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# Building an Evaluation Model of Academic Advising's Impact on Progression, Persistence, and Retention within University Settings

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# BUILDING AN EVALUATION MODEL OF ACADEMIC ADVISING'S IMPACT ON PROGRESSION, PERSISTENCE, AND RETENTION WITHIN UNIVERSITY SETTINGS

by

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Academic advising is at a point in its maturation as a field of study where anecdotal evidence is no longer sufficient to inform the measure of effectiveness. As the area becomes more research-based, advising's measurable impact should be based on an evaluative framework; no such structure currently exists. In this study, three methods were used to investigate this problem and ultimately to create a model and checklist. Firstly, a descriptive study was used to examine if there is an understanding of what evaluation is within the advising community, one where assessment has been the dominant practice. Secondly, a quasi-experimental design was utilized to determine if the practice of advising has any effect on student progression and retention. Thirdly, using results from the first two studies, a Delphi study was used to create a checklist for evaluating academic advising. Results indicated that academic advisors tended to associate the idea of evaluation with assessment. Additionally, there was an indication that academic advising affected student success when viewed through the lens of progression toward degree completion. Finally, a preliminary model and evaluative checklist were constructed.

In summation, academic advising is very much at its infancy as a field of study. If evaluative standards are to be accepted within the community, acceptable measures and methods must be employed when judging the practice. This research provides the advising population with a basic framework to evaluate their programs or units using language and criteria derived from the three studies.

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Abhik Roy

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# CHAPTER I

# INTRODUCTION

Colleges and universities are continually under pressure to improve both the retention and persistence rates of their student body. When looking at retention studies from the early 1990s and onward, approximately one quarter of each year's full-time freshman did not attend the same public four-year institution one year later (Consortium for Student Retention Data Exchange, 1999; The National Center for Higher Education Management Systems, 2010; National Student Clearinghouse, 2014). Concerning persistence, Porter (1990) and Tinto (1993) report that approximately 40 percent of students do not achieve a degree, while 75 percent of all dropouts occur after the second year of college (Tinto, 1987, 1988).

The definition of university retention can vary somewhat between institutions depending on scaling, measurement, and need; for the purposes of this dissertation, however, university retention will refer to the number of attending students in a given cohort that enrolled at the same institution in the following fall. The definition of persistence does not typically vary as it refers to the act of continuing towards a degreed goal in an academic institution.

There are many indictors of student retention and persistence (Astin, 1993; Noel, Levitz & Saluri, D, 1985; 1987). The National Center for Education Statistics (Kena, Aud, Johnson, Wang, Zhang, Rathbun, Wilkinson-Flicker, & Kristapovich, 2014) reported that defining factors related to student retention and persistence was multidimensional, including the availability of financial resources, socioeconomic status, secondary school experience, and student success.

University staff typically does not influence a student's financial resources, socioeconomic status, and/or secondary school experience, nor do they aim to. Despite this, student success is, by definition, a resultant of the experience within the university setting. While achievement can be measured in any number of ways, academic advising has been shown to be correlated with student success (Chiteng , 2014; Beal & Noel, 1980; National Survey of Student Engagement, 2014; Young-Jones, Burt, Dixon and Hawthorne, 2013), retention (Bai & Pan, 2009; Cuseo, 2003; Habley & McClanahan, 2014; Metzner, 1989; Nutt, 2003) and persistence (Cuseo, 2003; Nutt, 2003; Seidman, 1991; Steele, Kennedy & Gordon, 1993).

Seidman (1991) found that an experimental group that received pre- and post-test admission advising persisted at a rate of 20 percent above those in a corresponding control group. Additionally, a 2004 study found that three interventions directly related to the rate of student retention and persistence: first-year programs, learning support, and academic advising (American College Testing, 2004).

**Need for the Study**

Powers (2012) stated that the act of assessing academic advising must occur if the field is to be considered a learning-centered model with a focus on outcomes (Campbell & Nutt, 2008) and the achievement of those outcomes. Furthermore, the learner-centered academic advising model was delineated (Hancock, 2004) using the American Psychological Association's Learner-Centered Psychological Principles (1993). This task list, revised in 1997, outlined the benefits of fourteen learner-centered approaches, or criteria (McCombs, 2001):

Cognitive and Metacognitive Factors

1. Nature of the learning process: The learning of complex subject matter is most effective when it is an intentional process of constructing meaning from information and experience.
2. Goals of the learning process: The successful learner, over time and with support and instructional guidance, can create meaningful, coherent representations of knowledge.
3. Construction of Knowledge: The successful learner can link new information with existing knowledge in meaningful ways.
4. Strategic thinking: The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals.
5. Thinking about thinking: Higher order strategies for selecting and monitoring mental operations facilitate creative and critical thinking.
6. Context of Learning: Learning is influenced by environmental factor, including culture, technology, and instructional practices.

Motivational and Affective Factors

7. Motivational and emotional influences on learning: What and how much is learned is influenced by the learner's motivation. Motivation to learn, in turn, is influenced by the individual's emotional states, beliefs, interests and goals, and habits of thinking.
8. Intrinsic motivation to learn: The learner's creativity, higher order thinking, and natural curiosity all contribute to motivation to learn. Intrinsic motivation is

stimulated by tasks of optimal novelty and difficulty, relevant to personal interests, and providing for personal choice and control.

9. Effects of motivation on effort: Acquisition of complex knowledge and skills requires extended learner effort and guided practice. Without learners' motivation to learn, the willingness to exert this effort is unlikely without coercion.

Developmental and Social Factors

10. Developmental influence on learning: As individuals develop, there are different opportunities and constraints for learning. Learning is most effective when differential development within and across physical, intellectual, emotional, and social domains is taken into account.
11. Social influences on learning: Learning is influenced by social interactions, interpersonal relations, and communication with others.

Individual Differences Factors

12. Individual differences in learning: Learners have different strategies, approaches, and capabilities for learning that are a function of prior experience and heredity.
13. Learning and diversity: Learning is most effective when differences in learners' linguistic, cultural, and social backgrounds are taken into account.

14. Standards and assessment: Setting appropriately high and challenging standards and assessing the learner as well as learning progress - including diagnostic, process, and outcome assessment - are integral parts of the learning process.

These factors were then narrowed (Alexander & Murphy, 2000; Lambert & McCombs, 2000) into five domains of concentration and summarized by Blumberg (2009). The first domain is knowledge base, or the attainment and relevancy of new knowledge dependent on current knowledge. The next is strategic processing and executive control, which is defined as the skill and motivation needed for self-reflection that is required for learning. Motivation and affect, or the learner-centered education that leads to an increase in drive for learning and satisfaction with an academic experience, is yet another domain. Following motivation and affect is development and individual differences, which drive one's personal understanding and ability. The last domain is situation or context, referring to the higher active engagement and social interaction within the context of learning that leads to greater gains when compared to situations without those criteria.

While a direct link between academic advising and retention has yet to be proven, correlational evidence suggests five measures that may show a connection (Cuseo, 2003).

*Student Satisfaction with the College Experience*

Out of many predictors of student persistence, college satisfaction has been found to be a primary measure (Noel & Levitz, 1995). Astin (1991; 1993) and Aitken (1982) further described academic preparedness with a focus in academic advising to be a criteria of college satisfaction. Metzner (1989) employed a longitudinal study of freshman retention using a sample of $n = 1033$

students at a public, urban university. He found that student self-defined, high-quality advising had an indirect, yet statistically significant effect on student persistence.

*Effective Educational and Career Planning and Decision-Making*

Since the mid-1970s, the theory and utility of developmental advising has dominated the field of academic advising (Crookston, 1972; Gordon, 1994; Grites & Gordon, 2000; Lowenstein, 1999; Winston, Miller, Ender, & Grites, 1984). By definition, developmental advising requires educational and career planning yielded from advisor and student decisions. Astin (1975) found that those students who procrastinated in the identification of a major and career tended to drop out at a greater rate than those who declared earlier. Bean and Noel (1980) found that the primary reason for transfer students to drop out of college was indecision about a major and career goal based on a lack of knowledge of course availability or major pathway. Additionally, Lotkowski, Robbins and Noeth (2004), who used three national studies on retention practices and 20 years of data on college retention and degree completion rates, found that the knowledge of academic goals as found through communications with advisors have a positive correlation with university retention.

*Student Utilization of Campus Support Services*

A positive correlation exists between the usage of campus support services and the likelihood of completing a program or degree (Churchill & Iwai, 1981; Pascarella & Terenzini, 1991). As academic advising is a student support service, those who use the resource have higher

self-efficacy and tend to perform better in academics and persist (Lotkowski, Robbins & Noeth, 2004; Smith, Walter & Hoey, 1992).

*Student-Faculty Contact Outside the Classroom*

An abundance of research exhibits the notion that student-faculty contact beyond the classroom positively correlates with student retention, persistence, and progression (e.g. Astin, 1977; Bean, 1981; Kinzie, 2005; Kuh, Kinzie, Schuh & Whitt, (2005); Lotkowski , Robbins & Noeth, 2004; Pascarella 1980; Pascarella & Terenzini 1979, Terenzini & Pascarella, 1977, 1978; Pascarella & Terenzini, 1991; Tinto, 1987). Since faculty can and do serve as academic advisors, contact outside of the classroom can positively affect the persistence of students, especially those who are considering withdrawing (Tinto, 1975).

*Student Mentoring*

To promote student retention, schools and subsequent advisors can implement the practice of advising (Jacobi, 1991; Johnson, 1989; Thomas, 2000; Walker & Taub, 2001). Empirical studies on mentoring have shown a positive correlation between mentoring and student retention (Campbell & Cambell, 1997; Cosgrove, 1986; Jacobi, 1991; Miller, Neuner, & Glynn, 1988; Wallace & Abel, 1997). Within academic institutions, academic advising can be performed by various individuals and entities, such as certified advisors, counselors, professors, or other designated professionals. Typically, the impact and effectiveness of advising experiences are not measured; if measurement does occur, it is the result of basic descriptive statistical analysis stemming from student satisfaction surveys (e.g. Carlstrom & Miller, 2013;

Habley, 2004; Robbins, 2009, 2011). These surveys are a type of customer satisfaction indicator, thus very susceptible to measurement error (Dillman & Smyth, 2009).

**Delineating Between Research, Assessment and Evaluation of Academic Advising**

The development academic advising as a practice can be viewed in terms of research, such as collecting data on advisor(s) or advising departments for informational purposes known as assessment. Evaluations, or the judgment of merit, worth, or significance, of an advisor or advising program compared to institutional goals is also necessary. For this study, the latter is viewed in terms of impact with progression, persistence, and retention as criteria. What follows are theoretical examples of each: criteria, indicators, as well as research, assessment, and evaluative questions.

Consider the following example: a pre-professional student is accepted into a professional program such as a school of engineering. The student's acceptance would be considered as student progression, which is indicated by successful completion of prerequisite courses, minimum required entrance average GPA, availability of finances, and a lack of academic holds. A corresponding research question may ask what general requirements are necessary to enable professional programs to acquire high-performing students into their program. Alternatively, an assessment question may investigate what percentage of pre-professional students were accepted into a professional program. Furthermore, an evaluative question would study the aggregate intake of professional students by asking how a particular professional school ranks when compared other professional schools.

Now consider the following scenario: first-time, full-time freshmen successfully matriculate from their first semester to their second. In this case, student persistence is the focus. Indicators may include a minimum acceptable average GPA from (at least some) of all first semester courses, availability of courses, and a lack of academic holds. In this situation, a research question may examine what factors attribute themselves to the persistence of first-year, full-time students. An assessment question may inquire as to the number of students who went on to their second semester of courses, but failed a gateway course. Finally, of the full-time students who moved on to a second semester of their freshman year, an evaluation question could possibly gauge which of these students fall into varying categories, including low-performing, at-risk or at-need based on aggregate GPA, inability to pass a gateway mathematics course and/or financial needs.

Finally, consider if first-year, full-time students return every year and graduate in the same institution as they began. Student retention now becomes the central aspect to study. Indicators may include the number of students that successfully complete a degree in their declared program, count of students who left because of various reasons (financial, academic, etc.) and returned to finish their degree, and the percentage of first-time, full-time freshman who continued on a yearly basis at a said institution until graduation. An applicable research question may ask what primary elements affect student retention efforts at tier-1 research institutions. An assessment question may survey the past decade, ascertaining how many students, separated by year, were declared full-time freshman at an institution who also received a degree from that institution. Moreover, an evaluation question might ask, when compared to other flagship

universities in the United States with similar admission standards, how that institution rates in U.S. News & World Report.

If the assessment of academic advising is indeed, as Powers states, a learner-centered model, then we must assess it using the five domains and corresponding criteria. While assessment provides a look at small structures, it does not provide information regarding the impact of individual academic advisors and academic programs; this is especially true concerning the aforementioned five domains. Therefore, in order to gauge any given effect of academic advising on retention and persistence, program evaluations must occur. Additionally, for utility purposes, an evaluative model may be created and tested to measure advisor and advising program impact on student retention and persistent efforts.

**Purpose of the Study**

Three aspects of advising are true: (1) Assessment already exists within academic advising, (2) assessment and the term "evaluation" are interchanged, and (3) academic advising only uses assessment to measure any aspect within the field. In an academic area that is still relatively young, an introduction and utilization of methods that can measure impact will help to measure the effects or impact of advising.

The primary purpose of this study is to gauge the level of evaluative knowledge within the academic advising community. A secondary purpose is to construct an evaluative model with the intent to find a measure of correlation between advising practices, student retention, and persistence. Providing this information can allow academic advising departments or variations thereof to offer indirect proof of their impact on student success. The overall intent is to show

that the need for evaluating academic advisors and academic advising programs is pertinent to the growth and sustainability of the field.

**Research Questions**

The research questions addressed by this study are:

1. What is the extent of knowledge of program evaluation[1] within the academic advising field?
2. What aspects of impact on student growth and development can be measured through the evaluation of academic advisors and academic advising programs?
3. What evaluative model can be created to gauge the impact and effect of academic advising on student progression, persistence, and retention using the five domains of the Learner-Centered Psychological Principles?

**Definition of Terms**

1. Assessment: the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving learning and development (Palomba & Banta, 1994, p. 4).
2. Attrition: the loss of a student either by a lack of retention or persistence.

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[1] Includes definitional knowledge as well as an understanding of the evaluative process and methods used.

3. Completion/Graduation: the outcome of how many students within a cohort complete and/or graduate from an institution (Levitz & Saluri, 1985).
4. Developmental advising: a form of advising with a "systematic process based on a close student-advisor relationship intended to aid students in achieving educational, career and personal goals through the utilization of the full range of community resources" (Winston, Grites, Miller & Ender, 1984, p. 19) with the following knowledge base: (1) applying student development theory, (2) focusing incrementally on student and student needs, (3) challenging students to achieve learning objectives and to take academic risks, (4) treating students as academic partners to enable intellectual and personal growth, (5) helping students gauge self-importance and self-worth, and (6) setting and monitoring short- and long-term goals (Kramer, 1999).
5. Evaluation: the act or process of determining the merit (quality), worth (value), or significance (importance) of something or the product of that process (Davidson, 2004; Scriven, 1991).
6. Persistence: the enrollment headcount of any cohort compared to its headcount on its initial official census date. The goal is to measure the number of students who persist term to term and to completion (Levitz & Saluri, 1985).
7. Progression: The act of satisfying requirements for dependent classes (Levitz & Saluri, 1985).
8. Prescriptive advising: a form of advising where the advisor instructs the student to undertake action(s) by providing a list of rules and requirements. From this, a student is

given the responsibility to follow the list in order to meet his or her objectives. Learning may occur, but is not an intended output (Lowenstein, 2005).

9. Proactive advising: the creation and building of structures that incorporate intervention methodologies, delegating advising contacts for students who otherwise might not seek advising (Glennen, 1975).
10. Retention: the outcome of how many students remained enrolled from fall to fall. This number is typically derived from first-time, full-time traditional day students, but can be applied to any defined cohort (Levitz & Saluri, 1985).
11. Stakeholders: individuals or department/s who have a shared interest in academic advising (Aiken-Wisniewski et al., 2010, p. 61).
12. Student Learning Outcomes: an articulation of the learning (knowledge, skills, and/or values) that students are expected to have gained from the advising process (Aiken-Wisniewski et al., 2010, p. 12).
13. Student Success: academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational objectives, and post-college performance (Kuh, Kinzie, Buckley, Bridges & Hayek, 2006).

# CHAPTER II

# LITERATURE REVIEW

A great deal of research on the effect of academic advising on student populations was performed in the later third of the 20th century. However, many of the results were conflicting and often confusing. For example, some studies reported that academic advising resulted in higher rates of persistence (e.g. Endo & Harpel, 1979; Noel, 1978; Pascarellla & Terenzindi 1977; Trent & Medsker, 1968), while others found that the practice resulted in more students dropping out (e.g. Everett, 1979) or showed no effect (e.g., Rossmann, 1967, 1968; Johansson & Rossman, 1973; Kowalski, 1977; Staman, 1980).

There have been efforts to introduce the accepted definition of evaluation (Creamer & Scott, 2000) and the concept of program evaluations (e.g. Brown & Sanstead, 1982; Winston & Sandor, 2002) within academic advising. However, a literature search found no application of these within the field. In fact, most academic advising literature and practice continues to conflict with the accepted definition and practices of the field of evaluation.

The assessment outcomes of academic advisors and academic advising programs have sometimes been conflicting, insignificant, and constricted (Powers, 2012). Research focused on academic advising's impact on student success centered on retention has been fairly positive, though there is controversy over whether the effect is direct, correlated, or indirect. For example, some studies claim a direct link (e.g. Allen & Smith, 2008; Peterson, Wagner, & Lamb, 2001; Schertzer & Schertzer, 2004; Seidman, 1991), some found a positive correlation (e.g. Metzer, 1989; King, 1993; Pascarellla & Terenzini, 2005), and others describe an indirect connection (e.g. Allen & Smith, 2008; Astin, 1993; Bean & Noel, 1980; Grosset, 1991; Habley and

McClanahan, 2004). A large-scale study of the retention patterns, advising/retention relationship, and freshman advising programs of 31 colleges yielded that advising programs improved in quality with regards to increasing capacity. To do this, institutions empower students to delineate and attain personal, academically oriented goals and enable an environment where students feel intellectually and motivationally proficient and deserving of success. This results in a substantial increase in student retention (Barr, 1983).

It is worth noting that not all studies have yielded a positive correlation between academic advising and student retention. For example, Metzner (1989) highlighted 16 studies that illustrated a lack of consistency among results; eight of these studies found no statistical correlation between retention and either criteria, while the other eight found a positive statistical correlation between student retention and both the number of academic advising visits and the quality of academic advising. Cabrera, Nora and Castaneda (1993) used structural equation modeling of a student attrition model to find that many factors, with academic advising being one of them, do not improve retention efforts. Grites, Gordon & Habley (2008) and Chiteng (2014) argue that a majority of studies do not use proper experimental and quasi-experimental designs since students self-select into advising resulting in selection bias. Thus, not all students receive representation. In fact, it is possible that only high-achieving and low-achieving students receive advising, meaning that a majority of a student body is unrepresented in studies. Though one could surmise that a measure of proportion of the student body who receives advising may be an assessment or evaluation measure, undergraduate academic advising departments tend to target those students who are undecided or pre-professional

Recently, student satisfaction has become the primary measure of academic advising (e.g

Henkel, 2000; McFarlane, 2013 Weston, 1994). In a study of 595,641 students from 728 four-year public colleges and universities, students rated their satisfaction with academic advising to be a priority in their student success (Noel-Levitz, 2014). While Cuseo (2003) makes the argument that there is a great deal of correlational evidence to suggest satisfaction with academic advising relates to student retention, Pietras (2010) uses hierarchical OLS regression and binary regression techniques to show that satisfaction with advising may not be a proper indicator of student retention after all. Additionally, aside from single institution studies, advising is found to have some of the lowest ratings in satisfaction (e.g. Allen & Smith, 2008; Allen, Smith, & Muehleck, 2012; Astin, 1993; Keup & Stolzenberg, 2004; Low, 2000; Lyons, 1991; Nordquist, 1993). Some studies have abandoned student satisfaction as a measure of studying the impact of academic advising. For example, Young-Jones, Burt, Dixon and Hawthorn (1993) found that advisor accountability, advisor empowerment, student responsibility, student self-efficacy, student study skills, and perceived support significantly showed a relation between academic advising and retention.

**Model Oriented Approach**

Academic advising is very much a model driven field (Habley, 1983, 2004; Habley & Morales, 2008; King, 2003; Kuhn, 2008a). There are seven prevailing models grouped into three main categories (Habley, 1997, 2004): centralized, decentralized, and shared structures. Centralized advising is characterized as self-contained, meaning that all advising, regardless of student status, is performed in a central unit. The focus on decentralized advising is on whether students receive faculty-only or satellite advising. Faculty-only advising is defined as students

who are advised solely by faculty, whereas satellite advising occurs within each unit, school, department, division, college, etc. that employs its own type of advising. Shared structures advising can be delineated into four subcategories: Split, Supplementary, Dual, and Total Intake. The Split Model implies a central advising office that advises a select, specified population with all other students assigned to units, schools, departments, divisions, colleges, etc. The Supplementary Model defines an advising group or unit that provides academic advising to students where all transactions and processes receive authorization from a specified faculty advisor. The Dual Model illustrates that a specified faculty advisor advises a student with respect to a major, while other general requirements and processes are addressed by an advising group or unit. Finally, the Total Intake Model depicts how advising occurs by a set of defined staff until students reach a specific institution or program defined benchmark. At that time, faculty advisors within each unit, school, department, division, college, etc. assume the responsibility of advising students.

Hably (2004) and Pardee (2004) found that the Split Model has become the most prevalent across all public institutions within the United States. Unfortunately, no substantiation has been found for the evaluation of the validity or effectiveness of any of the models. Academic advisors often receive training in these models, while also receiving instruction that effective advising is not a closed system (Pardee, 2008). Therefore, a model based evaluative approach is most likely to be accepted within the academic advising community, resulting in a greater likelihood of acceptance and utility of the study model and corresponding results within the academic advising community.

Similar to many academic fields such as engineering and mathematics, academic advising is roughly composed of two components: an application aspect and a theoretical and research-based component. The former has a history of practice that has been handed down and retaught through generations and across the world (Cook, 1999; Kuhn, 2008a), while the latter is in its infantile stages (Kuhn, 2008b). Even though the concept of program evaluations has been introduced to the academic advising community (Brown, 1978; Brown & Sanstead, 1982), it was found that over 75 percent of all advising programs existed without plans for program evaluations and 50 percent did not perform personnel evaluations of academic advisors.

The field of advising is primarily constructed of and derived from practice. Thus, the impact of academic advising is inherently dependent on the practice of academic advisors. An implication of this is that a creation of evaluative criteria can be found by unpacking the necessary components of advising practices. As advising is grounded in education, using established pedagogical and content oriented frameworks is a viable avenue to establish the necessary and sufficient evaluative criteria.

Habley (1986; 2005) outlined three major content components for effective advisor training: conceptual, informational, and relational. Conceptual training is defined as the need for understanding to provide the proper delivery of services. Informational training is the knowledge and materials needed for effective advising. Finally, relational training is viewed as the interpersonal and intrapersonal skills necessary to have quality advisor/advisee relationships. This list of categories was further expanded on to include a personal content area in which to acquire knowledge, as well as an understanding of an advisor's own capacity and abilities related to the stresses of the practice. The list was also constructed to define the challenges of the

position including technological content areas. The challenges included recognizing, accepting, and understanding that the knowledge and the utility of technology are highly correlated with effective advising (McClellan, 2007). The former area is manufactured through personal analysis and self-assessments, while the latter is formed through the training of the usage and process of technologies used within the advising framework. This consideration of knowledge and development concerning the utilization of technology, such as email, learning management systems, degree progress reports, and student predicative analysis software, is especially pertinent in regards to student contact and progress.

These five components: conceptual, informational, relational, personal, and technological, sit within the field of academic advising. They are comprised of curriculum, pedagogy and student learning outcomes, all of which are continually shifting and changing (National: The Global Community for Academic Advising, 2006).

The curriculum of advising is derived from theories in social science, humanities, and education, and is related to items important to advising including an institution's mission and goals, the availability and offerings of schools, programs, courses and development, methods of developing cognitive abilities and logical thinking for making correct beneficial choices, and knowledge acquisition student resources policies and procedures. Using three principles, Hemwall and Trache (2005) described what students should learn through the curriculum of advising (p. 76). Academic advising should facilitate student learning about the mission of the college, of both lower- and higher-order thinking skills, and about the means of achieving the goals imbedded in the institution's mission statement and closely related documents.

The pedagogy of advising includes the knowledge, dissemination, documentation, and understanding of effective and impact-laden academic advising through teaching and learning. Hemwall and Trache (2005) describe seven principles associated with the idea of pedagogy. Academic advisors should view students as actively constructing their understanding of the mission of the institution, including concepts such as becoming responsible citizens, liberally educated persons, and critical thinkers. They should also incorporate knowledge about how the individual student learns. Furthermore, they should consider how the social context affects the learner's understanding of the meaning of education, as well as recognize that the possibilities for learning are influenced by the advisees' prior knowledge. Additionally, a dialogue in which the learner has the opportunity to express, justify, and discuss individual goals and ideas, and where the academic advisor guides the learner is required. Finally, academic advising must guide students so that they recognize and benefit from anomalies, disturbances, errors, and contradictions.

The student learning outcomes of academic advising describe what a student must show, gain, and value within the framework of advising. These student learning outcomes are derived from an academic institution's goals, objectives, and curriculum. Since institutions are all different, each must develop its own outcomes. Generally, outcomes imply that students will exhibit six practices. The first practice is the ability to construct a coherent educational plan based on the assessment of abilities, aspirations, interests, and values. Students should also be able to use complex information from various sources to set goals, reach decisions, and achieve those goals. Additionally, they must assume responsibility for meeting academic program requirements, as well as articulate the meaning of higher education and the intent of the

institution's curriculum. Finally, students should cultivate intellectual habits that lead to a lifetime of learning while behaving as citizens who engage in the wider world around them.

The components themselves are fairly generalized, resulting in a broad framework that allows for a great degree of flexibility when finding similar established model or models within the meta-field of education from which conclusions can be drawn. Thus, theoretical models are suggested to parallel the academic advising components listed prior: Technological Pedagogical Content Knowledge (TPACK; Mishra & Koehler, 2006) and a derivation of the domain map for mathematical knowledge for teaching (Hill, Ball & Schilling, 2008).

**TPACK and the Academic Advisor**

Academic advising has been described as the "cornerstone of student retention" (Crockett, 1978). Academic advising is defined by the following characteristics:

> …a series of intentional interactions with a curriculum, a pedagogy, and a set of student learning outcomes. Academic advising synthesizes and contextualizes students' educational experiences within the frameworks of their aspirations, abilities and lives to extend learning beyond campus boundaries and timeframes. (NACADA, 2006)

However, the work of a university academic advisor is typically viewed as prescriptive. In this, academic advisors are often mistaken as providing students an itemized, predefined path toward graduation.

Academic advisors often have to use knowledge necessary for effective pedagogical practice in tandem with technology to engage student involvement and enhance the learning

process and environment. While technology varies from institution to institution, advisors are typically able to see both the previous advising history of an enrolled student and the entire pre-collegiate and collegiate academic history of a student in order to guide them through a process of academic fulfillment (Pasquini, 2011). The term fulfillment can be defined by many means including, but not limited to graduation attainment, academic withdrawal, career life choices, and major exploration. In fact, many advisors use predictive analytics software to anticipate a student's success within a class, department, or program.

Since academic advising is considered a form of teaching, it tends to use the construct of Technological Pedagogical Content Knowledge. This multifaceted framework provides a list of knowledge attributes that lie between three primary forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK).

