. Lazlo and Lewis (Nano-Tech) have extensive experience in industry and technical education, respectively. They serve as consultants and evaluators to a variety of NSF-funded projects and centers.

Table 33

<table>
<thead>
<tr>
<th>Center</th>
<th>Name</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>Jupiter</td>
<td>Public administration</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Denton</td>
<td>Technology education</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Justice, PhD</td>
<td>Sociology</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Lazlo /Lewis, PhD</td>
<td>Industry /Technology education</td>
</tr>
</tbody>
</table>

Staffing

As mentioned in the introduction to this chapter, ATE provides very little prescription for the way a center must organize itself. Each center’s
approach to staffing reflects that clearly. The number of staff relates closely to the funding level, presented above in Table 27; however, the configuration of staff varies among centers (Figure 40). Eng-Tech, for instance, has deliberately chosen to use mostly part-time staff and contract employees because it makes them better able to adapt to changes in their funding over time. Nano-Tech runs most of its programs out of its lab and classrooms at Hilltop University, so the majority of staff are there. IT-Tech is the only center where neither the PI nor the co-PIs work at the center’s host college. Manu-Tech is the only center where the PI has no direct supervisory responsibility for staff.

Having a number of administrative staff commensurate with the size of the center and its activities is critical for mainstreaming evaluation. At Manu-Tech, Nano-Tech, and Eng-Tech the administrative staff handle data entry for nonelectronic surveys. (IT-Tech uses primarily online surveys, so it has a limited need for data entry.) At Eng-Tech and Nano-Tech the administrative staff also manage the databases of participants and alumni (although they have little or no training in database management). Dan Keller, co-PI at IT-Tech, described why he thinks the dedicated
Figure 40. Staff Configurations of Centers
administrative staff are critical:

IT-Tech is probably one of the most well-organized machines I’ve worked with in an academic setting, even before I became a part of it. I think that’s partly because they formatted and set up the center…with permanent staff whose job is the center. They aren’t faculty at the same time. I think that helps make it seem like less of a burden to do the evaluation because it’s somebody’s full-time job to run the program and make sure it’s continually improving. When it’s all faculty and no administrative staff other than departmental people (who have other things to attend to), then it’s much harder because everyone is juggling lots of different tasks. So it’s a lesson learned that it’s helpful to have at least one person who is full-time on the project, who can focus on [evaluation].

As centers seek to do more tracking of alumni and longitudinal tracking of faculty development participants for impact data, budgeting for support staff and data management training may become important issues.

Mainstreaming Evaluation

According to the theory developed in this study, mainstreaming evaluation in an organization happens in three different streams: Strategy and Design, Continuous Improvement, and Impact for Judgment. In each of those three streams, an organization can develop through six stages: awareness, compliance, obligation, desire, leadership, and mentor. The final
stage, mentor, was added to Sanders’ (2001, 2002) model based on IT-Tech’s interaction with its Mentored Colleges, which took mainstreaming evaluation out of the organization and passed it on to others. The four centers studied in this research had all reached at least the leadership stage in all three streams, but their starting points and pathways to that stage were varied. The stages and streams of evaluation mainstreaming appear alongside the figures that summarize the history of mainstreaming at each center in Figure 41.

**History in Evaluation Streams**

In the Strategy and Design stream, IT-Tech started at the leadership stage due to PI Brunner’s personal orientation and tools like the Business Advisory Committee and PCAL7. By sharing those tools with the center’s Mentored Colleges and mentoring them to adapt the tools to suit their schools and regional business needs, IT-Tech created the mentor stage in mainstreaming. Nano-Tech also started at the leadership stage through the establishment of the Nanotechnology Fabrication and Manufacturing partnership. Creating the partnership was the first action of PI Franklin, and its continuation is a testament to his commitment to collaborating with industry and community colleges. As the center goes national, it is likely
Figure 41. Centers’ History of Evaluation Mainstreaming
Nano-Tech will move to the mentor stage as it shares this partnership model with other schools. Manu-Tech and Eng-Tech began at the desire stage, with PIs and staff interested in getting information from industry and education to shape their efforts. Over time, both centers built relational networks and organizational structures to get and use evaluative information.

In the Continuous Improvement stream, all four PIs were committed to excellence, so seeking information to help improve the center was a given. IT-Tech and Manu-Tech had staff with capabilities in this area from their beginnings; therefore, they started and remained at the leadership stage. Langdon, the co-PI at Manu-Tech, said that for their staff, early use of external evaluators actually got them out of the habit of creating evaluative tools and collecting and analyzing information. However, a change in the external evaluators put this level of evaluation back under the staff’s purview, and they were at the leadership stage during the research visit. In Eng-Tech and Nano-Tech’s cases, the centers started at the desire stage, and their external evaluators helped them design instruments and systems. The centers moved to the leadership stage when their new external evaluators got staff more involved in planning evaluative activities.
In the Impact for Judgment stream, IT-Tech started at leadership in this area because in Brunner’s business background, metrics were required. At the other three centers, the PIs were not that interested in this stream, but began evaluation efforts to comply with the ATE requirement. At Nano-Tech and Eng-Tech, that compliance turned into leadership as the center leaders and staff saw the benefits of collecting outcome data in terms of evidence of impact both for funders and themselves. Their original external evaluators helped them build systems that made impact data collection possible and useful. Manu-Tech’s NVC pushed the staff to create metrics to understand whether its programs were successful. Their original external evaluator also helped staff build instruments and systems for this stream, and staff have seen that providing evidence yields further funding. They are the only center in this study conducting a quasi-experimental impact evaluation, which puts the center at the leadership level of mainstreaming.

**Contributing Factors**

The research showed several common factors among the centers that contributed to the mainstreaming of evaluation: an external requirement, data use leading to data valuing, leadership and staff commitment, and an
evaluation champion. The ATE program’s requirement for evaluation impacted all four centers, requiring them to hire an external evaluator. Although each center had a slightly different relationship with its evaluator, the engagement with that person (or persons) influenced each center in terms of choosing evaluation questions and creating systems and structures for getting information. IT-Tech was affected the least, since Silver, the director, was hired because of her ability to create metrics and collect data. Eng-Tech was the most affected. Dan West, the original external evaluator, influenced the center’s leaders about the importance of evaluation, as well as building systems to enable the staff to get the data.

An external requirement for evaluation also appeared as a contributing factor for creating a culture that valued data use (Katz et al., 2002; Sutherland, 2004). Sutherland’s (2004) two-year qualitative study of one school found, “External mandates, like data use requirements, offer an example of how using data for decision-making, and thereby for continuous improvement, can be realized” (p. 279). According to Sutherland, external mandates need to be accompanied by internal structures that transform those mandates into a useful means of pursuing continuous improvement, because then they can
feed into staff members’ intrinsic motivation to serve students.

The usefulness of data as a step toward enculturation of evaluation was identified in this study as well as by Cousins et al. (2006). In their qualitative case study of four schools exploring evaluative inquiry, Cousins et al. called this factor “data use leads to data valuing.” They found that “staff developed deeper appreciation for the power and utility of evaluative inquiry through concrete examples of how data and locally created knowledge can feed into the decision mix” (Cousins et al., 2006, p. 172). For the ATE centers studied herein, this also proved true for Eng-Tech and Nano-Tech in particular. Both centers have increased their sources and uses of evaluative feedback over their lifetimes as it has proved useful for both internal improvement and evidence for external stakeholders. As Nano-Tech’s Franklin summarized the process:

…the formal [evaluation] system came out of NSF forcing it on me. I’d never thought about it before that – so we started doing it and then discovered we liked it and it was really useful. It’s nice when their requirements are useful.

Thus, the external evaluation requirement can provide a starting point for evaluation mainstreaming. However, in the ATE context, the requirement
is often (rightfully) construed as a requirement for only summative evaluation, or Impact for Judgment. The resulting focus on summative results as the way to acquire further funding can actually be an impediment to a center finding its innovative niche. Manu-Tech’s early frustrations in seeking a niche and the center’s subsequent move to quasi-experimental evaluation of someone else’s program provides an example of this. Manu-Tech has moved a significant amount of its resources away from innovation to research in an attempt to satisfy ATE’s need for summative evaluation. An evolution of ATE evaluation requirements for centers that describes the different streams and useful activities in each based on the age of the center could be more effective. For instance, a young center could provide documentation that staff are creating systems to track impacts, rather than evidence of impacts in the first few years. This would allow centers to create good databases and alumni tracking centers early and make quality impact evaluation possible once their strategies and programs have been established.

The next two factors, leadership and staff commitment to evaluation, are closely related to each other. At all four centers, the leaders were the champions for at least one stream of evaluation at the beginning and by the
research visit they were advocates for all three streams. In addition, all four PIs have been at their centers since the beginning, and have had a chance to influence staffing. The PIs at Eng-Tech, Nano-Tech and IT-Tech also reported that they deliberately hired staff who were committed to excellence and sought feedback on performance as a way to achieve it. The result is a group of staff at every center committed to evaluative activities. These findings support those of Cousins et al. (2006) with regard to leadership’s influence on incorporating evaluation into organizational culture:

Leader’s propensity to embrace and value inquiry as well as to model the use of it had a potent effect on staff interest and commitment to engaging with local knowledge production in this way. School administrators in these schools were generally found to be highly collaborative, change oriented, and transparent about school matters with staff and community. Data were often used as a basis of opening up discussion and dialogue. (p. 172)

The characteristics of the leaders and leadership teams in this study will be discussed in the next section on leadership and culture.

The final factor found in this study was the presence of an evaluation champion. All four centers also had at least one person involved with the center who believed in the value of evaluation and had enough influence to
both persuade others and ensure that the necessary systems were created. In some cases, the champion varied depending on the evaluation stream. At IT-Tech, Brunner championed all three streams of evaluation. At Eng-Tech, Prince championed Strategy and Design in her original role as curriculum and industry manager. West, the original evaluator, championed evaluation in the other two streams. At Manu-Tech, Ford championed Strategy and Design; Ford and co-PI Langdon championed Continuous Improvement; and Randle, the original external evaluator, championed Impact for Judgment. At Nano-Tech, Franklin championed the first two streams, with later support from Grayson. Karl Davis, the community college administrator the center hired in its early days, was the original Impact for Judgment champion. The discovery of the integral role of an evaluation champion at these centers expands the idea of what “leadership” means in terms of enculturating evaluation.

Organizational Dimensions

In Chapter 2, the descriptive theory of evaluation mainstreaming presented was based on the understanding of an organization as a living system (Andreadis, 2009). Within that system are two nested levels of
dimensions: leadership and culture and capabilities, systems, and structures. The relationship between the two levels and four dimensions is reprised in Figure 42 below, originally found in Chapter 2. In the following section, the researcher compares the four cases on each dimension, with commonalities and key contrasts, as well as important unique examples. The four dimensions support the three streams of evaluative activity (Strategy and Design, Continuous Improvement, and Impact for Judgment). The researcher concludes the cross case analysis with a discussion of the centers’ current evaluation practices in each stream.

Leadership and Culture

In Chapter 2, as part of the descriptive theory of evaluation, the researcher posited that evaluation must be considered a core value in an organization in order for mainstreaming of evaluation to occur. Leadership and culture are the dimensions of an organization that deal with values, each influencing the other (Schein, 1992). Therefore, leadership and culture have been discussed together in all four of the case study presentations as well as here in the cross case analysis.

While the research interview protocols contained specific items about
leadership and culture, much of the information presented in the case studies and in the following section comparing them is based on pattern codes the researcher generated during data analysis. “Pattern codes are explanatory or inferential codes, ones that identify an emergent theme, configuration or explanation. They pull together a lot of material into more meaningful and parsimonious units of analysis. They are a sort of meta-code” (Miles & Huberman, 1994, p. 69). The characteristics of the PIs, the leadership team, and the broader culture of the staff described in the following sections are
pattern codes which the researcher found contributed to an organizational environment favorable for evaluation mainstreaming.

PI as Leader

As discussed above in Chapter 2, leadership of an organization consists of defining and defending the entity’s integrity, maintaining its wholeness and coherence as an entity (Friedman, 2007; Gray, 1998b; Selznick, 1957). A leader “is primarily an expert in the promotion and protection of values” (Selznick, 1957, p. 28). By signing on as PI, Brunner, Ford, Franklin and Prince accepted the official leadership role for their center. As a result, they are ultimately responsible for all center activities and products, as well as its identity, integrity, and values.

To receive ATE funding, each PI had to have a respectable level of subject matter expertise in the area of the grant, which is based on both academic credentials and experience. Since most ATE centers are located at community colleges, at least a master’s degree would be expected. In this sample, the PIs range in qualification from master’s degrees to PhDs. The PIs also bring work experience in their areas of expertise: DACUM for Prince and Ford, business for Brunner, and industry research and design for Franklin.
The background and expertise of center PIs are presented in Table 34.

Table 34

<table>
<thead>
<tr>
<th>Center</th>
<th>PI</th>
<th>Degree</th>
<th>Field</th>
<th>Work experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>Prince</td>
<td>MS (2)</td>
<td>Marine Science and Geography</td>
<td>Education and Training</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Brunner</td>
<td>PhD</td>
<td>Education, Leadership</td>
<td>Corporate Business and Academia</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Ford</td>
<td>MA</td>
<td>Counseling</td>
<td>Education and Training</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Franklin</td>
<td>PhD</td>
<td>Engineering</td>
<td>Academia, Research and Development</td>
</tr>
</tbody>
</table>

All four PIs have been with their respective centers since inception.

Three of the four also have been the PIs since their centers began; Prince at Eng-Tech is the exception. She started as the curriculum and industry manager and advanced to PI in 2007, although she had served as de facto PI for several years prior to that. Only Franklin is a faculty member of his center’s host college. Ford and Prince are staff members at theirs, and Brunner is a faculty member at another college in a different state from IT-Tech. Ford and Prince both work full-time at the center, Franklin and Brunner only part-time. Franklin’s commitment to the center is part of his
responsibilities at Hilltop University. Brunner’s relationship to Northtown College is contractual; she is required to keep it separate from her obligations as a dean at her current college. The PI’s relationships with the host college and their tenures are summarized in Table 35.

Table 35

<table>
<thead>
<tr>
<th>Center</th>
<th>PI</th>
<th>On-site</th>
<th>Time</th>
<th>Faculty at host</th>
<th>Years at center</th>
<th>Years as PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng-Tech</td>
<td>Prince</td>
<td>yes</td>
<td>full</td>
<td>no</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>IT-Tech</td>
<td>Brunner</td>
<td>no</td>
<td>part</td>
<td>no</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Manu-Tech</td>
<td>Ford</td>
<td>yes</td>
<td>full</td>
<td>no</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Nano-Tech</td>
<td>Franklin</td>
<td>yes</td>
<td>part</td>
<td>yes</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

All four PIs are committed to excellence and see evaluation in all three streams as a critical component of that pursuit. As a result, evaluation has become a value at each of the centers, as described above in Mainstreaming Evaluation. To support that value, the PIs make sure that staffing and budget resources are allocated to get and use evaluation from internal and external sources. The PIs all practice the discipline of Personal Mastery, discussed below, which is a critical factor in mainstreaming evaluation.

While the PI is the public leader of the center, the actual tasks for each
vary with regard to the roles he or she fills at the center. All four centers have leadership teams (presented in Figure 40, above) in which the various tasks of leadership are shared to some extent. The distribution of leadership roles and responsibilities for each center is discussed below in the subsection on Strategic Staffing. At all four centers, other staff members may be looked to for leadership, but only the PI is the leader and responsible for making final decisions at the strategic level.

**Personal Mastery**

Personal mastery is a leadership characteristic Senge (1990) used to describe “the discipline of personal growth and learning” (p. 141). Two of its key facets are personal vision and commitment to the truth. Personal vision is a picture of a specific destination, a desired future that has intrinsic value (Senge, 1990). Commitment to the truth was discussed above in Chapter 2 under Capabilities. Collins (2001) described it as “the discipline to confront the most brutal facts of your current reality, whatever they might be” (p. 13). The combination of personal vision plus an accurate picture of current reality provides a clear picture of the gap between the two. Understanding the gap can be a source of creative energy and tension that creates action that moves
the person closer to his or her goal. In this study, two centers showed that vision and commitment to truth drove the need for and use of evaluative activities as a way to understand current reality and the progress toward the vision. The other two centers demonstrated that in the absence of an articulated vision, the center goals and the PI’s commitment to excellence can provide an adequate substitute for vision.

In the research interviews, Prince (Eng-Tech) and Franklin (Nano-Tech), offered unsolicited statements of personal vision for their centers. Prince articulated her vision this way:

My philosophy was to become a national expert in marine technologist education… I wanted to build a reputation for being the best. Then you get to participate on higher levels to determine what goes into proposals, and you can respond to opportunities.

Franklin sees Nano-Tech as serving two- and four-year postsecondary education institutions by creating excellent resources for training nanotechnologists. As he expressed it, his vision is students prepared “for a life time of flexibility” with “a base to build on.” Franklin also shares that vision with Nano-Tech’s partners. Based on the researcher’s review of meeting agendas, he starts every meeting of the Nanotechnology Fabrication
and Manufacturing (NFM) partners with a short presentation reiterating the purpose and vision of Nano-Tech and the partnership. Neither Ford nor Brunner, the PIs of Manu-Tech and Nano-Tech, respectively, articulated a vision for his or her center to the researcher.17

The PI’s personal vision for the center gives something for staff and partners to work toward, serving as a shared vision for the future (see Shared Vision, below). Under-communicating that personal vision is a common error made by leaders and can impact staff and partners’ willingness to make needed short-term sacrifices to achieve the vision (Kotter, 2005). In small organizations like Manu-Tech and IT-Tech, frequent, clear articulation of the vision by the PI may not be as essential as it is for Nano-Tech and Eng-Tech, which are slightly larger. In fact, the staff seemed to be able to use the center’s articulated goals and a commitment to excellence in place of the PI’s vision. Since both Eng-Tech and Nano-Tech also had articulated goals and a commitment to excellence, future research could explore the relationship among mainstreaming evaluation, vision, articulated goals, and commitment to excellence.

17 This does not mean that Ford and Brunner do not have a personal vision for their centers.
The comparison between Nano-Tech and Manu-Tech provides some evidence of the difference the PI’s vision makes. As discussed above, Franklin at Nano-Tech has a clear personal vision for the center and articulates it plainly and often to both staff and partners. Staff and partners reported understanding and enthusiastically supporting that vision. On the other hand, Ford at Manu-Tech excels at generating ideas for potential center activities, according to those interviewed. However, after review of the data gathered for this study, the researcher was unable to piece together a vision that included the center’s various activities. This may be related to the fact that the center’s stated purpose is bidirectional: developing educational initiatives and improving the industry image. While the absence of a clear vision didn’t seem to be hurting Manu-Tech, it did seem to be preventing it from maximizing opportunities with their partners. As State Manufacturing Institute (SMI) Executive Director Calvin Ricci put it:

In the two grants, they have never asked to come before the SMI board to talk about Manu-Tech. They show up at board meetings because they’re on the board. I’ve made them a board item, but there’s never been, “Let me get on your agenda and tell you what we’re doing.” We’re closest to them, but no one on our board could talk about what they’re doing.
Partners who don’t know what the center seeks to achieve are less able to help the center achieve it.

The addition of Hinkle as Manu-Tech’s director, and the institution of the guiding principles seem to be pushing the center toward a more cohesive effort. Hinkle has been working with Rob Andrews, from the State Business RoundTable for Education on the careers website and campaign. Andrews reported a cohesive effort, due to the use of the goals and guiding principles. So in its more recent partnerships, Manu-Tech appears to be taking better advantage of the opportunity to build commitment and momentum among staff and partners toward a vision of the future for technician education.

With regard to commitment to the truth, all four PIs expressed understanding it as a necessary component of their commitment to excellence. Evaluation, particularly in the Continuous Improvement stream, is a critical component of understanding current reality. Prince’s comment summarized the sentiments of her fellow PIs:

We can’t be afraid of weaknesses if our true goal is to make something that is the best. You have to put yourself out there, be vulnerable, expose yourself to criticism. It’s a healthy process. You have to face it and understand that information will make you stronger and better. If you
embrace that attitude, then evaluation is the best tool for that process.

The external evaluators, NVC, partners, and activity participants serve as key information sources in this pursuit of understanding the current reality of center performance.

In most cases, the staff can and do serve as important sources of information about the reality of center performance. However, the researcher noticed an interesting phenomena at all four centers. Commitment to the truth is something that each PI demonstrated and spoke about in interviews saying some version of, “I’m very open; people can tell me anything.” However, also at every center, staff, partners, or both related this kind of information: “The PI doesn’t always listen to me/us.” “She is difficult to persuade on issues we know are important.” or “We don’t confront him even if we know something is going to fail.” Based on the researcher’s observations of the PIs and the high level of respect that staff and partners expressed for the PIs in interviews, these comments were not because the PIs are insincere about listening to feedback on strategy, activities, or even personal improvement.