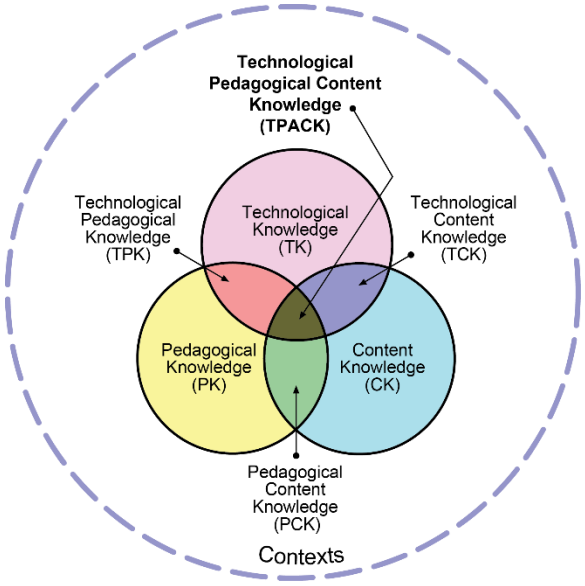


*Figure 1.* TPACK model (Koehler, 2012)

**Content Knowledge (CK)**. A basic requirement of advisor competency is the knowledge of all academic disciplines, institutional policies, degree plan options and implementations, course content, transferability, and degree planning and progress (Fox, 2008, p. 349).

**Pedagogical Knowledge (PK)**. Substantive discourse has delineated the act and structure of advising into different roles with a foundation in prescriptive advising, developmental advising (Habley, 1983; 2004), and proactive advising (Glennen, 1975). When discussing the practice of teaching within academic advising, Hemwall and Trache (2005) describe the pedagogical implications of student learning within academic advising by assisting students in meeting learning goals, encouraging them to be active learners, and by constructing knowledge. Lowenstein agreed with this description and furthered it by implying that advisors have an inherent investment in a student's entire curriculum, much as a teacher has investment in the content of a single course (2000; 2005).

A proficient and impactful advisor plays a part in a student's entire curriculum that parallels the role that a proficient and impactful teacher has with content delivery and transference with a class or course. Within this, the student cultivates the ability to understand and develop the logic and progression of his or her curriculum using help from the advisor. Therefore, the advisor's knowledge of teaching and of the curriculum enables the advisor's work to translate from a secondary role to a primary one in enriching a student's education.

**Technological Knowledge (TK**). The 2011 NACADA National Survey (Academic Advising Association, 2012) reported that the academic advising community integrated technology into its environment, requiring knowledge of learning and communication systems ranging from email/messaging to learning management systems to social networking. The survey

also found that students used multiple methods to stay in communication with academic advisors and advising departments including e-mail (99 percent), course management software (33 percent), social networking/advising websites (32 percent), and advising websites/portals (27 percent). The results from the survey follows a study from the Pew Research Center (Smith, Rainie, & Zickuhr, 2011) that found that approximately 94 percent of undergraduate, graduate, and community college students use the Internet. The study also found that 80 percent of those students were active on social networks.

**Technological Pedagogical Knowledge (TPK)**. University access to its student base has typically been through email, but the greatest challenge to advisors is communication and access. Within technological usage, communication between pre-college and university level students has shifted. A study (Lenhart, 2012) found that while a majority of students text each other every day, only 29 percent use messaging services through social networking sites. Furthermore, only six percent of students exchange emails daily. While email communication was higher than the Lenhart study, the 2011 NACADA National Survey (Academic Advising Association, 2012) found that full-time professional advisors are only able to communicate with 11 percent of their advisees via text messages and eight percent using instant messaging.

**Technological Content Knowledge (TCK)**. Much as learning management systems help with administration, documentation, student tracking and reporting, and distribution of educational technology with respect to the classroom experience in a student's life, student success systems have been implemented to find early warning and alerts of student regression and to generate predictions of student success within the academic environment.

**Pedagogical Content Knowledge (PCK)**. PCK is defined as content knowledge that is intertwined with the teaching process (Shulman, 1986). The benefit of such a blending is that specific aspects of content can be separated, organized, and packaged for instruction. This occurs when a teacher is able to identify and interpret particulars in content and enable differing methods of representing the information to make it accessible to a wide range of students or consumers. Within academic advising, advisors must inherently understand multiple approaches and adapt them to their own student population and contexts (e.g. Drake, Jordan & Miller, 2013).

## The Egg

Hill, Ball, and Schilling (2008) suggested that the Schulman' original formulation of PCK had not been expanded upon in two ways: what educators knew in the domain and how student gains are related to the domain. Hill and her colleagues proposed the "Egg" (Figure 1.2) to explain the two criteria listed prior.

In a similar sense with respect to academic advising, we wish to ask what advisors know in PCK and how are students impacted by PCK. In this case, PCK is denoted with respect to the domain of academic advising.

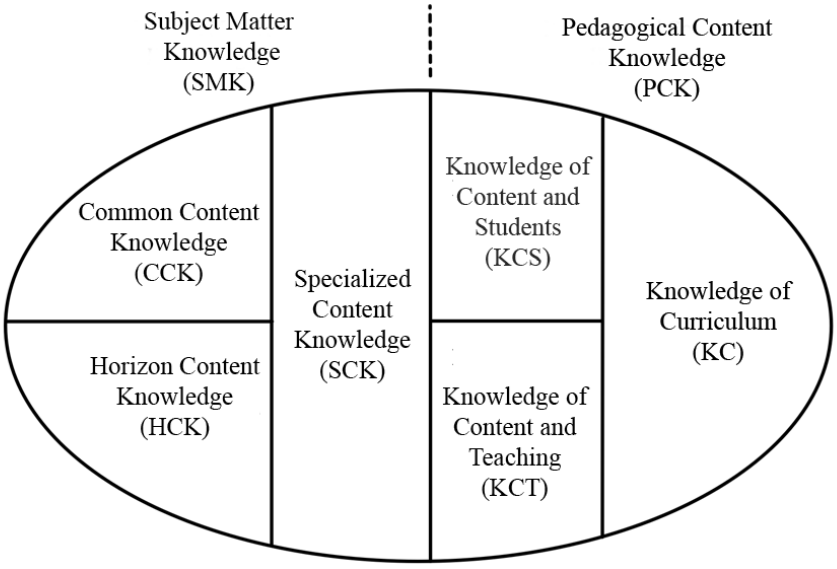


*Figure 2.* Derivation of Mathematical Knowledge for Teaching (Ball, Thames & Phelps 2008)

**Evaluative Model**

Since every individual subset of the The Egg applies to the student experience with an academic advisor, each directly or indirectly lends itself to student progression, retention, or persistence. Thus, we can use the construct of TPACK to evaluate the impact and effectiveness of academic advising using the following general criteria:

- Content Knowledge (CK): Amount of information about courses, course structures, school requirements and institution requirements that an advisor holds.
- Pedagogical Knowledge (PK): Ability to transfer university curriculum knowledge to a student.
- Technological Knowledge (TK): Skill need to use technology or technological components within and outside of advising sessions.

- Technological Pedagogical Knowledge (TPK): Using an approach to transfer knowledge while using technology to enhance the advising process typically for decision-making purposes.
- Technological Content Knowledge (TCK): Employing predicative techniques using technology and an advisor's knowledge of all institutional goals and requirements to create student assessments and evaluative claims.
- Pedagogical Content Knowledge (PCK): Basic information of what is needed for an advisor to communicate and institutional goals and mission to a student using instructional techniques:
    - Knowledge of Content and Students: Understanding the degree of content knowledge a student needs to fulfill graduation requirements.
    - Knowledge of Content and Teaching: Implementing an environment of traditional instruction and inquiry-based learning from which a student can simultaneously learn from the advising process and become an autonomous learner.
    - Knowledge of Curriculum: Partitioning what academic and non-academic resources of an institution can best benefit a student's needs for success.

From the above, it is theorized that advisors who use all aspects of Technological Pedagogical Content Knowledge (TPACK) simultaneously will produce the greatest impact on student progression, persistence and retention. Additionally, these factors will increase the likelihood of student completion in an intended program.

# CHAPTER III

# METHODS

Though literature defines the impact of academic advising mostly on student satisfaction, this research adds to the current body of literature by introducing an alternative method to evaluate effect. This study seeks to answer the question: Can an evaluative model be constructed to measure the impact of academic advising on student persistence, progression, and retention?

This chapter provides details on the design implemented to address the aforementioned research question, offering a description of the design with sampling, measures, and covariates, as well as a description of the need for matching and ethical concerns.

## Research Questions

The research questions addressed by this study were:

1. What is the extent of knowledge of program evaluation within the academic advising field?
2. What aspects of impact on student growth and development can be measured through the evaluation of academic advisors and academic advising programs?
3. What evaluative model can be created to gauge the impact and effect of academic advising on student progression, persistence and retention using the five domains of the Learner-Centered Psychological Principles?

**Design**

The study incorporated three differing designs based on the purpose of each research question.

Table 1: *Study Designs*

| No. | Purpose | Design | Sampling Frame |
|---|---|---|---|
| 1 | To gauge an indication of the extent of knowledge of program evaluation within the academic advising field. | Survey | S1 |
| 2 | To find indicators of advisor impact on student growth and development with regards to progression, persistence, and retention. | Quasi-Experimental | S2 |
| 3 | To construct a tool for measuring advisor impact on student progression, persistence, and retention. | Delphi | S1 |

*Study 1: Descriptive Design*

The primary focus of this study is to gain an indication of academic advisor's understanding of the differences and similarities between assessment, evaluation, and research.

In itself, the study does not claim to have overarching findings. However, this indication was necessary to ensure a suitable baseline existed when constructing the model.

### *Population*

The entire staff and faculty ($n$ = 2731) of a Midwestern flagship university were considered to be within the population, primarily because academic advising may not have been a primary role of some advisors. For example, support counselors at this university not only provide advising, but counseling services focusing on student progress and hindrances as well.

### *Sample*

The overall population of advisors at the university was considered for this study. All advisors were a member of a university organization and a list of all advisors was obtained from that organization. The response set was $m$ = 140 (5%). However, it is important to note that no faculty advisors were included in this population as they were not considered academic advisors as defined by the university.

### *Procedure*

A survey of 11 questions (See Appendix C) was produced and administered to the sampling frame via the university's internal email network. The design of the survey was a mixture of closed- and open-ended questions focused on advisor comprehension of evaluation, assessment, and research. Potential participants were notified of the cost and benefits of contributing. All responses from closed-ended questions were analyzed using descriptive

statistics. Responses from open-ended questions were analyzed by finding themes derived from coding. Furthermore, results from both were used to find commonalities of advisors' understanding of program evaluation terms and utilization of techniques.

*Study 2: Quasi-Experimental Design*

The study incorporating the quasi-experimental design integrated a correlational research design (Prettest Posttest Only Design with Non-Equivalent Control Groups**)** to determine if an aggregate number of students who received academic advising were retained over those who did not. Additionally, a secondary purpose of this quantitative design was to add research-based methodology to the body of work in academic advising and its impact on student persistence, progression, and retention.

To ensure comparisons of similarly matched students, the established criteria of gender, ethnicity, residency status, and earned student level were used in propensity score matching. Students were only identified as male or female as per established criteria set by the Midwestern university. Additionally, students were also matched by established groups of ethnicities delineated by American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, Multiethnic, Nonspecific, Native Hawaiian or Other Pacific Islander, White. Furthermore, students were only identified as in-state or out-of-state since this classification is used in demographic information and financial concerns. Lastly, of all students considered for the study, only those who were considered to be first-time, full-time freshman were matched. The primary reason for such a narrowing of data was that any treatment variable such as

academic advising primarily focuses on these students as they represent a group with the greatest attrition when compared to all other academic levels.

### *Population*

A primary population of $n$ = 190,490 students were drawn from twentieth day census data from the university's data warehouse using Tableau ©. This group consisted of all students eligible for academic advising at the undergraduate level between the academic years of 2012 to 2015. The data was limited by fall and spring semesters between the academic years of 2012 to 2015. Additionally, the population size was large since students who repeated by term were considered separate data points; this population would eventually inform a control group.

A subgroup of $m$ = 27,044 students was drawn from a kiosk system administered within the Midwestern university's undergraduate advising center. Students who were seen by advisors were required to log in to the kiosk with their university ID number. The data was again limited by fall and spring semesters between the academic years of 2012 to 2015. A constricted subset of this population would eventually form an experimental group. This amount was then subtracted from the primary population yielding a new subgroup of $n$ - $m$ = 163, 466 students to perform matching.

### *Sample*

In this particular case, the sample was equal to the population. Students were first given binary codes if they had received academic advising. Additionally, binary codes were also given

to the students who were retained. Then, students were narrowed by freshman, sophomore, or junior status, or only by first-time, full-time freshman status in Tableau ©.

### *Procedure*

The study employed an untreated control group design with dependent pre-test and post-test samples. Criteria for this study was first-time, full-time enrolled freshman. Qualified students were non-randomly assigned to the experimental and control groups based on advising attendance. The intended method of analysis was then to find effect sizes of the advising treatment using Cohens Eta Squared.

## *Study 3: Delphi Design*

This study is the result of a need for expert opinion. Since the researcher was not an academic advisor and there was need for a resultants model to implemented, it was imperative that academic advising experts and their structured opinions be included. A Delphi study satisfied this requirement.

This type of study is a widely used method for gathering data from respondents within their domain of expertise. It uses group communication that employs a convergence, consensus, or integration of opinions on a topic using questionnaires. Within this structure, there are multiple iterations allowing participants to reassess and refine a product. Typically, most Delphi studies will use three to four iterations. Using the Delphi Study framework design proposed by Hsu and Stanford (2007), the study incorporated four iterations. The following is a brief explanation of how each iteration was performed:

- Iteration 1: Open-ended and/or structured questionnaire exploring the components of advising and evaluation. In this, panelists described what areas of advising they believe needed evaluation.
- Iteration 2: Panelists were asked to review a summary of items from the first iteration. They also ranked and weighted them in order of importance.
- Iteration 3: Panelists were provided an opportunity to make clarifications of both the information and their decisions of the relative importance of the items.
- Iteration 4: In the fourth and often final round, the list of remaining items, their ranking/ratings, minority opinions, and items achieving convergence, consensus, or integration were distributed to the panelists for final refinements.

Experts included a director of an undergraduate advising unit, a pre-medical advisor, a general advisor whose focus was on student communication, a general advisor who performed research on retention, an administrative assistant who had more than 40 years of experience within advising, and a graduate student advisor.

While the administrative assistant was not an academic advisor, the individual was in charge of assigning students to advisors on a weekly basis using multiple criteria including, but not limited to, status, student ability as found by the university, conditionally admitted students, pre-professional students, student earned level and student GPA. The opinions of this person, along with longitudinal experience, were necessary in ensuring that any resultant tool would be considered useful. Barring this participant, other individuals in the sample had a typical load of 500-600 assigned students per semester. A suitable study was found by utilizing the Delphi technique construct developed by Hsu and Sanford (2007).

### *Population*

The overall population of advisors at the Midwestern university was considered for the Delphi study. By design, all participants were needed to complete the study in order to minimize bias. Additionally, the validity of the study was greater than if attrition was a factor.

### *Sample*

Sampling frame S1 was drawn from within a Midwestern flagship university's advising network. A purposeful sample ($m = 6$) was extracted from the frame to create a panel of experts to contribute to a Delphi study. Experts were determined by position within the hierarchy of the university, his or her publications focused in academic advising, the average advisor load, availability, and a study of student feedback.

### *Procedure*

All participants were provided a Delphi Study information sheet prior to beginning the questionnaire (See Appendix M). The Delphi study was completed in four iterations via SurveyMonkey ©. The construct for the first iteration of process were derived from a needs assessment given to the entire advising unit staff ($n = 24$; see Appendix J) as well as outcomes from the first two studies. In the first round, an open-ended questionnaire was administered, asking participants to provide their thoughts and opinions on which aspects of academic advising should/should not and could/could not be evaluated. The second round requested that contributors rank-order fifty themes derived from the previous iteration in order of priority of

evaluation. After the items were quantitatively examined by the percentage of agreement ratings, the third round asked partakers to specify reasons any of their choices were outside the agreement. A summary of all items was specified in a survey in the fourth round to provide an opportunity for panelists to revise their responses.

# CHAPTER IV

# ANALYSIS, RESULTS, AND SYNTHESIS

Outcomes from the descriptive study provided a reference point in regards to advisor knowledge of evaluation. Additionally, results from the second study provided indicators of advisor impact on student persistence, progression, and eventual retention. Finally, the Delphi Study assessed variables of advising deemed important and essential when viewed in the context of evaluation. The results from all three studies were then used to construct an evaluative model of advising. A timeline of events that informed one another is listed:

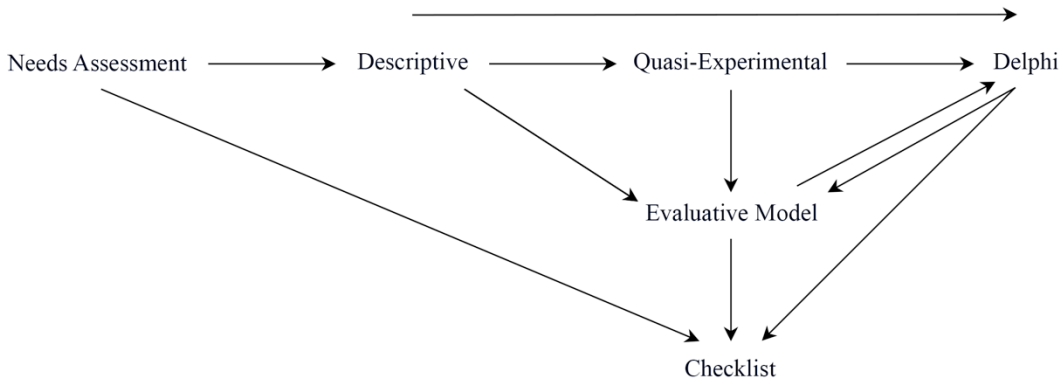


*Figure 3.* Flow Chart of Research Events

**Research Question 1: What is the extent of knowledge of program evaluation within the academic advising field?**

As previously stated, the purpose of this question was to gauge the extent of knowledge of program evaluation within the academic advising field. The study design was descriptive.

*Analysis*

Of the population, 55 individuals (approximately 40%) completed the survey. Since only descriptive statistics were used and the survey had the intended purpose of providing a baseline by which to measure standards, the analyses tool within SurveyMonkey © was used. While multiple roles were available for selection, respondents were evenly distributed amongst undergraduate professional (65%), pre-professional (60%), and open access (40%), or a combination thereof. Advisors tended to use prescriptive advising the most in their practice (30%), followed by developmental advising (24%), and intrusive advising (17%). This distribution aligns with the degree of difficulty that these differing advising practices require. For example, intrusive advising requires advisors to proactively seek out students prior to their need for advising. Intrusive advising entails a great deal of time on the part of the advisor, consequently making it the least performed type of advising. Alternatively, prescriptive advising requires the least amount of time and can be replicated for similar types of students, such as many of those who are in a pre-professional program, as it requires that an advisor have a plan for success already defined.

An overwhelming majority of respondents (75%) denoted that assessment and evaluation were similar terms. While both practices have similar and overlapping components, follow up questions that asked advisors to signify a best method in a given data collection or impact latent situation provided indicators that advisors interchanged assessment and evaluation consistently. A qualitative analysis using NVivo 10 © found that assessment and evaluation were used interchangeably to describe similar definitions or to explain similar circumstances, while

research was used in defining both assessment and evaluation. The frequency of terms can be measured by the size of the words given in a word cloud using the software package Wordle ©.


*Figure 4.* Word Cloud Displaying the Importance by Size and Delineation of Assessment, Evaluation and Research.

A separate analysis was performed with the removal of the key terms "assessment," "evaluation," and "research." The terms were omitted to display wording that described the three terms, providing an indicator that all three methods were viewed as data-driven and could be used in practice yielding needed information.


*Figure 5:* Word Cloud Displaying the Importance by Size and Negation of Terms Assessment, Evaluation, and Research.

Results from both word clouds provided a basis for survey questions administered in the Delphi Study. Additionally, the results of the latter word cloud were used in providing foundational themes for a checklist (see **Evaluative Academic Advising Checklist**).

*Outcome*

The descriptive study overwhelmingly indicated a lack of understanding when differentiating between evaluation and assessment (see Appendix K). A strong indicator that academic advisors interchange the terms "assessment" and "evaluation" to primarily describe the former term exists. Additionally, academic advisors had a great deal of difficulty separating the criteria that indicate "research" and those that indicate "evaluation." Moreover, 40 percent of the sample assumed that percentages were a measure of impact. After the study was completed, participants were provided descriptions that delineated "evaluation," "assessment," and "research" influenced by Mathison (2007).

**Research Question 2: What aspects of impact on student growth and development can be measured through the evaluation of academic advisors and academic advising programs?**

While not all aspect of academic advising can be measured or are even known, the purpose of this study is to find indicators of the impact of advising upon progression, persistence, and retention using a quantitative design. A list of possible indicators was derived from the second iteration of the Delphi study (see Appendix H), consisting of what advisors considered to be important criteria that affected student progress through their collegiate experience, which would eventually lead to graduation, hopefully in their intended field of study.

*Analysis*

Using the package Matching and MatchIt in R (see Appendix I), students were matched on four differing variables including gender, ethnicity, residency status, and earned student level. First, the data were matched using the nearest neighbor algorithm to ensure that any treated unit, or student, was closest with regards to distance measure; this ensured that each unit receiving treatment was matched with one unit in the control group and those without similar scores were discarded.

A general linear model was then used to estimate the propensity scores using logistic regression. Effect sizes with ANOVA were performed on the semester data sets to gauge impact when comparing advising and progression using the package granovaGG.

Table 2: *Effect Sizes by Term*

| Transition | Aggregate (F/S/J)* | $\eta^2$ | FTFT** | $\eta^2$ |
|---|---|---|---|---|
| Fall 2012 to Spring 2013 | 0.042 | Small effect | 0.042 | Small effect |
| Spring 2013 to Fall 2013 | 0.036 | Small effect | 0.137 | Medium effect |
| Fall 2013 to Spring 2014 | 0.052 | Small effect | 0.120 | Medium effect |
| Spring 2014 to Fall 2014 | 0.000 | No effect | 0.010 | No effect |
| Fall 2014 to Spring 2015 | 0.076 | Small effect | 0.104 | Medium effect |

*F/S/J – Freshman/Sophomore/Junior Status
**First Time Full Time Freshman

While outcomes from this study were not directly used, it provided support for advisor impact on progression and thus answered the research question. This was a fundamental

indicator that evaluative criteria should be created in order to measure and interpret advisor and program effects. Therefore, there existed a need for an evaluative model.

*Outcome*

While mitigating factors influence progression, it is clear that academic advising influences retention. This influence is especially prevalent when focusing on first-time, full-time freshman. Additionally, as shown in tables 1, 4, 7 and 10 in Appendix F, first-time, full-time international students were affected as well. Barring a great influence on students who identified themselves as Pacific Islander in spring 2013, the tables (Appendix F) indicated no influence of academic advising by race. Tables 4 and 10 specified some influence earlier on in-state and out-of-state students. A subgroup analysis of the aggregate data found that Caucasian students were influenced the most by advising while there was no impact on the progression of Native American students. Results indicated that female students were impacted more than males, especially those in the pre-professional fields such as Pre-Law, Pre-Medicine, Pre-Health Professions, Pre-Business and Pre-Engineering.

In sum, outcomes suggest that academic advising has an effect on student progression. In particular, the advising center had a greater effect in retaining first-time, full-time freshman students for progression than students in a grouping of freshman, sophomore, and junior-earned levels. Possibly due to chance, advising for transitions between spring and fall terms display negative effects for F/S/J and null effects for FTFT. Along with other mitigating variables, such as abilities of students and attrition of students after completion of the first year, this result may have occurred as summer sessions were not delineated as a covariate.

Table 3: *Effect Sizes of Academic Advising on Student Progression by Term*

| Transition | Aggregate (F/S/J*) | $\eta^2$*** | FTFT** | $\eta^2$*** |
|---|---|---|---|---|
| Fall 2012 to Spring 2013 | 0.042 | Small effect | 0.042 | Small effect |
| Spring 2013 to Fall 2013 | 0.036 | Small effect | 0.137 | Medium effect |
| Fall 2013 to Spring 2014 | 0.052 | Small effect | 0.120 | Medium effect |
| Spring 2014 to Fall 2014 | 0.000^ | No effect | 0.010^ | No effect |
| Fall 2014 to Spring 2015 | 0.076 | Small effect | 0.104 | Medium effect |
| Spring 2015 to Fall 2015 | 0.000 | No effect | 0.003^ | No effect |

*F/S/J – freshman, sophomore, junior status
**FTFT – first time full time freshman
***$\eta^2$ was the measure of effect size for ANOVA using scale (Cohen): 0.02 ~ small effect, 0.13 ~ medium effect, 0.26 ~ large effect
^ $p$-value insignificant

**Research Question 3: What evaluative model can be created to gauge the impact and effect of academic advising on student progression, persistence and retention using the five domains of the Learner-Centered Psychological Principles?**

This study used experts in the field with differing expertise, experiences, and academic backgrounds. The diversity provided multiple viewpoints both within and outside of the academic advising unit. Though the variety of opinions was great, all advisors agreed on many criteria that they believe needed to be evaluated to measure impact on student progression, persistence, and retention.

Results from both studies informed the construction of the Delphi study. The descriptive study provided a list of descriptive words that influenced what questions were asked in this study. For example, as "data" was a largely used terminology, questions in the first and second iteration were oriented towards the collection of what advisors considered data points (see Appendix G).

*Response Sets*

The Delphi study consisted of four iterations. Responses from each question were compiled prior to moving onto the next iteration. Each iteration narrowed response sets leaving only items that were agreed upon.

*Iteration 1: Areas of academic advising could be/should be evaluated.* Responses from four open-ended questions were collected. First, the importance of differing terms from the responses derived from each question of the compiled data were displayed by size using the software package Wordle ©. The word cloud provided an indication that participants believed that students, advising, and advisors could and should be evaluated. The primary reason for this was to ensure that what advisors deemed important would ultimately be used in an advising checklist.

*Analysis*

Using data from this study, statements were qualitatively examined from the first iteration using NVivo 10 ©. Qualitative data was analyzed in NVivo 10 © via a higher-level tree-node format and common themes were found by constructing a tag cloud in the software package Wordle. Similar codes were combined to create these that informed the second iteration. The third iteration data was quantitatively examined by the percentage of agreement ratings using Fleiss' kappa (Average: $\kappa = 0.62, p = 0.03$) using the package irr in R indicating moderate agreement between the six participants.


*Figure 6*. Word Cloud Response for Items That Can be Evaluated. This image is derived from response set from the first iteration of the Delphi Study.


*Figure 7*. Word Cloud Response for Items that Should be Evaluated. This image is derived from response set from the first iteration of the Delphi Study.

A majority of advisors considered the evaluations of students to be of major importance. While advisors felt both practice and self-evaluations could be evaluated, they were viewed as less important that student evaluations. An additional outcome of this iteration is that advisors did not view all aspects of academic advising as needing to be evaluated. Overall, the results indicated that the impact of academic advising was measured through a focus on student success rather than advising practices.

*Iteration 2: Ranking 50 evaluative variables in order of personal/professional importance.* Using variables calculated by frequency of usage in iteration 1 (see Appendix D), respondents ranked variables in order of evaluative preference.

*Iteration 3: Clarification, reordering and groupings.* Outcomes from the second iteration were then sent back for verification after two weeks, allowing respondents to further consider their choices and to make any changes. No panelist chose to change their preferences.

*Iteration 4: Convergence and consensus.* Variables were ranked using importance rankings (see Appendix H). Additionally, themes derived from the word cloud were provided to participants to compare and contrast with outcomes from the second iteration. Panelists were asked to use the consensus terms and the first iteration study thematic outcomes to find central groupings. These results would be used to further narrow utilizable data for model construction.

Founded on how advisors viewed the initial iteration of questioning (see Appendix G) and possibly through differing experiences and backgrounds, there was a moderate agreement between participants on what themes were most important for evaluation. Table 1 (Appendix H)

describes the initial outcome variables that were chosen by the panel. Each variable was assigned a weighted mean score calculated by multiplying the agreement and weight amongst all advisors. From that, the list needed to be reduced. The primary reasoning for this was strictly for utilization purposes. Since these variables would ultimately be used to construct an evaluation of advising checklist, the researcher decided that a reduced number of topics would be more likely to be used within advising units.