The researcher came up with four possible factors contributing to the
apparent disconnect: (i) lack of transparency – i.e., PIs don’t say, “I heard your idea and here’s why it doesn’t fit with the vision/staff situation/funding/etc.”; (ii) staff and partners love the PI and don’t want to hurt his or her feelings; (iii) staff don’t like to confront their boss; (iv) people trust the PI to do the right thing eventually, so the extra time to build data to persuade him or her is acceptable.

The researcher did not learn about any significant negative impacts from this disconnect. As discussed in Chapter 2, this sort of reticence is common in organizations (Argyris, 1993; Argyris & Schon, 1996b; Bain, 1998; Schein, 1992). However, it does indicate a gap between the PIs’ understanding of information flow and the current reality.

**Entrepreneurialism**

Entrepreneurialism is a leadership characteristic identified in this study. As a leadership characteristic, entrepreneurialism may be exhibited by any staff member, not just the center PI. At the centers in this sample, entrepreneurialism was exhibited primarily by the leadership team members. A person with entrepreneurialism uses the logic of evaluation (usually implicitly) to identify opportunities that will advance the center toward its
vision. The following components of entrepreneurialism demonstrate how PIs and leadership staff articulate and use criteria of merit, acquiring quality information from internal and external sources, and combine the two to choose the best opportunities in which to invest time and effort.

The first component is an understanding of the center’s vision. The person engaging in entrepreneurialism needs to know what it is the center is striving to achieve and to understand where to look externally for information and opportunities. As discussed above, this knowledge may come from the PI’s articulation of a vision for the center or from the center’s stated goals and objectives.

The next component is the capability to conduct effective external scanning. All four centers created collaborative relationships (discussed below under Capabilities) to acquire key information about trends and needs in industry and education associated with their subject matter area. The two older centers in particular also committed leadership team time and energy to scanning for external funding opportunities outside of the ATE program in an effort to diversify their financial base.

Once needs and opportunities have been identified, the next
component in entrepreneurialism is taking a step back and evaluating them. To do this, either the PI or the leadership team as a whole reflect on the intersections between the needs, opportunities, and the center’s vision. If the PI does it alone, as was the case at Manu-Tech before Hinkle came on as director, it can be an implicit, intuitive process. When the center has the PI's vision, guiding principles (current Manu-Tech), or a strategic plan (IT-Tech), it can make the process of evaluating opportunities more explicit and, therefore, easier for staff to participate meaningfully.

The center’s picture of the future is key in entrepreneurialism, because it determines the lens through which needs and opportunities are perceived. A comparison between Manu-Tech and Nano-Tech that arose from the research provides the clearest illustration of the difference vision makes. Manu-Tech exists to serve the needs of industry with regard to technician education and image improvement. The center’s early efforts involved extensive needs assessment with industry, which led to curriculum and programs specifically designed to meet those articulated needs. However, the colleges did not have the educational support to add the courses, and the manufacturing industry has changed, leaving the center with curriculum in
limited use and programs that have been terminated.

Nano-Tech, in contrast, is committed to training nanotechnicians with a broad skills base who can work in a variety of industries throughout their careers. When staff listen to the needs of industry and education, the vision allows them to use that information as inspiration, rather than as design specifications. The information helps them see what those groups need, even if it isn’t what they ask for specifically. As a result, they add programs like remote access and adapt the capstone and other educational resources based on the feedback, but in ways that maintain fidelity to the vision of technicians with that broad skills base. The result has been a growing slate of effective programs and a move to disseminating their model as a national center.

The difference between these two perspectives was recently highlighted in an article about Steve Jobs and Apple (Manjoo & Caplan, 2010). According to the authors, Jobs often cites a quote from Henry Ford, “If I’d have asked customers what they wanted, they would have told me, ‘A faster horse!’” (p. 112). So rather than giving customers what they ask for, Apple uses that information to design products that meet customers’ needs in ways they hadn’t imagined possible – like the iPhone. As one Apple
executive expressed it:

“The whole approach of the company is that people can’t really envision what they want,” says Reid. “They’ll tell you a bunch of stuff they want. Then if you build it, it turns out that’s not right. It’s hard to visualize things that don’t exist” (Manjoo & Caplan, 2010, p. 112).

This is exactly the trap that Manu-Tech fell into in its early history and one that Nano-Tech has neatly avoided by staying focused on Franklin’s vision.

Thus, the long-term effectiveness of entrepreneurialism hinges on a clear set of evaluative criteria for opportunities, one that is based on broad vision rather than just meeting constituent needs. As Eng-Tech’s move from DACUM efforts to knowledge and skill guidelines and the RoSV competition illustrates, it is possible for a center to move from strictly needs-based programming to a broader vision for impacting technician education.

The final component of entrepreneurialism is knowledge of center staff’s skills and resources. Once opportunities have been identified as worth pursuing, then the leadership must evaluate the current staffing and budget situation to determine what, if any, changes need to be made to support it. In the case of a small addition, like remote access for educators at Nano-Tech, a current full-time staff member took on extra responsibility to pilot test the
program. In the case of Eng-Tech’s internship program, exploring the barriers to participation required a new grant with funding specifically included for that activity, so the center could pay Danvers and Jupiter to conduct the study.

In the centers studied herein, the leadership characteristic of entrepreneurialism was a combination of a variety of capabilities and knowledge. PIs and leadership staff at all four centers demonstrated the following, albeit with various levels of skill: (i) basic understanding of the center’s vision to determine where to get information; (ii) relationship-based, high-quality, external scanning for needs, trends, and funding; (iii) evaluation of opportunities using criteria, preferably based on vision rather than specified by needs; and (iv) assess staff and financial resources required to take advantage of opportunities. In organizations where innovation is not so central, it is possible that evaluation criteria could be more needs specific. Further research could explore this concept.

Prioritizing

Prioritizing use of resources is a key leadership activity. The leadership teams at all four centers set clear priorities about what activities should get
the bulk of time and resources. The typical focus was on the largest programs, plus any new activities or those being revamped. Evaluative activities follow within that prioritization. So when a center is designing a new program or activity, more time and resources were invested in Strategy and Design efforts. When a program or activity is in the pilot stage, more resources were invested in Continuous Improvement and creating tools that will give Impact for Judgment data. Once the program or activity was up and running, evaluation took less priority in terms of resources committed. With systems in place to gather Continuous Improvement and Impact for Judgment information, it took fewer resources to harvest and use the data.

At all four centers, the leadership team also included the requirements of external stakeholders when prioritizing evaluative activities and resources. The ATE program’s requirements are the same for each center. However, each center also has a relationship with its host institution, and in some cases, other funding agencies, that also want performance information. The different groups often have different indicators for success. For example, IT-Tech and Manu-Tech have close relationships with their host colleges, which are looking for impact on enrollment as a result of the center’s work. ATE
wants enrollment information from every center’s partner colleges. Eng-Tech’s education and professional society partners want findings from the results of the center’s workforce studies. The leaders, therefore, must take into account the kind of performance evidence that each of its stakeholders needs when planning evaluative activities. Leaders at every center agreed that making sure partners, host institutions and ATE get the information they need is critical to each center’s continuing viability. As IT-Tech’s PI Brunner put it:

We know what kind of information is persuasive to different stakeholders. NSF, the dean, [and] upper administration need to know enough to be satisfied and stay out of our way so we can be creative. I’m very clear about what kind of evidence is effective to our stakeholder groups – and less is more. Just give them what they need to know. A few pieces of key data are valuable. [Northtown’s dean] wants numbers because that’s how he’s reviewed. Students, graduates. And for the most part he gets that.

Strategic Staffing

The ability to hire staff with appropriate skill sets and values is critical in any organization. In ATE centers, which run on soft money and continue to exist only if they can demonstrate results, there is less leeway for underperformers. Hiring quality people with skills and abilities that match a
center’s needs is essential. As author Collins expressed it, “People are not your most important asset. The right people are” (Collins, 2001, p. 13, emphasis author). Getting the “right people” means that whoever does the hiring has a clear understanding of the center’s needs and has translated those needs into selection criteria for prospective employees.

Understanding the staffing needs of a center is an ongoing process as funding sources change and programs evolve. Staff charged with hiring at each center understand what skills and knowledge are needed to move their center toward its goals – and what resources are available for paying those employees. For example, during their histories, both Eng-Tech and Nano-Tech had to dramatically reshape their staffs based on budget cuts. Eng-Tech switched to primarily part-time contract staff, while Nano-Tech downsized. At the smaller centers, responsibility for strategic staffing falls within the purview of the PI and one other leadership team member. At Nano-Tech, staff at several levels need to understand strategic staffing needs and hire appropriately.

At Nano-Tech and Manu-Tech the addition of leadership staff was based on the PI’s assessment of his or her own skill set. Both Franklin and
Ford described hiring or recruiting leadership team members who had different skill sets than theirs. Both needed to involve someone who was good at handling relations with the center’s host school and managing the day-to-day operations. In addition, Franklin needed a leadership staff member who was an expert at finding external funding. The strategic inclusion of Pierson and Grayson at Nano-Tech and Hinkle at Manu-Tech has ensured that the centers have subject matter experts to cover all their leadership and management needs.

At Eng-Tech and IT-Tech, Prince and Brunner made additions to the leadership staff based on strategic or programming needs. At Eng-Tech, a leadership team member left in 2008 to pursue graduate school. This enabled Prince to bring on two staff members. Danvers, a previous full-time Eng-Tech staff member, came back part-time to run the internship program. Peel, a three time veteran of the Summer Institute and a regional coordinator for the RoSV competition, also came on part-time to coordinate the Summer Institute. At IT-Tech, Brunner wanted to expand the program to include more Hispanic students and create smooth educational pathways for community college students to four year institutions. Adding Salazar and Keller as co-PIs
met both of those needs. Salazar is a faculty member at an urban community
college with a high Hispanic enrollment. Keller is an instructional staff
member at a nearby university and was instrumental in creating a Bachelor’s
in Information Technology program there.

All four centers shared two common selection criteria for hiring related
to mainstreaming evaluation: commitment to excellence and subject matter
expertise. The leaders at each center hired people with a commitment to
excellence, i.e., ability and interest in self-assessment and self-reflection for
improvement. To do this, three of the centers primarily hired people with
whom they had prior experience and knew they possessed this orientation.
At IT-Tech, PI Brunner did an open search for her staff positions and used it
as a selection criterion. In research interviews for this study, the staff from all
four centers demonstrated that mindset. Danvers, Eng-Tech’s internship
coordinator, expressed the views of staff members from all centers with
regard to using data for improvement when she said, “I can’t imagine doing
this another way.” Hiring staff with this orientation facilitated the
development (or maintenance, depending on the age of the center) of
organizational culture where evaluative feedback, particularly for continuous
improvement, are expected and indeed, demanded, by staff. The importance of strategic staffing to the culture at each center intersects with Schein’s (1992) theory that leaders establish culture by imposing their values on the staff. In all four cases, center leaders avoided “imposing” by hiring staff with values compatible to their own.

In terms of subject matter expertise, the selection criteria varied based on the leadership’s assessment of the center’s needs. IT-Tech has the most interdisciplinary staff group. While the PI and co-PIs are IT educators, two staff come from business backgrounds and the other from not-for-profit. Brunner staffed this way deliberately to enable the center to operate efficiently in terms of management and data collection while establishing good relationships with partners and participants. The majority of Nano-Tech’s staff have engineering backgrounds. Even the administrative assistant worked for years in the engineering department before coming to the center. Within the engineering umbrella, though, there is diversity. Grayson, the Director of Education and Outreach, is an engineer with a Master’s in Business Administration, but no background in nanotechnology. Within the program team, the staff represent different scientific disciplines, reflective of
the diversity present in the nanotechnology field. All three of Manu-Tech’s leadership staff have extensive backgrounds in education. Hinkle, who provides the day-to-day leadership and management for the center, is a retired high school principal. The other two staff members fill the center’s need for industry connection and administrative support. Eng-Tech appeared to have the least diverse leadership staff; all four are marine biologists with education expertise. The broader staff include people chosen for their expertise in specific areas like RoSV technical support, instruction, website development, and administrative support.

**Shared Vision**

As discussed above in Personal Mastery and Entrepreneurialism, having a vision for the center is key for understanding gaps between current reality and a desired future. When that vision is shared, the staff have an answer to the question, “What do we want to create?” (Senge, 1990, p. 206). Thus, the vision serves as the standard against which all Continuous Improvement and Impact for Judgment information is measured. When both the vision and the evaluative information are shared, the combination can drive the actions of every member of the organization.
The leaders and staff members of all four centers demonstrated a shared vision, which extended to some, if not all, partners. At Nano-Tech and Eng-Tech the shared vision is based on the PI’s personal vision. Manu-Tech and IT-Tech staff based their picture of the future on the articulated goals and objectives for the center.

As discussed in Chapter 2, shared vision was found across disciplines in the literature (Burke, 2002; Collins & Porras, 1996; Cousins et al., 2004; Gray, 1998b; Hale, 2007; Preskill & Torres, 1999b). This research shows, anecdotally, that it also works to unite staff toward a common picture of the future in cross-disciplinary teams. At IT-Tech, both the full-time staff members are not IT experts, even though it is an IT-focused organization. Silver and Plum understand the purpose of the organization and have committed their efforts to supporting it, so the vision is shared even though the skill sets are widely different. In all cases the shared vision is a critical component that enables the staff to work as a team.

Team

Various authors cited in the literature review and descriptive theory of mainstreaming evaluation presented in Chapter 2 discussed “team” as a
factor in organizational learning (Davidson, 2001; Ford et al., 2000; Goh, 2000; Senge, 1990; Watkins & Marsick, 1993). The concept was not included in the original descriptive theory of mainstreaming evaluation because it is not easily categorized. A team is both: (i) a way of being, a group value, and therefore part of the organization’s culture and (ii) a way that things get done and therefore an organizational capability. Analysis of these four cases made it clear that the team concept is a necessary inclusion in a descriptive theory of mainstreaming evaluation.

Staff at all four centers referred to themselves as a team. Observation and interviews confirmed that staff exemplified Katzenbach and Smith’s (1993) definition of team as “a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable” (p. 45). The complementarity of skills was ensured through leadership’s strategic staffing efforts. The common purpose is the shared vision described above. The performance goals and approaches the teams share are discussed below in the sections on Capabilities and Systems and Structures.

With regard to mainstreaming evaluation, working as a team is a
critical factor in both culture and capability. With regard to culture, when evaluation is part of the organizational value system, the team works together to make sure that necessary information for all three streams is gathered, analyzed, and used appropriately. Evaluation is considered an essential tool in their common pursuit of excellence and is part of the staff’s accountability to one another and to the center. Understanding needs, articulating criteria and performance goals, and assigning roles and responsibilities based on those goals are all evaluative capabilities these teams demonstrated in their pursuit of their centers’ purposes.

At all four centers staff described the diversity of skill sets among their colleagues as an asset. They discussed dividing up roles and responsibilities based on those skills and saw that differentiation as critical to achieving the center’s goals with excellence. However, they all also agreed that part of the team package was occasionally stepping across those lines to assist one another when needed. Anja Berry, the education coordinator at Nano-Tech, expressed a sentiment common among the staff at every center when she said:

I think we have a stellar team in terms of our ability to
interact and relate to the variety of people we work with, and we still have the technical skills to back it up. It’s always interesting when I go to other conferences and see how other people run the show, and I like what we do here.

The ability to work as a team did not seem to be limited by differences in backgrounds, gender, or geographic dispersion of staff, all of which are represented in this sample of cases. Scheduled, regular communication among staff was reported as an organizational structure that was critical to supporting team feeling and function at all four centers. Regular Communication is discussed below in the Systems and Structures section.

The dimensions of leadership and culture provide a supporting environment for evaluation mainstreaming. The various characteristics and practices described above contributed in some way to making the mainstreaming of evaluation possible in the four ATE centers studied. The overall organizational capabilities, systems, and structures that enabled those centers to sustainably use evaluation in the three streams are discussed in the following section.

**Capabilities**

Within an organization the leadership and culture support capabilities that help it fulfill its vision or purpose. Therefore, capabilities that enable
mainstreaming of evaluation must also support the center in that effort, or they would be neglected, undermined, or outright rejected. The following section highlights the capabilities found in the four centers that have made evaluation mainstreaming possible.

Goals → Roles → Evaluation Responsibilities

All four centers use some kind of strategic process through which the vision for the center is operationalized into goals. The staff at IT-Tech were the most explicit about that process. They create a project map with defined objectives, tasks, and milestones for each goal, which staff refer to throughout the year to check their progress. Based on the documents reviewed from the other three centers, they also have goals and objectives in place which, according to interviews, the staff use to guide their work.

The staff at each center have roles and responsibilities directly related to those goals and objectives. In all cases, the staff take personal responsibility for improving their individual performance in those areas based on feedback. The responsibility for creating evaluation systems and handling data, however, differs among centers. At Eng-Tech, staff roles are based on activities, and the evaluative piece flows from that. The three leadership staff
members responsible for activities work with the external evaluator to
develop tools and feedback systems in their areas, like the RoSV competition,
internship, and faculty professional development. Nonleadership staff also
have contributed to developing evaluative systems, like the selection process
for the Summer Institute.

At IT-Tech and Manu-Tech, one person has the designated “data
master” role. At IT-Tech, it is Hattie Silver, the center director. Her role is to
develop systems, analyze incoming information and disseminate it to the
other staff members and the external evaluator as appropriate. She works
directly with the Mentored Colleges to get impact information and with the
external evaluator to develop systems and instruments and create reports. At
Manu-Tech, co-PI Langdon handles getting information from the host and
partner schools. She also makes sure feedback data are collected from the
center’s limited number of direct activities for which they have already
developed instruments. At Manu-Tech the current external evaluator’s role is
focused on the quasi-experimental research study area schools, so he and the
staff have limited interaction in terms of building other evaluation systems or
interpreting feedback from activities. Most of the evaluation systems design
was handled by the original external evaluator in the first iteration of the center grant.

Nano-Tech combines the approaches of the other three centers. Education and Outreach Director Grayson is responsible for overseeing the overall data collection and dissemination, so he serves as the center’s data master. Nano-Tech also has two staff members, co-PI Marshall and Education Coordinator Berry, who are working directly with the evaluators to develop evaluation systems in their areas of programmatic responsibility.

As mentioned above, all staff members interviewed discussed using evaluative feedback to improve their performance. In the cases where individual staff members work directly with the external evaluator to develop systems for their areas of responsibility, evaluative activity has become integrated into their jobs. By participating in the process of creating the systems, staff members are able to shape the instruments to ask pertinent, specific questions of interest to them. Thus, the evaluative activity provides key information they need to help improve the programs and collects necessary evidence for external funders. The staff have ownership in the process, get relevant information, can make changes and see improvements
as a result, which perpetuates their interest and investment in evaluative activities. Talia Danvers, Eng-Tech’s internship coordinator, described the benefits of being personally involved with the evaluation process this way:

I know I went from two years ago, 80 percent of mentors said students were adequately prepared, then in 2008 it was 91 percent, and [in] 2009 it was 100 percent. [That shows] I’m doing something right! You want to look at the data… It’s important to me to see how well I did, and this is the only way I can know how it worked is to get this data, because I’m not there to look at [the interns]… I have a real sense of personal satisfaction when I see those numbers go up.

Collaborative Relationships

To get good information for all three streams of evaluation, the four centers in this study have cultivated collaborative relationships with a variety of partners. These include business and industry representatives, educators, and education institutions. The quantity and flow of information among the centers, educational and industry partners, and students for each center is summarized in Figure 43. This subsection compares how the centers have built and maintained these relationships and the kind of information they get from these sources.

In the community college context, having a business or industry
Figure 43. Comparison of Information Flow in Collaborative Relationships
advisory council is a common practice. However, the group is often used to give a rubber stamp for curriculum activities. In the university context, the focus tends to be on broader educational goals, so there is typically no direct connection to industry. The four centers in this study have created collaborative relationships with industry, albeit with different levels of structure and formality. The goal of their interactions is to make sure that the activities carried out, as well as materials, courses, and programs developed, are in line with current and future industry needs.

IT-Tech and Nano-Tech have each created business/industry advisory groups that they engage with to understand trends and get feedback on the knowledge and skills that need to be included in their courses. At Eng-Tech, rather than creating one industry advisory group for the center, staff use industry groups related to their various activities – like RoSV, drifters, and the knowledge and skill guidelines. Manu-Tech did not report having an industry advisory committee in the current grant cycle. Instead, the staff help recruit industry representatives for academic programs’ advisory committees at their host and partner colleges. At the center level, staff get information from partners in two primary ways: (i) through personal connections of staff
members and (ii) by collaborating on projects and activities, including commissioned research being done by their host college as well as other groups and agencies.

All four centers also engage in collaborative relationships with education partners. They all provide some level of financial support to educators so that they can attend professional development events sponsored by or affiliated with a center. For activities sponsored by the center, staff members also seek feedback regarding participants’ satisfaction with the event and the anticipated impact potential use of information disseminated. Nano-Tech, Eng-Tech and IT-Tech also use information from educators to shape their faculty professional development activities, which will be further discussed in Strategy and Design, below. All four centers have official partner colleges who supply information for NSF reporting. The level of connection beyond that varies among the group.

IT-Tech’s Mentored College program and Nano-Tech’s NFM partnership are more formal partnerships, with regular meetings and a clear intent to disseminate materials each center has created. IT-Tech also uses the Mentored College program to disseminate its model of operations. Nano-
Tech uses the NFM partnership to keep its partners up to date on the knowledge and skills students need to be prepared for the center’s capstone semester. Both centers get information from these partners that also helps them improve their materials.

Manu-Tech and Eng-Tech both also have partner colleges, but the relationship is less structured than with the other two centers. A large part of these relationships is related to the conference funding and data for NSF reports described above. In addition, Manu-Tech funds classroom buyouts for faculty at its partner colleges so they can do curriculum development related to manufacturing and engineering. Outside those formal partnerships, both centers engage in one-on-one relationships with faculty through other activities. Manu-Tech’s Learning Projects finances secondary and postsecondary faculty who want to create individualized professional development or services to students. Eng-Tech has begun collaborating closely with faculty as they develop the Ocean Drifters project.

All four centers also facilitate interaction between industry and educators to varying degrees. Manu-Tech does it through the Learning Projects and by giving faculty the names of potential industry advisory
committee members for their academic programs. At IT-Tech, Northtown faculty connect with the center’s Business Advisory Committee in the annual PCAL7 curriculum development process. Nano-Tech’s NFM partnership brings industry and educators together at regular meetings where industry trends and needs are discussed. In addition, faculty get the chance to interact with industry representatives at the annual Career Fair. At Eng-Tech, industry representatives are involved as judges in the RoSV competition, where both students and faculty have the chance to interact and get feedback from them.

Collaborating with a variety of partners has certainly been a key to mainstreaming evaluation and center success. This adds the challenge of how to track partners and the different ways they participate in center activities. Both Eng-Tech and Nano-Tech, the two oldest centers, have databases where they keep contact information for everyone who has ever participated in one of their programs. At Eng-Tech all information is kept in databases by activity, and those don’t communicate with each other. Thus, comparisons across databases require creation of new Excel sheets by cutting and pasting. None of the four centers discussed database creation or management as a
priority in their evaluative activities. However, with Nano-Tech and Eng-Tech as examples, an investment in skilled in database creation and management early could save administrative staff time and effort later.

While students are not collaborative partners, they are the targets of center products and activities. All four centers provide information to educators that is passed on to students. In addition, Nano-Tech provides training directly to students through the capstone semester. Eng-Tech and Nano-Tech provide opportunities for students to interact with industry through the RoSV competition (Eng-Tech) and career fairs (both). Eng-Tech, Nano-Tech, and IT-Tech get feedback directly from students to improve their activities and demonstrate impact.

**The Listening and Learning Loop**

As mentioned in Chapter 2, a variety of iterative processes (loops) have been described in the evaluation and learning organization literature (Andreadis, 2009; Argyris, 1977, 1999; Argyris & Schon, 1996a; Gray, 1998a; Haeckel, 1999; Korthagen, 2005; Preskill & Torres, 1999a). The research conducted in this study revealed a loop that combines facets from those listed in the literature. This iterative process was critical to creating and maintaining
the collaborative relationships discussed above, and collecting important information for all three streams of evaluative activity. The “Listening and Learning Loop” is presented in Figure 44, and described in more detail below.

![Listening and Learning Loop](image)

**Figure 44. Listening and Learning Loop**

**Step 1: Reflect and articulate.** In this step, the center answers three key questions: What do we need to know? Who do we need to ask? What questions do we ask? The process begins when the center reflects on its
actions, strategies, products, and activities. The parties involved in the process depend on the level at which the reflection is taking place. For example, to shape the NVC, the center’s leadership staff and the ATE program officer engage in the process. When the center’s purpose and overall strategies are under scrutiny, then the reflection process includes the center leaders, NVC, and perhaps the external evaluator. When the reflection is about an activity, like the RoSV competition at Eng-Tech, then the reflection process includes staff who are involved in planning and carrying out the activity and Jupiter, the external evaluator. In all cases, the reflection centers around what the center is doing (or should be doing), the positive and negative results, and any barriers.

The group then thinks about what further information it might need to get to improve or maintain desired results. The process participants articulate their needs and questions, and then determine from whom new information should be solicited. This step generates products appropriate for the level of reflection. For instance, at the strategic level, the centers created lists of prospective NVC or BAC members and questions or processes for those groups. In some cases the process was complex, like IT-Tech’s PCAL7; in
others, it might be a simple one- or two-question survey like Nano-Tech sends out periodically to its industry advisory committee. At the activity level, the products were usually a list of who should be surveyed and an online or paper survey instrument to get information from those individuals or groups. Thus, reflection on past performance and future possibilities leads to articulation of who else should be involved in the conversation and what information the center staff need from those external parties.

Step 2: Assemble experts. Once the center has articulated its list of who it needs to get information from, those sources have to be brought together. The four centers used a variety of approaches to assemble their experts. All four used in-person meetings and surveys. IT-Tech and Eng-Tech connect virtually using conference calls. Manu-Tech and Eng-Tech also conducted targeted research, using interviews and focus groups to get information. In Manu-Tech’s case, staff have targeted industry representatives this way, rather than having an advisory committee. Eng-Tech used targeted research to discover barriers to participation in internship and to improve its website. Here, also, the type of assembly varies based on the kind of information needed. When a center needed higher level strategic information then a more
expensive assembly method was used, like an in-person meeting, conference call, and/or targeted research. At the activity level, the assembly of experts tended to include more people and use cheaper methods, like surveys.

**Step 3: Ask questions, dialogue.** In this step, the center asks its questions of the assembled experts. In the cases where the assembly is in-person, via conference call, or targeted research, the staff dialogue and ask more probing questions about the issues at hand. The opportunity for deeper dialogue makes the more expensive method of assembly worthwhile. In the cases where surveys are used, they are distributed either by using paper or electronically to the target groups. Nano-Tech and Eng-Tech both used a hybrid method that allowed them to dialogue with survey respondents by following up via phone or in-person.

**Step 4: Listen to experts’ answers.** In this stage, the centers used processes to record and compile the information gathered from experts. Again, the method used depended on the level of information needed (strategic or activity) and the kind of assembly. For instance, Nano-Tech and IT-Tech create notes or reports from their advisory committee meetings, which are disseminated to the staff and partners. All four centers have
created systems where survey responses are compiled so that staff can view the results easily and efficiently.

This is a critical step, because if the information is not distributed to staff, the loop breaks down here and the information is not used by the center. Manu-Tech is an example of this at the strategic level. Individual staff members use their personal networks to get information, but this study found no way in which that information was systematically compiled and shared with the whole staff and/or education partners. The apparent result is that the center has limited its efforts in trying to meet the needs of industry and instead focused on targeted research regarding interventions with youth around STEM activities.

Step 5: Reflect, interpret. In this step, the center’s staff take time to reflect on the information gathered from the experts. Staff have the opportunity to process the feedback individually and then discuss it in a group setting. The group conversation typically happens during scheduled meetings, either in person or via conference call, depending on the center’s staffing situation. A key part of this step involves interpreting the information through the lenses of the organization’s vision, goals, staffing, and
capabilities. Nano-Tech, for example, gets information from its industry advisory committee about skills those experts think should be included in the capstone. The staff reflect on it in light of the center’s commitment to providing a broad-based education in nanotechnology for students. The information plus the center’s lens of commitment to students provide an interpretation of what the information means in terms of future action Nano-Tech can take to meet industry needs.

The interpretive move is key within this step and assumes that the center staff have a clear understanding of the organization’s purpose and capabilities. Without a clear understanding of purpose, the center could be constantly reacting to information and therefore continually changing its approaches, the way Manu-Tech did in its early days. Without a clear understanding of purpose, a center may add activities or direction that they cannot support in the long term.

**Step 6: Respond.** In this step, the center staff move from reflection and interpretation to response. The responses of the four centers included action, inaction, or filing the information away for later use. The next step could be to return to Reflection and Articulation, where the staff reflect on the results of
the action/inaction and assess the external and internal circumstances to see if
the information can now be put to use. Another option in the cycle is to report
a summary of the information gathered and the center’s response to it to the
external partners.

Step 7: Report (optional). In this step, the center staff report back to the
experts about the staff’s response to the information they provided to the
center in step one. This could be a formal report, an e-mail, or inclusion of
information on the center’s website with an e-mail notice to partners about
where to look for it. Overall, the experts interviewed for this study agreed
that they had seen changes in strategy or activities that seemed based on
feedback they had given. They found this sort of informal reporting
encouraging and listed it as a reason for their continued participation.

However, experts who were involved with the centers as partners (as
opposed to people who participate in a single activity and respond to a
survey) mentioned wanting to know a bit more about how and why decisions
were made that resulted in particular responses. They understood that staff
are busy and this would add more work, but also thought that greater
transparency in the centers’ decision making process would help them, as
experts, offer better information in future conversations and improve the relationship overall. As one Eng-Tech partner expressed it:

One of the things I’d like to see Eng-Tech do more, is let us know what the results of our feedback was (sic)... I feel data collection is a one-way street.... I would say this to anybody, “Don’t keep asking me for input and not giving me the assessment of all this input.” I know they’re getting it from more people like me – there must be two or three dozen people who are being sought for their input. So what’s the product of all this interviewing and data collecting?

Since the centers in this study did not consistently share their information findings and report on the actions based on those findings with external experts, this step is optional in the Listening-Learning loop. However, as the quote above demonstrates, formal reporting to the experts, particularly partners, about how the information has been used could amplify the positive benefits of this cycle. Once the reporting step is complete, the centers return to the reflection and articulation step in the cycle.

The Listening and Learning Loop is reinforcing, a causal system in which each step builds on the previous to move the organization (or in this case, a relationship) away from equilibrium (Senge, 1990; Voyer et al., 1997). The perceived positive or negative direction of the move determines whether
the cycle is virtuous or vicious, respectively (Senge, 1990). The nature of the
loop means that a virtuous cycle can turn vicious and vice versa, simply
based on a change in one of the causal links.

In the four centers studied here, the Listening-Learning Loop is a
virtuous cycle because of the inherent respect with which the experts are
treated. Experts are selected to participate because they have knowledge and
or information critical to the center and because they share a commitment to
the center’s purpose. The center staff listen actively to them by engaging in
dialogue during real time conversations and by compiling and disseminating
information from those conversations and surveys. The staff then make
changes based on the information. The experts appreciate being engaged in
areas that match their skills and interest and the attention to their input. They
see the changes made based on that feedback and, as a result, want to stay
engaged with the center. Thus, the center staff have positive relationships
with experts that enable them to get high quality information through a
variety of processes, which in turn increases the success of the center’s
strategies and activities.

A misstep in any part of this cycle could cause it to become vicious. For
example, if the wrong experts are assembled, the center staff would get misleading or poor quality information, leading to poor actions and poor results. If for some reason a staff member did not listen respectfully to the experts or the center failed to use the data to make changes, the experts could lose interest. Since most experts are volunteers, loss of interest would lead to a drop in participation, and the staff would be cut off from important sources of information. Lack of reporting is another possible spot that could damage the relationship, although it seems not to have had any major impact on the four centers involved here.

The Listening-Learning Loop describes the underlying capability that all centers used to get evaluative information. The quality of personal interaction between staff and partners has made it a virtuous cycle that benefited the centers overall. To ensure the cycle remains virtuous, the staff at each center created systems and structures within the organization to support it.

**Designing Systems and Structures**

All four centers studied in this research have a designated person or persons with the capability to develop systems and structures to make this
flow of information possible. The majority of the systems at the centers were set up in partnership with the external evaluator, although once staff reached the leadership level in all three evaluative streams, that was not always the case. The systems and structures presented in the subsection below incorporate data collection into the regular work of the center so that it is both integrated and sustainable.

The various capabilities presented in this section need to be combined with staff ability and dedicated resources to create effective systems and structures for handling information, since setting up systems is time-consuming. If the setup is not done well, the systems and structures will produce more difficulties than benefits. The following section compares the organizational systems and structures that support evaluation mainstreaming found at the four centers.

**Systems and Structures**

The centers that participated in this study have created a variety of systems and structures to get information from internal and external sources regarding the three streams of evaluative activity. Building these systems and structures has made evaluation a sustainable part of these centers’ daily
operations. The section begins with descriptions of systems and structures shared by all four centers. The last three subsections describe tools and processes that were present at only one or two of the centers, but which could be used to advantage by other organizations. All of the systems and structures described here have provided benefits to the centers that employ them.

Early Attention to Evaluation

All four centers consider evaluation during the design process with regard to both center strategy and programmatic activities. Staff agreed that it takes time and effort to have conversations about evaluation at the beginning of a grant cycle or during program planning. The efforts include defining success, determining what information would be needed to determine progress toward success, articulating possible evaluation questions, and setting up systems and strategies to get the needed information. Staff found that taking time to consider the evaluative task and set up the systems early meant less work later.

Eng-Tech’s experience with tracking students offers a clear example of the learning process that has helped it focus on evaluation as part of program
design. The center didn’t focus on tracking students early on, because they were focused on getting programs up and running. When the new external evaluator tried to track “lost” students from the center’s 13 year history, she discovered it was simply not feasible. As a result, she has added items to the AlumniWeb registration, like date of birth, which will allow the center to track students through national databases even if they lost contact with Eng-Tech.

**Regular Communication**

All four centers have created systems for regular communication with their staff that fit their organizational structures. None of the systems are alike, but all seemed to be effective. The leadership teams from all four centers meet periodically. For IT-Tech and Eng-Tech where staff are geographically dispersed, those meetings are often via conference call. At the larger centers, Nano-Tech and Eng-Tech, the programmatic staff also meet regularly.

All of the centers have come up with creative ways to connect with external partners. IT-Tech uses teleconferences with its BAC three times a year and brings them together once a year in person for curriculum review.
At Nano-Tech, the staff travel around the state to meet with educators and industry representatives in their home areas at regular intervals. Eng-Tech schedules meetings with partners before or after national conferences so no one has to make an extra trip. Manu-Tech goes out to meet with education partners and works on industry and government committees and research projects.

With both internal staff and external partners, evaluation is included on meeting agendas in terms of both gathering further information and reporting results. The information-gathering step ensures that questions about overall center strategy, continuous improvement, and impact of center activities are part of the ongoing conversation among these groups. The reporting aspect ensures that staff review the center’s progress, particularly for its NVC meetings and NSF annual reports. The scheduling of meetings with the inclusion of evaluation on agendas ensures that staff take a step back to reflect on the work of the center overall as well as getting regular feedback from external experts.

**Handling Information**

Evaluative activities, particularly surveys, produce a lot of data. Each
of the four centers has put a system in place for compiling feedback from
events onto one form. IT-Tech uses Zoomerang’s reporting functions, and
Silver sends out results via e-mail. At Eng-Tech, all surveys, both paper and
electronic, are entered into SurveyMonkey to make use of its reporting
functions. Zoomerang and SurveyMonkey both provide basic statistical
analysis and charts as part of their packages. At Manu-Tech and Nano-Tech,
someone on staff enters data by hand and creates a descriptive compilation.
The researcher did not explore whether the quantitative responses from those
compilations were put into a database for statistical analysis. Regardless of
the specific tools and processes, the compilations and dissemination make it
possible for staff at all four centers to view the descriptive results and read
the comments from respondents in an efficient way. Systems that get the
information from respondents into the hands of staff who can make changes
to the program are critical to mainstreaming evaluation. If the information is
not accessible, then it can’t be used and evaluation will not be integrated into
the daily operations of the center.

Web-based Survey Platforms

Eng-Tech and IT-Tech each use online survey tools and staff spoke
positively about the benefits. Both Zoomerang and SurveyMonkey make it possible for staff to access responses online as they come in. IT-Tech staff use that feature to address participant needs during their annual Connections event rather than fixing things for next year. Staff can view survey responses either by individual respondents or in a compilation that includes qualitative and quantitative responses. Both services include instant calculation of basic stats as well as tables and charts, which make it possible to view results graphically without having to build the graphs or spreadsheets in-house. In addition, the service provides a central, Web-based cache of all the surveys a center uses, which is particularly desirable for centers where the staff are geographically distant from one another. It also makes it possible to instantly view responses from geographically dispersed participants, like the Mentored College faculty, interns, and mentors.

One potential drawback to centers adopting this kind of online service is the requirement of Internet access for participants. IT-Tech, which is housed in the telecommunications campus of its host college, has built-in access. For the other centers and the venues in which they operate, access can be a challenge. Eng-Tech has hybridized its system to compensate. The staff
use electronic surveys whenever possible and enter paper survey responses into the electronic survey system when Internet access is not available. This approach allows them to take advantage of the data analysis services provided with the online survey package and keep the data cached all in one place. Nano-Tech has some electronic surveying embedded into its webinar program, courtesy of the other ATE center that runs its webinars.

The relatively low annual membership fees for these online surveys make them affordable options for centers. The speed of feedback and reduction in time invested in collecting, compiling and analyzing data makes it a move toward sustainability of evaluation within the organization. As technology continues to develop, with more venues offering wireless Internet, and more participants using Internet-enabled mobile devices, access to the Internet may no longer be an obstacle to more centers adopting this technology.

**Elegant Design of Evaluative Tools**

The centers involved in this study have designed evaluative tools that serve at least two purposes. For instance, all four centers include items on their end of event surveys that provide information for both continuous
improvement and impact evaluation needs. In most cases, those surveys also include one or two items that are the same across all the center’s activities. Information from those items, like overall satisfaction, provides a comprehensive picture of participants’ experience with the center for summative reports.

Nano-Tech and Eng-Tech, the oldest centers in the study, have developed particularly sophisticated tools, two of which will be summarized here. First, their end of program and follow up surveys for faculty development not only include items mentioned above, but also ask about the impediments to implementation participants have experienced or anticipate experiencing. The centers then can use that information to design center programs and shape future grant proposals to help faculty overcome those obstacles. Second, both centers have created applications that allow them to select appropriate participants for training opportunities and then place them in well-balanced groups for projects. In addition, the background information on the applications of those selected to participate is also disseminated to presenters, so they can tailor their presentations to the audience. Using a single survey or application to get a variety of information that serves the
needs of multiple groups enhances the sustainability of evaluative activities by increasing efficiency and usability.

**Short, Frequent Surveys**

All four centers use intermittent short surveys to get information from experts. These quick, one to four question instruments are sent out via e-mail or through the online survey system. These efforts served a variety of purposes. Centers asked professional development participants and faculty who downloaded materials follow-up questions about implementation. Industry experts reported being asked about the performance of alumni on the job and for their thoughts about required skills and knowledge for courses outside of the annual course reviews. Education and industry partners also got short surveys asking for feedback on survey tools, recruiting, and other PR materials being developed. These quick, occasional surveys make evaluative processes sustainable for centers, their partners, and participants. Additionally, they help maintain a center’s relationship with its expert information sources in between formal meetings and keep contact with people who can’t attend the regular meetings.

All four centers have the above systems and structures in place to
varying degrees, based on their staffing, partners, and activities. The following subsections highlight important systems and structures present at only one or two of the centers. These areas represent critical systems for creating shared mental models, protecting the rights of participants, and increasing participant response rates.

**Tools for Creating Shared Mental Models**

A shared mental model of a center’s vision, goals, and staff members’ roles and responsibilities is key to an effective organization. Two centers, IT-Tech and Manu-Tech, use specific tools to facilitate the creation of a shared mental model among the staff. At IT-Tech, the staff use a project management plan. The Excel document has a sheet for each of the center’s goals, with objectives and activities for each. Every activity has a row that maps out who has primary responsibility, what deliverables and evidence are expected, and when milestones should be met. Each row also includes a section for comments and suggestions, so staff can use the document as part of the ongoing conversation about moving from goals to results. This is a living document, continually changing and adapting as needed to reflect advances and setbacks. Center staff interviewed referred to it as essential in helping
them keep track of their roles and responsibilities with regard to activities and how their individual work fit into IT-Tech’s overall purpose.