Upon inspection of the weighted means, the researcher theorized that a near normal distribution fit would be a sufficient method to display the data. Using the peak of the distribution as a cut score would reduce the number of variables based on a threshold. A Cullen and Frey graph provided a means of testing this theory.

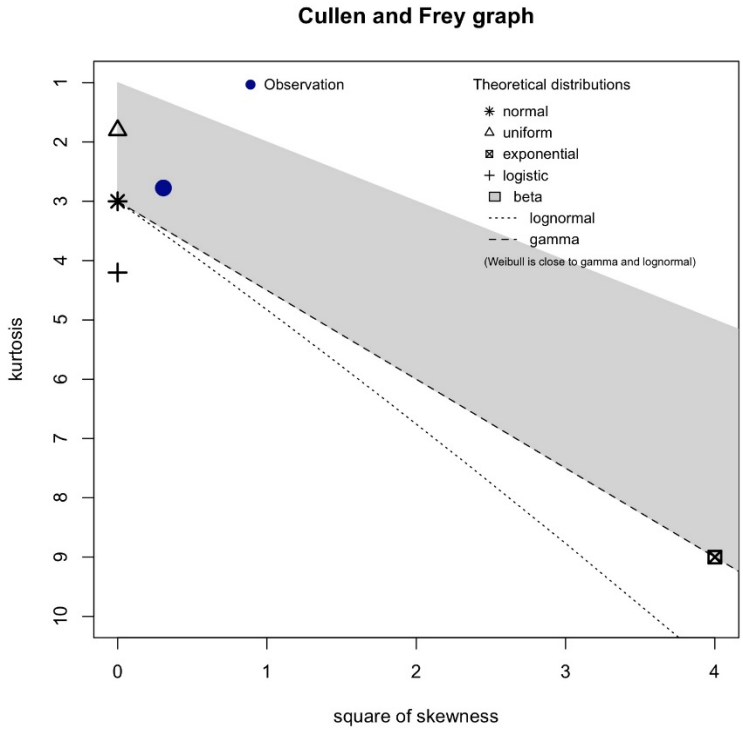


*Figure 8.* Possible for Distributions for Summary Means.

From the graph, possible distributions included Weibull, Gamma, and Normal as they were the perceived to be the closest to the observation, or the kurtosis, and squared skewness of the sample. After fitting all three models (see Appendix J), all appeared to fit the data well via the QQ-Plot. However, the Gamma appeared to be a bit better, especially when focusing on the tail ends. This was verified by calculating the AIC of all three fits where Gamma (370.1502) had a slightly lower fit value than both Weibull (372.1086) and the Norm (374.3672). Thus, the mean was used as criteria for inclusion and exclusion.

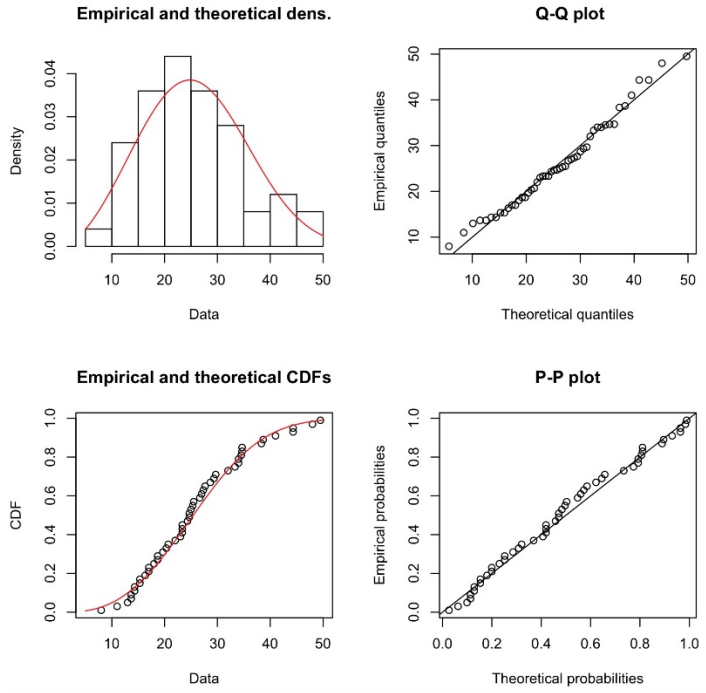


*Figure 9.* Weibull fit for Delphi Outcome Data.

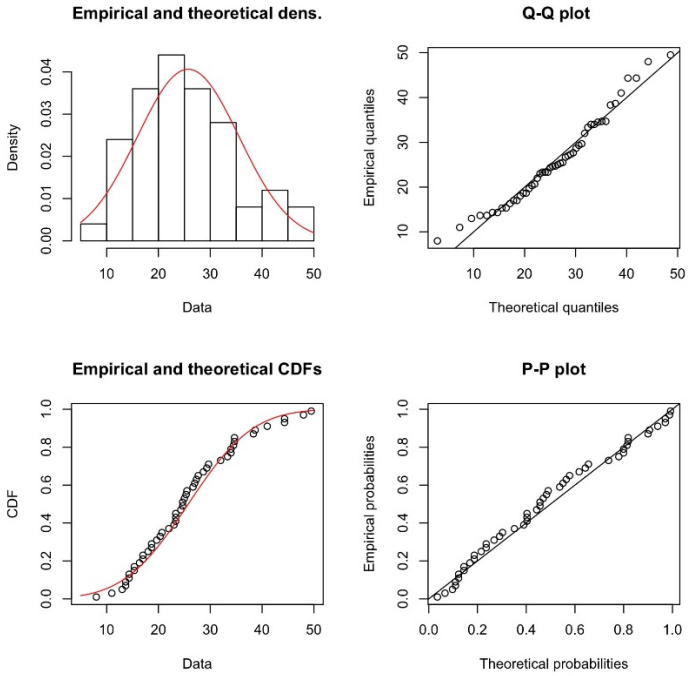


*Figure 10.* Norm fit for Delphi Outcome Data.

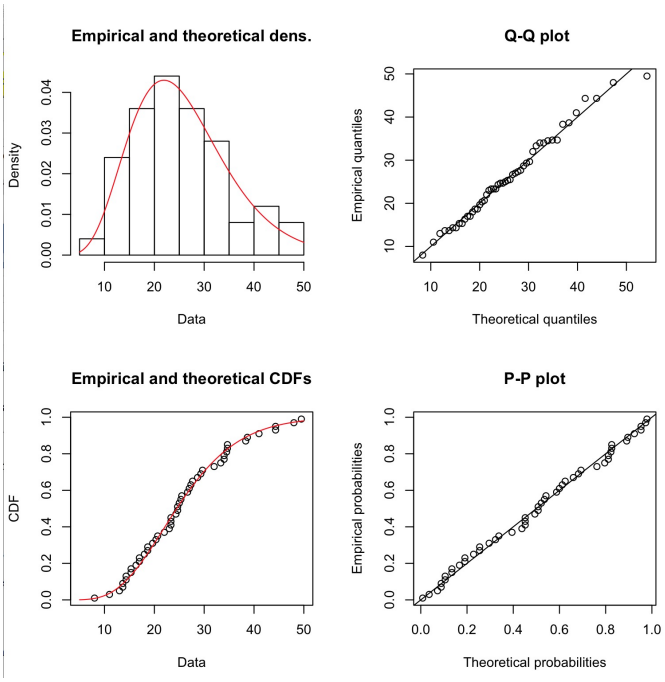


*Figure 11.* Gamma fit for Delphi Outcome Data.

The data was trimmed to reflect the top benchmark agreement average of 25.74. With this, a majority of criteria agreements were used in the construction of the evaluative model of advising and the corresponding checklist. Surprisingly, in general, the greater the weight given to an area within advising, the lower an agreement score between advisors was found.

**Model Construction**

While the primary utilization of the results from the first study were to gain an indication of advisors' understanding between assessment, evaluation, and---to some degree---research, a secondary use was to inform how the model was constructed. The outcome illustrated terms and themes that were important to advisors, hence both the Delphi Study and the model used such wording. The wording allowed the model to be understood and utilized by advisors with little need for referencing of terminology.

With the second study, the primary focus was on the impact of advising elements. Outcomes of the quasi-experimental design showed that there were effects of advising sessions based on and upon the advisor, advisee, and the methodology of the practice of advising derived from the primary themes of the first study, informing the outcomes of the model as well as a need for it as well.

In the third study, participants were able to use the themes resulted from the first study with the consensus themes in the third iteration to define groupings. Stages, criteria, and indicators listed in Table 4 display the results of this task.

**Framework and Model**

The academic advising framework for conducting evaluations of advising programs focuses on ensuring proper methodology. The framework is summarized in the figure below. The model is further described in a checklist, which may be utilized by advising departments. The initial criteria used in construction was derived from the trimming described in the previous section.

The 30 criteria that fall within the defined benchmark were first partitioned into pre-advising labor and knowledge, within advising session and post-advising. Then, within those sets, indicators further delineated each criterion.

Table 4: *Allocation of Delphi Study Survey Outcomes*

| Stage | Criteria | Indicators |
|---|---|---|
| Pre-advising labor and knowledge | Pre-Advising | Timely communication from advisors with students<br>Years of advising experience<br>Advisor training programs |
| | Historical Evidence | The accuracy of information<br>Low income students success<br>Probation students success<br>The impact of developmental courses |
| | Research Questions | Interventions on student outcomes<br>Percentage of advisees who enroll<br>The measurable amount of students advising |
| Within advising session | Meeting Interactions | Content of advising session<br>Remedying certain early warning indicators<br>Removing enrollment holds<br>Effectiveness of advising for students with admission requirements for their majors<br>Number of meetings with students |

| | | |
|---|---|---|
| Post-Advising | Advisee Impact | Persistence<br>Appropriateness of enrollment advising for student progress<br>Timely course registration<br>Removal of course enrollment holds<br>Retention<br>Changing majors<br>Progression<br>Advising knowledge/learning outcomes<br>First generation student's success<br>Academic success<br>Measurable qualitative dimensions |
| | Advising Impact | Advising actions (i.e. action items or advisee)<br>Remaining in good standing<br>Student's perceived satisfaction of advising received |
| | Advisor Impact | Outreach/Follow-up with advisee<br>Following through on referrals<br>Development/Refinement of best practices<br>Accountability for student success |

The model (Table 4) described three stages of the evaluation of advising: elements of pre-advising, within advising, and impact factors of post-advising. Each stage can be evaluated separately as a component of the advising process as derived from responses from participants within the Dephi study. Within the element of the pre-advising stage, advisors collect all relevant information and develop questions prior to an advising session. The evaluation of this stage is as important as the advising session itself, as a lack of relevant information about a student may lead to ineffective advising sessions or even student attrition (Creamer & Scott, 2000). The stage is divided into three components: pre-advising, historical evidence, and research questions.

Within pre-advising, advisors ensure that all items that contribute to the advising experience are available. This may include current schedule, paperwork, or program plan. Along with current documents, historical evidence may be necessary to effectively advise a student, especially regarding a future course of action. This may include any documentation relating to previous grades and schedules, holds and flags, as well as activities and prior notes if available. Finally, an advisor may have questions regarding a student that may need further research. Typically, these are overarching concerns beyond the content of the in-advising session, requiring resources beyond an advisor's knowledge base, such as student hold requirements and graduation determination.

During an advising session, the three primary components of program evaluation are measured. Merit refers to the quality of the session viewed through lenses of advisor delivery and interaction, as well as the information given and its alignment with university practices and policies, and student assistance, though at times the latter two criteria may not be in tandem. An example of this may be when a student may only have funding for one more year of schooling, but is required to take classes beyond that in order to qualify for graduation. Significance relates to the importance of the in-session experience. Questions relating to the meaning and effect on a student with regards to information being given and processed, personal growth and acceptance, and practicality are all feasible. Additionally, the advisor's impressions of these criteria are important for personal reflection and understanding of the meeting. Furthermore, an important aspect is also answering what behaviors and interactions are actually occurring within sessions. Indicators such as how advisors help students feel welcomed, cared for, engaged, challenged, and motivated can address this criteria.

For the last stage involving the impact factors of post-advising, effects of advising session(s) are observed and studied through three modes: advisee impact, advising impact, and advisor impact. How any advising session impacts an advisee must be the primary concern since the treatment is for student progress; impact can be measured in multiple ways including, but not limited to campus involvement, retention, progression, and persistence, and graduation. From the perspective of a student, the immediate impact of an advising session may be measured on proper class recommendations, sequencing options, and path explorations. The primary measure for advising impact is typically regarded with how the session effects other units. For example, some international students must be advised through multiple units, including an undergraduate advising unit and another unit whose chief purpose is to ensure that those students have proficiency in English. The advising of class sequencing may conflict between the two units if collaboration is not a concern. Finally, and possibly an overlooked criterion, is that of advisor impact. Though advisors grow professionally through conferences and training, practice and experience propagates personal and professional growth. What questions, concerns, skills, and understandings that an advisor learns from any advising session may be measured as well, enabling feedback and development of the practice not only individually, but also as a whole.

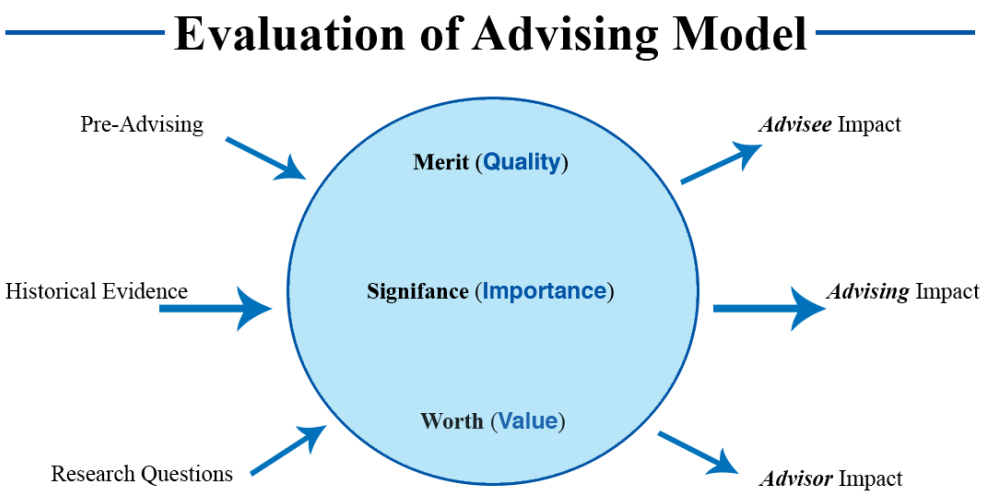


*Figure 12.* Framework for Evaluating Academic Advising Programs

**Evaluative Academic Advising Checklist**

Pre-evaluation Phase: Considerations

- Pre-Advising Considerations
  - Research Questions
    - ⇒ Provide a list of all questions you would like answered.
      - ☐ **Advisee impact** (questions addressing how a student or students respond to advising – e.g. reactions, satisfaction, understanding)
      - ☐ **Advising impact** (questions related to the effect and impact upon a student or students' progress – e.g. activities, progression, graduation)
      - ☐ **Advisor impact** (questions concerning how an advisor prepares for, administers, and reacts to advising – e.g. advice, communication, notes)
      - ☐ **Program impact** (questions regarding how a program as a whole effects retention – e.g. comparisons, direct effect, short, medium, and long-term outcomes)
  - Historical Evidence Considerations

⇒ Identify all aspects of historical evidence for ensuring high evaluative capacity
- ☐ **Previous student aspects** (e.g. course load, GPA, ability)
- ☐ **Previous documentation** (e.g. holds, flags, review of notes)

- Evaluation Phase: Merit, Worth and Significance of Advising
  - Subject Matter Knowledge
    - ⇒ Knowledge of common content
      - ☐ **Understanding of policies** (e.g. familiarity of school and program policies and procedures)
      - ☐ **Knowledge of courses** (e.g. memorization of courses and sequences and proper administration of said criteria)
    - ⇒ Knowledge of specialized content
      - ☐ **Awareness of specificities** (e.g. comprehension of how courses and classes differ based on various covered content areas and teaching styles)
    - ⇒ Knowledge of horizon content knowledge
      - ☐ **Knowledge of curriculum** (e.g. in-depth knowledge of topics and content of each available course and how those classes span entire programs, schools, and institutions)

  - Pedagogical Content Knowledge
    - ⇒ Knowledge of Students
      - ☐ **Knowledge of learner oriented environments** (e.g. intuition of what students may know and what they may be already perplexed by)
    - ⇒ Knowledge of Teaching
      - ☐ **Realization of students' learning styles and abilities** (e.g. advising based on the understating of student's abilities of learning and differing content delivery methods)
    - ⇒ Knowledge of Curriculum
      - ☐ **Knowledge of student activities** (e.g. understanding how curriculum affects student lives outside of the classroom)
      - ☐ **Knowledge of assets** (e.g. familiarity of instructional resources available for student success)

Post-evaluation Phase: Analysis

- Results
  - Satisfaction Outcomes
    - ☐ **Stakeholder satisfaction** (e.g. student satisfaction with advising sessions)

- ☐ **Student sponsor satisfaction** (e.g. parent or guardian satisfaction with student progress)
- ☐ **Advisor self-satisfaction** (e.g. advisor is aware that he or she has influenced a student's academic career)

- Statistical Impact Factors
  - ☐ **Effect** (e.g. impact of advising on student progression, persistence, and retention)
  - ☐ **Comparison** (e.g. contrast of advising outcomes between and within departments possibly across institutions)

*Compatibility*

*Models and Methods*

The checklist and model provides a framework for the evaluation of a practice known as academic advising. In fact, results of the three studies indicate a complex system whose effect cannot be easily measured by the simple satisfaction studies (e.g. Henkel, 2000; McFarlane, 2013; Weston, 1994) outlined in Chapter 2. In fact, Pietras (2010) used hierarchical OLS regression and binary regression techniques to describe how satisfaction with advising does not indicate any data about student retention. Other studies that found a positive statistical correlation between advising and retention prompted precursor work toward answering if any effect between academic advising and student progress existed. Using precautions outlined by Grites, Gordon & Habley (2008) and Chiteng (2014), the second study employed a quasi-experimental design. Additionally, since it was found that at least one non-descriptive, statistically sound methodology had been used to study advising effectiveness, including structural equation modeling of a student attrition model and advising (Cabrera, Nora and Castaneda, 1993), the second study also used effect sizes to describe advising impact.

The evaluative model and checklist is not built on a single advising model, thus when studying advising model implementation such as centralized, decentralized, and shared structures---which inherently share the same characteristics---implementation is seamless. Additionally, regardless of practice approach, the model and corresponding checklist may be used. For example, within developmental advising, the approach is utilized to enable students to explore careers, define academic goals, and delineate paths towards said goals (Jeschke, Johnson, & Williams, 2001). As a result, the tactic has a secondary outcome that has helped students to become empowered, autonomous learners of university policies and procedures. While the first stage is the same regardless of practice, the primary criteria are measured through the second stage and the ancillary results can be done so using the third stage.

Another example of an advising approach is that of prescriptive advising. This is a traditional method which is informational in nature, providing what courses and sequencing are needed to finish a program plan, program, and/or major (Jeschke, Johnson, & Williams, 2001). As simplistic as this approach is, the measurable outcomes can once again be evaluated though all three stages where the treatment is gauged in stage two, while the primary effect is allocated to stage three.

A final example is that of intrusive, or proactive, advising. This method requires that initial contact is made by an advisor rather than a student (Jeschke, Johnson, & Williams, 2001). An initial study showed that this type of advising had a positive effect on student retention and degree completion rates (Vander Schee, 2007). Though the study lacked enough of a sample size for generalizability or statistical power, all three stages are able to address the effect of the method and to verify if the outcomes are true.

*The Egg*

Foundationally, the evaluative model and corresponding checklist is built on the TPACK model. In this, advisors must have a firm grasp of the content knowledge of courses, a basic pedagogical knowledge of any subject area---at minimum being able to describe what encompasses a class----and sequence or major. Additionally, advisors must be versed in technological knowledge of advisor tools and analytical software used to keep records and provide applicable information in student and advisor decisions. Advisors must be able to combine these components by using (1) technological, pedagogical knowledge via advising what technological components are necessary in classes and in communication, (2) technological content knowledge in how using recommendations---and possibly predictive analytics---informs and reinforces advising decisions, and (3) pedagogical content knowledge demonstrating the advisor's understanding that the delivery of university policies and procedures is a student learning process that may be accomplished using various modes.

# CHAPTER V

# SUMMARY AND SYNTHESIS

As academic advising has been denoted as a form of teaching, (Crookston, 1994), the evaluation of the practice of academic advising was almost nonexistent or tended to be interchanged with assessment (e.g. Creamer & Scott, 2000; Cuseo, 2008; Gordon, 2008; Lynch, 2000; Robbins, 2009; Troxel, 2008). In fact, within the academic advising community, evaluation is defined as being "centered around the performance of the individual academic advisor, while assessment is concerned with the academic advising program and services overall, primarily the achievement of student learning outcomes (SLOs)" (Robbins & Zarges, 2011). This description was virtually contradictory to the definition given by Patton (1997) who stated that "program evaluation is the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future programs." Such disparate definitions of "evaluation" within academic advising make the practice one that has been previously difficult to implement in the field.

To find if academic advising is effective and creates impact with student development and learning, an evaluation of practices is necessary. The purpose of this study is to begin to bring evaluative standards within the academic advising community using university retention and persistence efforts as a measure of impact. Two primary modes were created to accomplish these tasks: (1) First, an argument for the necessity for evaluative standards within the field of

academic advising must be developed and (2) secondly, the construction of a preliminary evaluation model was necessary.

**Summary**

This research was divided into three parts intended to lay a foundation for the construction of an evaluation tool for academic advising. The first study was descriptive in nature, providing indicators for the fundamental understanding between evaluation, assessment, and research within academic advising, which in turn supplied information as to how complex or simple the evaluation tool should be. Based on the results of the study, the tool should be relatively simplistic in nature in order for utilization to occur within academic advising.

The second study was quantitative in nature, utilizing a single group pre-test/post-test quasi-experimental design. The sole purpose of this research was to measure if academic advising influenced student progress---namely in progression---persistence, and retention. As results indicate, there is a small to moderate effect on student groups and progress through their matriculation. The basis of the entire aggregate study was influenced by the results of the second study. If the results had described that academic advising negatively impacted student progression, the construction of the study would have been different, in that the research questions would have asked what factors academic advising influenced; this may have led to a goal-free evaluation.

The third and final study was that of a Delphi study design. A selected panel of six advisors spanning differing backgrounds and practices were chosen not at random. Through four iterations, they eventually provided a list of suitable criteria and indicators that would be used to layer the model.

The model and checklist were created to provide academic advisors with a list of criteria and indicators that will help them evaluate their own advising departments or units. While the checklist is a living document since advising continually evolves, it encompasses the thoughts and opinions of influential and award-winning academic advisors who are respected within and outside of the targeted university.

**Synthesis**

At the very heart of the model are the Learner-Centered Psychological Principles. Advisors attempt to help students become successful and often autonomous learners. They use methods through practice to support students in creating goals from various informational sources, personal and professional experiences, and making sense of student data via a belief structure derived from their own opinions. Advisors also assist learners to create meaningful goals aligned with their personal desires and educational ambitions. Additionally, they assist students in obtaining and developing knowledge by approaches such as inquiry and open communication, often resulting in an organization of university information and developing a course in their personal path toward graduation and beyond.

Besides knowledge acquisition, compartmentalization and analysis, effective advisors tend to provide a nurturing environment in which to develop trust with individuals and build short- to long-term relationships, sometimes existing after a student departs from an institution. Within this, they are also expected to address and work with students in varying emotional states, at times using discourse to nullify a negative situation or referring them to other agents of the university that can further assist them. Furthermore, this learning environment affords students

the opportunity to pursue interests cultivated from personal desires and fosters creativity, all while exploring multiple academic paths and scenarios, facilitating enthusiasm and drive.

None of these criteria are effective if advisors are not able to understand their audience. This includes an ability to read and assess students prior to a meeting, throughout an advising session, and when synthesizing notes and creating outcomes. While creating a perception of a student is important, to accurately learn about them requires the ability to socialize with respect, support, and open communication, developing a sense of trust and self-esteem.

**Limitations**

First and foremost, there is a lack of methodologically sound quantitative, qualitative, or mixed method studies dedicated to the impact of academic advising on students. Therefore, while this study may clearly be the first--or one of the first---of its kind, it does not have the added benefit of a strong literature foundation. Additionally, this study occurred at a single institution. While the university is recognized for its dedication and focus on academic advising, a single body does not predict or assume to generalize results across the entirety of academic advising. Within the institution, not all advisors from all units were able to participate in either the descriptive or Delphi studies, which may have led to increased bias as differing advising units often see specific, stratified sets of students, and corresponding advising methodologies can differ. The second study was only conducted using data from the Fall term 2012 to the Fall term 2015, primarily due to of a lack of sufficient data prior to that time. Moreover, analysis was not performed on advising notes, which may have altered the acceptable students that were tested.

Furthermore, many institutions lack a central academic advising unit, or only have faculty who are also academic advisors. While these individuals or sets of individuals may benefit from this study, the method in which they interact and address students differs by design and environment. It is also important to note that advising is still a maturing field on the cusp of shifting from an anecdotally based field to one founded on empirical evidence. However, there is a possibility of some resistance to use the tool presented in this study, as proper research methodologies are not often employed within the field. Utilization of the tool and the test of its validity may take longer when compared to fields that have a history of empirical studies. A great deal of empowerment evaluation, or providing units with tools to monitor and evaluate their own departments, may be administered to propagate the usage of the tool.

**Further Research**

There is a need for further research within the evaluation of academic advising. Primarily, there must be a cultural shift within academic advising from that of practice founded on anecdotal evidence to that of empirically based findings. This study provides an initial framework for such a shift, but it testing must occur in the field to assess its validity.

Additional types of evaluations of academic advising are also necessary not only within institutions, but across institutions as well. Though this study provides an initial indication of the impact of academic advising on student progress, a goal-free evaluation will provide researchers with information about all of the effects of advising, including those that may be unknown. This is especially important, as academic advising units often not only interact with a large population of students, but also with service departments.

Furthermore, an associated study such as cost-benefit analyses may be sensible after discovering if an advising unit does indeed create an impact on student retention. This may address the need for a greater number of advisors. Based on findings from the National Survey of Academic Advising (Carlstrom, 2013), in 2011 the average case load for large academic institutions, or those with at least 24,000 students, was 600 students per full-time advisor; this was followed by 333 students per advisor for medium sized, or those between 6000 and 23,999 students, academic institutions followed by 233 students per advisor for small, or less than 5999 students, academic institutions.

While this study provides an indication of the evaluation and effectiveness of academic advising, the model and corresponding checklist must be tested in practice. Though the initial model is derived through multiple iterations of various studies, its validity and reliability must also be verified, which may be accomplished by the implementation of the evaluative model and checklist within multiple units and over multiple semesters. Furthermore, a separate component testing academic completion and failure such as a survival analysis, or analyzing the expected duration of time until one more events happens, would enhance the model as well. In this case, cohorts may be studied using a survival analysis where the event of concern would most likely be if a student withdrew from a university.

From this research, there is an indication that advising does indeed affect student progression, but it may also affect other areas of student lives. Since academic advisors are advocates, teachers, and sometimes mentors, it is extremely likely that many other aspects outside of an academic environment are also influenced. Short-term, mid-term, and long-term outcomes may all be greatly shaped by academic advising.

## Conclusion

The number of academic advisors is gaining momentum in the United States. With NACADA (2014) maintaining a growing membership load of 11,000 active members, the field is becoming theory-oriented (Williams, 2007). While the role of an advisor varies among individuals (National: The Global Community for Academic Advising, 2006), the number of essential academic advisors must grow as enrollment rates surge.

In fall 1990, the aggregate undergraduate enrollment in degree-granting postsecondary institutions was 12.0 million students. In 2012, this number improved to 17.7 million and is projected to increase to 20.2 million by 2023 (Kena et al, 2014). Furthermore, according to the *NACADA 2011 National Survey of Academic Advising*, the median advisor load is 296 students to a single advisor (Carlstrom & Miller, 2013). Thus, to maintain this median, the number of utilized academic advisors must number above 68,000.

As the student body continues to grow in diversity (Franklin, 2012), how they are served becomes more complex. Reporting of single incidents and personal experiences, as well as individual and group assessments, while important, are insufficient to address the needs of students and to measure the impact and effect of academic advising on differing classifications of students or an aggregate populous.

This notion of measuring impact and effect begs the question: Must the field of academic advising accept evaluation and research as standards? The question about differences between academic advising and research is driven by the idea that advising is an interdisciplinary field and is therefore grounded in multiple foundations. As advising matures as both a profession and an academic discipline, this question may be used to explain how academic advising is defined.

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# Appendices

## Appendix A: IRB Approval

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: August 5, 2015

To: Tabitha Mingus, Principal Investigator
Abhik Roy, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project "Building an Evaluation Model of Academic Advising's Impact on Progression, Persistence, and Retention within University Settings"

This letter will serve as confirmation that the Western Michigan University Human Subjects Institutional Review Board (HSIRB) received a copy of the University of Kansas Institutional Review Board (KU IRB) protocol submission and approval letter for your project titled, "Building an Evaluation Model of Academic Advising's Impact on Progression, Persistence, and Retention within University Settings."

After reviewing your submission, the HSIRB will accept the review and determination of KU IRB given that all data collection is related to Kansas University and no data collection will occur on the WMU campus.

While Kansas University's Federalwide Assurance (FWA) on file with Department of Health and Human Services, covers this activity:

*Assurance Identification Number FWA00003310, the expiration date: May 30, 2019*
*IRB Registration Number IRB00000292, Expires March 4, 2018*

*HSIRB* remains responsible for ensuring compliance of WMU faculty, staff, and students with the KU IRB's determinations and with the Terms of the OHRP-approved FWAs; safeguarding the rights and welfare of human subjects, educating its researchers to establish and maintain a culture of compliance with federal regulations and applicable institutional policies for the protection of human subjects; and more broadly for fulfilling the institutional obligations described in the federal regulations. A copy of approved changes, deviations, renewals, and closure reports are requested as applicable and will be maintained in your HSIRB file.

The Board wishes you success in the pursuit of your research goals.

**Approval Termination:** **July 30, 2016**

1903 W. Michigan Ave., Kalamazoo, MI 49008-5456
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CAMPUS SITE: 251 W. Walwood Hall

**Appendix B: Matching R Code**

PSM using nearest neighbor method for MATCHIT package and multivariate matching using Mahalanobis distance via the MATCHING package in R

MATCHIT code:

```
mydata <- read.csv("~/Documents/Dissertation WMU/Current/Numbers/Hub/*.csv")
attach(mydata)
library(MatchIt)
m.out =matchit(advising~sex+level+ec+res, data = mydata, method = "nearest", ratio = 1)
plot(m.out, type = "jitter")
plot (m.out, type = "hist")
summary(m.out)
```

MATCHING code:

```
current<-read.csv("~/Desktop/Hub/*.csv")
library(Matching)
glm1 <-glm(current.formu, family=binomial, data=current)
current.formu <- advising~sex+level+ec+res
summary(glm1)
ps1 <- fitted(glm1)
Y1 <- current$retained
Tr1 <- current$advising
rr1 <- Match(Y=Y1, Tr=Tr1, X=ps1, ties=FALSE)
summary(rr1)
matches
<_data.frame(Treat=current[rr1$index.treated,'retained'],Control=current[rr1$index.control,'retai
ned'])
library(granovaGG)
print(granovagg.ds(matches))
```

**Appendix C: Survey Items**

1. Please denote what type of advising you perform (select all that apply).
    a. Undergraduate pre-professional
    b. Undergraduate open access
    c. Undergraduate professional
    d. Graduate
    e. Other (please describe)
2. Do you adhere to a specific type of advising model? [If yes/Maybe not Not sure…skip to 3. Otherwise, skip to 4]
    a. Yes
    b. No
    c. Maybe or Not sure
    d. Not applicable
3. What type of advising model do you use (select all that apply)
    a. Intrusive
    b. Prescriptive
    c. Developmental
    d. Not applicable
    e. Other (please specify)
4. Of the four choices below, please select the term that is synonymous with assessment.
    a. Research
    b. Data collection
    c. Evaluation
    d. None of the above
5. Consider the following situation: A director wishes to gather information about the practices of some of his/her advising staff to measure the number of students seen. What should he/she be doing?
    a. Researching their practice
    b. Assessing their practice
    c. Evaluating their practice
    d. None of the above
6. Consider the following situation: A director wishes to gather information about the practices of some of his/her advising staff to measure advisor impact on student retention. What should he/she be doing?
    a. Researching their practice
    b. Assessing their practice
    c. Evaluating their practice
    d. None of the above
7. Consider the following situation: A director wishes to gather information about the practices of some of his/her advising staff to measure advisor utilization of advising models. What should he/she be doing?
    a. Researching their practice

   b. Assessing their practice
   c. Evaluating their practice
   d. None of the above
8. If you wanted to judge the quality of your advising, would you
   a. Research your advising
   b. Assess your advising
   c. Evaluate your advising
   d. None of the above
9. If you wanted to judge the worth of your advising techniques, would you
   a. Research your advising
   b. Assess your advising
   c. Evaluate your advising
   d. None of the above
10. If you wanted to judge the importance of your advising on student persistence, would you
   a. Research your advising
   b. Assess your advising
   c. Evaluate your advising
   d. None of the above

If you believe that there is a difference between research, assessment and evaluation, please describe them below. If not, please state it.

**Appendix D: Top 50 Utilized Variables Resulting from Iteration 1 of Delphi Study**

Table 1

| Unranked variables in alphabetical order |
|---|
| Academic intervention models (email, holds, etc.) |
| Academic success |
| Acceptance into graduate programs |
| Advising actions |
| Advising knowledge |
| Advising outcomes |
| Advising practices |
| Appropriateness of enrollment advising for student progress |
| Changing majors |
| Content of advising session |
| Declaring majors |
| Degree completion |
| Departmental structure |
| Effectiveness for student demographics |
| Effectiveness of advising for students with admission requirements for their majors |
| First generation students success |
| Following through on referrals |
| Graduation rates |
| Hand-holding students |
| Interventions on student outcomes |
| Length of meetings with students |
| Low income student's success |
| Low test scores |
| Mode of appointments |
| Number of e-mail message |
| Number of meetings with students |
| Other advisors' morale |
| Outreach |
| Percentage of advisees who enroll |
| Persistence |
| Probation students |

Progression
Registering for courses
Remaining in good standing
Remedying certain early warning indicators
Removing enrollment holds
Retention
Student determination
Student GPA
Student independence
Student self-efficacy
Student worth
Student's perceived satisfaction of advising received
Students in lower ability bands
The accuracy of information
The impact of developmental courses
The volume of students advise
Timely communication from advisors with students
Timing of advising session
Utilization of early warning variables

## Appendix E: Separation of Evaluation and Research

Table I

*Evaluation and Research within Academic Advising*

| **Criteria** | **Delineation between Evaluation and Research** | **Generality to Academic Advising** |
|---|---|---|
| Purpose | Evaluation: Particularizes | Describes detailed findings of a research study on academic advising. |
| | Research: Generalizes | Application of study finding to other academic advising units. |
| Design | Evaluation: To improve | Outcomes define needs of academic advising programs. |
| | Research: To prove | Establishes if some item within an academic advising unit is occurring or exists. |
| Offering | Evaluation: Provides a foundation for value judgments | Designates the status of merit, worth and/or significance of an academic advising unit or a product of that unit. |
| | Research: Provides a foundation for determining conclusions | Defines fundamental criteria necessary for inferring deductions about the status of an academic advising unit or a product of that unit. |
| Question | Evaluation: Asks so what? | Inquires about the inputs activities, outputs outcomes and impact of an academic advising unit or its components. |
| | Research: Asks what's so? | Probes general questions regarding change and status of an academic advising unit or its components. |
| Scope | Evaluation: Investigates the extent of effectiveness in comparison to standards. | Examines and determines the measure of impact and effect of an academic advising unit and./or its components on others. |
| | Research: Unpacks and describes a framework or construct. | Outlines, defines and describes how a program or unit within an academic advising program functions. |
| Focus | Evaluation: Assesses value. | Process indicates aspects of an academic advising program that are of significance to stakeholders. |

| | |
|---|---|
| Research: Describes status. | Reports of outcomes and conclusions define results as they appear through scholarship. |

Construct derived from Mathison (2007)

## Appendix F: GLM Modeling Outputs

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.5287  -0.8775  -0.5432   1.0530   2.0905

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.3123891  0.6340845   2.070   0.0385 *
sexM        -0.2269805  0.0396070  -5.731 9.99e-09 ***
level       -0.1069369  0.0025596 -41.778  < 2e-16 ***
ecASIAN      0.0006278  0.3043535   0.002   0.9984
ecBLACK      0.0732958  0.3021827   0.243   0.8084
ecHISPA      0.0780906  0.2958421   0.264   0.7918
ecINTL       0.4816351  0.6264030   0.769   0.4420
ecMULTI     -0.0009406  0.3002081  -0.003   0.9975
ecNSPEC     -0.0642511  0.3921629  -0.164   0.8699
ecPACIF     -0.6953985  0.8808720  -0.789   0.4299
ecWHITE     -0.0698000  0.2867679  -0.243   0.8077
resIS        0.2985332  0.5636451   0.530   0.5964
resOS        0.1266377  0.5656052   0.224   0.8228
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 17174  on 13077  degrees of freedom
Residual deviance: 15067  on 13065  degrees of freedom
AIC: 15093

Number of Fisher Scoring iterations: 3
```

*Figure 1*. Fall 2012 to Spring 2013 advising versus retention output for F/S/J after GLM Modeling.

```
Estimate...  0.016729
SE.........  0.0057977
T-stat.....  2.8855
p.val......  0.0039078

Original number of observations..............  13078
Original number of treated obs...............  4782
Matched number of observations...............  4782
Matched number of observations  (unweighted).  4782
```

*Figure 2*. Fall 2012 to Spring 2013 advising versus retention matching output for F/S/J after GLM Modeling.

```
                               Summary Statistics
n                                        4782.000
Treat mean                                  0.917
Control mean                                0.900
mean(D = Treat - Control)                   0.017
SD(D)                                       0.401
Effect Size                                 0.042
r(Treat, Control)                           0.031
r(Treat + Control, D)                      -0.082
Lower 95% Confidence Interval               0.005
Upper 95% Confidence Interval               0.028
t (D-bar)                                   2.885
df.t                                     4781.000
p-value (t-statistic)                       0.004
```

*Figure 3*. Fall 2012 to Spring 2013 advising versus retention matching output summary statistics for F/S/J after GLM Modeling.

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.9198  -1.2160   0.9847   1.0692   1.4617

Coefficients: (1 not defined because of singularities)
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -0.72236    1.17714  -0.614    0.539
sexM        -0.38129    0.05788  -6.588 4.46e-11 ***
level             NA         NA      NA       NA
ecASIAN     -0.35010    0.49668  -0.705    0.481
ecBLACK     -0.22176    0.49101  -0.452    0.652
ecHISPA     -0.21653    0.48346  -0.448    0.654
ecINTL       1.19405    1.17010   1.020    0.308
ecMULTI     -0.47916    0.48608  -0.986    0.324
ecNSPEC     -0.33943    0.64643  -0.525    0.600
ecPACIF     -1.12367    1.31300  -0.856    0.392
ecWHITE     -0.43123    0.47218  -0.913    0.361
resIS        1.58003    1.07761   1.466    0.143
resOS        1.44025    1.07966   1.334    0.182
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6770.0  on 4928  degrees of freedom
Residual deviance: 6711.8  on 4917  degrees of freedom
AIC: 6735.8

Number of Fisher Scoring iterations: 4
```

*Figure 4*. Fall 2012 to Spring 2013 advising versus retention output for FTFT after GLM Modeling.

```
Estimate...  0.017864
SE.........  0.008038
T-stat.....  2.2224
p.val......  0.026256

Original number of observations..............  4929
Original number of treated obs...............  2743
Matched number of observations...............  2743
Matched number of observations  (unweighted).  2743
```

*Figure 5*. Fall 2012 to Spring 2013 advising versus retention matching output for FTFT after GLM Modeling.

| | Summary Statistics |
|---|---|
| n | 2743.000 |
| Treat mean | 0.912 |
| Control mean | 0.894 |
| mean(D = Treat - Control) | 0.018 |
| SD(D) | 0.421 |
| Effect Size | 0.042 |
| r(Treat, Control) | -0.011 |
| r(Treat + Control, D) | -0.082 |
| Lower 95% Confidence Interval | 0.002 |
| Upper 95% Confidence Interval | 0.034 |
| t (D-bar) | 2.222 |
| df.t | 2742.000 |
| p-value (t-statistic) | 0.026 |

*Figure 6*. Fall 2012 to Spring 2013 advising versus retention matching output summary statistics for FTFT after GLM Modeling.

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.5626  -0.7969  -0.5454   1.0601   2.1799

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.294909   0.738679   1.753   0.0796 .
sexM        -0.216658   0.044817  -4.834 1.34e-06 ***
level       -0.105640   0.002933 -36.014  < 2e-16 ***
ecASIAN      0.639750   0.391699   1.633   0.1024
ecBLACK      0.624611   0.389801   1.602   0.1091
ecHISPA      0.534895   0.383657   1.394   0.1633
ecINTL       0.632798   0.729943   0.867   0.3860
ecMULTI      0.334157   0.387895   0.861   0.3890
ecNSPEC      0.522689   0.481985   1.084   0.2782
ecPACIF      0.381209   0.921917   0.413   0.6792
ecWHITE      0.355403   0.375166   0.947   0.3435
resIS       -0.311583   0.633013  -0.492   0.6226
resOS       -0.521730   0.635343  -0.821   0.4115
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 13555  on 10989  degrees of freedom
Residual deviance: 11972  on 10977  degrees of freedom
AIC: 11998

Number of Fisher Scoring iterations: 4
```

*Figure 7*. Spring 2013 to Fall 2013 advising versus retention output for F/S/J after GLM Modeling.

```
Estimate...  0.017487
SE.........  0.0083092
T-stat.....  2.1045
p.val......  0.035335

Original number of observations..............  10990
Original number of treated obs...............  3374
Matched number of observations...............  3374
Matched number of observations  (unweighted).  3374
```

*Figure 8*. Spring 2013 to Fall 2013 advising versus retention matching output for F/S/J after GLM Modeling.

```
|
                                  Summary Statistics
n                                            3374.000
Treat mean                                      0.871
Control mean                                    0.853
mean(D = Treat - Control)                       0.017
SD(D)                                           0.483
Effect Size                                     0.036
r(Treat, Control)                               0.020
r(Treat + Control, D)                          -0.053
Lower 95% Confidence Interval                   0.001
Upper 95% Confidence Interval                   0.034
t (D-bar)                                       2.104
df.t                                         3373.000
p-value (t-statistic)                           0.035
```

*Figure 9*. Spring 2013 to Fall 2013 advising versus retention matching output summary statistics for F/S/J after GLM Modeling.

```
eviance Residuals:
    Min       1Q   Median       3Q      Max
1.6988  -1.2066   0.9055   1.1288   1.3643

oefficients: (1 not defined because of singularities)
             Estimate Std. Error z value Pr(>|z|)
Intercept)  -0.91169    1.31640  -0.693    0.489
exM         -0.37118    0.07175  -5.173  2.3e-07 ***
evel              NA         NA      NA       NA
cASIAN       0.52008    0.70293   0.740    0.459
cBLACK       0.27221    0.69704   0.391    0.696
cHISPA       0.49641    0.68695   0.723    0.470
cINTL        1.59134    1.30825   1.216    0.224
cMULTI       0.11499    0.68852   0.167    0.867
cNSPEC       0.24670    0.82384   0.299    0.765
cPACIF      11.98388  196.96884   0.061    0.951
cWHITE       0.28867    0.67576   0.427    0.669
esIS         0.86505    1.12981   0.766    0.444
esOS         0.73853    1.13280   0.652    0.514
---
ignif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' '

Dispersion parameter for binomial family taken to be 1)

    Null deviance: 4402.6  on 3177  degrees of freedom
esidual deviance: 4356.6  on 3166  degrees of freedom
IC: 4380.6

umber of Fisher Scoring iterations: 10
```

*Figure 10*. Spring 2013 to Fall 2013 advising versus retention output for FTFT after GLM Modeling.

```
Estimate...  0.075092
SE.........  0.013538
T-stat.....  5.5466
p.val......  2.9128e-08

Original number of observations..............  3178
Original number of treated obs...............  1638
Matched number of observations...............  1638
Matched number of observations  (unweighted).  1638
```

*Figure 11*. Spring 2013 to Fall 2013 versus retention matching output for FTFT after GLM Modeling.

```
                                Summary Statistics
n                                         1638.000
Treat mean                                   0.850
Control mean                                 0.775
mean(D = Treat - Control)                    0.075
SD(D)                                        0.548
Effect Size                                  0.137
r(Treat, Control)                            0.004
r(Treat + Control, D)                       -0.156
Lower 95% Confidence Interval                0.049
Upper 95% Confidence Interval                0.102
t (D-bar)                                    5.545
df.t                                      1637.000
p-value (t-statistic)                        0.000
```

*Figure 12*. Spring 2013 to Fall 2013 versus retention matching output summary statistics for FTFT after GLM Modeling.

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.3011  -0.7282  -0.4512   1.1922   2.3235

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.044459   0.597853   1.747   0.0806 .
sexM        -0.088291   0.042213  -2.092   0.0365 *
level       -0.104169   0.002864 -36.377   <2e-16 ***
ecASIAN     -0.423538   0.312263  -1.356   0.1750
ecBLACK     -0.085783   0.307115  -0.279   0.7800
ecHISPA     -0.505829   0.302985  -1.669   0.0950 .
ecINTL       0.050909   0.587651   0.087   0.9310
ecMULTI     -0.329440   0.306277  -1.076   0.2821
ecNSPEC     -0.671641   0.390491  -1.720   0.0854 .
ecPACIF     -0.710920   0.857937  -0.829   0.4073
ecWHITE     -0.385587   0.292763  -1.317   0.1878
resIS        0.232519   0.518647   0.448   0.6539
resOS        0.045044   0.520828   0.086   0.9311
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 15205  on 13158  degrees of freedom
Residual deviance: 13592  on 13146  degrees of freedom
AIC: 13618

Number of Fisher Scoring iterations: 4
```

*Figure 13*. Fall 2013 to Spring 2014 advising versus retention output for F/S/J after GLM Modeling.

```
Estimate...  0.019535
SE.........  0.0063764
T-stat.....  3.0636
p.val......  0.002187

Original number of observations..............  13159
Original number of treated obs...............  3481
Matched number of observations...............  3481
Matched number of observations  (unweighted).  3481
```

*Figure 14*. Fall 2013 to Spring 2014 advising versus retention matching output for F/S/J after GLM Modeling.

```
                                  Summary Statistics
n                                           3481.000
Treat mean                                     0.932
Control mean                                   0.913
mean(D = Treat - Control)                      0.020
SD(D)                                          0.376
Effect Size                                    0.052
r(Treat, Control)                              0.006
r(Treat + Control, D)                         -0.116
Lower 95% Confidence Interval                  0.007
Upper 95% Confidence Interval                  0.032
t (D-bar)                                      3.063
df.t                                        3480.000
p-value (t-statistic)                          0.002
```

*Figure 15*. Fall 2013 to Spring 2014 advising versus retention matching output summary statistics for F/S/J after GLM Modeling.

```
Deviance Residuals:
   Min      1Q  Median      3Q     Max
-1.344  -1.055  -1.006   1.284   1.487

Coefficients: (1 not defined because of singularities)
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  0.95747    0.86382   1.108   0.2677
sexM        -0.13398    0.05712  -2.345   0.0190 *
level             NA         NA      NA       NA
ecASIAN     -0.68002    0.46790  -1.453   0.1461
ecBLACK     -0.41506    0.45921  -0.904   0.3661
ecHISPA     -0.80094    0.45432  -1.763   0.0779 .
ecINTL      -0.81182    0.85358  -0.951   0.3416
ecMULTI     -0.72228    0.45837  -1.576   0.1151
ecNSPEC     -0.88221    0.55389  -1.593   0.1112
ecPACIF     -0.96151    1.30368  -0.738   0.4608
ecWHITE     -0.55857    0.44281  -1.261   0.2072
resIS       -0.57326    0.74164  -0.773   0.4395
resOS       -0.64512    0.74433  -0.867   0.3861
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6911.8  on 5051  degrees of freedom
Residual deviance: 6887.6  on 5040  degrees of freedom
AIC: 6911.6

Number of Fisher Scoring iterations: 4
```

*Figure 16*. Fall 2013 to Spring 2014 advising versus retention output for FTFT after GLM Modeling.

```
Estimate...  0.05032
SE.........  0.0089697
T-stat.....  5.61
p.val......  2.023e-08

Original number of observations..............  5052
Original number of treated obs...............  2186
Matched number of observations...............  2186
Matched number of observations  (unweighted).  2186
```

*Figure 17*. Fall 2013 to Spring 2014 versus retention matching output for FTFT after GLM Modeling.

| | Summary Statistics |
|---|---|
| n | 2186.000 |
| Treat mean | 0.926 |
| Control mean | 0.876 |
| mean(D = Treat - Control) | 0.050 |
| SD(D) | 0.419 |
| Effect Size | 0.120 |
| r(Treat, Control) | 0.010 |
| r(Treat + Control, D) | -0.227 |
| Lower 95% Confidence Interval | 0.033 |
| Upper 95% Confidence Interval | 0.068 |
| t (D-bar) | 5.609 |
| df.t | 2185.000 |
| p-value (t-statistic) | 0.000 |

*Figure 18*. Fall 2013 to Spring 2014 versus retention matching output summary statistics for FTFT after GLM Modeling.

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.6407  -0.9340  -0.6397   1.0690   2.1241

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  2.034853   0.546530   3.723 0.000197 ***
sexM        -0.175822   0.041766  -4.210 2.56e-05 ***
level       -0.087903   0.002669 -32.933  < 2e-16 ***
ecASIAN     -0.345141   0.318530  -1.084 0.278567
ecBLACK     -0.192253   0.316285  -0.608 0.543288
ecHISPA     -0.608101   0.311264  -1.954 0.050742 .
ecINTL      -0.313905   0.535219  -0.586 0.557541
ecMULTI     -0.498993   0.314872  -1.585 0.113023
ecNSPEC     -0.999432   0.389390  -2.567 0.010268 *
ecPACIF     -0.624000   0.716823  -0.871 0.384023
ecWHITE     -0.593273   0.301674  -1.967 0.049229 *
resIS       -0.111449   0.451266  -0.247 0.804932
resOS       -0.367701   0.453717  -0.810 0.417699
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 14693  on 11158  degrees of freedom
Residual deviance: 13426  on 11146  degrees of freedom
AIC: 13452

Number of Fisher Scoring iterations: 4
```

*Figure 19*. Spring 2014 to Fall 2014 advising versus retention output for F/S/J after GLM Modeling.

```
Estimate...  -0.012391
SE.........  0.0074582
T-stat.....  -1.6613
p.val......  0.096644

Original number of observations..............  11159
Original number of treated obs...............  4116
Matched number of observations...............  4116
Matched number of observations  (unweighted).  4116
```

*Figure 20*. Spring 2014 to Fall 2014 advising versus retention matching output for F/S/J after GLM Modeling.

```
                               Summary Statistics
n                                        4116.000
Treat mean                                  0.857
Control mean                                0.870
mean(D = Treat - Control)                  -0.012
SD(D)                                       0.479
Effect Size                                -0.026
r(Treat, Control)                           0.029
r(Treat + Control, D)                       0.038
Lower 95% Confidence Interval              -0.027
Upper 95% Confidence Interval               0.002
t (D-bar)                                  -1.661
df.t                                     4115.000
p-value (t-statistic)                       0.097
```

*Figure 21*. Spring 2014 to Fall 2014 advising versus retention matching output summary statistics for F/S/J after GLM Modeling.

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.7989  -1.2441   0.9734   1.0685   1.3604

Coefficients: (1 not defined because of singularities)
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  0.78311    0.90594   0.864    0.387
sexM        -0.34540    0.07166  -4.820 1.44e-06 ***
level             NA         NA      NA       NA
ecASIAN      0.32375    0.54585   0.593    0.553
ecBLACK     -0.07406    0.52852  -0.140    0.889
ecHISPA     -0.17569    0.52300  -0.336    0.737
ecINTL       0.20231    0.89079   0.227    0.820
ecMULTI      0.05090    0.53082   0.096    0.924
ecNSPEC     -0.35855    0.63861  -0.561    0.574
ecPACIF      0.88373    1.26557   0.698    0.485
ecWHITE     -0.01248    0.50883  -0.025    0.980
resIS       -0.26983    0.74890  -0.360    0.719
resOS       -0.49975    0.75195  -0.665    0.506
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 4452.5  on 3254  degrees of freedom
Residual deviance: 4403.8  on 3243  degrees of freedom
AIC: 4427.8

Number of Fisher Scoring iterations: 4
```

*Figure 22*. Spring 2014 to Fall 2014 advising versus retention output for FTFT after GLM Modeling.

```
Estimate...  0.0054113
SE.........  0.012315
T-stat.....  0.4394
p.val......  0.66037

Original number of observations..............  3255
Original number of treated obs...............  1848
Matched number of observations...............  1848
Matched number of observations  (unweighted).  1848
```

*Figure 23*. Spring 2014 to Fall 2014 versus retention matching output for FTFT after GLM Modeling.

```
                                  Summary Statistics
n                                           1848.000
Treat mean                                     0.824
Control mean                                   0.818
mean(D = Treat - Control)                      0.005
SD(D)                                          0.530
Effect Size                                    0.010
r(Treat, Control)                              0.047
r(Treat + Control, D)                         -0.012
Lower 95% Confidence Interval                 -0.019
Upper 95% Confidence Interval                  0.030
t (D-bar)                                      0.439
df.t                                        1847.000
p-value (t-statistic)                          0.661
```

*Figure 24*. Spring 2014 to Fall 2014 versus retention matching output summary statistics for FTFT after GLM Modeling.

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.5607  -0.8041  -0.4802   1.0892   2.3266

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.969721   0.593921   3.316 0.000912 ***
sexM        -0.171205   0.044020  -3.889 0.000101 ***
level       -0.113865   0.002953 -38.558  < 2e-16 ***
ecASIAN     -0.754301   0.343350  -2.197 0.028028 *
ecBLACK     -0.592357   0.337729  -1.754 0.079441 .
ecHISPA     -0.750973   0.334375  -2.246 0.024710 *
ecINTL      -0.505487   0.582743  -0.867 0.385709
ecMULTI     -0.691692   0.337296  -2.051 0.040297 *
ecNSPEC     -0.986555   0.416827  -2.367 0.017942 *
ecPACIF     -1.489785   0.872764  -1.707 0.087827 .
ecWHITE     -0.655910   0.324372  -2.022 0.043167 *
resIS        0.035961   0.494773   0.073 0.942059
resOS       -0.265682   0.497020  -0.535 0.592962
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 14265  on 11728  degrees of freedom
Residual deviance: 12425  on 11716  degrees of freedom
AIC: 12451

Number of Fisher Scoring iterations: 4
```

*Figure 25*. Fall 2014 to Spring 2015 advising versus retention output for F/S/J after GLM Modeling.

```
Estimate...  0.029302
SE.........  0.0065446
T-stat.....  4.4773
p.val......  7.5609e-06

Original number of observations..............  11729
Original number of treated obs...............  3481
Matched number of observations...............  3481
Matched number of observations  (unweighted).  3481
```

*Figure 26*. Fall 2014 to Spring 2015 advising versus retention matching output for F/S/J after GLM Modeling.

| | Summary Statistics |
|---|---|
| n | 3481.000 |
| Treat mean | 0.932 |
| Control mean | 0.903 |
| mean(D = Treat - Control) | 0.029 |
| SD(D) | 0.386 |
| Effect Size | 0.076 |
| r(Treat, Control) | 0.009 |
| r(Treat + Control, D) | -0.163 |
| Lower 95% Confidence Interval | 0.016 |
| Upper 95% Confidence Interval | 0.042 |
| t (D-bar) | 4.477 |
| df.t | 3480.000 |
| p-value (t-statistic) | 0.000 |

*Figure 27*. Fall 2014 to Spring 2015 advising versus retention matching output summary statistics for F/S/J after GLM Modeling.