Manu-Tech uses two different tools to facilitate the creation of a shared mental model among staff. The first is the center’s guiding principles, a set of questions and statements based on the center’s goals and objectives. The staff use them to evaluate prospective activities for alignment with the center’s mission. The guiding principles help ensure that the center staff invest resources in activities that forward the center’s overall purpose. The second tool is the whiteboard in Director Hinkle’s office. Any staff member can write ideas or issues on the board for the leadership team to consider. The whiteboard makes them public and gets those topics into informal and formal conversations among staff. The staff reported the result of having the whiteboard is an evolution of ideas that lead to new activities and improvements in existing activities.

**Protecting Rights of Participants**

In the community college context where most ATE centers operate, research with human subjects is not a common occurrence. As a result, most community colleges do not have institutional review boards (IRB) or other
processes in place to protect the rights of human subjects. In this study, Nano-Tech and Manu-Tech are exceptions to that situation. Nano-Tech is located at a state university where IRB approval is a normal part of any research agenda. Manu-Tech is located at a community college, so its use of IRB is based on two external factors. First, the center’s external evaluator, Justice, is an assistant professor of Sociology; his home college has similar IRB requirements to Nano-Tech’s. Second, since the center’s quasi-experimental research involves middle school students, it was required to get approval from the school district’s IRB as well. The ultimate result of using IRB processes is that both Nano-Tech and Manu-Tech ensure that the rights of participants are protected while they get the evaluative information they need.

**Rewards for Evaluation**

The ladies at Eng-Tech are experts at using rewards to increase their response rate for evaluations. Similar to the other centers, Eng-Tech has high response rates from education and industry partners due their relationship with the center staff and a shared commitment to the center’s purpose. However, through its RoSV competitions and internship program, the center
has the largest population of activity participants. These participants do not have personal relationships with the center staff, may or may not care about the center’s purpose, and thus do not feel obliged to complete postevent evaluations for those reasons.

As a result, Eng-Tech’s staff have become quite creative about making sure they have a high response rate from those groups. At the regional RoSV competitions, the coordinators offer anything from raffle tickets to meal tickets as incentives to get students, mentors, and parents to fill out event evaluations. At the international RoSV competition, competition patches are the reward. For community college students involved in the Barriers to Participation study, the center sends survey respondents a laser pen. Interns don’t get paid until they have turned in all their paperwork, including the evaluation. Higher response rates mean stronger inferences can be made about the center’s performance in those activities for summative reporting.

The systems and structures described above are overall methods by which the four centers have integrated evaluation into the daily work of the center. They also ensure that collection and use of evaluative information is feasible for each center’s resource constraints. The following sections discuss
the centers’ activities in each of the three streams of evaluation: Strategy and Design, Continuous Improvement, and Impact for Judgment.

**Strategy and Design Stream**

In this stream, all four centers engaged in evaluative activity regarding their overall strategy, designing (or contributing to the design of) content for courses and activities, and designing excellent experiences for activity participants. At the overall strategy level, the researcher observed a difference among the centers that appeared to be based on age. Staff and NVC members interviewed from Manu-Tech and IT-Tech reported spending more time, comparatively, on issues around the center’s purpose. For instance, both shifted their visions to include green technology. Manu-Tech moved away from a focus on improving community college curriculum to providing workshops and other learning opportunities for faculty, as well as researching the impacts of external programs like FIRST Robotics. Nano-Tech and Eng-Tech, which both have been in existence for more than 10 years, reported no major changes in their overall purpose or method of operating. Instead, they used feedback in this stream to choose new activities or adapt existing ones. Their more established purpose and longer history also meant
that they have developed more sophisticated systems for selecting participants and designing excellent experiences for them.

At all four centers, key evaluative activities in this stream included needs assessment, identification and prioritization of technician and educator knowledge and skills, and articulation of selection criteria. Each center uses selection criteria for different levels within its operations. Rather than recounting them all, an example from each center is included here to highlight the different levels. At the center strategy level, Manu-Tech’s guiding principles serve as an example of explicit selection criteria for choosing activities appropriate for the center. (The other centers appeared to operate with a less explicit set of criteria, discussed above in the subsection on Entrepreneurialism.) IT-Tech’s PCAL 7 method exemplifies a criteria-based approach to selecting content for course design. Nano-Tech demonstrates the use of selection criteria at the activity level, ensuring that participants attend a session commensurate with their skill level. Eng-Tech uses selection criteria at the within-activity level to create work groups with balanced skill sets.

A variety of experts provide information in this stream. While the specifics vary by center, as described above in Partners and Collaborative
Relationships, they include (i) the center’s NVC; (ii) representatives from industry, business, education, professional societies, and agencies; and (iii) activity applicants. At Eng-Tech and Nano-Tech program staff also contribute to the selection of content and applicants.

The centers’ practices in this stream include several key innovations that have increased utility and feasibility of evaluative activities and provided clear benefits. Nano-Tech leaders took the advice of the center’s co-PI for materials dissemination and went electronic so that users register to access materials and can be tracked for follow-up. Nano-Tech and Eng-Tech both use preliminary application information to place participants in cross-disciplinary groups for the capstone and Summer Institute, respectively. This ensures that the groups are able to successfully complete their assigned projects, while giving participants the opportunity to learn from their colleagues in addition to the instructors. The benefits include higher participant satisfaction levels and successful cross-disciplinary experiences. In Eng-Tech’s internship program, the addition of a preinternship quiz enables center staff to prescribe remedial preparation materials if necessary, which has increased satisfaction for mentors and students. Involving industry
representatives in the design of RoSV missions is another way Eng-Tech has innovated in this area. Their contributions make the competition tasks skillful simulations of real life in the marine industry. In Manu-Tech’s Learning Project, applicants are asked to provide activities, deliverables, and measurable objectives. Co-PI Langdon works with applicants to refine and develop those aspects of their project, so that the evaluation is in place before the educator receives the grant. Thus, center staff do not have to scramble at the end of the year to figure out how to evaluate the broad spectrum of grants, and educators get experience in creating evaluation plans. IT-Tech serves a rapidly evolving field, so its staff ask prospective Connections participants for ideas and rankings of topics for the annual event. Giving participants the opportunity to vote for their topics of choice eight months before the event gets Connections on their calendar and increases the odds that something of interest to them will be on the agenda. It also gives IT-Tech staff time to recruit faculty to teach the desired courses.

Continuous Improvement Stream

All four centers conduct their continuous improvement efforts at the activity level. These include professional development events, college
courses, programs like IT-Tech’s Mentored Colleges, Manu-Tech’s Learning Projects, and Eng-Tech’s at-sea internships, center activities like Eng-Tech’s RoSV competition, and the various center websites. The most common process was survey responses followed by staff discussion and reflection to make improvements for next event. Centers also use informal conversations with participants, observation, and targeted research to gather Continuous Improvement information. Information sources were event/activity participants, center staff, and website users.

Three of the four centers have taken innovative or extra steps in this stream to increase utility and feasibility of evaluative activities. At both Nano-Tech and Eng-Tech, professional development participants are surveyed multiple times during workshops to get specific feedback for improvement. At IT-Tech, the use of online survey tools has allowed the staff to use that information to make improvements during Connections. All three centers also use the information to make improvements for the next event. Both IT-Tech and Eng-Tech use classroom observers during professional development events to catch any issues that need to be addressed and give feedback to instructors during the course of the events. At Eng-Tech’s RoSV
competition, industry professionals give feedback directly to students and mentors, which enhances continuous improvement opportunities for those groups.

Impact for Judgment Stream

In this stream, centers sought information about the impacts their efforts made on people and institutions. Manu-Tech, in addition to tracking its own work, was conducting a study about the impacts of others’ programs (i.e., FIRST Robotics). All four centers were primarily interested in the impacts on faculty and students, although they also looked for impacts on their partner institutions and the business or industry with which they affiliate.

To this end, centers sought information about enrollment levels, courses added, materials used, satisfaction with workshops and services like webinars, as well as overall quality of materials and services. Enrollment levels and courses added, in particular, are reporting requirements of the ATE program. Information sources include partner colleges and partner college faculty, center staff, external evaluators, participants, and students either directly involved with center programs or who participate in classes or
activities where center materials or training are used. All four centers use a variety of tools, like surveys, data forms for institutional reporting, observations, group discussion, interviews, and informal conversation to gather data.

Two centers have taken a common research practice and used it in an innovative way to get information in this evaluative stream. After achieving limited results with one of its original partner organizations, Manu-Tech is using quasi-experimental design to determine whether FIRST Robotics is a worthwhile investment. IT-Tech is using pre-post surveying of recruiting event participants to look for impacts on knowledge and interest.

In this evaluative stream in particular, information can be difficult to acquire for several reasons. First, the time lag between participation with the center and classroom use of training or materials, for instance can be months, which means follow-up surveys at the very least. In the case of impact on the workforce as the result of technician education, the time lag can be years. Second, most centers are looking for impacts on populations beyond their immediate relational connections, which serve them so well in the other streams. The third problem is one of scale. ATE funds centers to leverage
their resources with the intent of reaching a broader population. Thus, centers focus on dissemination of models, materials, and knowledge and skill guidelines, which means their reach in terms of numbers of students affected and geographic dispersion of participants can be enormous. In Eng-Tech’s case, it is international.

Professional development activities provide a basic example of the impact challenge. Centers interact with educators at professional development events, at which time some information about initial impacts on the educators can be gathered. The impacts of interest, however, occur with students. Those impacts can’t manifest until the students have interacted with the instructor on the materials or information provided in the professional development. Often they don’t manifest until after the students have left the class of the educator who participated in the center’s professional development. Center staff reported that alumni sometimes take entry level jobs that are not necessarily related to the center’s technician training, so impact on business or industry can’t be measured until the students move to a job that uses those skills. Thus, the time delay is compounded. So over the life of a center, hundreds of educators will participate in professional
development activities, reaching potentially thousands of students. However, the impact from the training on those thousands of students can’t be understood until years after the educator participated in the workshop. As Eng-Tech’s pilot study on student tracking discovered, finding students years after participating in events is simply not feasible – and those were students who participated personally in Eng-Tech activities, rather than having an instructor who did professional development. The ATE program simply does not provide evaluation funding for centers at the level necessary to track these long-term, dispersed impacts.

The two older centers are taking a few approaches to address this challenge. By choosing online materials dissemination using a system with registered users, Nano-Tech enabled its external evaluators to follow up and get further information about how those materials are being used in the classroom. For its remote access program, which is just entering its pilot phase, Nano-Tech will study learning impacts on students who participate. Conducting the evaluation of student learning in the early stages of the program is more financially feasible, due to the smaller number of participants. It also will help the staff determine the value of the program,
before any decision is made about scaling up.

Both Eng-Tech and Nano-Tech have alumni websites, where students and educators who have participated in their activities can register. (Eng-Tech requires registration for RoSV competition participants.) The website registration provides the center staff with information they can use to track and follow up with participants. To facilitate follow-up using national databases, Eng-Tech recently included date of birth as an item on the registration. As enticement, both centers’ websites offer registrants opportunities to get connected with colleagues, quick links to information about the industry, and access to job information. Nano-Tech provides a private service connecting alumni with employers, where the staff match applicants to inquiries. Eng-Tech provides a job and resume posting service as part of its website. Website registration has proven to be an effective way to follow participants over the long term, and participants are willing to register because they receive benefits like free materials, opportunities to interact with colleagues, and job services. These Web-based resources for alumni could be of even greater benefit if centers build them in their early years, rather than waiting until their programs are fully developed, as Nano-
Tech and Eng-Tech did. Then as programs scale up, the ability to track participants long term is already in place.

Chapter Summary

In Chapter 2, the researcher outlined a descriptive theory of evaluation mainstreaming. The research design presented in Chapter 3 was created to explore that theory in real-life organizational contexts. The researcher selected four ATE centers as the study sample, conducted site visits and interviews, and reviewed documents and websites to learn about their efforts in mainstreaming evaluation. In this chapter, the findings from those case studies were presented, along with a cross case analysis. The researcher discusses the study’s the contribution, limitations, and directions for future research in Chapter 5.
CHAPTER 5: CONCLUSIONS AND FUTURE RESEARCH

As stated in Chapter 1, evaluation is the determination of the merit, worth, or significance of something (Scriven, 1991), which can be done either informally or systematically. Systematic evaluation is defined as “The identification, clarification, and application of defensible criteria to determine an evaluation object’s value (worth or merit) in relation to those criteria” (Fitzpatrick et al., 2004, p. 5). This dissertation focused on increasing the knowledge base about systematic evaluation in organizations through research on evaluation mainstreaming. Evaluation mainstreaming is defined herein as integrating systematic evaluation into the culture, systems, and daily job responsibilities of stakeholders throughout an organization.

A review of the literature base revealed limited research on mainstreaming and related topics. The researcher found no other descriptive studies in which an external person used mixed methods to compare multiple organizations’ mainstreaming of evaluation. In fact, no such study existed on any of the topics related to evaluation mainstreaming in the literature. Thus, the researcher’s first contribution to the field was made by the design of the study.
Evidence

The researcher used an iterative mixed methods research design to expand understanding of the constructs of mainstreaming evaluation (Greene, 2007). In the quantitative portion of the study, she reviewed three years of survey responses to create a sampling frame, which was used in concert with other factors to choose the research sample. For the qualitative research, she employed Yin’s (2009) replication model, seeking to generalize from the qualitative findings to the theory of mainstreaming evaluation.

Due to the researcher’s access to existing survey data, the NSF ATE program was chosen as the context for the research. Four ATE centers comprised the qualitative sample, which was large enough to make replication possible, but small enough to make the research feasible for one researcher with a preset budget. The sample included two regional, one national, and one resource center, all in different subject matter areas with ages ranging from 4 to 13 years. The qualitative research included two- or three-day site visits to the four centers, 87 interviews with 97 people, and review of 135 documents and 96 webpages. The researcher sent her notes from every interview out to the participants for validation. Across centers, an
average of 65 percent of participants returned the notes with an affirmation of accuracy, some of which included minor changes and comments. The researcher used MaxQDA to analyze the data within and across cases. The completed case studies were sent out to the PIs and in-house leadership staff at each of the centers for validation. All four centers responded and approved the case studies. The findings were presented in Chapter 4 above, as individual case studies of each center followed by a cross case analysis.

This section presents a summary of the evidence gathered in the research study and presented in Chapter 4. The subsections are based on the five research questions delineated at the end of Chapter 1. Each subsection includes the question and a summary of the research findings related to it.

Research Question #1

1. What should be included in a theory that describes mainstreaming evaluation in an organization?

In Chapter 2, the researcher proposed a descriptive theory of mainstreaming based on a review of related literature and grounded in the definition of an organization as a living, open system (Andreadis, 2009). Four dimensions within the organization were deemed likely to be related to evaluation mainstreaming: leadership, culture, capabilities, and systems and
structures. The researcher posited that organizations mainstreaming evaluation would exhibit the following characteristics within those dimensions: shared vision, commitment to the truth, iterative processes for learning, and embedded internal and external evaluation activities. In addition, the researcher proposed that evaluation mainstreaming could be further understood further by assessing evaluation attitudes and practices in an organization’s component subsystems: governance, management, work, and people.

Research Question #2

2. How are the theoretical dimensions and components presented in Chapter 2 manifested in organizations that are mainstreaming evaluation?

The researcher used the mixed methods design described above to explore how mainstreaming of evaluation manifested in four ATE centers. Due to the small staff size of the centers, the study focused on characteristics of the organizational dimensions (leadership, culture, capabilities, systems and structures) related to evaluation mainstreaming. Characteristics and values of the leader and the staff comprise the dimensions of leadership and culture. The research evidence supported the close relationship between the
two dimensions observed by Schein (Schein, 1992). Several leadership and cultural characteristics found across all four organizations were added to the descriptive theory. With regard to leadership, the researcher identified the PI’s commitment to excellence and his or her perception that evaluation is integral to that pursuit as critical to mainstreaming evaluation in every center. The relationship between excellence and evaluation was summarized under the characteristic of personal mastery. Other key characteristics found across the sample included entrepreneurialism, prioritizing, and strategic staffing. The cultural characteristics of shared vision and commitment to the truth, both posited by the researcher in the original theory, were demonstrated in some form in all four centers. The characteristic “team,” which operates as both an organizational value and capability, was also exhibited by the staff at all four centers. The characteristics of leadership and culture included in the descriptive theory of mainstreaming evaluation are presented in Figure 45.

The characteristics and values described above in leadership and culture provide a supportive environment for organizational capabilities, systems and structures through which evaluation is integrated into the daily work of the organization. As posited by the researcher in the original
descriptive theory, all four centers did demonstrate internal and external evaluation as well as iterative processes for learning. The research documented the iterative learning capability as the Listening-Learning Loop, which enables the centers to get and use evaluative information from external and internal sources. The analysis also revealed several other capabilities that contributed to the mainstreaming of evaluation. All four centers demonstrated the ability to (i) move from goals to specific roles and responsibilities for staff, including evaluative activities; (ii) engage in collaborative relationships as a means for acquiring quality evaluative information; (iii) design systems and structures that support evaluative
activities. The presence of these capabilities at all four centers indicates that they should also be added to the descriptive theory.

Good organizational systems and structures for evaluative activities make mainstreaming sustainable. All four centers created systems and structures to (i) address evaluation needs in strategic and program planning; (ii) acquire, analyze, and disseminate evaluative information and findings; and (iii) facilitate regular communication among staff and partners. Centers employed elegant instrument design; Web-based survey tools and shorter, more frequent surveys of partners to maximize the amount of useful evaluative information for the effort invested. A few systems were found in only one or two of the centers in the research sample. Two centers had a system for creating shared mental models among staff and partners, two had systems for protecting the rights of participants, and one used a reward system for participants who provided evaluative information in order to increase response rates. The capabilities, systems and structures added to the descriptive theory as a result of this research are summarized below in Figure 46.

When the researcher began her conversations with the ATE program
officers and center staffs, it became clear that their understanding of evaluation would have to be expanded beyond summative to mainstreaming.

To do that, the researcher began describing three purposes for evaluation when introducing the study to potential participants. The following example of this description comes from the protocol e-mailed to interviewees found in (Appendix K):

"Mainstreaming evaluation" means the centers use data to: 1. shape program efforts to meet the needs of constituent groups (developmental evaluation), 2. continuously improve program efforts (formative evaluation), and 3. as evidence of

Figure 46. Capabilities, Systems and Structures Related to Evaluation Mainstreaming
performance to warrant further funding (summative evaluation).

In analyzing the data from the four centers, however, these common evaluation purposes did not seem to fit the reality of evaluation practice and use. Upon further reflection about the purposes and uses of evaluation in the qualitative data and the literature base of the research, the researcher decided to expand the descriptive theory of mainstreaming evaluation to include the emerging pattern. The researcher categorized evaluative activity in “streams,” to make it distinctive from purpose, use, type, and approach, all of which are common in the interdisciplinary evaluation literature. The three streams, which have been mentioned in Chapter 4 and Chapter 5, are Strategy and Design, Continuous Improvement, and Impact for Judgment. In the following sections, each of the streams will be related to evaluation terms in Chapter 1 and the literature reviewed in Chapter 2.

In the Strategy and Design stream, organizations focus on the first two steps in the logic of evaluation: establishing criteria of merit and constructing standards of performance (Fournier, 1995; Scriven, 1991), although all four steps are used to make those determinations. The purpose is often developmental, supporting innovation and adaptation that will help the
center establish appropriate goals in line with the organization’s vision and
required performance. Thus, this stream subsumes double loop learning
(Argyris, 1977; Argyris & Schon, 1996a), in which the organization evaluates
its norms. These criteria and standards may apply to the overall strategy and
performance of the center, its activities, or activity participants. Organizations
use the evaluative information instrumentally to make selection decisions at
these different levels. Strategy and Design also includes an orientation to
evaluative information from external sources through needs assessment.
Several authors have emphasized the importance of environmental scanning
as a source of evaluative information (Andreadis, 2009; Argyris, 1977; Argyris
& Schon, 1996a; Davidson, 2001; DiBella, 2001).

The most prominent feature of the Continuous Improvement stream is
the focus on measuring performance and comparing it to standards, the third
step in the logic of evaluation. Based on the organizations in this study, the
stream subsumes formative evaluation (Scriven, 1991) and single loop
learning (Argyris, 1977; Argyris & Schon, 1996a). In the organizational
learning literature, it also includes DiBella’s facilitating factors of awareness of
a performance gap and concern for measurement (DiBella, 2001). Use is most often
instrumental; staff use evaluative information to make decisions to adapt programs and activities to make them more effective.

Impact for Judgment reflects the final step in the logic of evaluation: synthesis of data into a judgment of merit, worth or significance. Center staff and external evaluators conduct evaluative activities for both summative and formative purposes (Scriven, 1991). Evaluative information in this stream has both instrumental and political uses. The participating centers rely heavily on external funding, so the political use of evaluation results to seek further funding was a given for each. In other organizational contexts, the political use may not be as significant.

The three streams are not independent of one another. Staff use evaluative activities, data and results from each stream to inform their process in the others. The relationship among the three reflects the overall process and conceptual use of evaluative information by the staff (Figure 47).

Another expansion of the descriptive theory of mainstreaming evaluation also came out of reflection on the literature in light of the reality of the centers’ evaluation history. The data clearly showed that centers could be
at different stages of mainstreaming in each stream based on a variety of organizational factors, and that the centers did evolve from one stage to the next over time. In addition, the actions of IT-Tech in teaching its Mentored Colleges how to create quality IT programs demonstrated that the “Mentor” stage needed to be added to the original five stages proposed by Sanders (2001, 2002). A visual summary of the original and revised stages of mainstreaming is presented in Figure 48.

Thus, the researcher revised the descriptive theory of evaluation mainstreaming proposed in Chapter 2 based on the evidence gathered from the case studies of four ATE centers, presented in Chapter 4. While the organizational dimensions of leadership, culture, capabilities, systems, and
structures remained constant, the research dramatically expanded the characteristics associated with evaluation mainstreaming in each. In addition, evaluative activities in the centers were categorized into three streams, with development in each stream happening in stages. The streams and stages as they relate to each center’s history of evaluation mainstreaming are further discussed in the next research question.
Research Question #3

3. What evaluation history and current practices are found in a sample of organizations that are mainstreaming?

The history and current practices of each center are described in the Mainstreaming Evaluation sections of their respective case studies and summarized and compared in the cross case analysis section titled History of Mainstreaming, found in Chapter 4. The history varied among the four centers and, in several cases, within centers among the three streams of evaluative activity. As expected, mainstreaming was a condition with equifinality – centers attained leadership stage in mainstreaming in all three streams from a variety of starting points and by a variety of paths (Burke, 2002; von Bertalanffy, 1995). In the three streams, centers began at stages ranging from compulsion to leadership. At the time of the research visit, all centers were at the leadership stage in all three streams, with the exception of IT-Tech, which was at the mentor stage in Strategy and Design. IT-Tech’s dissemination of its strategic model, which integrates evaluative practices, was the basis for creating the mentor stage of mainstreaming evaluation.

As posited by the original descriptive theory, the centers engaged in a combination of internal and external evaluation activities, most often in
partnership with their external evaluator(s). Highlights of evaluative practices were described in the Strategy and Design, Continuous Improvement, and Impact for Judgment sections of each case study and compared sections with the same names in the cross case analysis. The centers used a variety of tools and approaches to get evaluative information, including electronic and paper surveys, meetings, personal conversations, targeted research, observations, event and course applications, and curriculum development strategies. The systems described above in Research Question #2 to analyze and disseminate evaluation findings were key to use of the information.

Research Question #4

4. What activities, attitudes, or innovations have made it possible to sustainably mainstream evaluation?

Each center that participated in this study had capabilities, systems, structures and instruments to get useful evaluative information from good sources and disseminate the findings to at least the most involved stakeholders (i.e., staff). The systemization of the evaluative process along with well-designed tools that acquired specific information for multiple
streams at once, made it sustainable in terms of overall budget and time. The use of Web-based survey tools increased efficiency at Eng-Tech and IT-Tech in particular. IT-Tech staff further innovated with that tool to create a rapid feedback loop for the center’s annual faculty professional development event.

At all four centers, mainstreaming of evaluation was sustainable because leaders and staff considered it an essential component in the pursuit of excellence. External evaluator Parker Randle summarized the attitude of center staff in this study when he described sustainability at Manu-Tech:

I would say the sustainability is a latent construct – it really reflected more of the desire to self-assess. That’s what makes it sustainable. It wasn’t that there were a lot of structures in place. We did develop general strategies, but the concept is, evaluate everything you do.

This evaluative attitude exhibited by the PI, leadership team, and staff, has resulted in the integration of evaluation into the values of each center. Evaluation mainstreaming is sustainable, therefore, because it is understood as necessary, an essential part of culture and operations.

Research Question #5

5. What benefits or detriments have these organizations experienced as a result of mainstreaming?
Three\textsuperscript{18} of the four centers that participated in this study reported the same primary detriment with evaluation mainstreaming: it takes time and money that could be spent on programmatic activities. Interviewees also reported the basic fact that people find it difficult to be criticized or discover that a program they are responsible for is not working as planned, even when they ask for the feedback and want to use it to improve. In addition, if no systems exist to collect, analyze, and disseminate evaluative information in a “digestable” format, it is easy for staff to become overwhelmed and the data to go unused.

All four centers have addressed these difficulties by making evaluation part of the core values of their organizations, as described above. Staff set aside time to think about the merit, worth, and significance of the center’s actions as individuals and in groups. In all four centers, this time is “collectively agreed upon as valuable, labeled legitimate and treated as precious” (Wadsworth, 1997, p. 4). The capabilities, systems and structures described above have also made it possible for staff at each center to work

\textsuperscript{18} IT-Tech did not report this concern because the center director is trained in developing metrics and they use only Web-based survey tools.
through the difficulties and enjoy the benefits of evaluation mainstreaming.

Center staff, partners and participants interviewed for this study listed a wide variety of benefits they had experienced as the result of evaluation mainstreaming. These include:

- Selection of activities that forward the vision of the center and therefore more effective operations.
- Selection and grouping of participants (and students) to create positive cross disciplinary experiences in the subject matter area.
- Access to critical information about trends and needs as a result of collaborative relationships.
- Collaborative relationships yielding good quality information and high response rates.
- Information for continuous improvement of programs and activities, leading to a positive evolution of those over time, as observed by participants and external stakeholders.
- Evidence for funders.
- Evidence for centers in terms of what to continue and what to quit.

Contribution

In Chapter 1, the researcher proposed that this study of evaluation mainstreaming would contribute to the interdisciplinary evaluation and ATE program knowledge bases. Those proposed contributions are presented again in Table 36, along with the locations herein where the evidence that makes the contribution can be found.
Table 36

Contributions of the Dissertation

<table>
<thead>
<tr>
<th>Proposed Contribution</th>
<th>Evidence Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A descriptive theory of evaluation mainstreaming in organizations</td>
<td>Chapter 2: Organizational Dimensions</td>
</tr>
<tr>
<td></td>
<td>Chapter 4: Cross Case Analysis</td>
</tr>
<tr>
<td></td>
<td>Chapter 5: Research Question #2</td>
</tr>
<tr>
<td>2. Descriptions of how mainstreaming actually happened including obstacles, mechanisms, influences, time frame</td>
<td>Chapter 4: Case Studies, Mainstreaming Evaluation</td>
</tr>
<tr>
<td></td>
<td>Chapter 4: Cross Case Analysis, History of Mainstreaming</td>
</tr>
<tr>
<td>3. Steps that have been taken to make evaluation a sustainable part of the organizations’ daily operations</td>
<td>Chapter 4</td>
</tr>
<tr>
<td></td>
<td>Chapter 5: Evidence, Research Question #4</td>
</tr>
<tr>
<td>4. Actual benefits organizations have experienced as a result of mainstreaming</td>
<td>Chapter 4: Strategy and Design, Continuous Improvement, and Impact for Judgment sections of case studies and Cross Case Analysis</td>
</tr>
<tr>
<td>5. A comprehensive picture of how four centers have used evaluation to improve their ATE efforts based on the Evaluation Survey and site visit data</td>
<td>Chapter 4: Case Studies and Cross Case Analysis</td>
</tr>
<tr>
<td></td>
<td>Chapter 5: Evidence</td>
</tr>
<tr>
<td>6. Descriptions of how those Centers mainstreamed evaluation in terms of their internal organization culture and practice</td>
<td>Chapter 4: Case Studies, Mainstreaming Evaluation</td>
</tr>
<tr>
<td></td>
<td>Chapter 4: Cross Case Analysis, History of Mainstreaming</td>
</tr>
</tbody>
</table>
Table 36 – Continued

Contributions of the Dissertation

<table>
<thead>
<tr>
<th>Proposed Contribution</th>
<th>Evidence Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Delineation of any remaining needs in those Centers to maximize mainstreaming for organizational effectiveness</td>
<td>Chapter 4: Case Studies, Mainstreaming Evaluation</td>
</tr>
<tr>
<td></td>
<td>Chapter 4: Cross Case Analysis, History of Mainstreaming</td>
</tr>
</tbody>
</table>

Study Limitations

In this dissertation, the researcher has presented an in-depth look at evaluation mainstreaming in four ATE centers. The research presented herein was subject to the following limitations:

Single researcher. Since only one person collected the data and conducted the research analysis, there was no opportunity to protect against bias through the perspectives of multiple researchers. The researcher compensated for this by triangulating multiple sources of data and returning the interviews and completed case studies to participants for validation.

Confirmation bias. The researcher deliberately chose four organizations that were likely to be mainstreaming evaluation and then analyzed the data based on the descriptive theory of mainstreaming evaluation generated through a literature review. This was a deliberate choice
on the researcher’s part to ensure enough replication to generalize to the theory. Although interviewees offered descriptions of characteristics of other organizations that were not mainstreaming evaluation, that information was not included in the case studies or cross case analysis. Thus, no evidence has been presented herein to demonstrate that these characteristics attributed to evaluation mainstreaming are, in fact, different in excellent organizations that are mainstreaming evaluation versus underperforming organizations that are not mainstreaming evaluation. The researcher used data triangulation, member checks, and review of the final case studies to ensure validity of the findings; however, it is possible the results were influenced by confirmation bias. Further research could address this limitation.

Short site visits. The researcher had face-to-face engagement with centers for between two and three days on-site, deliberately scheduled during periods of low center activity so she could have access to staff for interviews. Therefore, the opportunities to observe staff working together, center programs, and evaluative activities were limited. Extensive phone interviews with partners and participants, as well as document and website review, were included to compensate.
Unequal time periods for research at each site. As mentioned in Chapter 4, the ATE program does not prescribe how centers should be organized. As a result, the researcher spent a significant amount of time trying to understand the staffing, partners, and activities of each center while at the same time scheduling site visits and interviews. Once she grasped the basic organizational system of each center, she often discovered she needed to schedule a new round of interviews with a group of stakeholders that had been left out of the original sample. As a result, the time span from the first interview to the last interview at individual centers ranged from one and one-half to five months. The researcher does not know what impact of the unequal time frames may have had on data analysis; however, the expansion of the interview sample provided a more balanced data set across centers.

Sample limitations. All of the organizations in this study are grant-funded centers operated at least partially with funds from the National Science Foundation. Although the organizational configurations were different in each center, they had several common factors, like the requirement of an NVC and external evaluation, which may have influenced the findings. In addition, the centers were relatively small organizations
compared with the levels of hierarchy and differentiation in a company like Apple. Nano-Tech, the largest center in this study, had four layers of hierarchy with seven full-time and twelve part-time staff. In two centers, the PI, who is basically the CEO of the organization, did not work for the center full-time. One of those part-time PIs was not even on-site at the center because she was employed by another education institution.

Potential for bias in the findings based on the sample of participants and partners interviewed. The researcher relied on the leadership staff of each center to make initial contacts with advisory committee members, industry and education partners, and activity participants for interviews; then she interviewed those who were willing to participate. Therefore, there is a potential for a favorable bias in the data, particularly with regard to the findings on collaborative relationships.

The researcher is confident that these limitations were sufficiently addressed, where possible, to ensure the validity of the research findings presented. Further research under different limitations could explore mainstreaming and develop the literature base on the descriptive theory and real world examples of mainstreaming evaluation. Ideas for future research
follow.

Future Research

As discussed in Chapter 1, Chapter 4, and here in Chapter 5, mainstreaming evaluation is a theory with equifinality – organizations may start at any stage and take any number of paths to the leadership or mentor stage. So while the descriptive theory has been posited and expanded by this study, plenty of opportunities for further research remain. Several research questions and potential designs on this topic are presented below. Future qualitative research to further understand the relationship between mainstreaming and the organizational factors described in the first three future research questions could use the protocols developed for this study.

Future Research Question #1: Does the structure (i.e., flat hierarchy, bureaucracy, etc.) or size of the organization have any relationship to the level of mainstreaming? All the organizations included in this study were relatively small, which may mean that mainstreaming evaluation was easier. Evaluation as a cultural value may be easier to instill when there are fewer people. The PI can participate in hiring or have a staff member just one person removed from the PI in the hierarchy do the hiring, so it’s easier to
make sure that candidates are self-motivated and committed to excellence.

The interview protocols from this study could be used to research mainstreaming of evaluation in larger organizations or with a sample of organizations of different sizes to see if size matters.

Future Research Question #2: *What influence does the longevity of the organization’s leader have on mainstreaming evaluation?* All four centers in this study had PIs who had either been in that role or involved as leadership staff at the center since its inception. Therefore, all had the opportunity to build an organizational culture that valued excellence. A future study could choose a sample based on the leaders’ tenure to look for differences in mainstreaming.

Future Research Question #3: *Does mainstreaming of evaluation within an organization differ by component subsystem (governance, management, work, people) in larger organizations?* As mentioned above, the centers in this sample were too small for feasible characterization of evaluation mainstreaming based on component subsystems. A study of one or more larger organizations incorporating this level of analysis might reveal additional aspects of mainstreaming that could be added to the streams and stages. Within a large organization, a sample across organizational departments or component
subsystems could explore what factors enable and inhibit mainstreaming in each case.

Future Research Question #4: How does evaluation mainstreaming differ between organizations with poor performance versus those with great performance?

The descriptive theory from this dissertation could be used to develop a quantitative instrument for assessing (i) the stages of mainstreaming present in an organization in each stream as well as (ii) the level of the organizational characteristics present that support evaluation mainstreaming. Using quasi-experimental design, organizations of any sort could be identified by selected performance indicators as “poor” or “great,” the instrument employed and the results compared to see if mainstreaming contributes significantly to organizational performance. (This research would address the potential confirmation bias inherent in the current study.) The experiment could be repeated comparing “good” versus “great” organizations to further develop the knowledge base.

Future Research Question #5: What is the relationship between evaluator distance (external – partner) to the organization’s cultural value of commitment to the truth and the perceived objectivity/independence of the evaluator? The ATE
program requires an NVC and external evaluation, at least partly for the assumed objectivity outsiders bring to the role. As mentioned in the case studies, the centers have relationships with their external evaluators that range from the traditional to close partnership. The centers engaged in a close partnership with their external evaluators strongly advocated the benefits of that relationship, with no apparent concern about loss of objectivity.

Qualitative research to identify the factors operating in those relationships, followed by instrument design and a correlational study on those factors could build the professional evaluation knowledge base about the perception of independence versus the benefits of partnership with an external evaluator. Further research could also explore whether different distances are more beneficial at different developmental stages (i.e. based on the age of the organization) and in the different streams of evaluation mainstreaming.

**Future Research Question #6:** Do the three streams of evaluation mainstreaming hold up in other organizational contexts? If so, is there more emphasis on one over the others depending on the age/type of the organization (business, education, non-profit) and its primary activities? The streams of Strategy and Design, Continuous Improvement, and Impact for Judgment were identified
in development of the descriptive theory through literature review and data analysis for this study. However, all four of the centers in the sample are highly innovative organizations, with funding to work as change agents in education and industry in their subject matter areas. Qualitative research using the same protocols in organizations whose core identity is less focused on innovation could explore the validity of the streams as part of the descriptive theory of evaluation mainstreaming.

Future Research Question #7: What, if any, relationship exists between the composition of external advisory boards, entrepreneurialism, and the success of strategy and design efforts in ATE centers? According to the information gathered in this study, the composition of the NVC, industry and other external advisory boards is decided by the center PI in consultation with the NSF program officer. Based on the findings of this research, center staff heavily weight the information from those groups when making decisions about Strategy and Design. How heavily that information is factored also seemed to relate to the center’s level of entrepreneurialism. Qualitative reviews of center reports as well as interviews with PIs and advisory board members could explore the relationships between those three factors, further
define them and perhaps reveal strategies for best practices with regard to choosing committee members.

Future Research Question #8: *In terms of mainstreaming, is a leader’s articulation of a vision essential to mainstreaming, or are there other factors that can serve in that spot (like goals + excellence)?* This question was raised in relation to the entrepreneurialism characteristic of leadership in this research. The research presented here could be used to develop an instrument to explore how staff members understand the purpose of their organization. After pilot testing, the instrument could be used in a variety of organizations followed by exploratory and confirmatory factor analysis to identify sources of information employees use to understand their organization’s purpose and how it relates to them.

**Conclusion**

Mainstreaming evaluation in organizations as a concept has had limited attention in terms of research and publications. In this dissertation, the student researcher conducted a literature review followed by mixed methods research to generate a descriptive theory of mainstreaming evaluation. ATE centers funded by the National Science Foundation provided
the real world context in which the researcher conducted qualitative case studies. The research and findings resulted in a refined descriptive theory of evaluation mainstreaming, which makes a contribution to the literature base in professional evaluation.
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APPENDICES

Appendix A: HSIRB Approval Not Needed

HSIRB for Evaluation

Date: March 25, 2008
To: Arlen Gullickson, Principal Investigator
From: Christopher Cheatham, Ph.D., Vice Chair
Re: Approval not needed

This letter will serve as confirmation that your NSF proposal number 0802245 project “Advanced Technological Education Evaluation Resource Center” has been reviewed by the Human Subjects Institutional Review Board (HSIRB). Based on that review, the HSIRB has determined that approval is not required for you to conduct this project because you are studying projects/centers and are not gathering private information about individuals. Thank you for your concerns about protecting the rights and welfare of human subjects.

A copy of your protocol and a copy of this letter will be maintained in the HSIRB files.

HSIRB for Mainstreaming Evaluation

Date: April 23, 2009
To: Amy Gullickson, Student Investigator
From: Amy Naugle, Ph.D., Chair
Re: Approval not needed

This letter will serve as confirmation that your project “Evaluation of Advanced Technological Education Centers” has been reviewed by the Human Subjects Institutional Review Board (HSIRB). Based on that review, the HSIRB has determined that approval is not required for you to conduct this project because you are collecting information about organizations and not about individuals. Thank you for your concerns about protecting the rights and welfare of human subjects.

A copy of your protocol and a copy of this letter will be maintained in the HSIRB files.
Hi Vicki,

Back in April/May I contacted you about my dissertation research with ATE centers. I sent you my interview questions and got an "Approval not needed" letter from the OVPR. My study has changed a bit since then, so I thought it would be good to double check with you before I head into the field to collect data.

My focus is still on evaluation in organizations, and I'll be collecting organizational level data. I've attached the interview protocols I intend to use. Let me know if I need to change anything to preserve my approval not needed status, please. :)

Thanks!

AmyG
Amy Gullickson
Doctoral Candidate
Interdisciplinary PhD in Evaluation
SkypeID: amy.gullickson
amy.m.gullickson@wmich.edu
Western Michigan University
c: Nick Andreadis, Dissertation Committee Chair

Subject: Re: HSIRB Approval Not Needed - re-check
December 9, 2009 2:50 PM
From: "Vicki Janson" <victoria.janson@wmich.edu>
To: Gullickson, Amy M
Amy,
Approval is still not needed. Thanks for asking.
Vicki
Victoria Janson
Research Compliance Coordinator
Office of the Vice President for Research
Western Michigan University
251W Walwood Hall
Appendix B: 2009 ATE Survey

Section 1: Background Information

2009 ATE Survey

Overview

This survey serves three primary purposes: (1) to provide information about the ATE program activities and impacts, (2) to provide information that will guide possible studies on specific topics and issues, and (3) to help guide projects and centers in their activities.

Findings from this survey will be used by NSF program staff to prepare their annual reports and make program decisions. ATE projects and centers can use the survey results to learn about the activities reported by other ATE grantees and to serve their own information needs. Additional information about the survey is available at http://ate.wmich.edu and http://www.evaluate-ate.org.

We will neither report individual survey responses nor attribute any data to a specific respondent. Survey findings and aggregated data across projects and centers will be made available through our Web site and in formal reports to NSF.

The deadline for survey completion is March 13, 2009. We recommend that you review the survey in its entirety before responding so that you will have all the necessary information at hand to answer the questions.

Questions regarding this survey should be directed to

Lori Wingate, Project Manager
Evaluati[e
The Evaluation Center, Western Michigan University
269-387-5613
lori.wingate@wmich.edu

Thank you for participating in this survey.