```
Deviance Residuals:
   Min      1Q  Median      3Q     Max
-1.661  -1.158  -1.003   1.174   1.761

Coefficients: (1 not defined because of singularities)
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  0.82918    1.06804   0.776   0.4375
sexM        -0.25087    0.06075  -4.129 3.64e-05 ***
level            NA         NA      NA       NA
ecASIAN     -1.07204    0.55841  -1.920   0.0549 .
ecBLACK     -1.08056    0.54794  -1.972   0.0486 *
ecHISPA     -1.02687    0.54632  -1.880   0.0602 .
ecINTL      -0.54578    1.05876  -0.515   0.6062
ecMULTI     -1.13394    0.54909  -2.065   0.0389 *
ecNSPEC     -1.02506    0.64788  -1.582   0.1136
ecPACIF     -2.21766    1.23977  -1.789   0.0737 .
ecWHITE     -0.88436    0.53495  -1.653   0.0983 .
resIS        0.26054    0.92359   0.282   0.7779
resOS        0.07660    0.92507   0.083   0.9340
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6113.2  on 4409  degrees of freedom
Residual deviance: 6076.2  on 4398  degrees of freedom
AIC: 6100.2

Number of Fisher Scoring iterations: 4
```

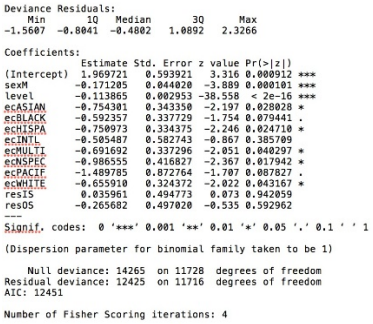
*Figure 28*. Fall 2014 to Spring 2015 advising versus retention output for FTFT after GLM Modeling.

```
Estimate...  0.043458
SE.........  0.0089511
T-stat.....  4.8551
p.val......  1.2033e-06

Original number of observations..............  4410
Original number of treated obs...............  2186
Matched number of observations...............  2186
Matched number of observations  (unweighted).  2186
```

*Figure 29*. Fall 2014 to Spring 2015 versus retention matching output for FTFT after GLM Modeling.

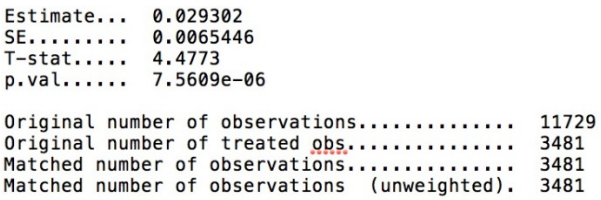
```
                                Summary Statistics
n                                         2186.000
Treat mean                                   0.926
Control mean                                 0.882
mean(D = Treat - Control)                    0.043
SD(D)                                        0.419
Effect Size                                  0.104
r(Treat, Control)                           -0.017
r(Treat + Control, D)                       -0.204
Lower 95% Confidence Interval                0.026
Upper 95% Confidence Interval                0.061
t (D-bar)                                    4.854
df.t                                      2185.000
p-value (t-statistic)                        0.000
```

*Figure 30*. Fall 2014 to Spring 2015 versus retention matching output summary statistics for FTFT after GLM Modeling.



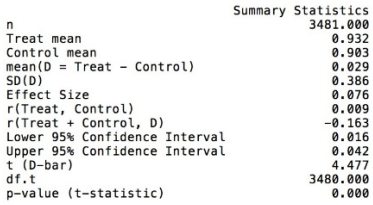
```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.5607  -0.8041  -0.4802   1.0892   2.3266

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.969721   0.593921   3.316 0.000912 ***
sexM        -0.171205   0.044020  -3.889 0.000101 ***
level       -0.113865   0.002953 -38.558  < 2e-16 ***
ecASIAN     -0.754301   0.343350  -2.197 0.028028 *
ecBLACK     -0.592357   0.337729  -1.754 0.079441 .
ecHISPA     -0.750973   0.334375  -2.246 0.024710 *
ecINTL      -0.505487   0.582743  -0.867 0.385709
ecMULTI     -0.691692   0.337296  -2.051 0.040297 *
ecNSPEC     -0.986555   0.416827  -2.367 0.017942 *
ecPACIF     -1.489785   0.872764  -1.707 0.087827 .
ecWHITE     -0.655910   0.324372  -2.022 0.043167 *
resIS        0.035961   0.494773   0.073 0.942059
resOS       -0.265682   0.497020  -0.535 0.592962
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 14265  on 11728  degrees of freedom
Residual deviance: 12425  on 11716  degrees of freedom
AIC: 12451

Number of Fisher Scoring iterations: 4
```

*Figure 31*. Spring 2015 to Fall 2015 advising versus retention output for F/S/J after GLM Modeling.



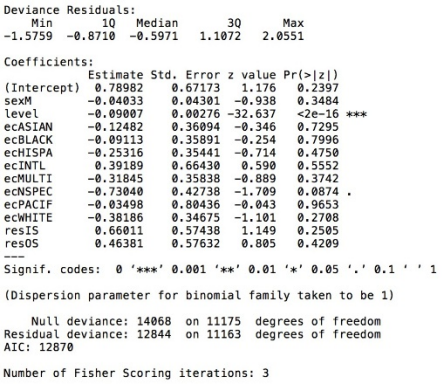
```
Estimate...  0.029302
SE.........  0.0065446
T-stat.....  4.4773
p.val......  7.5609e-06

Original number of observations..............  11729
Original number of treated obs...............  3481
Matched number of observations...............  3481
Matched number of observations  (unweighted).  3481
```

Figure 31. Spring 2015 to Fall 2015 advising versus retention matching output for F/S/J after GLM Modeling.



| | Summary Statistics |
|---|---|
| n | 3481.000 |
| Treat mean | 0.932 |
| Control mean | 0.903 |
| mean(D = Treat - Control) | 0.029 |
| SD(D) | 0.386 |
| Effect Size | 0.076 |
| r(Treat, Control) | 0.009 |
| r(Treat + Control, D) | -0.163 |
| Lower 95% Confidence Interval | 0.016 |
| Upper 95% Confidence Interval | 0.042 |
| t (D-bar) | 4.477 |
| df.t | 3480.000 |
| p-value (t-statistic) | 0.000 |

*Figure 32*. Spring 2015 to Fall 2015 advising versus retention matching output summary statistics for F/S/J after GLM Modeling.



```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.5759  -0.8710  -0.5971   1.1072   2.0551

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  0.78982    0.67173   1.176   0.2397
sexM        -0.04033    0.04301  -0.938   0.3484
level       -0.09007    0.00276 -32.637   <2e-16 ***
ecASIAN     -0.12482    0.36094  -0.346   0.7295
ecBLACK     -0.09113    0.35891  -0.254   0.7996
ecHISPA     -0.25316    0.35441  -0.714   0.4750
ecINTL       0.39189    0.66430   0.590   0.5552
ecMULTI     -0.31845    0.35838  -0.889   0.3742
ecNSPEC     -0.73040    0.42738  -1.709   0.0874 .
ecPACIF     -0.03498    0.80436  -0.043   0.9653
ecWHITE     -0.38186    0.34675  -1.101   0.2708
resIS        0.66011    0.57438   1.149   0.2505
resOS        0.46381    0.57632   0.805   0.4209
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 14068  on 11175  degrees of freedom
Residual deviance: 12844  on 11163  degrees of freedom
AIC: 12870

Number of Fisher Scoring iterations: 3
```

*Figure 33*. Spring 2015 to Fall 2015 advising versus retention output for FTFT after GLM Modeling.

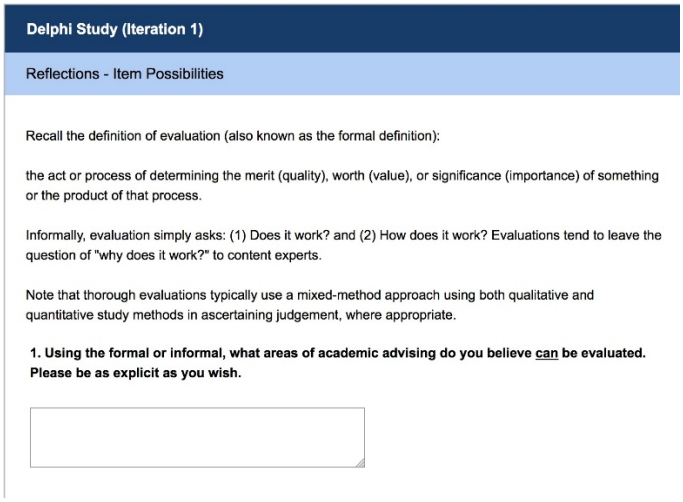
```
Estimate...  -0.022136
SE.........  0.007915
T-stat.....  -2.7967
p.val......  0.0051621

Original number of observations..............  11176
Original number of treated obs...............  3614
Matched number of observations...............  3614
Matched number of observations  (unweighted).  3614
```

*Figure 34*. Spring 2015 to Fall 2015 versus retention matching output for FTFT after GLM Modeling.

| | Summary Statistics |
|---|---|
| n | 3614.000 |
| Treat mean | 0.854 |
| Control mean | 0.876 |
| mean(D = Treat - Control) | -0.022 |
| SD(D) | 0.476 |
| Effect Size | -0.047 |
| r(Treat, Control) | 0.032 |
| r(Treat + Control, D) | 0.069 |
| Lower 95% Confidence Interval | -0.038 |
| Upper 95% Confidence Interval | -0.007 |
| t (D-bar) | -2.796 |
| df.t | 3613.000 |
| p-value (t-statistic) | 0.005 |

*Figure 35*. Spring 2015 to Fall 2015 versus retention matching output summary statistics for FTFT after GLM Modeling.

# Appendix G: First Iteration Questions Provided to Participants of Delphi Study



**Delphi Study (Iteration 1)**

Reflections - Item Possibilities

Recall the definition of evaluation (also known as the formal definition):

the act or process of determining the merit (quality), worth (value), or significance (importance) of something or the product of that process.

Informally, evaluation simply asks: (1) Does it work? and (2) How does it work? Evaluations tend to leave the question of "why does it work?" to content experts.

Note that thorough evaluations typically use a mixed-method approach using both qualitative and quantitative study methods in ascertaining judgement, where appropriate.

**1. Using the formal or informal, what areas of academic advising do you believe can be evaluated. Please be as explicit as you wish.**

**Delphi Study (Iteration 1)**

Reflections - Item Impossibilities

Recall the definition of evaluation (also known as the formal definition):

the act or process of determining the merit (quality), worth (value), or significance (importance) of something or the product of that process.

Informally, evaluation simply asks: (1) Does it work? and (2) How does it work? Evaluations tend to leave the question of "why does it work?" to content experts.

Note that thorough evaluations typically use a mixed-method approach using both qualitative and quantitative study methods in ascertaining judgement, where appropriate.

**2. Using the formal or informal, what areas of academic advising do you believe cannot be evaluated. Please be as explicit as you wish.**

**Delphi Study (Iteration 1)**

Reflections - Needs

Recall the definition of evaluation (also known as the formal definition):

the act or process of determining the merit (quality), worth (value), or significance (importance) of something or the product of that process.

Informally, evaluation simply asks: (1) Does it work? and (2) How does it work? Evaluations tend to leave the question of "why does it work?" to content experts.

Note that thorough evaluations typically use a mixed-method approach using both qualitative and quantitative study methods in ascertaining judgement, where appropriate.

**3. Using the formal or informal, what areas of academic advising do you believe should be evaluated and why. Please be as explicit as you wish.**

**Delphi Study (Iteration 1)**

Reflections - Unnecessary Items

Recall the definition of evaluation (also known as the formal definition):

the act or process of determining the merit (quality), worth (value), or significance (importance) of something or the product of that process.

Informally, evaluation simply asks: (1) Does it work? and (2) How does it work? Evaluations tend to leave the question of "why does it work?" to content experts.

Note that thorough evaluations typically use a mixed-method approach using both qualitative and quantitative study methods in ascertaining judgement, where appropriate.

**4. Using the formal or informal, what areas of academic advising do you believe should not be evaluated and why. Please be as explicit as you wish.**

**Delphi Study (Iteration 2)**

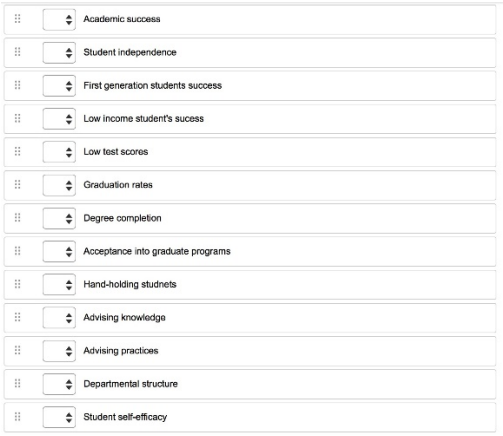
Outcomes Ranking

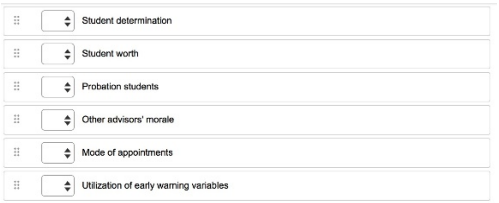
**1. Please rank the following evaluative variables in order of importance with 1 being most important to 50 being least important. In this, you are asked to prioritize what aspects of advising should be evaluated by your personal or professional preference. You may use the drop down menu or drag and drop the preferences. Also as there are numerous items, you may print them for reference.**

**Please note that the choices are not necessarily mutually exclusive nor independent. Some items may be more specific than other by design or construct.**

**Assume that all variables will be evaluated using "advisors effect on"**

- Registering for courses
- Remedying certain early warning indicators
- Changing majors
- Declaring majors
- Following through on referrals
- Removing enrollment holds
- Student's perceived satisfaction of advising received
- Timely communication from advisors with students
- The volume of students advise
- Academic intervention models (email, holds, etc)
- Outreach
- Content of advising session
- Timing of advising session
- Advising actions
- Advising outcomes
- Length of meetings with students
- Number of meetings with students
- Number of e-mail message
- Percentage of advisees who enroll
- Remaining in good standing
- Progression
- Persistence
- Retention
- The accuracy of information
- Appropriateness of enrollment advising for student progress
- Effectiveness of advising for students with admission requirements for their majors
- Interventions on student outcomes
- Effectiveness for student demographics
- Students in lower ability bands
- The impact of developmental courses
- Student GPA


Academic success
Student independence
First generation students success
Low income student's sucess
Low test scores
Graduation rates
Degree completion
Acceptance into graduate programs
Hand-holding studnets
Advising knowledge
Advising practices
Departmental structure
Student self-efficacy


Student determination
Student worth
Probation students
Other advisors' morale
Mode of appointments
Utilization of early warning variables

**Appendix H: Ranked Variables Resulted from Iteration 2 of Delphi Study**

Table 1
Ranked variables in order of importance by least mean score

| Theme | Weight Mean score |
|---|---|
| Persistence | 8 |
| The accuracy of information | 11 |
| Appropriateness of enrollment advising for student progress | 13 |
| Content of advising session | 13.67 |
| Advising outcomes | 13.67 |
| Timely communication from advisors with students | 14.33 |
| Retention | 14.33 |
| Changing majors | 15.33 |
| Advising actions | 15.33 |
| Remedying certain early warning indicators | 16.33 |
| Remaining in good standing | 17 |
| Low income student's success | 17 |
| Probation students | 18 |
| Outreach | 18.67 |
| Interventions on student outcomes | 18.67 |
| Student's perceived satisfaction of advising received | 19.67 |
| Academic intervention models (email, holds, etc.) | 20.33 |
| Progression | 20.67 |
| Advising knowledge | 22 |
| Registering for courses | 23 |
| Following through on referrals | 23.33 |
| Percentage of advisees who enroll | 23.33 |
| The impact of developmental courses | 23.33 |
| Removing enrollment holds | 24.33 |
| The volume of students advise | 24.67 |
| First generation students success | 24.67 |
| Effectiveness of advising for students with admission requirements for their majors | 25 |
| Number of meetings with students | 25.33 |
| Academic success | 25.5 |

| | |
|---|---|
| Number of e-mail message | 26.67 |
| Effectiveness for student demographics | 27 |
| Student self-efficacy | 27.33 |
| Student determination | 27.67 |
| Graduation rates | 28.67 |
| Declaring majors | 29.33 |
| Timing of advising session | 29.67 |
| Students in lower ability bands | 32 |
| Low test scores | 33.33 |
| Length of meetings with students | 34 |
| Acceptance into graduate programs | 34 |
| Utilization of early warning variables | 34.5 |
| Student GPA | 34.67 |
| Advising practices | 34.67 |
| Student independence | 38.33 |
| Degree completion | 38.67 |
| Mode of appointments | 41 |
| Student worth | 44.33 |
| Other advisors' morale | 44.33 |
| Departmental structure | 48 |
| Hand-holding students | 49.5 |

## Appendix I: Raw Matches

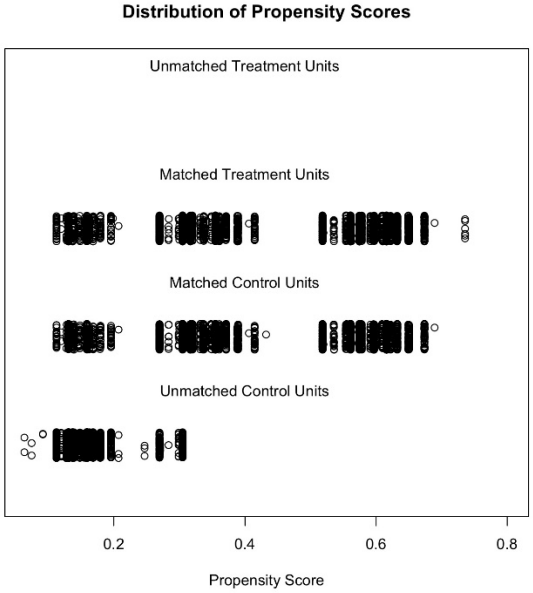



*Figure 1*. Distribution of propensity scores (F/S/J Fall 2012 to Spring 2013 semesters).

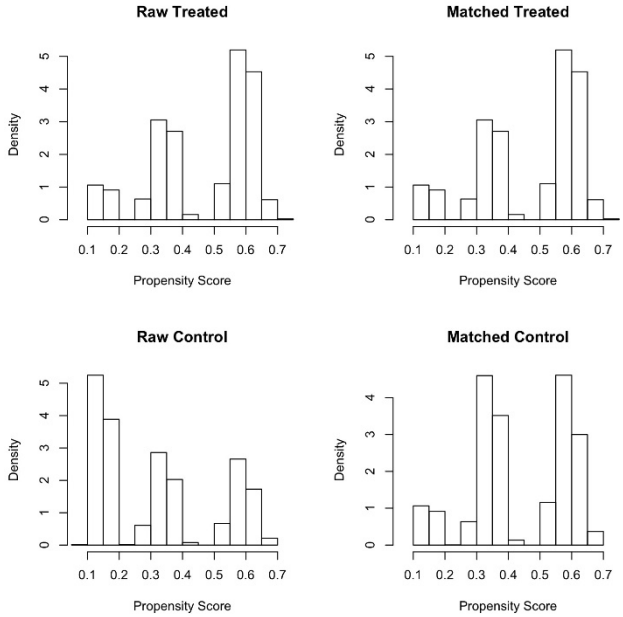
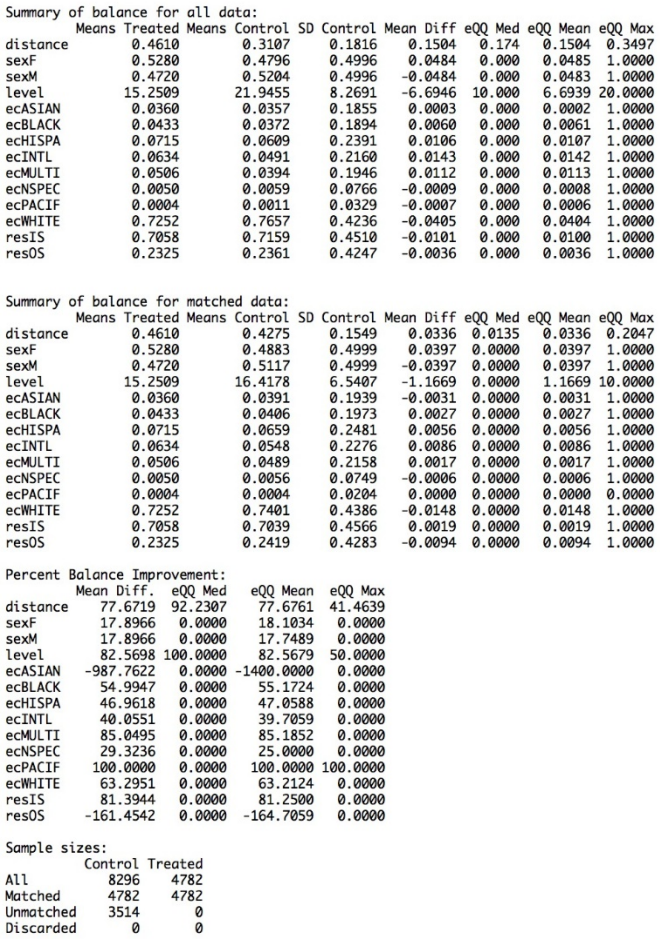


*Figure 2*. Histograms of propensity scores before and after matching (F/S/J Fall 2012 to Spring 2013 semesters).



```
Summary of balance for all data:
         Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.4610        0.3107     0.1816    0.1504   0.174   0.1504  0.3497
sexF            0.5280        0.4796     0.4996    0.0484   0.000   0.0485  1.0000
sexM            0.4720        0.5204     0.4996   -0.0484   0.000   0.0483  1.0000
level          15.2509       21.9455     8.2691   -6.6946  10.000   6.6939 20.0000
ecASIAN         0.0360        0.0357     0.1855    0.0003   0.000   0.0002  1.0000
ecBLACK         0.0433        0.0372     0.1894    0.0060   0.000   0.0061  1.0000
ecHISPA         0.0715        0.0609     0.2391    0.0106   0.000   0.0107  1.0000
ecINTL          0.0634        0.0491     0.2160    0.0143   0.000   0.0142  1.0000
ecMULTI         0.0506        0.0394     0.1946    0.0112   0.000   0.0113  1.0000
ecNSPEC         0.0050        0.0059     0.0766   -0.0009   0.000   0.0008  1.0000
ecPACIF         0.0004        0.0011     0.0329   -0.0007   0.000   0.0006  1.0000
ecWHITE         0.7252        0.7657     0.4236   -0.0405   0.000   0.0404  1.0000
resIS           0.7058        0.7159     0.4510   -0.0101   0.000   0.0100  1.0000
resOS           0.2325        0.2361     0.4247   -0.0036   0.000   0.0036  1.0000


Summary of balance for matched data:
         Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.4610        0.4275     0.1549    0.0336  0.0135   0.0336  0.2047
sexF            0.5280        0.4883     0.4999    0.0397  0.0000   0.0397  1.0000
sexM            0.4720        0.5117     0.4999   -0.0397  0.0000   0.0397  1.0000
level          15.2509       16.4178     6.5407   -1.1669  0.0000   1.1669 10.0000
ecASIAN         0.0360        0.0391     0.1939   -0.0031  0.0000   0.0031  1.0000
ecBLACK         0.0433        0.0406     0.1973    0.0027  0.0000   0.0027  1.0000
ecHISPA         0.0715        0.0659     0.2481    0.0056  0.0000   0.0056  1.0000
ecINTL          0.0634        0.0548     0.2276    0.0086  0.0000   0.0086  1.0000
ecMULTI         0.0506        0.0489     0.2158    0.0017  0.0000   0.0017  1.0000
ecNSPEC         0.0050        0.0056     0.0749   -0.0006  0.0000   0.0006  1.0000
ecPACIF         0.0004        0.0004     0.0204    0.0000  0.0000   0.0000  0.0000
ecWHITE         0.7252        0.7401     0.4386   -0.0148  0.0000   0.0148  1.0000
resIS           0.7058        0.7039     0.4566    0.0019  0.0000   0.0019  1.0000
resOS           0.2325        0.2419     0.4283   -0.0094  0.0000   0.0094  1.0000

Percent Balance Improvement:
         Mean Diff.  eQQ Med   eQQ Mean  eQQ Max
distance    77.6719  92.2307    77.6761  41.4639
sexF        17.8966   0.0000    18.1034   0.0000
sexM        17.8966   0.0000    17.7489   0.0000
level       82.5698 100.0000    82.5679  50.0000
ecASIAN   -987.7622   0.0000 -1400.0000   0.0000
ecBLACK     54.9947   0.0000    55.1724   0.0000
ecHISPA     46.9618   0.0000    47.0588   0.0000
ecINTL      40.0551   0.0000    39.7059   0.0000
ecMULTI     85.0495   0.0000    85.1852   0.0000
ecNSPEC     29.3236   0.0000    25.0000   0.0000
ecPACIF    100.0000   0.0000   100.0000 100.0000
ecWHITE     63.2951   0.0000    63.2124   0.0000
resIS       81.3944   0.0000    81.2500   0.0000
resOS     -161.4542   0.0000  -164.7059   0.0000

Sample sizes:
          Control Treated
All          8296    4782
Matched      4782    4782
Unmatched    3514       0
Discarded       0       0
```

*Figure 3*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (F/S/J Fall 2012 to Spring 2013 semesters).

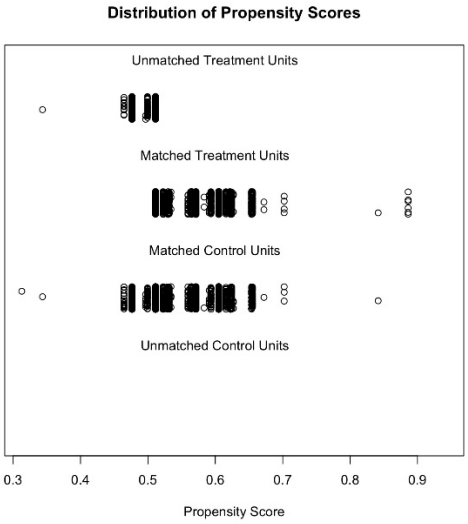



*Figure 4*. Distribution of propensity scores (FTFT Fall 2012 to Spring 2013 semesters).

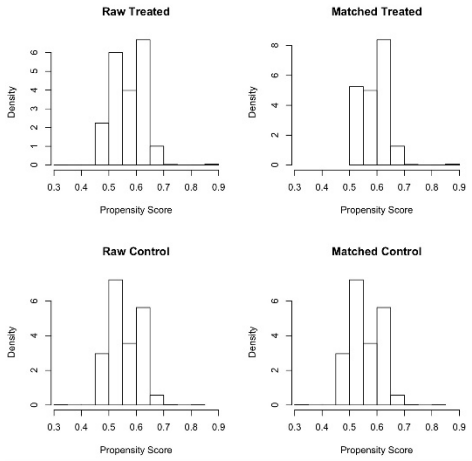



*Figure 5*. Histograms of propensity scores before and after matching (FTFT Fall 2012 to Spring 2013 semesters).