General Instructions

1. Sections 1-3 are required for all respondents. These sections address grantee characteristics, organizational practices, and collaborative activities.

2. Sections 4-6 are about materials development, professional development, and program improvement, respectively. Only complete those sections if in 2008 you allocated EITHER 30 percent or more of your project/center’s direct costs OR at least $100,000 to the activity in question.

Section 1: Background Information

SECTION 1: BACKGROUND INFORMATION

Please provide the following information. If you are responding to the online version of the survey, much of the information will be shown in the response areas. Please check to make sure it is accurate. If not, replace the incorrect information with correct information.

1. NSF ATE award #: ____________________________

2. Award category: 
   - Project (including articulation agreements) 
   - Center

3. Your name: ________________________________

4. Your institution: ______________________________

5. Your role on the ATE grant: ____________________________

6. Your office address: ________________________________

7. Phone: ( ____ ____ ____ ) ____ ____ ____ - ____ ____ ____

8. Your e-mail address: _____________________________ @ ______________________

9. Project/Center Web site, if there is one. http:// ____________________________

10. Total funds awarded in the current grant for this project/center. $ ______________________

11. Beginning date for current award: ______ / ______ / ______ (MM/DD/YYYY)

12. Ending date for current award: ______ / ______ / ______ (MM/DD/YYYY)

13. What is your center/project's current annual budget? $ ______ , ______ , ______ , ______ , ______ , ______
Section 1: Background Information

14. Based on your response to item 13, estimate the percentage of your annual budget allocated to the following activities. Percentages should total 100 percent.

__________________ Materials development for national dissemination
__________________ Professional development
__________________ Program improvement
__________________ Targeted research
__________________ Evaluation (internal and external)
__________________ Advisory committees
__________________ Institutional indirect costs
__________________ Other (specify):
__________________ 100% Total annual project/center costs

15. Have you received any other ATE grant awards that are associated with your current award?
   ___ Yes
   ___ No
   
   If you answered YES, report their award numbers below. If NO, go to the next question.

   __________________________

16. Which one of the following received the NSF grant funds (i.e., is the budgetary agent) for your project/center?

   ___ 4-year college/university
   ___ 2-year college or 2-year college system
   ___ K-12 school or school system
   ___ Nonprofit organization
   ___ Association/society
   ___ Other (describe):
Section 1: Background Information

17. What percentage of the grant budget was targeted to serve individuals or groups at each type of institution? Estimate to the nearest 10 percent.

   ___% 4-year college/university
   ___% 2-year college
   ___% Association/society
   ___% Secondary school
   ___% Business/industry
   ___% Other
   100% Total

18. Choose one of the following options to describe the major emphasis of your project/center.

   ___ Advanced materials (polymers, nanotechnology, microsystems, composites)
   ___ Bio-related technologies (biotechnology, biomanufacturing)
   ___ Chemical technology (process technicians, lab tech, pharmaceuticals)
   ___ Electronics and photonics (also instrumentation)
   ___ Energy technology (alternative energy, fuel cells, power plants, hybrid vehicles)
   ___ Engineering technology (also core technology courses)
   ___ Environmental technology (agriculture, sustainable resources, sustainable development)
   ___ Graphics and multimedia (video and gaming)
   ___ Information technology (telecommunications, GIS, information systems)
   ___ Manufacturing (automated manufacturing, rapid prototyping, welding)
   ___ Marine technologies
   ___ Professional development (problem-based case learning, in-service and preservice education)
   ___ Science core (mathematics, physics, biology)
   ___ Student issues (recruitment, retention, articulation)
   ___ Targeted research
   ___ Transportation (automotive, aerospace, logistics)
   ___ Other (e.g., forensics, construction)
19. Listed below are possible dissemination activities that your project/center may have carried out in 2008.
(i) Check (✓) those activities that you have accomplished.
(ii) Write in the number of such activities.
(iii) Estimate the audience size for these activities (cells left blank will be treated as zeros).

<table>
<thead>
<tr>
<th>Dissemination Activities</th>
<th>(i) We did this</th>
<th>(ii) # of times</th>
<th>(iii) Estimated Audience Size for the Target Audience(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Business/Industry</td>
</tr>
<tr>
<td>a. Presentations at conferences</td>
<td></td>
<td></td>
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<tr>
<td>b. Booths at conferences or career days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Presentations at education institutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Special project/center events at this project/center site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Special project/center events at a collaborator site</td>
<td></td>
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</tr>
<tr>
<td>f. Distributed promotional materials (e.g., brochures, posters) related to your project/center</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Developed Web site for your project/center</td>
<td></td>
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<tr>
<td>h. Other (describe):</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
20. Please rate the priority your project/center gave to each of the following outcomes in 2008.

High priority: A large proportion (e.g., 50% or more) of our project/center's work emphasis was placed here.  
Medium priority: Some of the project/center's work emphasis was placed here, but other aspects of the project received equal or greater emphases.  
Low priority: Little (e.g., 10%) or no project/center work emphasis was placed here.  

<table>
<thead>
<tr>
<th>Possible Grant Outcomes</th>
<th>Low Priority</th>
<th>Medium Priority</th>
<th>High Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Student recruitment and retention: Increasing the number or diversity of students in your program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Materials development: Improving the quality of or access to instructional materials</td>
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<td></td>
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<tr>
<td>c. Faculty development: Upgrading faculty/instructor skills in defined technician areas</td>
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<td></td>
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<tr>
<td>d. Program improvement: Increasing the number of programs, courses, or other program options available to students</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>e. General skill development: Increasing student knowledge and skill in STEM (science, technology, engineering, and mathematics) disciplines</td>
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</tbody>
</table>

21. Sustaining your project/center or its products, outcomes, and collaborative relations beyond the completion of ATE grant funding (select only one) . . .

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>has not been considered</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>is expected to happen as a natural project/center outcome</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>has been discussed on occasion (e.g., with an advisory panel)</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>is regularly considered in our project planning and work (e.g., evident in project reports)</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>is an objective for which we regularly evaluate progress (e.g., evident in evaluation reports)</td>
<td></td>
</tr>
</tbody>
</table>

21a. Please reflect on the impact that the grant has had on your academic program, your institution, the community, or other interested parties. These effects of the grant may be positive, negative or neutral; intended or unintended. Please briefly describe the most important effects of your project/center.
Section 1: Background Information

21b. Imagine your institution in the future, perhaps three years after the ATE grant has ended. (Institution is defined broadly to include students, faculty, materials, community stakeholders, etc.) What activities or outcomes of the grant will still be in place? Please describe these things in a paragraph or two.
Articulation Agreements

Articulation agreements are defined as specific agreements that allow students who complete an education program or series of courses to matriculate to a higher level of education at specified institutions. Matriculation may occur in a sequential or concurrent (seamless) fashion. Sequential matriculation occurs when a student completes the program at the lower level and then begins taking courses at the higher level institution. Concurrent matriculation occurs when the student is simultaneously (dual) enrolled at both the lower and higher education level institutions. This section addresses articulation agreements for students preparing for careers as technicians as well as teacher preparation agreements.

22. Is developing articulation agreements part of your project/center activities?
   ____ Yes (if YES, go to Question 23.)
   ____ No (if NO, go to Section 2)

23. Provide the requested number at each education level for each of the following articulation characteristics.

<table>
<thead>
<tr>
<th>Articulation Characteristic</th>
<th>High School to 2-Year College</th>
<th>2-Year College to 4-Year College</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Total number of articulation agreements in place (sequential and concurrent)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Number of articulation agreements that provide for concurrent matriculation—dual enrollment of students at both education levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Number of institutions involved in all the agreements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Number of students that articulated in the past 12 months (enrolled at the higher education level under the terms of an articulation agreement)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Answer Question 24 only if your project/center has one or more articulation agreements in place.
Section 1: Background Information

24. Indicate (check) which of the following characteristics describe at least one of your articulation agreements. Check all that apply for each education level.

<table>
<thead>
<tr>
<th>Agreement Characteristics</th>
<th>High School to 2-Year College</th>
<th>2-Year College to 4-Year College</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Students can enroll for dual credit (i.e., credit at both institutions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Course credits can be applied to the matriculating institution whether or not the student graduates from the &quot;feeder&quot; institution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Dual credit courses receive full college credit (e.g., as part of the major) at the matriculating institution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. The number of dual credit courses that can be applied to a degree or program at the matriculating institution is restricted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Some or all of the general education credits for specific courses transfer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Some or all of the technical education credits for specific courses transfer as elective credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Program completion allows students to matriculate at selected institutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Agreement provides for students to matriculate at selected institutions, but not necessarily into specific degree programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Agreement provides for students to matriculate into specific degree programs at selected institutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Some or all of the technical education credits for specific courses transfer as a part of the matriculation program's requirements (i.e., student's major)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Other (describe):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

25. What types of evidence would you consider most useful for making the case for or demonstrating the success of articulation agreements? Please describe.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
**Section 2: Organizational Practices**

### Workforce Needs Assessment

1. Did your project/center gather workforce needs assessment data in 2008?
   - **Yes** (If YES, go to Question 2.)
   - **No** (If NO, go to Question 3 regarding Advisory Committees.)

2. Check the types of workforce needs assessments your project/center carried out and specify if the focus was local, regional, and/or national for each one that you marked. Please note that you may check (✓) more than one focus.

<table>
<thead>
<tr>
<th>Types of Workforce Needs Assessment Information and Processes</th>
<th>Check ✓ those that apply</th>
<th>Focus of Those You Marked (✓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Review of reports/studies written by others (state, agencies, specific industry groups, etc.)</td>
<td></td>
<td>Local Regional National</td>
</tr>
<tr>
<td>b. Obtained work performance data from business/industry or other constituent group (items c-k below are intended to more fully describe actions you took to gather or use this data)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Complete c-k only for columns checked in b above.*

| c. Conducted your own survey (via telephone/mail/internet) | | |
| d. Hired an outside individual or organization to conduct a survey (via telephone/mail/internet) specifically for your project/center | | |
| e. Analyzed existing data regarding workforce needs (i.e., data gathered by business or industry for their own purposes but made available to you for your purposes) | | |
| f. Conducted focus group(s) with industry/business representatives | | |
| g. Conducted formal interviews with industry/business representatives | | |
| h. Obtained feedback from an advisory committee | | |
| i. Gathered anecdotal information through conversations with business/industry representatives | | |
| j. Obtained feedback from partners and alliances | | |
| k. Other (describe): | | |
Advisory Committees

3. For the following questions about advisory committee activities, please check (✓) the appropriate boxes if the answer is YES.

<table>
<thead>
<tr>
<th>Type of Committee</th>
<th>National Committee (National Visiting Committee, National Advisory Board, etc.)</th>
<th>Regional Committee</th>
<th>Local Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Did you use this type of committee in 2008?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Is ATE grant work the primary focus of the committee?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Answer parts c-f for only those columns where you answered yes to both questions a and b above.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>c. How many times per year do they meet (face-to-face or via video or teleconference)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Is this committee funded by your project/center ATE grant?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Did the committee provide a written report?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Did you respond in writing to this report? (Only answer if your response to e was yes.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evaluation

4. Select the type of evaluator(s) used by your project/center (select only one).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. We do not have an evaluator, either internal or external (If you check this response, skip to question 11.)</td>
<td></td>
</tr>
<tr>
<td>b. Type 1 external evaluator only (i.e., hired specifically to evaluate this grant—External to project and institution)</td>
<td></td>
</tr>
<tr>
<td>c. Type 2 external evaluator only (i.e., hired specifically to evaluate this grant—External to project but internal to institution)</td>
<td></td>
</tr>
<tr>
<td>d. Internal evaluator only (i.e., is a member of your staff)</td>
<td></td>
</tr>
<tr>
<td>e. We have both an external evaluator and an internal evaluator.</td>
<td></td>
</tr>
</tbody>
</table>

5. Do you have a current, detailed evaluation plan for your project/center?

   ☐ Yes
   ☐ No
Section 2: Organizational Practices

6. Did you receive a written report from your evaluator in 2008?
   _____ Yes
   _____ No

7. Did you receive an oral report from your evaluator in 2008?
   _____ Yes
   _____ No

8. If you answered YES to Question 6 or 7, how has your project/center used the information provided in these written or oral reports? Please describe.

Answer Questions 9 and 10 only if you indicated use of an external evaluator.

9. In 2008, how frequently did your external evaluator interact with and exchange project/center-related information with your staff (e.g., e-mail, teleconferences, face-to-face meetings)? (select only one)
   a. Rarely (one to three times)
   b. Infrequently (not every month but at least quarterly)
   c. Occasionally (more often than quarterly and as much as monthly)
   d. Often (more often than monthly and as much as biweekly)
   e. Continually (very nearly weekly, weekly, or more often)

10. How useful is the interaction you have with your project/center's external evaluator?
    a. Not useful
    b. Minimally useful
    c. Somewhat useful
    d. Useful
    e. Essential to our work
Professional Development Opportunities for Project/Center Staff

The questions in this section pertain only to professional development opportunities that your project/center staff attended. Please **DO NOT** include professional development activities provided by your project/center; these are addressed in Section 5 of this survey.

11. Did your project/center use grant funds to provide support for professional development involvement by project/center faculty in 2008?
   - Yes (If YES go to Question 12)
   - No (If NO, skip to Section 3)

12. Which of the following types of professional development activities describe the ways in which project/center faculty members were engaged? (check all that apply)

<table>
<thead>
<tr>
<th>Meetings and conferences pertinent to ATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Participation in the annual ATE PI meeting</td>
</tr>
<tr>
<td>b. Attended without presenting at a regional or national conference</td>
</tr>
<tr>
<td>c. Attended and presented at a regional or national conference</td>
</tr>
<tr>
<td>d. Other (describe): ________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Directed learning experiences pertinent to ATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Participation in a short-term workshop or training program (one week or less)</td>
</tr>
<tr>
<td>b. Enrollment in a course or multaweek training program</td>
</tr>
<tr>
<td>c. Participation in a long-term (e.g., semester) internship, externship, work release program, or study (e.g., on location at a business or industry)</td>
</tr>
<tr>
<td>d. Enrollment in a degree program</td>
</tr>
<tr>
<td>e. Other (describe): _________________________</td>
</tr>
</tbody>
</table>
SECTION 3: COLLABORATION

Collaboration is defined as a relationship with another institution, business, or group that provides money and/or other support to your project/center. Collaborators are not funded by the grant; collaborators may include local businesses, other education institutions, public agencies, industry groups, other ATE projects and centers, or groups within your host institution but outside your project/center.

1. For each type of collaborator listed below, report the number of different groups or organizations you collaborate with and the number from which your project/center received substantial monetary support (e.g., cash contributions, other grants) or in-kind support (e.g., personnel time, equipment, space, facilities) in 2008.

<table>
<thead>
<tr>
<th>Type of Collaborator</th>
<th># of Collaborator Groups or Organizations</th>
<th># Providing Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Monetary</td>
</tr>
<tr>
<td>a. Business/industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Within your host institution (e.g., another department)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Other education institutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Public agencies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Other ATE awards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Report the total dollar value of monetary and in-kind support received by your project/center in 2008 from all sources other than your ATE award (round to the nearest thousand dollars).

Monetary support $ , , , , , , In-kind support $ , , , , ,
3. For each type of collaborator listed below, check (√) up to two options that best describe the primary benefits to your project/center in 2008. Each column should have two checked benefits at most.

<table>
<thead>
<tr>
<th>Collaboration Benefit to Your Project/Center</th>
<th>Type of Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Business/Industry</td>
</tr>
<tr>
<td></td>
<td>Within Your Host Institution</td>
</tr>
<tr>
<td></td>
<td>Other Education Institutions</td>
</tr>
<tr>
<td></td>
<td>Public Agencies</td>
</tr>
<tr>
<td></td>
<td>Other ATE Awarded</td>
</tr>
<tr>
<td>a. General support</td>
<td></td>
</tr>
<tr>
<td>b. Financial support</td>
<td></td>
</tr>
<tr>
<td>c. Developing program content</td>
<td></td>
</tr>
<tr>
<td>d. Facilitating service delivery</td>
<td></td>
</tr>
<tr>
<td>e. Providing access to decision makers</td>
<td></td>
</tr>
<tr>
<td>f. Providing information regarding workforce needs</td>
<td></td>
</tr>
<tr>
<td>g. Developing articulation agreements</td>
<td></td>
</tr>
</tbody>
</table>

4. If your project/center received other types of benefits from these collaborative efforts in 2008, please briefly describe the nature of benefits received and which of the collaborator groups provided these benefits.
Section 3: Collaboration

5. Collaborative efforts are expected to produce benefits to the collaborator groups as well as to your project/center. For each type of collaborator, please check (√) up to two benefits that you believe the collaborator group received. Each column should have two checked benefits at most.

<table>
<thead>
<tr>
<th>Benefit to the Collaborating Group</th>
<th>Type of Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Business/Industry</td>
</tr>
<tr>
<td>a. Direct monetary benefit (e.g., reduced costs for training employees)</td>
<td></td>
</tr>
<tr>
<td>b. Access to facilities, equipment, etc.</td>
<td></td>
</tr>
<tr>
<td>c. Intellectual support (new ideas, better techniques, expert advice, etc.)</td>
<td></td>
</tr>
<tr>
<td>d. Increased time on task—more people and/or more time applied to defined priorities</td>
<td></td>
</tr>
<tr>
<td>e. Improved quality of a targeted group (workforce technicians, students, etc.)</td>
<td></td>
</tr>
<tr>
<td>f. Marketing or sales improvement</td>
<td></td>
</tr>
<tr>
<td>g. Improved outcomes (better quality products, community relations, etc.)</td>
<td></td>
</tr>
<tr>
<td>h. Access to your program or its students</td>
<td></td>
</tr>
<tr>
<td>i. Opportunities to teach in your college</td>
<td></td>
</tr>
</tbody>
</table>

6. If other benefits resulted from these collaborations in 2008, please describe the nature of benefits received and indicate which of the collaborating groups received the benefits.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
Section 3: Collaboration

7. What factors do you consider important for extending your collaborative relationships beyond the completion of your ATE grant funding?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
SECTION 4: MATERIALS DEVELOPMENT

Complete this section if your project/center develops materials for national dissemination and the funds you allocated to materials development activities in 2008 amounted to EITHER 30 percent or more of your project/center’s direct costs OR at least $100,000.

This section of the survey focuses strictly on materials developed for national dissemination to serve instructional purposes (e.g., it does not include project/center promotional materials). Materials addressed here are the media (textbooks, laboratory experiments and manuals, software, CD-ROMs, videos, or other courseware) used to convey the content and instruction of activities, modules, and courses. For survey purposes we have defined activity, module, and course as follows:

Course: A stand-alone collection of instructional content and activities to achieve some desired educational outcomes. Courses usually last a semester or a year.

Module: A self-contained collection of content and activities designed to achieve a set of specific objectives. Modules are generally shorter than courses and focus on fewer outcomes.

Activity: An activity is an instructional exercise—for example, a laboratory experiment—designed to achieve a discrete learning outcome or a test to measure achievement or progress toward that outcome.

For the items in this section, we are interested in the number of discrete activities, modules, and courses that your project/center developed in 2008. Do not count an activity in the activity category if it was included as part of a module or course. Similarly, do not count a module separately if it is part of a course that you are reporting on.

1. For each type of material listed below, report the number of materials that were in draft stage (or field-tested) in 2008:

<table>
<thead>
<tr>
<th>Development Stage</th>
<th>Type of Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Course</td>
</tr>
<tr>
<td>a.</td>
<td># in draft stage</td>
</tr>
<tr>
<td>b.</td>
<td># field-tested</td>
</tr>
</tbody>
</table>

2. For each type of material listed below, report the number of materials that were completed in 2008:

<table>
<thead>
<tr>
<th>Type of Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course</td>
</tr>
<tr>
<td>a. Number that were completed (If your answer is 0 for each of these three cells, skip to item 4)</td>
</tr>
</tbody>
</table>
Section 4: Materials Development

3. For the materials you reported as complete in Question 2, report the number that are being used locally, elsewhere, and that have been published commercially. A single course, module, or activity may be reported in multiple rows.

<table>
<thead>
<tr>
<th>Materials Distribution</th>
<th>Type of Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Course</td>
</tr>
<tr>
<td>a. Number in use locally (at your institution)</td>
<td></td>
</tr>
<tr>
<td>b. Number in use elsewhere (i.e., at other institutions)</td>
<td></td>
</tr>
<tr>
<td>c. Number that were published commercially</td>
<td></td>
</tr>
</tbody>
</table>

4. For the materials you reported as complete in Question 2, report the number of institutions, other than your own, that are using at least one of them.

5. For the materials you reported in Questions 1a-b and Question 2, report the number of materials that are directed at each target audience for each type of material.

<table>
<thead>
<tr>
<th>Target Audience</th>
<th>Type of Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Course</td>
</tr>
<tr>
<td>a. Secondary school</td>
<td></td>
</tr>
<tr>
<td>b. 2-year college</td>
<td></td>
</tr>
<tr>
<td>c. 4-year college</td>
<td></td>
</tr>
<tr>
<td>d. Business/industry training or education program</td>
<td></td>
</tr>
<tr>
<td>e. Other (specify):</td>
<td></td>
</tr>
</tbody>
</table>

6. For the materials you reported in Questions 1a-b and Question 2, report the number of materials that use the instructional media indicated.

<table>
<thead>
<tr>
<th>Instructional Media</th>
<th>Type of Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Course</td>
</tr>
<tr>
<td>a. Print only (e.g., textbooks, manuals)</td>
<td></td>
</tr>
<tr>
<td>b. Audio/video only (e.g., cassettes, videotapes, one medium only)</td>
<td></td>
</tr>
<tr>
<td>c. CD-ROMs (e.g., may include video, DVDs, audio, text, or a combination)</td>
<td></td>
</tr>
<tr>
<td>d. Online/Web-based only (e.g., Web CT, online self-paced learning)</td>
<td></td>
</tr>
<tr>
<td>e. Mixed media (e.g., textbooks with supporting CD-ROM—any combination of above types)</td>
<td></td>
</tr>
<tr>
<td>f. Ipods, MP3s, etc.</td>
<td></td>
</tr>
<tr>
<td>g. Other (describe):</td>
<td></td>
</tr>
</tbody>
</table>
Section 4: Materials Development

7. In 2008, did you evaluate the quality of materials developed by your project/center?
   ____ Yes (If YES, please go to Question 8)
   ____ No (If NO, please skip to Section 5)

8. How useful were the following types of data or practices for that evaluation?

<table>
<thead>
<tr>
<th>Type of Data or Practice</th>
<th>Data Gathered or Practice We Used</th>
<th>Degree of Usefulness of Data or Practice Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Business and industry input to verify the alignment of materials to industry needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Student and industry standards or guidelines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Review by external experts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Field test of materials internally (i.e., within your project/center)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Field test of materials externally (i.e., outside your project/center)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Assessment of student performance in the classroom (learning effects)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Assessment of student performance in the workforce (work performance effects)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Other (describe):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


**SECTION 5: PROFESSIONAL DEVELOPMENT**

Complete this section if the funds you allocated to professional development activities in 2008 amounted to **EITHER** 30 percent or more of your project/center’s direct costs **OR** at least $100,000.

For purposes of this survey, professional development is defined as opportunities for secondary school teachers and college faculty to enhance their disciplinary capabilities, teaching skills, vitality, and understanding of current technologies and practices in areas that directly impact technician education.

1. Listed below are various types of professional development activities. In column 1, report the total number of such opportunities your project/center provided in 2008.

   In columns ii, iii, iv, and v provide additional descriptive information about those activities.

   - In column ii, report the number of these activities that were conducted at your institution.
   - In column iii, report the number of these activities that were conducted mainly at a business or industry site.
   - In column iv, report the number of activities that employed distance education techniques (e.g., conducted online or with online support).
   - In column v, report the number of activities that employed follow-up after an initial event (e.g., workshop) to support implementation.

   **If you haven’t done the activity, put a zero (0) in the space provided.**

<table>
<thead>
<tr>
<th>Professional Development Activity</th>
<th>Total Number of Activities Offered</th>
<th>(i) Number Offered On Site at Your Institution</th>
<th>(ii) Number Offered On Site at a Business or Industry</th>
<th>(iii) Number Offered Using Distance Education Techniques</th>
<th>(iv) Number Offered With Follow-Up to Support Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Short presentations to raise awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Instructional activities of less than a day (e.g., lecture, training session)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Instructional activities that last one day to one week (e.g., workshop, online module)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Instructional activities that last from one to several weeks (e.g., course, summer institute)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. A long-term periodic instructional activity (e.g., internship, peer coaching)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 5: Professional Development

2. For the listed types of professional development activities provided by your project/center, write in the number of each type of participant who attended these activities. Enter zero (0) in the space provided if activities had no participants in a particular category.

<table>
<thead>
<tr>
<th>Professional Development Activity</th>
<th>Total Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Business/Industry or</td>
</tr>
<tr>
<td></td>
<td>Organizations</td>
</tr>
<tr>
<td></td>
<td>Secondary Education Level</td>
</tr>
<tr>
<td></td>
<td>Associate Degree Level</td>
</tr>
<tr>
<td></td>
<td>Baccalaureate Degree Level</td>
</tr>
<tr>
<td>a. Short presentations to raise awareness</td>
<td></td>
</tr>
<tr>
<td>b. Instructional activities of less than a day (e.g., lecture, training session)</td>
<td></td>
</tr>
<tr>
<td>c. Instructional activities that last one day to one week (e.g., workshop, online module)</td>
<td></td>
</tr>
<tr>
<td>d. Instructional activities that last from one to several weeks (e.g., course, summer institute)</td>
<td></td>
</tr>
<tr>
<td>e. A long-term periodic instructional activity (e.g., internship, peer coaching)</td>
<td></td>
</tr>
</tbody>
</table>

3. This question is about the impact of professional development activities. Please report the percentage of participants that actually implemented new materials or ideas after attending a professional development program. Your estimate for each response should be based on follow-up data your project/center collected. If you did not collect data for a type of activity, enter N.A.

<table>
<thead>
<tr>
<th>Professional Development Activity</th>
<th>Level of Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of participants who implemented one or more of the new materials or ideas</td>
</tr>
<tr>
<td>a. Short presentations to provide awareness</td>
<td>____ %</td>
</tr>
<tr>
<td>b. Instructional activities of half-day or less (e.g., a lecture, training session)</td>
<td>____ %</td>
</tr>
<tr>
<td>c. Instructional activities that last one day to one week (e.g., workshop, online module)</td>
<td>____ %</td>
</tr>
<tr>
<td>d. Instructional activities that last from one to several weeks (e.g., a course, summer institute, etc.)</td>
<td>____ %</td>
</tr>
<tr>
<td>e. A long-term periodic instructional activity (e.g., internship, peer coaching)</td>
<td>____ %</td>
</tr>
</tbody>
</table>
4. For professional development activities provided by your project/center, please rank order the following purposes in terms of importance for your project/center’s efforts. 1 = greatest importance; 5 = least importance. To exclude a purpose from the ranking, check “not a focus.”

<table>
<thead>
<tr>
<th>Purpose of Professional Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Prepare participants to teach new courses or programs</td>
</tr>
<tr>
<td>b. Update participants’ knowledge and skills for specific equipment or technology used in business or industry (e.g., milling machine)</td>
</tr>
<tr>
<td>c. Update participants’ general technology knowledge and skills (continuous learning processes, future trends, etc.)</td>
</tr>
<tr>
<td>d. Update participants’ specific instructional knowledge and skills (learning new techniques to teach a course)</td>
</tr>
<tr>
<td>e. Update participants’ general instructional knowledge and skills (e.g., increase attention and sensitivity to diversity in the classroom and workplace, prepare faculty to manage team problem-solving situations)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Importance (Rank 1-5 where 1=highest and 5=lowest)</th>
<th>Not a focus</th>
</tr>
</thead>
</table>

5. Did you evaluate the quality of your project/center’s professional development program in 2008?
   ___ Yes (If YES, go to Question 6)
   ___ No (If NO, skip to Section 6)

6. How many professional development activities were evaluated? ________________

   If you evaluated more than one professional development activity, use your most comprehensive evaluation effort to answer Questions 7–9.

7. a. Did you collect end-of-program participant reaction data (e.g., satisfaction, intent to use)?
   ___ Yes
   ___ No
Section 5: Professional Development

b. If YES, indicate which of the following types of data you collected (check all that apply).
   ___ Participants’ opinions about the training.
   ___ Perceived value of new ideas, materials, or techniques for use in the participants’ home institutions
   ___ Participant learning/achievement in the professional development program you provided

c. If you assessed participant learning/achievement, what method(s) did you use? (check all that apply)
   ___ Participants’ self-assessment of how much they learned
   ___ Instructor-prepared hands-on or written assessments
   ___ Externally prepared exams (e.g., Microsoft certification exam)

8. a. Did the evaluation include follow-up with participants to determine implementation or adoption of ideas?
   ___ Yes
   ___ No (If NO, go to Question 9.)

b. If YES, did you probe to learn about whether the participants implemented the ideas, materials, or techniques correctly?
   ___ Yes
   ___ No

c. If YES, did you probe to learn about any changes in their students’ interest or achievement?
   ___ Yes
   ___ No

9. Did your evaluation obtain feedback from experts about the content and instruction of the professional development activities?
   ___ Yes
   ___ No
Section 6: Program Improvement

Complete this section if the funds you allocated to program improvement activities in 2008 amounted to either 30 percent or more of your project/center’s direct costs or at least $100,000.

ATE program guidelines state that program improvement “activities should enhance a curriculum in multiple ways, producing a coherent sequence of classes, laboratories, and work-based educational experiences that revitalize the learning environment, course content, and experience of instruction for students preparing to be science and engineering technicians. The improved program leads students to an appropriate degree, certification, or occupational competency point and provides industry with a larger pool of skilled technicians.”

For purposes of this survey, a program is defined as a sequence of classes, laboratories and/or work-based experiences that lead students to a degree, certification, or an occupational competency point.

1. For the year 2008, report the number of programs, institutions, courses, and students enrolled for each education level and on-the-job training that your project/center targeted with program improvement efforts. If a requested number is not applicable to your project/center situation, enter the letters NA for “not applicable.” Blank cells will be treated as zeros.

<table>
<thead>
<tr>
<th>Education Level</th>
<th>On-the-Job Training/ Contract Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary</td>
</tr>
</tbody>
</table>

a. Total number of ATE grant-funded programs developed and/or offered

b. Total number of separate courses offered across all ATE grant-funded programs. If a course appears in more than one program, count it only once.

c. Total number of individual students who took at least 1 course in 1 of your ATE grant-funded programs. If students took more than 1 course, count them only once.

d. Total number of institutions/businesses where the ATE grant-funded programs were offered
2. Based on the total number of students reported in item 1c above, estimate the number of students in each of the following demographic categories across all of your ATE grant-funded programs at the levels indicated.

<table>
<thead>
<tr>
<th>Education Level</th>
<th>On-the-Job Training/ Contract Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary</td>
</tr>
<tr>
<td>a. Male</td>
<td></td>
</tr>
<tr>
<td>b. Female</td>
<td></td>
</tr>
<tr>
<td>c. Hispanic/Latino</td>
<td></td>
</tr>
<tr>
<td>d. American Indian or Alaska Native</td>
<td></td>
</tr>
<tr>
<td>e. Asian</td>
<td></td>
</tr>
<tr>
<td>f. Black or African American</td>
<td></td>
</tr>
<tr>
<td>g. Native Hawaiian or other Pacific Islander</td>
<td></td>
</tr>
<tr>
<td>h. Multiracial</td>
<td></td>
</tr>
<tr>
<td>i. White Non-Hispanic/Latino</td>
<td></td>
</tr>
<tr>
<td>j. Students requesting accommodation under the Americans with Disabilities Act</td>
<td></td>
</tr>
<tr>
<td>k. Incumbent workers (i.e., individuals who were employed as technicians while enrolled in courses)</td>
<td></td>
</tr>
</tbody>
</table>
Section 6: Program Improvement

3. Estimate the number of applicants to all of your ATE-funded programs in 2008 that may be characterized according to each of the following categories.

<table>
<thead>
<tr>
<th>Applicant Categories</th>
<th>Education Level</th>
<th>On-the-Job Training/Contract Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary</td>
<td>Associate</td>
</tr>
<tr>
<td>a. Number of applicants to our programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Number of students who were accepted to our programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Number of students whose applications were denied due to the students’ lack of qualifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Number of students whose applications were denied because space was not available in the program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Number of students who newly enrolled in our programs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Please estimate the number of students across all of your ATE-funded programs who met the respective student status definitions at each education level.

<table>
<thead>
<tr>
<th>Student Status</th>
<th>Education Level</th>
<th>On-the-Job Training/Contract Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary</td>
<td>Associate</td>
</tr>
<tr>
<td>a. Completed the specified program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Started or continued employment as a technician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Continued STEM education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Continued STEM education AND started or continued technician employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Did not continue STEM education or start or continue employment as a technician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Left the program prior to completion (e.g., dropped out, changed majors, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Started or continued employment as a technician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Continued STEM education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Continued STEM education AND started or continued technician employment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 6: Program Improvement

4. Did not continue STEM education or start or continue employment as a technician
   
   c. Students remaining in the program (i.e., did not complete or leave the program)

5. For 2008, estimate the percentage of students across all of your ATE-funded programs in each of the following categories.

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Secondary %</th>
<th>Associate %</th>
<th>Bachelor %</th>
<th>On-the-Job Training/Contract Training %</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Full- or part-time students not employed as technicians at the same time they are taking coursework</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Incumbent workers (i.e., individuals who were employed as technicians while enrolled)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Employed as technician prior to enrollment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Were your project/center’s program improvement activities evaluated in 2008?
   
   ______ Yes (if YES, go to Question 7.)
   
   ______ No (if NO, you are finished with this section.)
7. Below is a list of sources of potential evaluation information. Please rate the usefulness of the evaluation information that your project gathered.

<table>
<thead>
<tr>
<th>Potential Evaluation Information</th>
<th>Data We Gathered</th>
<th>Degree of Usefulness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Check (✓) those that apply</td>
<td>Not Useful</td>
</tr>
<tr>
<td>a. Course-level student satisfaction data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. End-of-program student satisfaction data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Student course grades</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Data regarding student dropout rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Data on student or industry referrals to the program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Postprogram follow-up data from students (e.g., employment status, preparedness for industry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Postprogram follow-up data from supervisors of students (e.g., students’ skills, knowledge, preparedness for industry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Testing of students’ knowledge and skills against established business/industry work standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Comparison of students’ knowledge and skills against other critical competitors (e.g., personnel from other colleges or military programs or other course options)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Faculty feedback on course and program implementation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Course records/logs (syllabi, content taught, sample assignments, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Feedback from instructional experts regarding content and instruction of courses and program (e.g., comparisons of program content and instruction against critical competitors)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. Feedback from companies that employ your students and graduates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. Expert panel review of program and/or products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o. Other (describe):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 6: Program Improvement

8. Please briefly describe efforts your project/center has made to improve the student pipeline (recruitment, retention, and placement)?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

9. As a PI or project leader, do you need any assistance from experts on pipeline (recruitment, retention, and placement) issues? If so, briefly summarize what questions you have or help that you need.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Greetings, Dr. Gullickson

I am a doctoral candidate at Western Michigan in the Interdisciplinary Evaluation program. My thesis topic is on the use of evaluation in organizations; our purpose is to discover whether evaluative activities have been explicitly linked to the objectives of the organizations, how the data gathered are used to inform the work of the organization, and how the culture of the organization influences the activities and use of evaluation.

We would like to focus our data collection efforts on the ATE Centers in an effort to create an explicit audience for the findings, and to contribute to the development of the Evaluation Resource Center being developed for the ATE program at The Evaluation Center. As a result, I am writing to request permission to access and use

1. ATE survey data from the last nine years.
2. Any available information on the mission and purpose of individual ATE Centers
3. Contact information for the Centers selected for our study in order to conduct a survey and interviews
4. Other data, to be negotiated on a case by case basis with you or your co-PIs

In return, we will maintain the confidentiality agreements you have established for the survey and other data collection endeavors. When our research is complete, we will turn all copies of the data from our study over to you. In addition, findings from our research that you deem suitable for inclusion will be available for use in the Evaluation Research Center.

On behalf of myself, and my dissertation committee chair, Dr. Nicholas Andreadis, thank you for this opportunity to advance the use of evaluation in ATE work.

Sincerely,

Amy M. Gullickson
Doctoral Candidate

Dr. Nicholas Andreadis
Assistant Professor
Coordinator, Human Resources Development
Interim Associate Dean, Lee Honors College
Appendix D: First E-mail to ATE Program Officers

Subject: Mixed-method research on ATE Centers' evaluation practices
Date:    July 11, 2009 11:01:55 AM
From:    Gullickson, Amy M
To:      ATE Program Officers
Cc:      Nicholas AndreadisN; Arlen Gullickson

Dear Drs. XXXX:

I am a doctoral candidate at Western Michigan University in the Interdisciplinary Evaluation program. My dissertation is a mixed-methods study of organizations that have mainstreamed evaluation. James Sanders described the hallmarks of mainstreaming in 2002 as "an organization whose culture values evaluation, whose practices make evaluation continuous, and whose history is of ongoing use of evaluations to improve the organization’s effectiveness.” I intend to study Advanced Technological Education (ATE) Centers to investigate how evaluation became mainstreamed (history) and their current evaluation culture and practices.

I have chosen Advanced Technological Education Centers as my sampling frame for three primary reasons. First, I am able to access a great deal of historical information from The Evaluation Center’s files and its Website, and from the ATE Web pages at NSF.gov. Available information includes annual solicitations from NSF, descriptive brochures about the program, annual survey findings, status reports from previous evaluative efforts, and research findings from other funded projects. (I have requested and received permission to access The Evaluation Center’s 10 years of annual survey data with the caveat that findings for individual projects and centers will be kept confidential).

Second, the ATE program has continuously encouraged projects and centers to conduct evaluations. This emphasis on evaluation is apparent in both the annual program solicitations (guidelines) for development of proposals and in the annual survey of projects and centers. Survey responses of ATE Centers indicate that many of them have made evaluation an integral part of their day-to-day operations.

Third, many organizations have been funded multiple times. We anticipate
that these multiple exposures will strengthen use of evaluation, increase the likelihood that evaluation becomes integral to the Center's operation, and encourage its use within the host organization.

My approved plan of study calls for me to study organizations at four centers. Since the study focuses on organizations that have mainstreamed evaluation, it is crucial that the ATE Centers I study have actually done that. In that regard I have set forward two criteria:

- **Longevity**: The centers selected need to be at least 5 years old, or if younger, have been re-funded once by NSF. Longevity is my indicator of effectiveness/success, since NSF does not continue to fund organizations that do not produce results.
- **Culture and practice of evaluation**: Center leadership and staff use evaluation to forward the progress of the organization toward its goals, mission and vision. Evaluation is not just an externally required activity, but an orientation of the leadership and staff toward inquiry and feedback, integrated into their daily work.

I suspect that there are other important criteria as well. Because you have led the ATE program, since the program’s inception, I believe you are in the best position to see and know other factors of importance. I would appreciate your input on additional criteria; additionally I would appreciate your insights into which Centers you believe can most profitably be studied, and factors that you believe will be important to investigate in the study itself.

I can be reached by reply e-mail (amy.m.gullickson@wmich.edu) or by telephone (XXX/XXX-XXXX, cell or XXX/XXX-XXXX, home). If you have time and believe it would serve this study’s needs, I would welcome the opportunity to meet personally with you to gain your input on sampling issues and the study as a whole.

Thanks for your time and attention. I look forward to hearing from you.

Sincerely,

Amy Gullickson
c Arlen Gullickson, Evalu|a|t|e Director; Nick Andreadis, Dissertation Chair
Dear Dr. XXXX:

I am writing to follow-up on my July 11 e-mail message to you regarding my dissertation: Mixed-method research on ATE Centers' evaluation practices. Dr. Arlen Gullickson conveyed to me that you did receive that message. However, since it sounded like you have been busy, I thought a follow-up note would be appropriate.

As a refresher, I plan to study how and to what extent ATE Centers have mainstreamed evaluation into their culture and regular practices. I intend to conduct case studies of four Centers that are exemplars of 'mainstreaming.' My current criteria are center longevity and existing culture and practice of evaluation. I am seeking your input on additional criteria, your insights into which Centers you believe can most profitably be studied, and your contribution of other factors you believe will be important to investigate in the study itself. I have attached my sampling frame as a guide. It is a Word document that lists the Centers from which The Evaluation Center has collected survey data. The last column presents the number of years of survey data to which I have access for each Center.

My research will make several contributions to the existing ATE knowledge base.

1. A comprehensive picture of how four Centers have used evaluation to improve their ATE efforts based on the Evaluation Survey and site visit data.
2. Descriptions of how those Centers mainstreamed evaluation in terms of their internal organization culture and practices.
3. Delineation of any remaining needs in those Centers to achieve mainstreaming for organizational effectiveness. Contributions 1 and 2 can be used to help both existing and proposed projects and centers integrate evaluation into their daily operations in order to increase their effectiveness. All three contributions can benefit the Centers that participate as case study examples by providing them a narrative history of evaluation in their organization, and areas of potential improvement.
I look forward to hearing from you with regard to my study. I can be reached by reply e-mail (amy.m.gullickson@wmich.edu) or by telephone (XXX/XXX-XXXX, cell or XXX/XXX-XXXX, home). If you have time and believe it would serve this study’s needs, I would welcome the opportunity to meet personally with you to gain your input on sampling issues and the study as a whole.