```
Summary of balance for all data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.5617        0.5500     0.0521    0.0116       0   0.0115  0.1839
sexF             0.5432        0.4492     0.4975    0.0940       0   0.0938  1.0000
sexM             0.4568        0.5508     0.4975   -0.0940       0   0.0942  1.0000
level           10.0000       10.0000     0.0000    0.0000       0   0.0000  0.0000
ecASIAN          0.0350        0.0325     0.1773    0.0025       0   0.0023  1.0000
ecBLACK          0.0474        0.0403     0.1966    0.0071       0   0.0069  1.0000
ecHISPA          0.0773        0.0645     0.2457    0.0128       0   0.0128  1.0000
ecINTL           0.0612        0.0590     0.2357    0.0022       0   0.0023  1.0000
ecMULTI          0.0558        0.0590     0.2357   -0.0032       0   0.0032  1.0000
ecNSPEC          0.0044        0.0041     0.0640    0.0003       0   0.0000  0.0000
ecPACIF          0.0004        0.0009     0.0302   -0.0006       0   0.0005  1.0000
ecWHITE          0.7138        0.7365     0.4406   -0.0227       0   0.0229  1.0000
resIS            0.6821        0.6569     0.4749    0.0252       0   0.0252  1.0000
resOS            0.2592        0.2845     0.4513   -0.0253       0   0.0256  1.0000


Summary of balance for matched data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.5790        0.5500     0.0521    0.0290  0.0338   0.0290  0.2311
sexF             0.6816        0.4492     0.4975    0.2324  0.0000   0.2324  1.0000
sexM             0.3184        0.5508     0.4975   -0.2324  0.0000   0.2324  1.0000
level           10.0000       10.0000     0.0000    0.0000  0.0000   0.0000  0.0000
ecASIAN          0.0430        0.0325     0.1773    0.0105  0.0000   0.0105  1.0000
ecBLACK          0.0595        0.0403     0.1966    0.0192  0.0000   0.0192  1.0000
ecHISPA          0.0970        0.0645     0.2457    0.0325  0.0000   0.0325  1.0000
ecINTL           0.0769        0.0590     0.2357    0.0178  0.0000   0.0178  1.0000
ecMULTI          0.0435        0.0590     0.2357   -0.0156  0.0000   0.0156  1.0000
ecNSPEC          0.0050        0.0041     0.0640    0.0009  0.0000   0.0009  1.0000
ecPACIF          0.0000        0.0009     0.0302   -0.0009  0.0000   0.0009  1.0000
ecWHITE          0.6693        0.7365     0.4406   -0.0672  0.0000   0.0672  1.0000
resIS            0.7210        0.6569     0.4749    0.0640  0.0000   0.0640  1.0000
resOS            0.2054        0.2845     0.4513   -0.0791  0.0000   0.0791  1.0000

Percent Balance Improvement:
          Mean Diff. eQQ Med  eQQ Mean  eQQ Max
distance  -149.6602    -Inf -152.4011 -25.6387
sexF      -147.2776       0 -147.8049   0.0000
sexM      -147.2776       0 -146.6019   0.0000
level        0.0000       0    0.0000   0.0000
ecASIAN   -317.7250       0 -360.0000   0.0000
ecBLACK   -169.1981       0 -180.0000   0.0000
ecHISPA   -154.0179       0 -153.5714   0.0000
ecINTL    -698.2762       0 -680.0000   0.0000
ecMULTI   -381.0047       0 -385.7143   0.0000
ecNSPEC   -255.0809       0      -Inf     -Inf
ecPACIF    -66.2424       0 -100.0000   0.0000
ecWHITE   -196.3945       0 -194.0000   0.0000
resIS     -154.2202       0 -154.5455   0.0000
resOS     -212.4022       0 -208.9286   0.0000

Sample sizes:
          Control Treated
All          2186    2743
Matched      2186    2186
Unmatched       0     557
Discarded       0       0
```

*Figure 6*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (FTFT Fall 2012 to Spring 2013 semesters).

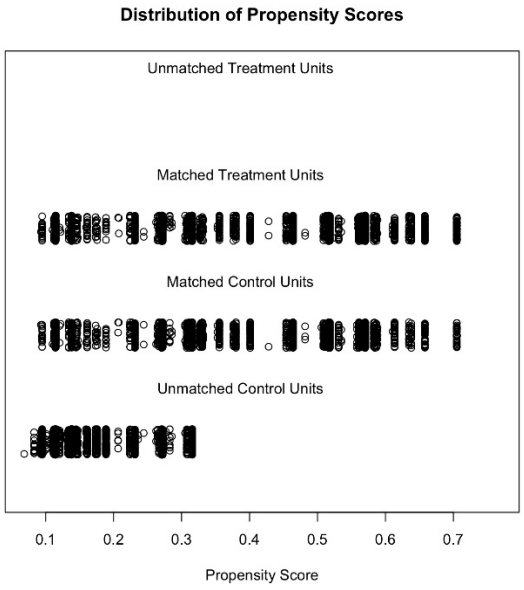


*Figure 7*. Distribution of propensity scores (F/S/J Spring 2013 to Fall 2013 semesters).

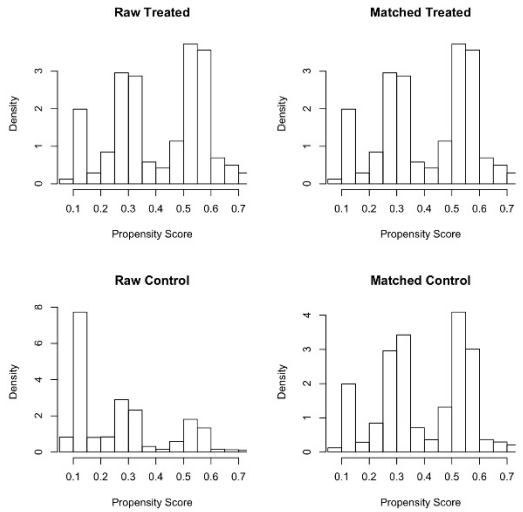



*Figure 8*. Histograms of propensity scores before and after matching (F/S/J Spring 2013 to Fall 2013 semesters).

```
Summary of balance for all data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.4026        0.2647     0.1609    0.1379  0.1558   0.1379  0.2456
sexF             0.5258        0.4831     0.4997    0.0427  0.0000   0.0427  1.0000
sexM             0.4742        0.5169     0.4997   -0.0427  0.0000   0.0427  1.0000
level           16.4049       22.7455     7.7696   -6.3407 10.0000   6.3367 10.0000
ecASIAN          0.0394        0.0332     0.1792    0.0062  0.0000   0.0062  1.0000
ecBLACK          0.0448        0.0374     0.1898    0.0073  0.0000   0.0074  1.0000
ecHISPA          0.0738        0.0624     0.2418    0.0114  0.0000   0.0116  1.0000
ecINTL           0.0812        0.0458     0.2091    0.0354  0.0000   0.0353  1.0000
ecMULTI          0.0504        0.0427     0.2021    0.0077  0.0000   0.0077  1.0000
ecNSPEC          0.0056        0.0050     0.0705    0.0006  0.0000   0.0006  1.0000
ecPACIF          0.0006        0.0009     0.0303   -0.0003  0.0000   0.0003  1.0000
ecWHITE          0.7012        0.7672     0.4226   -0.0660  0.0000   0.0658  1.0000
resIS            0.6953        0.7122     0.4528   -0.0169  0.0000   0.0169  1.0000
resOS            0.2250        0.2430     0.4289   -0.0181  0.0000   0.0181  1.0000


Summary of balance for matched data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.4026        0.3907     0.1547    0.0119       0   0.0119  0.0787
sexF             0.5258        0.4908     0.5000    0.0350       0   0.0350  1.0000
sexM             0.4742        0.5092     0.5000   -0.0350       0   0.0350  1.0000
level           16.4049       16.6983     6.8834   -0.2934       0   0.2934 10.0000
ecASIAN          0.0394        0.0436     0.2042   -0.0041       0   0.0041  1.0000
ecBLACK          0.0448        0.0519     0.2218   -0.0071       0   0.0071  1.0000
ecHISPA          0.0738        0.0705     0.2561    0.0033       0   0.0033  1.0000
ecINTL           0.0812        0.0622     0.2416    0.0190       0   0.0190  1.0000
ecMULTI          0.0504        0.0542     0.2265   -0.0039       0   0.0039  1.0000
ecNSPEC          0.0056        0.0056     0.0748    0.0000       0   0.0000  0.0000
ecPACIF          0.0006        0.0000     0.0000    0.0006       0   0.0006  1.0000
ecWHITE          0.7012        0.7090     0.4543   -0.0077       0   0.0077  1.0000
resIS            0.6953        0.7051     0.4561   -0.0098       0   0.0098  1.0000
resOS            0.2250        0.2341     0.4235   -0.0092       0   0.0092  1.0000

Percent Balance Improvement:
          Mean Diff. eQQ Med  eQQ Mean  eQQ Max
distance     91.3672     100   91.3680  67.9592
sexF         18.1402       0   18.0556   0.0000
sexM         18.1402       0   18.0556   0.0000
level        95.3724     100   95.3695   0.0000
ecASIAN      33.0697       0   33.3333   0.0000
ecBLACK       2.9943       0    4.0000   0.0000
ecHISPA      71.4790       0   71.7949   0.0000
ecINTL       46.3932       0   46.2185   0.0000
ecMULTI      50.0389       0   50.0000   0.0000
ecNSPEC     100.0000       0  100.0000 100.0000
ecPACIF     -81.6361       0 -100.0000   0.0000
ecWHITE      88.3164       0   88.2883   0.0000
resIS        42.0155       0   42.1053   0.0000
resOS        49.1972       0   49.1803   0.0000

Sample sizes:
            Control Treated
All            7616    3374
Matched        3374    3374
Unmatched      4242       0
Discarded         0       0
```

*Figure 9*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (F/S/J Spring 2013 to Fall 2013 semesters).

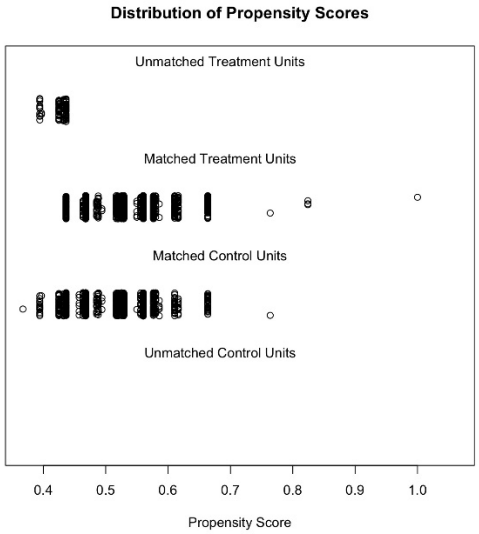



*Figure 10*. Distribution of propensity scores (FTFT Spring 2013 to Fall 2013 semesters).

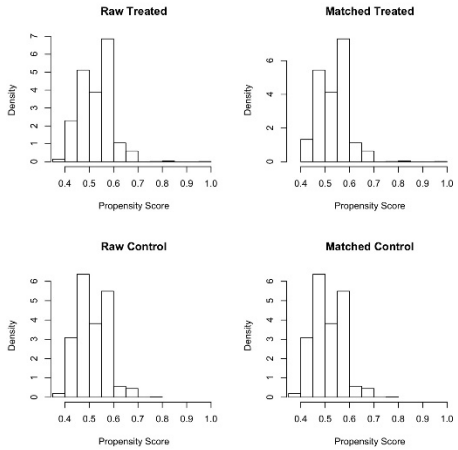



*Figure 11*. Histograms of propensity scores before and after matching (FTFT Spring 2013 to Fall 2013 semesters).

```
Summary of balance for all data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.5223        0.5081     0.0573    0.0142   0.004   0.0141  0.2362
sexF             0.5372        0.4500     0.4977    0.0872   0.000   0.0870  1.0000
sexM             0.4628        0.5500     0.4977   -0.0872   0.000   0.0877  1.0000
level           10.0000       10.0000     0.0000    0.0000   0.000   0.0000  0.0000
ecASIAN          0.0360        0.0292     0.1685    0.0068   0.000   0.0065  1.0000
ecBLACK          0.0397        0.0435     0.2041   -0.0038   0.000   0.0039  1.0000
ecHISPA          0.0812        0.0688     0.2532    0.0124   0.000   0.0123  1.0000
ecINTL           0.0836        0.0558     0.2297    0.0278   0.000   0.0273  1.0000
ecMULTI          0.0598        0.0721     0.2587   -0.0122   0.000   0.0123  1.0000
ecNSPEC          0.0055        0.0058     0.0762   -0.0003   0.000   0.0006  1.0000
ecPACIF          0.0006        0.0000     0.0000    0.0006   0.000   0.0006  1.0000
ecWHITE          0.6911        0.7214     0.4484   -0.0303   0.000   0.0305  1.0000
resIS            0.6636        0.6578     0.4746    0.0058   0.000   0.0052  1.0000
resOS            0.2552        0.2870     0.4525   -0.0318   0.000   0.0318  1.0000


Summary of balance for matched data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.5284        0.5081     0.0573    0.0203  0.0163   0.0203  0.2362
sexF             0.5714        0.4500     0.4977    0.1214  0.0000   0.1214  1.0000
sexM             0.4286        0.5500     0.4977   -0.1214  0.0000   0.1214  1.0000
level           10.0000       10.0000     0.0000    0.0000  0.0000   0.0000  0.0000
ecASIAN          0.0383        0.0292     0.1685    0.0091  0.0000   0.0091  1.0000
ecBLACK          0.0325        0.0435     0.2041   -0.0110  0.0000   0.0110  1.0000
ecHISPA          0.0864        0.0688     0.2532    0.0175  0.0000   0.0175  1.0000
ecINTL           0.0890        0.0558     0.2297    0.0331  0.0000   0.0331  1.0000
ecMULTI          0.0383        0.0721     0.2587   -0.0338  0.0000   0.0338  1.0000
ecNSPEC          0.0058        0.0058     0.0762    0.0000  0.0000   0.0000  0.0000
ecPACIF          0.0006        0.0000     0.0000    0.0006  0.0000   0.0006  1.0000
ecWHITE          0.7078        0.7214     0.4484   -0.0136  0.0000   0.0136  1.0000
resIS            0.6857        0.6578     0.4746    0.0279  0.0000   0.0279  1.0000
resOS            0.2279        0.2870     0.4525   -0.0591  0.0000   0.0591  1.0000

Percent Balance Improvement:
          Mean Diff.   eQQ Med  eQQ Mean eQQ Max
distance   -42.4558 -302.9057  -44.1841       0
sexF       -39.1882    0.0000  -39.5522       0
sexM       -39.1882    0.0000  -38.5185       0
level        0.0000    0.0000    0.0000       0
ecASIAN    -33.7143    0.0000  -40.0000       0
ecBLACK   -188.6792    0.0000 -183.3333       0
ecHISPA    -41.7864    0.0000  -42.1053       0
ecINTL     -19.1494    0.0000  -21.4286       0
ecMULTI   -175.6683    0.0000 -173.6842       0
ecNSPEC    100.0000    0.0000  100.0000     100
ecPACIF     -6.3636    0.0000    0.0000       0
ecWHITE     55.0576    0.0000   55.3191       0
resIS     -379.5996    0.0000 -437.5000       0
resOS      -85.6819    0.0000  -85.7143       0

Sample sizes:
           Control Treated
All           1540    1638
Matched       1540    1540
Unmatched        0      98
Discarded        0       0
```

*Figure 12*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (FTFT Spring 2013 to Fall 2013 semesters).

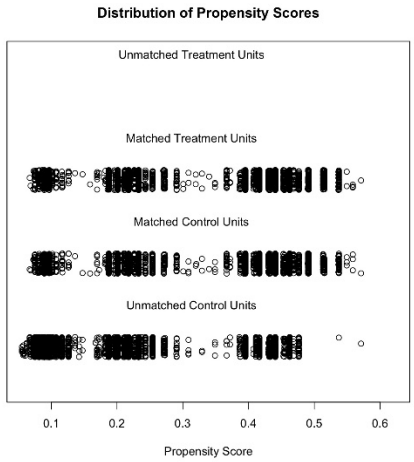



*Figure 13.* Distribution of propensity scores (F/S/J Fall 2013 to Spring 2013 semesters).

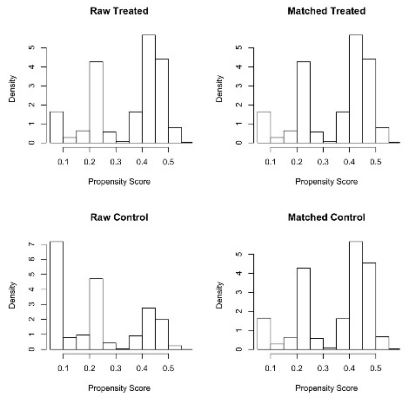



*Figure 14*. Histograms of propensity scores before and after matching (F/S/J Fall 2013 to Spring 2013 semesters).

```
Summary of balance for all data:
         Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.3496        0.2339     0.1461    0.1156  0.1282   0.1157  0.2757
sexF            0.5136        0.4988     0.5000    0.0149  0.0000   0.0149  1.0000
sexM            0.4864        0.5012     0.5000   -0.0149  0.0000   0.0149  1.0000
level          14.6797       21.0178     8.2690   -6.3381 10.0000   6.3373 20.0000
ecASIAN         0.0348        0.0371     0.1890   -0.0023  0.0000   0.0023  1.0000
ecBLACK         0.0543        0.0394     0.1945    0.0149  0.0000   0.0149  1.0000
ecHISPA         0.0646        0.0671     0.2501   -0.0024  0.0000   0.0026  1.0000
ecINTL          0.0569        0.0447     0.2067    0.0121  0.0000   0.0121  1.0000
ecMULTI         0.0529        0.0455     0.2083    0.0074  0.0000   0.0075  1.0000
ecNSPEC         0.0060        0.0084     0.0911   -0.0023  0.0000   0.0023  1.0000
ecPACIF         0.0006        0.0011     0.0337   -0.0006  0.0000   0.0006  1.0000
ecWHITE         0.7242        0.7524     0.4316   -0.0282  0.0000   0.0282  1.0000
resIS           0.6903        0.6969     0.4596   -0.0066  0.0000   0.0066  1.0000
resOS           0.2548        0.2596     0.4384   -0.0047  0.0000   0.0046  1.0000


Summary of balance for matched data:
         Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.3496        0.3494     0.1312    0.0002       0   0.0002  0.0221
sexF            0.5136        0.5128     0.4999    0.0009       0   0.0009  1.0000
sexM            0.4864        0.4872     0.4999   -0.0009       0   0.0009  1.0000
level          14.6797       14.6768     6.6406    0.0029       0   0.0029 10.0000
ecASIAN         0.0348        0.0350     0.1839   -0.0003       0   0.0003  1.0000
ecBLACK         0.0543        0.0569     0.2316   -0.0026       0   0.0026  1.0000
ecHISPA         0.0646        0.0646     0.2459    0.0000       0   0.0000  0.0000
ecINTL          0.0569        0.0546     0.2272    0.0023       0   0.0023  1.0000
ecMULTI         0.0529        0.0531     0.2244   -0.0003       0   0.0003  1.0000
ecNSPEC         0.0060        0.0060     0.0774    0.0000       0   0.0000  0.0000
ecPACIF         0.0006        0.0006     0.0240    0.0000       0   0.0000  0.0000
ecWHITE         0.7242        0.7242     0.4470    0.0000       0   0.0000  0.0000
resIS           0.6903        0.6880     0.4634    0.0023       0   0.0023  1.0000
resOS           0.2548        0.2591     0.4382   -0.0043       0   0.0043  1.0000

Percent Balance Improvement:
         Mean Diff. eQQ Med eQQ Mean  eQQ Max
distance    99.8540     100  99.8476  91.9959
sexF        94.2103       0  94.2308   0.0000
sexM        94.2103       0  94.2308   0.0000
level       99.9547     100  99.9547  50.0000
ecASIAN     87.6934       0  87.5000   0.0000
ecBLACK     82.6794       0  82.6923   0.0000
ecHISPA    100.0000       0 100.0000 100.0000
ecINTL      81.0686       0  80.9524   0.0000
ecMULTI     96.1150       0  96.1538   0.0000
ecNSPEC    100.0000       0 100.0000 100.0000
ecPACIF    100.0000       0 100.0000 100.0000
ecWHITE    100.0000       0 100.0000 100.0000
resIS       65.2980       0  65.2174   0.0000
resOS        9.2041       0   6.2500   0.0000

Sample sizes:
          Control Treated
All          9678    3481
Matched      3481    3481
Unmatched    6197       0
Discarded       0       0
```

*Figure 15*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (F/S/J Fall 2013 to Spring 2013 semesters).

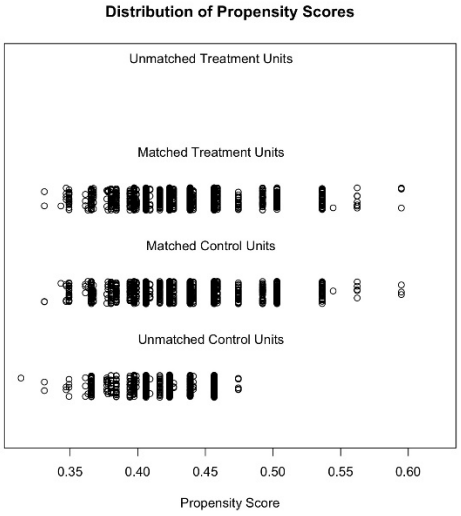



*Figure 16*. Distribution of propensity scores (FTFT Fall 2013 to Spring 2013 semesters).

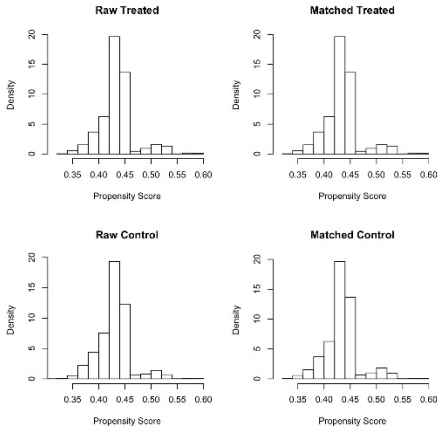



*Figure 17*. Histograms of propensity scores before and after matching (Fall 2013 to Spring 2013 semesters).

```
Summary of balance for all data:
         Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.4354        0.4306     0.0334    0.0048       0   0.0048  0.0358
sexF            0.5146        0.4853     0.4999    0.0293       0   0.0293  1.0000
sexM            0.4854        0.5147     0.4999   -0.0293       0   0.0293  1.0000
level          10.0000       10.0000     0.0000    0.0000       0   0.0000  0.0000
ecASIAN         0.0320        0.0356     0.1853   -0.0036       0   0.0037  1.0000
ecBLACK         0.0554        0.0478     0.2134    0.0076       0   0.0078  1.0000
ecHISPA         0.0645        0.0809     0.2728   -0.0164       0   0.0165  1.0000
ecINTL          0.0599        0.0436     0.2043    0.0163       0   0.0165  1.0000
ecMULTI         0.0503        0.0579     0.2336   -0.0076       0   0.0073  1.0000
ecNSPEC         0.0064        0.0087     0.0930   -0.0023       0   0.0023  1.0000
ecPACIF         0.0005        0.0007     0.0264   -0.0002       0   0.0000  0.0000
ecWHITE         0.7255        0.7216     0.4483    0.0040       0   0.0041  1.0000
resIS           0.6496        0.6490     0.4774    0.0006       0   0.0009  1.0000
resOS           0.2919        0.3091     0.4622   -0.0173       0   0.0169  1.0000

Summary of balance for matched data:
         Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.4354        0.4349     0.0340    0.0005       0   0.0005  0.0334
sexF            0.5146        0.5142     0.4999    0.0005       0   0.0005  1.0000
sexM            0.4854        0.4858     0.4999   -0.0005       0   0.0005  1.0000
level          10.0000       10.0000     0.0000    0.0000       0   0.0000  0.0000
ecASIAN         0.0320        0.0320     0.1761    0.0000       0   0.0000  0.0000
ecBLACK         0.0554        0.0572     0.2322   -0.0018       0   0.0018  1.0000
ecHISPA         0.0645        0.0645     0.2457    0.0000       0   0.0000  0.0000
ecINTL          0.0599        0.0563     0.2305    0.0037       0   0.0037  1.0000
ecMULTI         0.0503        0.0503     0.2187    0.0000       0   0.0000  0.0000
ecNSPEC         0.0064        0.0064     0.0798    0.0000       0   0.0000  0.0000
ecPACIF         0.0005        0.0005     0.0214    0.0000       0   0.0000  0.0000
ecWHITE         0.7255        0.7287     0.4447   -0.0032       0   0.0032  1.0000
resIS           0.6496        0.6496     0.4772    0.0000       0   0.0000  0.0000
resOS           0.2919        0.2955     0.4564   -0.0037       0   0.0037  1.0000

Percent Balance Improvement:
         Mean Diff. eQQ Med eQQ Mean  eQQ Max
distance    89.5780       0  89.6669   6.5399
sexF        98.4384       0  98.4375   0.0000
sexM        98.4384       0  98.4375   0.0000
level        0.0000       0   0.0000   0.0000
ecASIAN    100.0000       0 100.0000 100.0000
ecBLACK     75.7653       0  76.4706   0.0000
ecHISPA    100.0000       0 100.0000 100.0000
ecINTL      77.5647       0  77.7778   0.0000
ecMULTI    100.0000       0 100.0000 100.0000
ecNSPEC    100.0000       0 100.0000 100.0000
ecPACIF    100.0000       0   0.0000   0.0000
ecWHITE     19.1961       0  22.2222   0.0000
resIS      100.0000       0 100.0000 100.0000
resOS       78.8268       0  78.3784   0.0000

Sample sizes:
          Control Treated
All          2866    2186
Matched      2186    2186
Unmatched     680       0
Discarded       0       0
```

*Figure 18*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (FTFT Fall 2013 to Spring 2013 semesters).

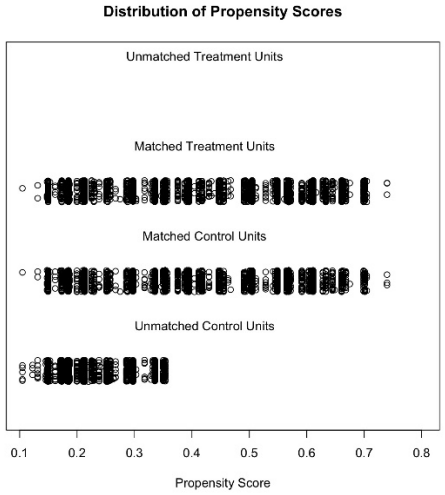



*Figure 19.* Distribution of propensity scores (F/S/J Spring 2014 to Fall 2014 semesters).

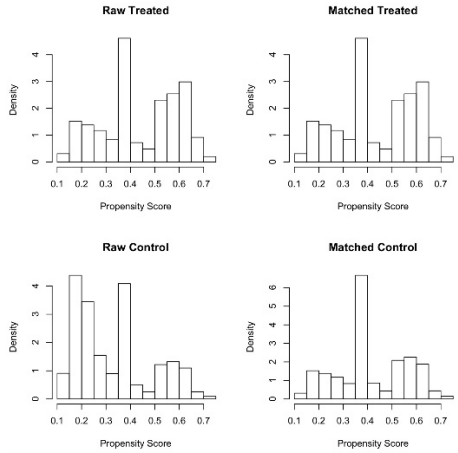



*Figure 20.* Histograms of propensity scores before and after matching (F/S/J Spring 2014 to Fall 2014 semesters).

Summary of balance for all data:

| | Means Treated | Means Control | SD Control | Mean Diff | eQQ Med | eQQ Mean | eQQ Max |
|---|---|---|---|---|---|---|---|
| distance | 0.4385 | 0.3282 | 0.1502 | 0.1103 | 0.1262 | 0.1103 | 0.1951 |
| sexF | 0.5204 | 0.4898 | 0.4999 | 0.0306 | 0.0000 | 0.0306 | 1.0000 |
| sexM | 0.4796 | 0.5102 | 0.4999 | -0.0306 | 0.0000 | 0.0304 | 1.0000 |
| level | 17.3834 | 22.7659 | 7.7441 | -5.3825 | 10.0000 | 5.3790 | 10.0000 |
| ecASIAN | 0.0415 | 0.0346 | 0.1829 | 0.0069 | 0.0000 | 0.0070 | 1.0000 |
| ecBLACK | 0.0537 | 0.0373 | 0.1896 | 0.0164 | 0.0000 | 0.0163 | 1.0000 |
| ecHISPA | 0.0671 | 0.0660 | 0.2483 | 0.0010 | 0.0000 | 0.0010 | 1.0000 |
| ecINTL | 0.0646 | 0.0425 | 0.2016 | 0.0222 | 0.0000 | 0.0221 | 1.0000 |
| ecMULTI | 0.0515 | 0.0453 | 0.2080 | 0.0062 | 0.0000 | 0.0063 | 1.0000 |
| ecNSPEC | 0.0061 | 0.0094 | 0.0964 | -0.0033 | 0.0000 | 0.0032 | 1.0000 |
| ecPACIF | 0.0010 | 0.0013 | 0.0357 | -0.0003 | 0.0000 | 0.0002 | 1.0000 |
| ecWHITE | 0.7085 | 0.7600 | 0.4271 | -0.0516 | 0.0000 | 0.0515 | 1.0000 |
| resIS | 0.6902 | 0.6889 | 0.4630 | 0.0013 | 0.0000 | 0.0015 | 1.0000 |
| resOS | 0.2476 | 0.2701 | 0.4440 | -0.0225 | 0.0000 | 0.0224 | 1.0000 |

Summary of balance for matched data:

| | Means Treated | Means Control | SD Control | Mean Diff | eQQ Med | eQQ Mean | eQQ Max |
|---|---|---|---|---|---|---|---|
| distance | 0.4385 | 0.4119 | 0.1413 | 0.0266 | 0.0074 | 0.0266 | 0.1329 |
| sexF | 0.5204 | 0.4793 | 0.4996 | 0.0411 | 0.0000 | 0.0411 | 1.0000 |
| sexM | 0.4796 | 0.5207 | 0.4996 | -0.0411 | 0.0000 | 0.0411 | 1.0000 |
| level | 17.3834 | 18.4548 | 7.1092 | -1.0714 | 0.0000 | 1.0714 | 10.0000 |
| ecASIAN | 0.0415 | 0.0374 | 0.1898 | 0.0041 | 0.0000 | 0.0041 | 1.0000 |
| ecBLACK | 0.0537 | 0.0464 | 0.2104 | 0.0073 | 0.0000 | 0.0073 | 1.0000 |
| ecHISPA | 0.0671 | 0.0658 | 0.2480 | 0.0012 | 0.0000 | 0.0012 | 1.0000 |
| ecINTL | 0.0646 | 0.0500 | 0.2181 | 0.0146 | 0.0000 | 0.0146 | 1.0000 |
| ecMULTI | 0.0515 | 0.0554 | 0.2288 | -0.0039 | 0.0000 | 0.0039 | 1.0000 |
| ecNSPEC | 0.0061 | 0.0063 | 0.0792 | -0.0002 | 0.0000 | 0.0002 | 1.0000 |
| ecPACIF | 0.0010 | 0.0005 | 0.0220 | 0.0005 | 0.0000 | 0.0005 | 1.0000 |
| ecWHITE | 0.7085 | 0.7340 | 0.4419 | -0.0255 | 0.0000 | 0.0255 | 1.0000 |
| resIS | 0.6902 | 0.7153 | 0.4513 | -0.0250 | 0.0000 | 0.0250 | 1.0000 |
| resOS | 0.2476 | 0.2366 | 0.4251 | 0.0109 | 0.0000 | 0.0109 | 1.0000 |

Percent Balance Improvement:

| | Mean Diff. | eQQ Med | eQQ Mean | eQQ Max |
|---|---|---|---|---|
| distance | 75.8980 | 94.1452 | 75.9058 | 31.8903 |
| sexF | -34.3559 | 0.0000 | -34.1270 | 0.0000 |
| sexM | -34.3559 | 0.0000 | -35.2000 | 0.0000 |
| level | 80.0942 | 100.0000 | 80.0813 | 0.0000 |
| ecASIAN | 40.1492 | 0.0000 | 41.3793 | 0.0000 |
| ecBLACK | 55.4236 | 0.0000 | 55.2239 | 0.0000 |
| ecHISPA | -17.6657 | 0.0000 | -25.0000 | 0.0000 |
| ecINTL | 34.2548 | 0.0000 | 34.0659 | 0.0000 |
| ecMULTI | 37.4345 | 0.0000 | 38.4615 | 0.0000 |
| ecNSPEC | 92.6314 | 0.0000 | 92.3077 | 0.0000 |
| ecPACIF | -58.7692 | 0.0000 | -100.0000 | 0.0000 |
| ecWHITE | 50.5526 | 0.0000 | 50.4717 | 0.0000 |
| resIS | -1792.5387 | 0.0000 | -1616.6667 | 0.0000 |
| resOS | 51.3765 | 0.0000 | 51.0870 | 0.0000 |

Sample sizes:

| | Control | Treated |
|---|---|---|
| All | 7043 | 4116 |
| Matched | 4116 | 4116 |
| Unmatched | 2927 | 0 |
| Discarded | 0 | 0 |

*Figure 21*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (F/S/J Spring 2014 to Fall 2014 semesters).

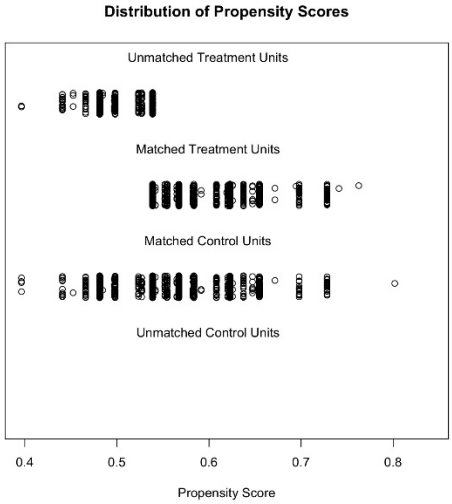



*Figure 22*. Distribution of propensity scores (FTFT Spring 2014 to Fall 2014 semesters).

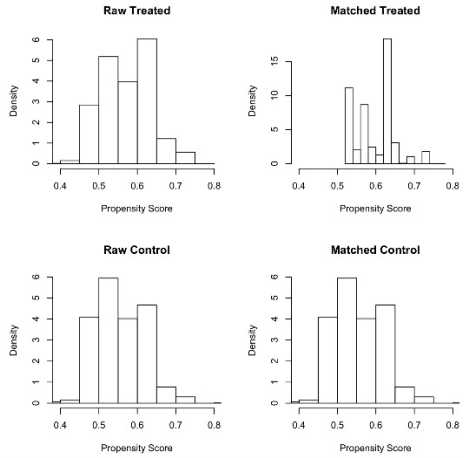



*Figure 23*. Histograms of propensity scores before and after matching (Spring 2014 to Fall 2014 semesters).

```
Summary of balance for all data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.5742        0.5593     0.0586    0.0148  0.0119   0.0148  0.0734
sexF             0.5233        0.4442     0.4971    0.0791  0.0000   0.0789  1.0000
sexM             0.4767        0.5558     0.4971   -0.0791  0.0000   0.0796  1.0000
level           10.0000       10.0000     0.0000    0.0000  0.0000   0.0000  0.0000
ecASIAN          0.0379        0.0270     0.1622    0.0109  0.0000   0.0107  1.0000
ecBLACK          0.0547        0.0604     0.2383   -0.0058  0.0000   0.0057  1.0000
ecHISPA          0.0703        0.0824     0.2751   -0.0121  0.0000   0.0121  1.0000
ecINTL           0.0736        0.0455     0.2084    0.0281  0.0000   0.0277  1.0000
ecMULTI          0.0530        0.0498     0.2175    0.0033  0.0000   0.0028  1.0000
ecNSPEC          0.0070        0.0100     0.0993   -0.0029  0.0000   0.0028  1.0000
ecPACIF          0.0016        0.0007     0.0267    0.0009  0.0000   0.0007  1.0000
ecWHITE          0.6970        0.7193     0.4495   -0.0223  0.0000   0.0227  1.0000
resIS            0.6358        0.6077     0.4884    0.0281  0.0000   0.0277  1.0000
resOS            0.2933        0.3490     0.4768   -0.0557  0.0000   0.0561  1.0000


Summary of balance for matched data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.5973        0.5593     0.0586    0.0379   0.039   0.0380  0.1424
sexF             0.6667        0.4442     0.4971    0.2225   0.000   0.2225  1.0000
sexM             0.3333        0.5558     0.4971   -0.2225   0.000   0.2225  1.0000
level           10.0000       10.0000     0.0000    0.0000   0.000   0.0000  0.0000
ecASIAN          0.0498        0.0270     0.1622    0.0227   0.000   0.0227  1.0000
ecBLACK          0.0384        0.0604     0.2383   -0.0220   0.000   0.0220  1.0000
ecHISPA          0.0362        0.0824     0.2751   -0.0462   0.000   0.0462  1.0000
ecINTL           0.0967        0.0455     0.2084    0.0512   0.000   0.0512  1.0000
ecMULTI          0.0625        0.0498     0.2175    0.0128   0.000   0.0128  1.0000
ecNSPEC          0.0000        0.0100     0.0993   -0.0100   0.000   0.0100  1.0000
ecPACIF          0.0021        0.0007     0.0267    0.0014   0.000   0.0014  1.0000
ecWHITE          0.7093        0.7193     0.4495   -0.0100   0.000   0.0100  1.0000
resIS            0.7015        0.6077     0.4884    0.0938   0.000   0.0938  1.0000
resOS            0.2054        0.3490     0.4768   -0.1436   0.000   0.1436  1.0000

Percent Balance Improvement:
          Mean Diff.   eQQ Med  eQQ Mean  eQQ Max
distance  -155.7718 -228.6537 -156.9939 -93.9366
sexF      -181.3771    0.0000 -181.9820   0.0000
sexM      -181.3771    0.0000 -179.4643   0.0000
level        0.0000    0.0000    0.0000   0.0000
ecASIAN   -109.2125    0.0000 -113.3333   0.0000
ecBLACK   -282.6087    0.0000 -287.5000   0.0000
ecHISPA   -281.8425    0.0000 -282.3529   0.0000
ecINTL     -82.0690    0.0000  -84.6154   0.0000
ecMULTI   -290.1478    0.0000 -350.0000   0.0000
ecNSPEC   -241.2742    0.0000 -250.0000   0.0000
ecPACIF    -55.7522    0.0000 -100.0000   0.0000
ecWHITE     55.3623    0.0000   56.2500   0.0000
resIS     -233.3142    0.0000 -238.4615   0.0000
resOS     -157.8474    0.0000 -155.6962   0.0000

Sample sizes:
           Control Treated
All           1407    1848
Matched       1407    1407
Unmatched        0     441
Discarded        0       0
```

*Figure 24*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (FTFT Spring 2014 to Fall 2014 semesters).

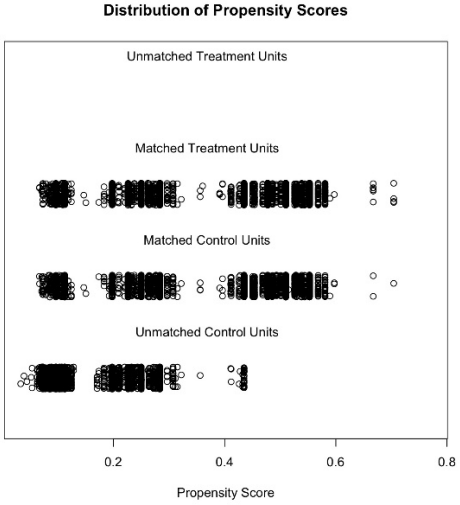



*Figure 25*. Distribution of propensity scores (F/S/J Fall 2014 to Spring 2015 semesters).

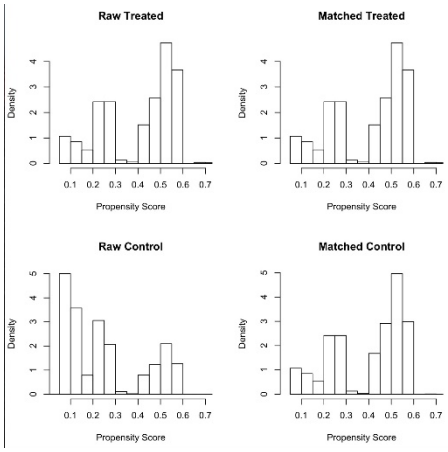



*Figure 26*. Histograms of propensity scores before and after matching (F/S/J Fall 2014 to Spring 2015 semesters).

```
Summary of balance for all data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.4007        0.2529     0.1677    0.1477  0.1535   0.1478  0.3225
sexF             0.5136        0.4884     0.4999    0.0253  0.0000   0.0253  1.0000
sexM             0.4864        0.5116     0.4999   -0.0253  0.0000   0.0253  1.0000
level           14.6797       21.6077     8.2115   -6.9280 10.0000   6.9262 20.0000
ecASIAN          0.0348        0.0386     0.1925   -0.0038  0.0000   0.0037  1.0000
ecBLACK          0.0543        0.0456     0.2086    0.0087  0.0000   0.0086  1.0000
ecHISPA          0.0646        0.0679     0.2516   -0.0033  0.0000   0.0032  1.0000
ecINTL           0.0569        0.0435     0.2040    0.0134  0.0000   0.0132  1.0000
ecMULTI          0.0529        0.0497     0.2174    0.0031  0.0000   0.0032  1.0000
ecNSPEC          0.0060        0.0101     0.0998   -0.0040  0.0000   0.0040  1.0000
ecPACIF          0.0006        0.0012     0.0348   -0.0006  0.0000   0.0006  1.0000
ecWHITE          0.7242        0.7402     0.4386   -0.0160  0.0000   0.0158  1.0000
resIS            0.6903        0.6839     0.4650    0.0064  0.0000   0.0066  1.0000
resOS            0.2548        0.2742     0.4462   -0.0194  0.0000   0.0195  1.0000

Summary of balance for matched data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance         0.4007        0.3975     0.1504    0.0032       0   0.0032  0.1068
sexF             0.5136        0.4820     0.4997    0.0316       0   0.0316  1.0000
sexM             0.4864        0.5180     0.4997   -0.0316       0   0.0316  1.0000
level           14.6797       14.6711     6.6404    0.0086       0   0.0086 10.0000
ecASIAN          0.0348        0.0373     0.1896   -0.0026       0   0.0026  1.0000
ecBLACK          0.0543        0.0623     0.2418   -0.0080       0   0.0080  1.0000
ecHISPA          0.0646        0.0689     0.2534   -0.0043       0   0.0043  1.0000
ecINTL           0.0569        0.0523     0.2226    0.0046       0   0.0046  1.0000
ecMULTI          0.0529        0.0600     0.2376   -0.0072       0   0.0072  1.0000
ecNSPEC          0.0060        0.0060     0.0774    0.0000       0   0.0000  0.0000
ecPACIF          0.0006        0.0006     0.0240    0.0000       0   0.0000  0.0000
ecWHITE          0.7242        0.7096     0.4540    0.0147       0   0.0147  1.0000
resIS            0.6903        0.6757     0.4682    0.0147       0   0.0147  1.0000
resOS            0.2548        0.2738     0.4460   -0.0190       0   0.0190  1.0000

Percent Balance Improvement:
          Mean Diff. eQQ Med  eQQ Mean eQQ Max
distance     97.8275     100   97.8124  66.873
sexF        -24.9773       0  -25.0000   0.000
sexM        -24.9773       0  -25.0000   0.000
level        99.8756     100   99.8756  50.000
ecASIAN      31.8660       0   30.7692   0.000
ecBLACK       7.6283       0    6.6667   0.000
ecHISPA     -32.2360       0  -36.3636   0.000
ecINTL       65.5818       0   65.2174   0.000
ecMULTI    -128.0418       0 -127.2727   0.000
ecNSPEC     100.0000       0  100.0000 100.000
ecPACIF     100.0000       0  100.0000 100.000
ecWHITE       8.2150       0    7.2727   0.000
resIS      -129.0824       0 -121.7391   0.000
resOS         2.4511       0    2.9412   0.000

Sample sizes:
          Control Treated
All          8248    3481
Matched      3481    3481
Unmatched    4767       0
Discarded       0       0
```

*Figure 27*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (F/S/J Fall 2014 to Spring 2015 semesters).

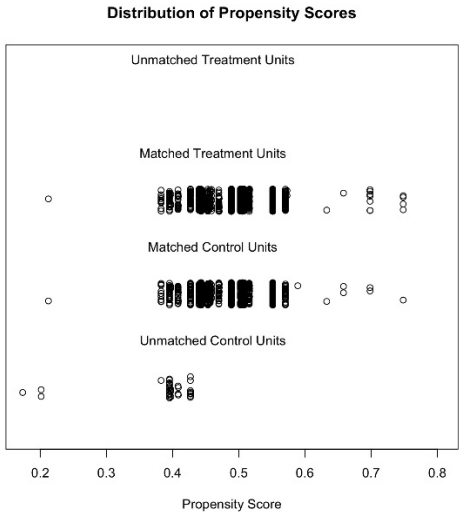



*Figure 28*. Distribution of propensity scores (FTFT Fall 2014 to Spring 2015 semesters).

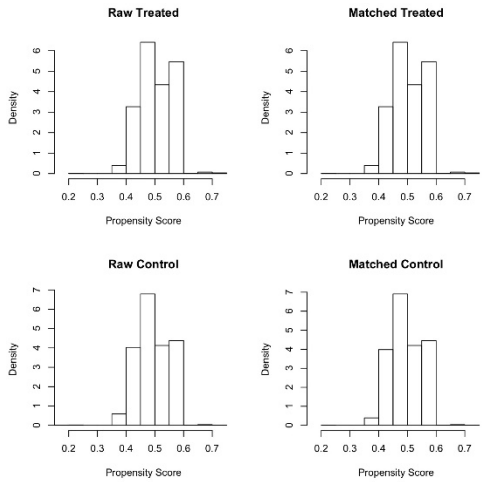



*Figure 29*. Histograms of propensity scores before and after matching (FTFT Fall 2014 to Spring 2015 semesters).

```
Summary of balance for all data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance          0.4999        0.4916     0.0455    0.0083       0   0.0084  0.1813
sexF              0.5146        0.4568     0.4982    0.0578       0   0.0581  1.0000
sexM              0.4854        0.5432     0.4982   -0.0578       0   0.0576  1.0000
level            10.0000       10.0000     0.0000    0.0000       0   0.0000  0.0000
ecASIAN           0.0320        0.0360     0.1863   -0.0039       0   0.0037  1.0000
ecBLACK           0.0554        0.0670     0.2501   -0.0116       0   0.0114  1.0000
ecHISPA           0.0645        0.0710     0.2570   -0.0065       0   0.0064  1.0000
ecINTL            0.0599        0.0517     0.2215    0.0082       0   0.0082  1.0000
ecMULTI           0.0503        0.0612     0.2397   -0.0108       0   0.0105  1.0000
ecNSPEC           0.0064        0.0072     0.0845   -0.0008       0   0.0005  1.0000
ecPACIF           0.0005        0.0018     0.0424   -0.0013       0   0.0009  1.0000
ecWHITE           0.7255        0.7019     0.4575    0.0236       0   0.0238  1.0000
resIS             0.6496        0.6178     0.4860    0.0318       0   0.0320  1.0000
resOS             0.2919        0.3314     0.4708   -0.0395       0   0.0393  1.0000


Summary of balance for matched data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance          0.4999        0.4934     0.0431    0.0065       0   0.0065  0.1278
sexF              0.5146        0.4648     0.4989    0.0499       0   0.0499  1.0000
sexM              0.4854        0.5352     0.4989   -0.0499       0   0.0499  1.0000
level            10.0000       10.0000     0.0000    0.0000       0   0.0000  0.0000
ecASIAN           0.0320        0.0352     0.1844   -0.0032       0   0.0032  1.0000
ecBLACK           0.0554        0.0599     0.2374   -0.0046       0   0.0046  1.0000
ecHISPA           0.0645        0.0714     0.2575   -0.0069       0   0.0069  1.0000
ecINTL            0.0599        0.0526     0.2233    0.0073       0   0.0073  1.0000
ecMULTI           0.0503        0.0576     0.2331   -0.0073       0   0.0073  1.0000
ecNSPEC           0.0064        0.0064     0.0798    0.0000       0   0.0000  0.0000
ecPACIF           0.0005        0.0005     0.0214    0.0000       0   0.0000  0.0000
ecWHITE           0.7255        0.7141     0.4520    0.0114       0   0.0114  1.0000
resIS             0.6496        0.6235     0.4846    0.0261       0   0.0261  1.0000
resOS             0.2919        0.3248     0.4684   -0.0329       0   0.0329  1.0000

Percent Balance Improvement:
          Mean Diff. eQQ Med eQQ Mean  eQQ Max
distance    21.6775       0  22.6260  29.4787
sexF        13.7383       0  14.1732   0.0000
sexM        13.7383       0  13.4921   0.0000
level        0.0000       0   0.0000   0.0000
ecASIAN     18.9167       0  12.5000   0.0000
ecBLACK     60.7137       0  60.0000   0.0000
ecHISPA     -4.8925       0  -7.1429   0.0000
ecINTL      10.9376       0  11.1111   0.0000
ecMULTI     32.4218       0  30.4348   0.0000
ecNSPEC    100.0000       0 100.0000 100.0000
ecPACIF    100.0000       0 100.0000 100.0000
ecWHITE     51.6177       0  51.9231   0.0000
resIS       17.9580       0  18.5714   0.0000
resOS       16.6738       0  16.2791   0.0000

Sample sizes:
          Control Treated
All          2224    2186
Matched      2186    2186
Unmatched      38       0
Discarded       0       0
```

*Figure 30*. Results showing the effectiveness of the nearest neighbor propensity scores matching. (FTFT Fall 2014 to Spring 2015 semesters).

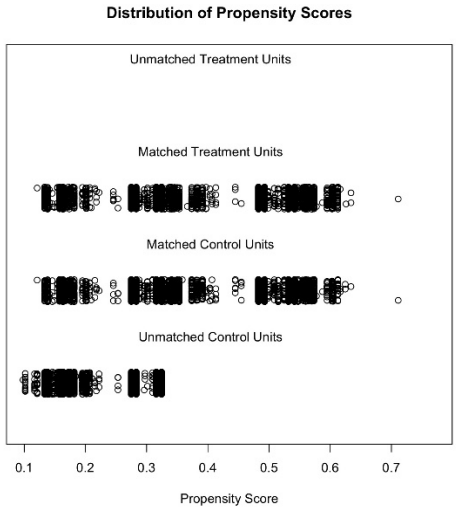



*Figure 31*. Distribution of propensity scores (F/S/J Spring 2015 to Fall 2015 semesters).

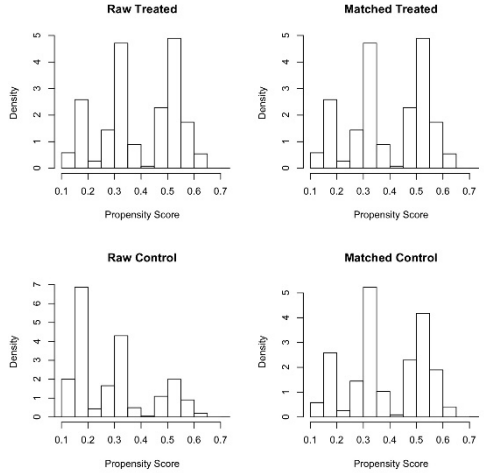



*Figure 32*. Histograms of propensity scores before and after matching (F/S/J Spring 2015 to Fall 2015 semesters).

Summary of balance for all data:

| | Means Treated | Means Control | SD Control | Mean Diff | eQQ Med | eQQ Mean | eQQ Max |
|---|---|---|---|---|---|---|---|
| distance | 0.3954 | 0.2890 | 0.1452 | 0.1064 | 0.1252 | 0.1064 | 0.2073 |
| sexF | 0.5017 | 0.5045 | 0.5000 | -0.0028 | 0.0000 | 0.0028 | 1.0000 |
| sexM | 0.4983 | 0.4955 | 0.5000 | 0.0028 | 0.0000 | 0.0028 | 1.0000 |
| level | 16.9507 | 22.5390 | 7.8223 | -5.5883 | 10.0000 | 5.5866 | 10.0000 |
| ecASIAN | 0.0445 | 0.0395 | 0.1949 | 0.0050 | 0.0000 | 0.0050 | 1.0000 |
| ecBLACK | 0.0573 | 0.0406 | 0.1974 | 0.0167 | 0.0000 | 0.0166 | 1.0000 |
| ecHISPA | 0.0791 | 0.0697 | 0.2546 | 0.0094 | 0.0000 | 0.0094 | 1.0000 |
| ecINTL | 0.0672 | 0.0479 | 0.2135 | 0.0194 | 0.0000 | 0.0194 | 1.0000 |
| ecMULTI | 0.0526 | 0.0497 | 0.2174 | 0.0029 | 0.0000 | 0.0028 | 1.0000 |
| ecNSPEC | 0.0064 | 0.0097 | 0.0978 | -0.0033 | 0.0000 | 0.0033 | 1.0000 |
| ecPACIF | 0.0011 | 0.0007 | 0.0257 | 0.0004 | 0.0000 | 0.0006 | 1.0000 |
| ecWHITE | 0.6876 | 0.7391 | 0.4392 | -0.0515 | 0.0000 | 0.0515 | 1.0000 |
| resIS | 0.6685 | 0.6760 | 0.4680 | -0.0075 | 0.0000 | 0.0075 | 1.0000 |
| resOS | 0.2659 | 0.2772 | 0.4476 | -0.0113 | 0.0000 | 0.0113 | 1.0000 |

Summary of balance for matched data:

| | Means Treated | Means Control | SD Control | Mean Diff | eQQ Med | eQQ Mean | eQQ Max |
|---|---|---|---|---|---|---|---|
| distance | 0.3954 | 0.3883 | 0.1425 | 0.0071 | 0 | 0.0072 | 0.1091 |
| sexF | 0.5017 | 0.4820 | 0.4997 | 0.0196 | 0 | 0.0196 | 1.0000 |
| sexM | 0.4983 | 0.5180 | 0.4997 | -0.0196 | 0 | 0.0196 | 1.0000 |
| level | 16.9507 | 17.2828 | 7.3374 | -0.3320 | 0 | 0.3320 | 10.0000 |
| ecASIAN | 0.0445 | 0.0468 | 0.2112 | -0.0022 | 0 | 0.0022 | 1.0000 |
| ecBLACK | 0.0573 | 0.0612 | 0.2396 | -0.0039 | 0 | 0.0039 | 1.0000 |
| ecHISPA | 0.0791 | 0.0930 | 0.2904 | -0.0138 | 0 | 0.0138 | 1.0000 |
| ecINTL | 0.0672 | 0.0742 | 0.2621 | -0.0069 | 0 | 0.0069 | 1.0000 |
| ecMULTI | 0.0526 | 0.0656 | 0.2476 | -0.0130 | 0 | 0.0130 | 1.0000 |
| ecNSPEC | 0.0064 | 0.0075 | 0.0861 | -0.0011 | 0 | 0.0011 | 1.0000 |
| ecPACIF | 0.0011 | 0.0011 | 0.0333 | 0.0000 | 0 | 0.0000 | 0.0000 |
| ecWHITE | 0.6876 | 0.6464 | 0.4782 | 0.0412 | 0 | 0.0412 | 1.0000 |
| resIS | 0.6685 | 0.6453 | 0.4785 | 0.0232 | 0 | 0.0232 | 1.0000 |
| resOS | 0.2659 | 0.2820 | 0.4500 | -0.0160 | 0 | 0.0160 | 1.0000 |

Percent Balance Improvement:

| | Mean Diff. | eQQ Med | eQQ Mean | eQQ Max |
|---|---|---|---|---|
| distance | 93.3237 | 100 | 93.2487 | 47.3812 |
| sexF | -592.7410 | 0 | -610.0000 | 0.0000 |
| sexM | -592.7410 | 0 | -610.0000 | 0.0000 |
| level | 94.0582 | 100 | 94.0565 | 0.0000 |
| ecASIAN | 55.8088 | 0 | 55.5556 | 0.0000 |
| ecBLACK | 76.7750 | 0 | 76.6667 | 0.0000 |
| ecHISPA | -46.4630 | 0 | -47.0588 | 0.0000 |
| ecINTL | 64.2829 | 0 | 64.2857 | 0.0000 |
| ecMULTI | -356.1502 | 0 | -370.0000 | 0.0000 |
| ecNSPEC | 66.3522 | 0 | 66.6667 | 0.0000 |
| ecPACIF | 100.0000 | 0 | 100.0000 | 100.0000 |
| ecWHITE | 19.9234 | 0 | 19.8925 | 0.0000 |
| resIS | -209.8938 | 0 | -211.1111 | 0.0000 |
| resOS | -42.4651 | 0 | -41.4634 | 0.0000 |

Sample sizes:

| | Control | Treated |
|---|---|---|
| All | 7562 | 3614 |
| Matched | 3614 | 3614 |
| Unmatched | 3948 | 0 |
| Discarded | 0 | 0 |

*Figure 33.* Results showing the effectiveness of the nearest neighbor propensity scores matching. (F/S/J Spring 2015 to Fall 2015 semesters).

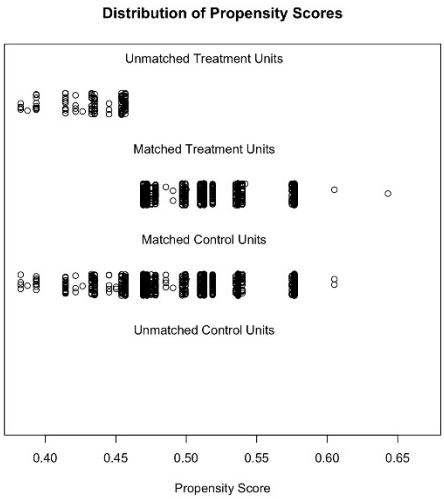



*Figure 34.* Distribution of propensity scores (FTFT Spring 2015 to Fall 2015 semesters).

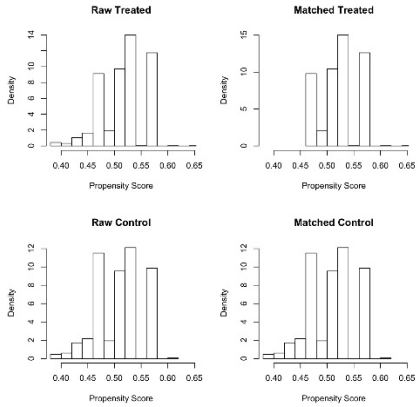



*Figure 35.* Histograms of propensity scores before and after matching (FTFT Spring 2015 to Fall 2015 semesters).