Best regards,

Amy Gullickson  
Doctoral Candidate  
Interdisciplinary PhD in Evaluation  
SkypeID: amy.gullickson  
amy.m.gullickson@wmich.edu  
Western Michigan University

c  Arlen Gullickson, Evalu|a|t|e Director  
Nicholas Andreadis, Dissertation Chair
Appendix F: Solicitation Letter to Center Principal Investigators

Study of ATE Centers' Evaluation Practices
October 16, 2009 9:29 AM

From: Gullickson, Amy M
To: PIs
Cc: Arlen Gullickson; Nicholas Andreadis

Dear [Principal Investigator Name],

My name is Amy Gullickson and I am a PhD candidate in Interdisciplinary Evaluation at Western Michigan University. My dissertation research is a study of ATE centers that have mainstreamed evaluation into their organizational practices. This means the center staff seek and use data in at least three ways: (1) to shape program efforts to meet the needs of constituent groups, (2) to continuously improve program efforts and (3) as evidence of performance to warrant further funding. These evaluative activities are a mixture of work by center staff and external evaluators. Based on my review of responses to the ATE Annual Survey data at The Evaluation Center at Western Michigan University, [Center Name] has emerged as a potential exemplar of this kind of organization.

I will be attending the PI conference next week in Washington, DC, and would value the opportunity to talk with you about your center’s approach to evaluation. I will be participating in conference activities Wednesday through Friday and at booth 403 of the Student Showcase on Thursday evening. If I’ve not had a chance to meet you prior to your Wednesday showcase presentation, I will try to stop by at that time. I’ve attached a photo to help you recognize me.

I know the conference is a particularly busy time for Center PIs, so I appreciate any time you are able to make to visit with me. I’d be happy to buy you your beverage of choice and chat over it, if you have room in your schedule for that. If you wish to contact me ahead of time, I can be reached via cell phone XXX-XXX-XXXX or e-mail amy.m.gullickson@wmich.edu.

Thanks! I look forward to meeting you next week.
Sincerely,

Amy Gullickson

C: Arlen Gullickson, EvaluATE Principal Investigator
   Nick Andreadis, Dissertation Chair

Amy Gullickson
Doctoral Candidate
Interdisciplinary PhD in Evaluation
amy.m.gullickson@wmich.edu
Western Michigan University
Appendix G: ATE PI Conference Follow-up E-mail

Subject: Study of ATE Centers' Evaluation Practices
Date: October 27, 2009 2:38 PM
From: Gullickson, Amy M
To: xxx@gmail.com, xxxxx@xxxxx.xxx

Dear Alexis and Hattie:

My thanks to you and all your colleagues for taking the time to visit with me last Wednesday at the ATE PI Conference Center Showcase. I'm delighted you are interested in participating in my dissertation study on ATE centers that have mainstreamed evaluation. This e-mail outlines study confidentiality, purpose, scope and methodology. Some of it we discussed last week, but I hope this e-mail will clarify matters and describe what I’m looking for in terms of documents to review and my visit to IT-Tech.

Confidentiality: As a member of The Evaluation Center I was given access to Evalu-ate’s ATE annual survey data under strict confidentiality constraints. I am required to and will hold confidential the information I gain from the survey and from you. That is, I will not reveal to any persons outside the parameters of this study (i.e., individual participating center PIs, my dissertation committee, and Evalu-ate staff) information that identifies centers included in the study or individuals who provided information to me. As the PI of a participating center, you will receive a draft form of your case study for your review before the dissertation is published. In addition, you will receive the final draft of your case and a copy of the cross case analysis when the study is complete. You personally may choose whether or not to reveal your participation in this study to other sources, i.e. referencing it in your own reports.

Purpose: As we discussed, my study focuses on ATE centers that have mainstreamed evaluation. You were chosen because according to your survey responses and our conversation last week, you seek and use information at IT-Tech for three evaluative purposes:

1. to shape program efforts to meet the needs of constituent groups (developmental evaluation),
2. to continuously improve program efforts (formative evaluation)
3. as evidence of performance to warrant further funding (summative
evaluation)  
The goal of my study is to describe (a) how you arrived at the criteria by which you seek information, (b) your evaluation processes and uses, and (c) any benefits and difficulties or detriments you’ve experienced as a result.

Scope: The scope of my study is limited to your center; it does not include your host institution. I’ve broken my analysis down into four organizational subsystems: governance, management, work and people. The following gives a brief description of each system and my hunches about who is involved in each system in ATE centers.

- Governance: Leaders set direction and make decisions to guide the organization. Common governance system participants include PIs, ATE program officers and advisory committees.
- Management: Decisions made by governance are implemented by management. Managers may include PIs, center directors, and other partners.
- Work: This is the process system, transforming raw materials (time, information) into products and services (materials, professional development, program improvement). Center staff and partners likely are involved in this system.
- People: This system includes the training, professional development and evaluation of center personnel. All center staff participate in this system, but it is governed and managed by center leaders.

Methodology: As outlined in the brochure I gave you, my study of IT-Tech will be based on analysis of your ATE survey responses, document review, and a site visit. I have already begun working my way through your survey responses. I would like to review documents related your evaluation efforts including reports from needs assessments, advisory committees, and activity and center evaluations. If you have brochures or other information about your center that is not available on the web, I would appreciate the opportunity to review that as well. Electronic copies are ideal; however, if for the sake of confidentiality you prefer that I read hard copies when I visit your center, I can arrange my travel to accommodate that. Please send electronic documents to my hotmail account (xxxxxxx@hotmail.com). My WMU account is limited in terms of the size of files it can receive.

In terms of my visit to IT-Tech, I am hoping for two entire, consecutive days at your center (with an additional day for document review, if necessary).
During my visit I would like to interview the IT-Tech staff and your external evaluator individually. I also will want to connect with representatives from your mentored colleges and your advisory groups through face-to-face/phone/skype/webinar/focus group – basically, whatever works. As stated above, the scope of my study is limited to your center. However, I would appreciate your suggestions about other people or groups I might interview who are involved in the subsystems I described above, or who might inform me about your evaluation policies, practices, and use.

Visit Dates: Alexis suggested that she’ll be in Northtown December 8th through the rest of the month. That time frame can work for me. Please suggest some dates that fit with your schedules. I can certainly travel on a Sunday to be there for a Monday-Tuesday visit, or on a Saturday if my visit is a Thursday-Friday.

Gratuity: I have funding to provide a $600 gratuity to the center for participating. This can go to the person who coordinates my visit, to the center, or some other designation. Let me know if the amount is appropriate and how we should go about transferring the money.

Thanks again for your willingness to participate. I look forward to learning more about IT-Tech and how you are integrating evaluation into your center work. I can be reached via e-mail at amy.m.gullickson@wmich.edu, or xxxxxxx@hotmail.com, or by phone (cell XXX-XXX-XXXX or home XXX-XXX-XXXX) regarding questions, coordinating visit dates and determining your document review protocol.

Best regards,
AmyG

Amy Gullickson
Doctoral Candidate
Interdisciplinary PhD in Evaluation
amy.m.gullickson@wmich.edu
Western Michigan University

P.S. I've attached a word version of this in case you need it for distribution.
INTERVIEW SOLICITATION

Subject: Research Study  
Date: December 14, 2009 8:43 AM  
From: Hinkle, Kurt  
To: [Upstate faculty who work with Manu-Tech]  
Cc: Gullickson, Amy M

Manu-Tech is participating in a research study being conducted by a doctoral student from Western Michigan University, Amy Gullickson. The Evaluation Center at Western Michigan University is a long-standing partner to the NSF ATE program, our funding agency, helping to evaluate the effectiveness and impact of ATE Centers such as ours regionally and nationally. We are one of four Centers included in Amy’s study which is focused on their evaluation practices and their impact on the Manu-Tech’s goals, objectives and effectiveness.

Amy would like to interview you either in person or by phone during her visit on Jan. 6-7 or at a mutually convenient time before or after her visit. The interviews will be approximately 45 minutes.

Amy will be contacting you to arrange a convenient date for an interview.

Thanks in advance,

Kurt

Kurt Hinkle  
Director  
Manu-Tech  
Upstate Community College  
XXX-XXX-XXXX  
Fax XXX-XXX-XXXX  
E-mail Address xxxx@xxxxxxxx
Appendix I: Personal Interview Solicitation Example

Re: Research Study
Date: December 17, 2009 1:10 PM

From: Gullickson, Amy M
To: Gordon Callan

Hello Mr. Callan,

As Kurt Hinkle mentioned, I am a doctoral student in Interdisciplinary Evaluation at Western Michigan University. I am studying Manu-Tech as part of my dissertation research. I would like to interview you about your involvement with them - it will take about 45 minutes of your time.

I am on campus at Upstate College January 6-7, so we could meet in person then, or we could talk by phone before or after those dates. If you are willing to visit with me, will you please contact me with some options for times and dates? I can be reached via e-mail amy.m.gullickson@wmich.edu or by phone, cell: XXX-XXX-XXXX or home: XXX-XXX-XXXX.

Thanks. Have a great holiday break!
AmyG

Amy Gullickson
Doctoral Candidate
Interdisciplinary PhD in Evaluation
amy.m.gullickson@wmich.edu
Western Michigan University
Appendix J: IT-Tech Example Interview Protocols

Hattie Silver
12.9.09
845a

GOVERNANCE/MANAGEMENT SUBSYSTEM MEMBERS
Principal Investigators, Leadership team
• How do you decide what information is important to seek out?
• What information/feedback are you seeking from your needs assessments, evaluations, and advisory committees?
• Are there other sources of information you find essential to your work?
• What capabilities (knowledge/skill/attitudes among staff) are in place to facilitate getting and using the information and enabling learning and change from it? What kind of systems (organizational policies/structure/processes)?
• How does the culture of the center relate to that process? How does the center leadership relate?
• How do you determine the criteria by which center success/effectiveness will be evaluated?
• Do you disseminate those criteria? If so, to whom and by what means?
• How do non-leadership staff understand their role in relation to these criteria?
• What benefits or difficulties have you experienced as a result of this iterative process of seeking data, evaluating it and using it to enable your center to be more effective?
• Do you re-assess your criteria and the kinds and sources of information/feedback you use? How often? What are the triggers?

Critical incidents:
• Feedback on instructor (Basil?) for Programming Mobile Devices. What has happened as a result of that feedback? How are instructors selected?
• Partner college downgrade
• GreenIT switch
• Evaluation training for mentored colleges
Kelli Tyler
Program Assistant
12.9.09

CENTER STAFF

- What are your job responsibilities at CTC?
- Do you use information gathered from needs assessments, advisory committees, or evaluations in your work at the center? How?
- How does the culture of the center relate to that process? How does the center leadership relate?
- What's your attitude about evaluation? What factors contribute positively or negatively to that attitude?
- How does the structure of the center influence evaluation - whether and how it gets done, used, learned from? Does it make it easier or more difficult?
- Do you seek information or feedback specific to your job or role in the center?
- What benefits or difficulties have you experienced as a result of this iterative process of seeking data, evaluating it and using it to enable your center to be more effective?
- What kind of training/development and evaluation have you had with regard to seeking information, learning from it and changing appropriately?
Thanks again for participating in my dissertation research on IT-Tech. The purpose of my study is to explore and describe ATE Centers that are mainstreaming evaluation. "Mainstreaming evaluation" means the centers use data to:

1. shape program efforts to meet the needs of constituent groups (developmental evaluation),
2. continuously improve program efforts (formative evaluation) and
3. provide evidence of performance to warrant further funding (summative evaluation).

The following questions are designed to explore your knowledge about those topics. This is NOT an evaluation of IT-Tech, it's a descriptive study. I look forward to visiting with you this week!

- How have you been involved with IT-Tech?
- In what ways have they sought information from you to help them improve?
- What, if any, consequences have you observed from that?
- What's your role with regard to the mentored college?
- In what ways are you engaged in seeking data to shape, improve and evaluate the success of the convergence activities at your college?
- To what extent (if any) has IT-Tech helped you develop that capacity?
- How do you decide what data to collect?
- How do you use the data you collect to improve your programs, etc.?
Appendix K: Eng-Tech Example Interview Protocols

Jamie Sommers
Eng-Tech Core Staff
Friday, February 12, 2010
Sometime between 1-3p PST (4-7p EST)
Xxx-xxx-xxxx
Xxx@xxxxx.edu

Thanks again for participating in my dissertation research on Eng-Tech. The purpose of my study is to explore and describe ATE Centers that are mainstreaming evaluation. "Mainstreaming evaluation" means the centers use data to:

1. shape program efforts to meet the needs of constituent groups (developmental evaluation),
2. continuously improve program efforts (formative evaluation) and
3. as evidence of performance to warrant further funding (summative evaluation).

The following questions are designed to explore your knowledge about those topics. This is NOT an evaluation of Eng-Tech, it's a descriptive study. I look forward to visiting with you this week!

- Will you make me a list of all the different ways you get feedback from internal and external sources related to your responsibilities?
- How do you decide what information is important to seek out?
- Are there other sources of information you find essential to your work? What are they?
- Is the way you get and use information sustainable? How did that happen?
- What capabilities (knowledge/skill/attitudes among staff) are in place to facilitate getting and using the information and enabling learning and change from it? What kind of systems (organizational policies/structure/processes)?
- How does the culture of the center relate to that process? How does the center leadership relate?
- How do you determine the criteria by which center success/effectiveness will be evaluated?
- Benefits/detriment or pros/cons of using data for improvement?

After our interview, I will send my notes to you for validation. If you need to reach me with questions or further comments...

E-mail: xxx@hotmail.com  phone: xxx-xxx-xxxx

Don Fredrickson
Eng-Tech – Summer Institute and RoSV competition

Thanks again for participating in my dissertation research on Eng-Tech. The purpose of my study is to explore and describe ATE Centers that are mainstreaming evaluation. "Mainstreaming evaluation" means the centers use data to:

1. shape program efforts to meet the needs of constituent groups (developmental evaluation),
2. continuously improve program efforts (formative evaluation) and
3. provide evidence of performance to warrant further funding (summative evaluation).

The following questions are designed to explore your knowledge about those topics. This is NOT an evaluation of Eng-Tech, it's a descriptive study. I look forward to visiting with you this week!

- Please describe your involvement with Eng-Tech.
- What kind of information does the center seek from you? In what other ways do they use you as a resource?
- Do you get feedback on how to improve your performance in Eng-Tech activities? How does that process work?
- Do you participate in determining what other kinds/sources of feedback the center should seek? How does that process work?
- Can you think of any examples of something that didn’t work in terms of Eng-Tech's goals or processes since you've been involved with them? Please describe the situation and steps (if any) the center staff took to adapt.
- What capabilities (knowledge/skill/attitudes) among staff are in place at Eng-Tech to facilitate getting and using the information and enabling learning and change from it? What kind of systems (organizational policies/structure/processes)?
- How does the culture of the center relate to that process? How does the center leadership relate?
- Please describe whatever you know about how those capabilities, systems, and/or culture were developed.
- In your experience with Eng-Tech, can you think of any benefits/detriments or pros/cons you've seen from using data for improvement?

After our interview, I will send my notes to you for validation. If you need to reach me with questions or further comments...

E-mail: xxx@hotmail.com  phone: xxx-xxx-xxxx
Appendix L: Document Summary Form Example

<table>
<thead>
<tr>
<th><strong>Center</strong></th>
<th>Nano-Tech</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name/Description of document</strong></td>
<td>Remote Access of AFM by Queensland University of Technology</td>
</tr>
<tr>
<td><strong>Document date</strong></td>
<td>8.31.09</td>
</tr>
<tr>
<td><strong>Significance/Importance</strong></td>
<td>Annual FastLane Report for Nano-Tech (p. 44)</td>
</tr>
<tr>
<td><strong>Date received/acquired</strong></td>
<td>1.10.10</td>
</tr>
<tr>
<td><strong>Date summarized</strong></td>
<td>5.14.10</td>
</tr>
<tr>
<td><strong>Summarized by</strong></td>
<td>AMG</td>
</tr>
<tr>
<td><strong>Associated event or contact</strong></td>
<td>E-mail from Rich Grayson</td>
</tr>
</tbody>
</table>

**Brief summary of contents**
Pre-service high school teachers and high school students received lectures from Nano-Tech staff on the Atomic Force Microscope, then conducted remote operation of the AFM to conduct activities – so students could operate the microscope at Penn State from their classroom in Australia.

**Key information for data analysis**
The experience was documented from the pre-service teacher’s perspective and we are currently drafting a paper and looking for future opportunities. Feedback from the high school students and teachers was positive and helpful. The students responded that the AFM interaction and 3D visualization capabilities of the tool were helpful and that it was fun to talk to a scientist in another country.
Appendix M: Qualitative Codes from MAXQDA

MAXQDA

Code System [6172]
  connecting the dots [1]
  Network [72]
  SContrast Cases [52]
  Critical incidents [120]
  critical incidents [14]
  Pattern Codes [67]
  Decision making [1]

Ctr Description [6]
  Mission/Goals [62]
  Work of the Center [152]
    Products/activities [304]
    Participants [117]
    Recruiting [20]
  Partners [47]
    Government/Agency partners [1]
      Administrators [21]
      Educational Partners [160]
      External evaluators [117]
      Faculty@host college [39]
      Industry partners [136]
      NVC [81]
    Members [5]
    Partners (prev) [12]
  Current staffing [52]
    Roles [158]

Context [16]
  Education [8]
  ATE/NSF [57]
  Host school [87]
  Industry [75]
  Partner schools [9]
  Physical setting [6]
  State/Region/Nation [52]

History [9]
  Center History (prev) [77]

Culture and Leadership [3]
  Leader Expertise [119]
    Values [5]
    Vision [6]
  Communication [78]
  Criteria/Values [105]
  Excellence [2]
  EvnAdoption [7]
  Relationships [25]
  E-attitude (1) [143]
    Evn as Value [11]
    +Learning [1]
  Formative [2]
  Needs Based [15]
    needs assessment [5]
    Developmental [7]
  Outcome oriented [4]
    Summative [8]
  Ogm Characteristics/KSAOs [487]
  Shared vision [115]
Team [55]
Current evaluation systems [4]
  e-challenges [39]
Innovations/Dissemination [52]
  dissemination [27]
  4Innovation [60]
  4Innovation(a) [14]
Loops/Relationships [203]
  Info Sources [129]
Results [87]
  detriments [31]
  benefits [148]
Roles [58]
Sustainable [27]
Systems/Structures [347]
  Overall approach [106]
  Fit and Design [174]
  Improve [50]
  Outcome [159]
  systems/structure [53]
Evaluation History/Mtg Progression [2]
  eval history [42]
Capabilities [3]
  Prioritizing [33]
  2Staff Capabilities [79]
  Expertise [76]
  ksao [83]
Future scanning [5]
Commitment to truth [7]
Concerns [7]
Challenges [3]
Important-Random [26]
Process [6]
Loops [3]
  Activities [0]
  Professional Development [0]
  Curriculum [0]
  Industry [0]
  noisy parade [8]
  Experimental mindset [26]
Roles [85]
1 Organizational Characteristics [216]
  Culture [9]
  Leader [32]
3 Evaluation [7]
  detriments [0]
  benefits [0]
6 Context [83]
  Region [0]
  Partner organizations [0]
  Center Host Organizations [0]
Partners [27]
Criteria [23]
2 Staff Capabilities [3]
  ksao [0]
team [0]
Center History [7]
Work of the Center [3]
E-attitude [3]
Communication [0]
Sets [0]
Hi Francine,
Thanks so much for taking time to visit with me about your involvement with Manu-Tech Center. I enjoyed visiting with you, and I appreciate your contribution to my research.

I've attached my notes from our conversation for your review. If you would like, please read them and make any comments, corrections or additions as you see fit, and return the notes to me. If I don't hear back from you by this coming Saturday, May 22, I'll assume your approval of this version and use it for my data analysis.

Please contact with me if you have any questions or concerns. This week my cell phone is the best way to reach me: XXX-XXX-XXXX.

One of the other centers I'm studying works with middle school kids and robotics. They might be able to connect you (or your robotics instructor) with some other people or materials for your project. Let me know if you are interested and I'd be happy to pass along contact information.

Thanks again for your time, and best of luck with your camp this summer.

Best regards,
AmyG