```
Summary of balance for all data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.5215        0.5139     0.0443    0.0076       0   0.0076    0.04
sexF            0.5038        0.4671     0.4991    0.0367       0   0.0363    1.00
sexM            0.4962        0.5329     0.4991   -0.0367       0   0.0369    1.00
level          10.0000       10.0000     0.0000    0.0000       0   0.0000    0.00
ecASIAN         0.0362        0.0326     0.1775    0.0036       0   0.0031    1.00
ecBLACK         0.0571        0.0639     0.2446   -0.0067       0   0.0069    1.00
ecHISPA         0.0723        0.0839     0.2773   -0.0116       0   0.0119    1.00
ecINTL          0.0776        0.0895     0.2856   -0.0120       0   0.0125    1.00
ecMULTI         0.0478        0.0607     0.2389   -0.0129       0   0.0131    1.00
ecNSPEC         0.0070        0.0100     0.0996   -0.0030       0   0.0031    1.00
ecPACIF         0.0017        0.0013     0.0354    0.0005       0   0.0000    0.00
ecWHITE         0.6980        0.6550     0.4755    0.0430       0   0.0426    1.00
resIS           0.6233        0.5648     0.4959    0.0585       0   0.0582    1.00
resOS           0.2997        0.3463     0.4759   -0.0466       0   0.0470    1.00


Summary of balance for matched data:
          Means Treated Means Control SD Control Mean Diff eQQ Med eQQ Mean eQQ Max
distance        0.5278        0.5139     0.0443    0.0139  0.0057   0.0139   0.087
sexF            0.5135        0.4671     0.4991    0.0463  0.0000   0.0463   1.000
sexM            0.4865        0.5329     0.4991   -0.0463  0.0000   0.0463   1.000
level          10.0000       10.0000     0.0000    0.0000  0.0000   0.0000   0.000
ecASIAN         0.0388        0.0326     0.1775    0.0063  0.0000   0.0063   1.000
ecBLACK         0.0507        0.0639     0.2446   -0.0131  0.0000   0.0131   1.000
ecHISPA         0.0551        0.0839     0.2773   -0.0288  0.0000   0.0288   1.000
ecINTL          0.0833        0.0895     0.2856   -0.0063  0.0000   0.0063   1.000
ecMULTI         0.0188        0.0607     0.2389   -0.0420  0.0000   0.0420   1.000
ecNSPEC         0.0006        0.0100     0.0996   -0.0094  0.0000   0.0094   1.000
ecPACIF         0.0019        0.0013     0.0354    0.0006  0.0000   0.0006   1.000
ecWHITE         0.7495        0.6550     0.4755    0.0946  0.0000   0.0946   1.000
resIS           0.6500        0.5648     0.4959    0.0852  0.0000   0.0852   1.000
resOS           0.2674        0.3463     0.4759   -0.0789  0.0000   0.0789   1.000

Percent Balance Improvement:
          Mean Diff. eQQ Med  eQQ Mean   eQQ Max
distance   -82.9700    -Inf  -83.2280 -117.5929
sexF       -26.3817       0  -27.5862    0.0000
sexM       -26.3817       0  -25.4237    0.0000
level        0.0000       0    0.0000    0.0000
ecASIAN    -74.3950       0 -100.0000    0.0000
ecBLACK    -95.4787       0  -90.9091    0.0000
ecHISPA   -148.2223       0 -142.1053    0.0000
ecINTL      47.7835       0   50.0000    0.0000
ecMULTI   -224.5812       0 -219.0476    0.0000
ecNSPEC   -210.8386       0 -200.0000    0.0000
ecPACIF    -26.0103       0      -Inf      -Inf
ecWHITE   -119.9857       0 -122.0588    0.0000
resIS      -45.5358       0  -46.2366    0.0000
resOS      -69.4332       0  -68.0000    0.0000

Sample sizes:
            Control Treated
All            1597    1715
Matched        1597    1597
Unmatched         0     118
Discarded         0       0
```

*Figure 36.* Results showing the effectiveness of the nearest neighbor propensity scores matching. (FTFT Spring 2015 to Fall 2015 semesters).

# Appendix J: Needs Assessment

## :Assessment of Assets and Needs

### Welcome

Welcome to the : Assessment of Assets and Needs. The research analyst and program evaluator in the is conducting what is known as a needs assessment. There are many definitions of a needs assessment, but it is fundamentally a systematic set of procedures that are used to determine individual and departmental needs, examine their nature and causes, and set priorities for future action. Your response will help shape how research and evaluations are performed from focus to implementation and analysis.

The following are a series of questions to help collect your preferences on the scope and function of the . The desired outcome is to identify needs and gaps that may exist within practices and with interactions with students. Please feel free to be as explicit as you like.

You are always free to ask questions or seek clarification on any item in this survey. This may be accomplished by

1. contacting the research analyst/program evaluator in Room ,
2. connecting to x or
3. via email at .

You may return to this survey at any point in time prior to submission. Additionally all responses are **anonymous**, **encrypted** and **participants will not be tracked**.

There is no time limit on the survey and times for completion will vary by individual. Please consider taking some time to think about each question in depth. Again, your thoughts, feelings and written reactions will shape the direction of internal and external evaluations across campus. The impact and effect of your responses will most likely be felt campus wide.

You may skip any item you wish, but it is asked that you answer all questions. Thank you for your time and thoughts.

1

: Assessment of Assets and Needs

General Background

**This first set of questions are being asked for informational purposes. This is such that the research analyst/program evaluator can get to know you better.**

2

**: Assessment of Assets and Needs**

Copy of page: Personal Responsibilities

1. Please describe your responsibilities as it pertains to student populations and programmatic duties.

3

: Assessment of Assets and Needs

Professional Background

2. Please discuss your professional background and experience working with student populations.

4

: Assessment of Assets and Needs

Handshakes

3. What type of undergraduate initiatives and/or collaborations have you participated in? If possible, please elaborate on each. If you do not use initiatives or collaborations, please write N/A in the box.

5

: Assessment of Assets and Needs

Current Topics

4. How do you currently stay informed about topics related to your role in the ? If possible, please elaborate on each. If you do not stay informed, please write N/A in the box.

6

**: Assessment of Assets and Needs**

Peer Collaborations

5. Describe ways, if any, in which you already collaborate with your peers within your role in the . If possible, please elaborate on each. If you do not already collaborate, please write N/A in the box.

**: Assessment of Assets and Needs**

Anticipation of Collaboration

6. Describe ways in which you anticipate collaborating with your peers within your role in the and/or across campus. If possible, please elaborate on each. If you do not anticipate collaboration, please write N/A in the box.

8

: Assessment of Assets and Needs

Current or Past Collaborations

7. Describe ways, if any, in which you already collaborate with your peers across campus. If possible, please elaborate on each. If you do not collaborate, please write N/A in the box.

9

**: Assessment of Assets and Needs**

Anticipation of Collaboration

8. Please describe ways in which you anticipate collaborating with your peers across campus. If possible, elaborate on each. If you do not collaborate, please write N/A in the box.

10

: Assessment of Assets and Needs

Scope

**The last section include questions that will help define the scope of this needs assessment. The hope is that the results will lead to shared understanding and specific projects and amendments that address students' diverse needs and interests.**

: Assessment of Assets and Needs

Academic Advising Focus

9. What areas of academic advising would you like the to focus on in the next year?

12

: Assessment of Assets and Needs

Student Development Focus

10. What areas of student development would you like the to focus on in the next year?

13

: Assessment of Assets and Needs

Student Issues and Advising Challenges

11. What student issues present undergraduate advisors difficult challenges?

14

: Assessment of Assets and Needs

Policies and Advising Challenges

12. What do you feel are the policies, practices or processes that may present undergraduate advisors difficult challenges?

15

: Assessment of Assets and Needs

Resulting Benefits

13. In your role, what tools and/or resources would benefit you?

16

: Assessment of Assets and Needs

Personal Growth

14. What do you feel that you need to learn?

: Assessment of Assets and Needs

Goals

15. Do you feel that you are connected to the goals? Please explain.

18

: Assessment of Assets and Needs

Formative Evaluations

16. The purpose of a formative evaluation is to strengthen the individual connection to the mission of the organization by looking at program design and implementation issues rather than outcomes such as graduation rates. What aspects of the , if any, do you believe need formative evaluations?

19

**: Assessment of Assets and Needs**

Pre/Post Survey

17. The administration team will be implementing a pre-post survey for visiting students. In this scenario, the following would occur:

- A student checked into the kiosk would be asked to take a short survey (pre) whose purpose will be to assess needs and expectations prior to an appointment with an advisor. The student would be asked to input his or her email address but this would be for tracking purposes by Survey Monkey and not for identification purposes. The reason is listed in step 2.
- After the student completes his or her advising appointment, a survey (post) will automatically be sent to the email address provided asking follow up questions about needs and expectations as well as their experience.

What questions or criteria would you like to see addressed on the surveys?

20

**: Assessment of Assets and Needs**

Additional Comments

**If you have any additional comments, questions, concerns, etc, please voice them here. A great deal of evaluative research has shown that random, unfocused musings loosely centered around a particular topic area can produce value-added writings and conclusions that may explain many latent variables.**

**So rather than skipping this additional comments page as many participants do, please simply start writing with the in the back of your mind. The results have the potential of informing you about your deeper thoughts regarding the and its staff.**

18. Musings:

: Assessment of Assets and Needs

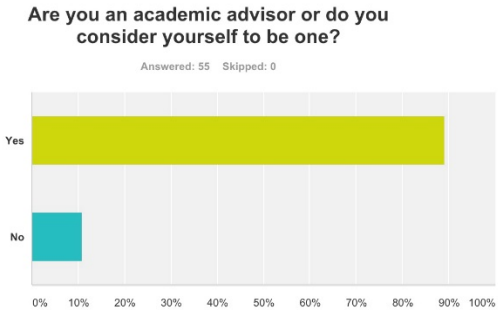
## Thank You

Thank you for your participation. Your responses are valuable and will help the grow and adapt to student and environmental changes. If you have any questions, please feel free to contact the research analyst/program evaluator by

1. visiting Room ,
2. phoning x or
3. emailing_ .

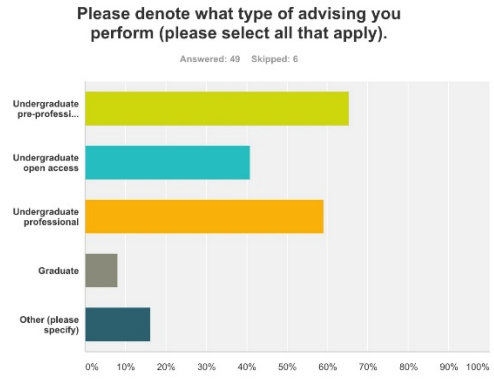
Have a wonderful day!

## Appendix K: Output of Descriptive Study Analysis



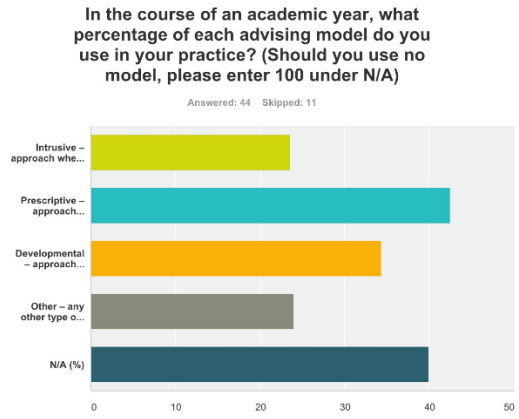

| Answer Choices | Responses | |
|---|---|---|
| Yes | 89.09% | 49 |
| No | 10.91% | 6 |
| Total | | 55 |

*Figure 1.*



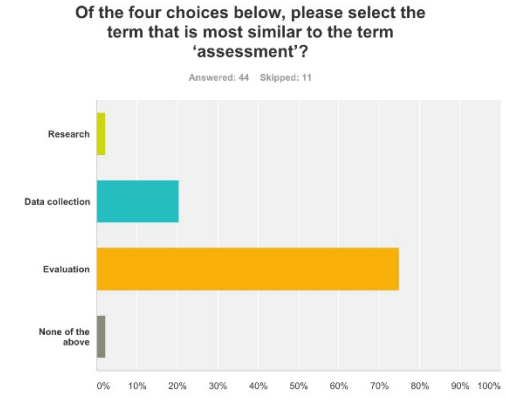

| Answer Choices | | Responses | |
|---|---|---|---|
| Undergraduate pre-professional | | 65.31% | 32 |
| Undergraduate open access | | 40.82% | 20 |
| Undergraduate professional | | 59.18% | 29 |
| Graduate | | 8.16% | 4 |
| Other (please specify) | Responses | 16.33% | 8 |
| Total Respondents: 49 | | | |

*Figure 2.*



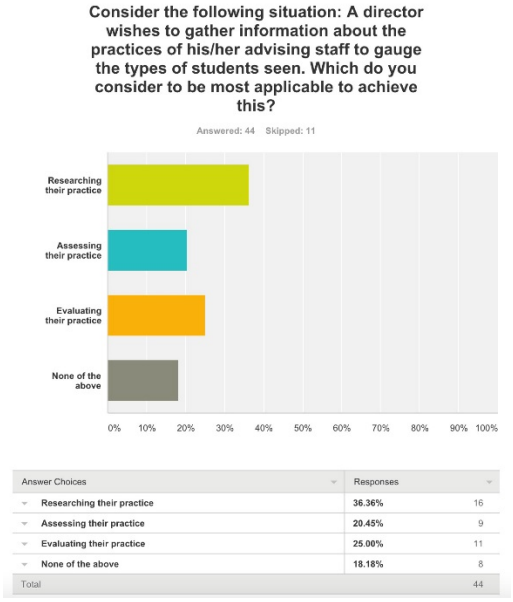

| Answer Choices | Average Number | Total Number | Responses |
|---|---|---|---|
| Intrusive – approach where advising is conducted at pivotal benchmarks throughout a student's academic career. Examples include orientation, declaration of a major, or class audits. (%) Responses | 24 | 944 | 40 |
| Prescriptive – approach centered on offering students with information directly related to their academic program and progress. This may include such as academic procedures and guidelines, school, college or major requirements and selection of courses. (%) Responses | 42 | 1,698 | 40 |
| Developmental – approach centered on helping students to explore and define academic, career and life goals. This is typically accomplished by student development through problem-solving and decision-making skills with academic advisors. (%) Responses | 34 | 1,478 | 43 |
| Other – any other type of advising that is not directly associated with intrusive, prescriptive, or developmental advising. (%) Responses | 24 | 240 | 10 |
| N/A (%) Responses | 40 | 40 | 1 |
| Total Respondents: 44 | | | |

*Figure 3.*



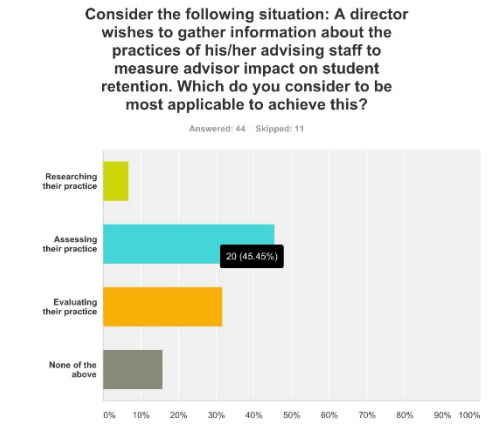

| Answer Choices | Responses | |
|---|---|---|
| Research | 2.27% | 1 |
| Data collection | 20.45% | 9 |
| Evaluation | 75.00% | 33 |
| None of the above | 2.27% | 1 |
| Total | | 44 |

*Figure 4.*



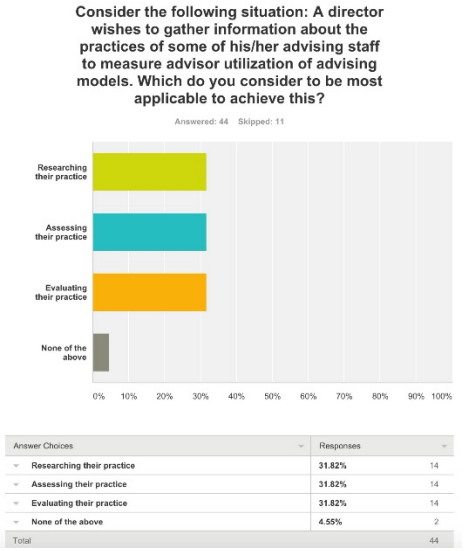

| Answer Choices | Responses | |
|---|---|---|
| Researching their practice | 36.36% | 16 |
| Assessing their practice | 20.45% | 9 |
| Evaluating their practice | 25.00% | 11 |
| None of the above | 18.18% | 8 |
| Total | | 44 |

*Figure 5.*



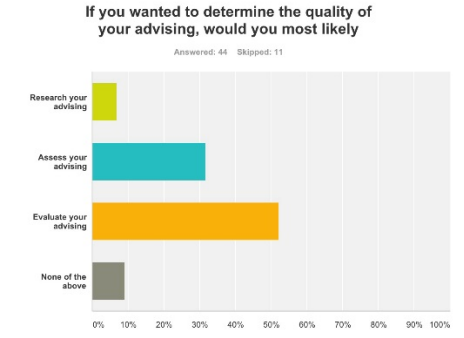

| Answer Choices | Responses | |
|---|---|---|
| Researching their practice | 6.82% | 3 |
| Assessing their practice | 45.45% | 20 |
| Evaluating their practice | 31.82% | 14 |
| None of the above | 15.91% | 7 |
| Total | | 44 |

*Figure 6.*



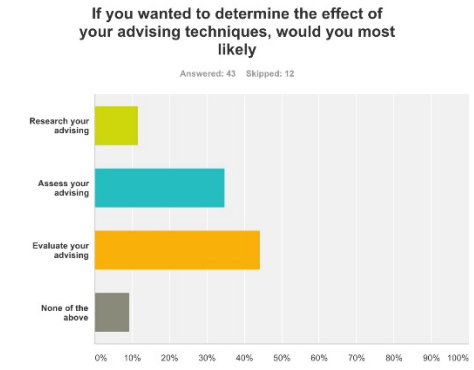

| Answer Choices | Responses | |
|---|---|---|
| Researching their practice | 31.82% | 14 |
| Assessing their practice | 31.82% | 14 |
| Evaluating their practice | 31.82% | 14 |
| None of the above | 4.55% | 2 |
| Total | | 44 |

*Figure 7.*



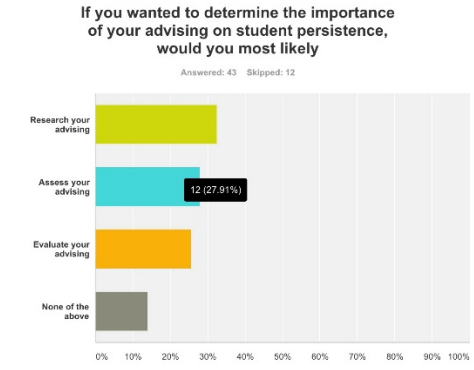

| Answer Choices | Responses | |
|---|---|---|
| Research your advising | 6.82% | 3 |
| Assess your advising | 31.82% | 14 |
| Evaluate your advising | 52.27% | 23 |
| None of the above | 9.09% | 4 |
| Total | | 44 |

*Figure 8.*




| Answer Choices | Responses | |
|---|---|---|
| Research your advising | 11.63% | 5 |
| Assess your advising | 34.88% | 15 |
| Evaluate your advising | 44.19% | 19 |
| None of the above | 9.30% | 4 |
| Total | | 43 |

*Figure 9.*




| Answer Choices | Responses | |
|---|---|---|
| Research your advising | 32.56% | 14 |
| Assess your advising | 27.91% | 12 |
| Evaluate your advising | 25.58% | 11 |
| None of the above | 13.95% | 6 |
| Total | | 43 |

*Figure 10.*

# Appendix L: Response Set for Descriptive Study

| # | Responses | Date |
|---|---|---|
| 1 | Research: Scholarly research, qualitative vs. quantitative Assessment: Are identified needs being met? Evaluation:What is the value of a program or advising practice that you are using? | 9/29/2015 9:22 AM |
| 2 | Yes, there is a difference. Research - to review, understand and gather information. Assessment - measuring specific markers to determine results. Evaluation - combining qualitative and quantitative information from a variety of aspects. I see evaluation as something both sides participate in. | 9/29/2015 6:42 AM |
| 3 | I believe that the terms are used loosely and commonly seen as the same term. Research is different because it requires using outside sources to determine best practice. I suggest that assessment and evaluation are very similar. | 9/28/2015 9:49 AM |
| 4 | Research is data driven Assessment can include hard data and more subjective information Evaluation is predominantly subjective and/or anecdotal. | 9/23/2015 10:46 AM |
| 5 | To assess is to collect information. To evaluate is to make value judgments based on data collection, such as how effectively a program or practice is meeting its stated objectives. Research is provoked by curiosity, by social need, by academic integrity. Good research can be generalized, to some extent, to assist with other issues. However, with regard to academic advising and student development, quantitative measurements fail to capture nuance. They can say the "what" but not the "why," and the "why" is what good advisors concern themselves with. | 9/23/2015 10:11 AM |
| 6 | research indicates a hypothesis, model being examined, and outcome evaluated assessment is more reflective of gathering data and what it means evaluation mean placing 'judgment' on your findings. | 9/23/2015 8:23 AM |
| 7 | Research means gathering information. Assessing is part of analyzing the data gathered. Evaluation is determining what has worked or not. | 9/22/2015 3:56 PM |
| 8 | n/a | 9/21/2015 10:58 AM |
| 9 | Research = broad scope/depth. Assessment = gauge effectiveness of a limited scope of an operation. Evaluate =survey constituents/advisees to glean feedback on satisfaction/effectiveness. This might be a component of assessment, which might be a component of researching the bigger picture. Respectfully opined here... enjoy! | 9/18/2015 4:37 PM |
| 10 | Research - A gathering of theories, models, and experiences from and for one's experience. Assessment - Taking into consideration what other individuals and institutions have uncovered in their research and making a decision to integrate or not integrate into ones own research. Evaluation - An in-depth analysis of research and assessment findings that ideally should result in some kind of action or forward movement. | 9/14/2015 5:04 PM |
| 11 | Assessment is the collection of data around an educational practice. Evaluation has more to do with measuring how well something is working and how valuable it is. | 9/14/2015 1:49 PM |
| 12 | Research is the process of developing a statement(s) of inquiry and the techniques needed to collect data and determine how the information collected is intended to be measured and interpreted. Assessment is the stage of research that involves the collection and analysis of data. Evaluation is the interpretation of results and their relationship to the research questions raised. | 9/13/2015 10:32 PM |
| 13 | I believe there is very little difference. I see them, especially evaluation and assessment, as synonyms, even though I selected them at different times over the last few questions. I see research as being, perhaps, more involved. I also feel that research is more systematic and about reaching new conclusions, not just using investigation to establish facts. | 9/11/2015 9:48 AM |
| 14 | I believe they're different, though interrelated. Research is exploring and gathering information about a question, which can include assessment. Assessment is collecting data, and attempting to measuring relationships. And, evaluation is making judgments, hopefully informed by information gathered. | 9/10/2015 1:31 PM |
| 15 | Research is to report findings. Assessment is to measure. | 9/9/2015 1:17 PM |

## Appendix M: Delphi Study Information Sheet

**Building an Evaluation Model of Academic Advising's Impact on Progression, Persistence and Retention within University Settings - Delphi Study**

Thank you for your consideration regarding participation in this Delphi Study. In this short document, there will be a description of a Delphi Study as well as the benefits and potential drawbacks that may come as a result of you assuming the role of a panelist. Foremost, while your participation is solicited, it is strictly voluntary. Your name will not be associated in any way with the research findings unless you so denote otherwise. Your identifiable information will not be shared with anyone else unless (a) it is required by law or university policy, or (b) you give written permission. You may also choose to not participate at any time without recourse. Should you have any questions or concerns, please notify Abhik Roy at xxx@xx.xxx at your earliest convenience.

### The Delphi Study

This is a widely used method for gathering data from respondents within their domain of expertise. It uses group communication that uses a convergence, consensus, or integration of opinions on a topic using questionnaires. Within this structure, there are multiple iterations that allow participants to reassess and refine a product. Typically, most Delphi studies will use three to four iterations.

Using the Delphi Study framework design proposed by Hsu and Stanford (2007), this study will incorporate four iterations. A brief explanation of each iteration is included:

- Iteration 1: Open-ended and/or structured questionnaire exploring the components of advising and evaluation. In this, panelists can describe what areas of advising they believe need to be evaluated.
- Iteration 2: Panelists are asked to review a summary of items from the first iteration. They should also rank or rate them in order of importance.
- Iteration 3: Panelists are provided an opportunity to make clarifications of both the information and their decisions of the relative importance of the items.
- Iteration 4: In the fourth and often final round, the list of remaining items (if any), their ranking/ratings, minority opinions, and items achieving convergence, consensus, or integration are distributed to the panelists for final refinements.

### Benefits and Potential Disadvantages

Benefits:

- Panelists have a utilization-focused product. In this case, panelists will have informed and helped to create the first defined evaluative model for academic advising.

- Panelists remain absolutely anonymous revealed only to the researcher. With regards to this study, panelists will not be identified at all, even to each other.
- Panelists have the opportunity to afford their opinions/needs onto a content area. With regards to academic advising, panelists will have created an artifact that targets what they believe needs evaluated in advising. This will resonate with any person or unit that decides to employ the evaluative model or any derivation thereof.

Potential Disadvantages:

- Timing between iterations: There exists a potential of days to weeks between iterations. This is solely dependent on the completion and analysis of each previous iteration.
- Timing within iterations: The amount of time necessary for completion of each iteration is dependent on numerous factors including the depth of opinions of panelists and the complexity of criteria.
- Union of opinions: As the construct of the study is limited, not all opinions can be represented in the model. This may make panelists feel uneasy and/or perceived that their views are unimportant. However, also by the construct, at minimum some of the opinions of any panelists must be included.
- Identification: Though extremely unlikely, there always exists a chance that members on the panel could be identified.

## Reference

Hsu, C. and Sandford, B. (2007) *The Delphi Technique: Making Sense of Consensus. Practical Assessment, Research & Evaluation, 12*(10), 1-8.