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Training the Execution of Single-Case Research Methodology Skills in an Early and Intensive Behavioral Intervention Setting

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TRAINING THE EXECUTION OF SINGLE-CASE RESEARCH METHODOLOGY SKILLS IN AN EARLY AND INTENSIVE BEHAVIORAL INTERVENTION SETTING

by

Jessa R. Love

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
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Department of Psychology
Advisor: R. Wayne Fuqua, Ph.D.

Western Michigan University
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Jessa R. Love
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INTRODUCTION

The Scientist-Practitioner Model

The scientist-practitioner model asserts that psychologists should fulfill three important roles: (a) a consumer of research, especially with respect to new assessments or intervention procedures that can be put into practice; (b) an evaluator of the interventions he uses, and (c) a researcher, producing new data from the setting in which he works (Hayes, Barlow, & Nelson-Gray, 1999). Within this model, science and practice are considered inseparable, such that efforts that advance one area also advance the other (Witmer, 1907/1996). Thus, a scientist-practitioner utilizes a research orientation in his practice, and maintains a relevance to practice in his research (Belar & Perry, 1992). This model is fundamental to the growth of professional psychology in that innovations by clinicians are vital to advances in scientific knowledge, and the market for psychological services changes as the base of knowledge for the field grows (Belar, 2000).

History. In May of 1941, the Committee on the Training of Clinical Psychologists met for a one-day conference at the New York Psychiatric Institute (Baker & Benjamin, 2000). Following this meeting, David Shakow outlined a four-year doctoral program in psychology indicating that the first two years of training should involve establishing the foundation in psychology needed for clinical work, and education with respect to psychometric and therapeutic principles and practices. The third and fourth years would focus on internship experiences and a dissertation. This report was forwarded to the American Association for Applied Psychology (AAAP)
with the suggestion that a committee be formed to design a program for the professional training of clinical psychologists. Several months later the AAAP officially formed the Committee on Training in Clinical Psychology (CTCP) and requested that the committee formulate a recommended program for training in clinical psychology with standards for institutions providing that training. Further, the AAAP asked the CTCP to visit institutions providing instruction in clinical psychology to make a detailed report on each one (Baker & Benjamin).

The CTCP's report on these institutions as well as their recommendations for training programs came to be known as the Shakow Report, and was submitted and endorsed at the 1947 meeting of the American Psychological Association (APA) (Baker & Benjamin, 2000). The Shakow report was the most comprehensive statement regarding the training of clinical psychologists to date, and offered detailed recommendations for training skills with respect to diagnosis, therapy, and research (Baker & Benjamin). Two years after its initial endorsement by the APA, the Shakow report became the central working document for the Boulder Conference (Baker & Benjamin), a convention attended by over 70 representatives from universities, health service agencies, and allied professions (Hayes et al., 1999) in the first real effort in American psychology to address the standardization of graduate training (Petersen, 2007). After meeting daily for two weeks, the scientist-practitioner model was unanimously recommended by the conference attendees (Hayes et al.), proposing that practitioners in clinical psychology need to be trained in a way that blends the roles of researcher and clinician (Petersen).
The unanimous decision of this large group of individuals was based on five important reasons for scientist-practitioner training (Hayes et al., 1999). First, conference attendees decided that such training was required to foster interest and background in both areas, even though some students might focus on only one area during their career. Second, they noted that the general lack of reliable knowledge within the field of psychology required that research be considered a crucial part of the field. Third, conference attendees did not believe there was any reason that the field of clinical psychology could not find individuals capable of executing both roles. Fourth, it was suggested that requiring researchers to have direct involvement with clinical practice would bring them into contact with important issues that warranted research attention. Finally, it was proposed that the delivery of quality psychological services might provide financial support for research endeavors. Following the Boulder conference in 1949, several other conferences occurred in order to review the recommendations and refine the scientist-practitioner model. For example, a conference in Chicago in 1965 reaffirmed the model but relaxed the definition of science and research to include theoretical, historical, or other scholarly contributions that might not involve direct data collection (Hayes et al., 1999).

Current interpretations. In 1990, the National Conference on Scientist-Practitioner Education and Training for the Professional Practice of Psychology was held in Gainesville, Florida to define the essential characteristics of the model (Belar & Perry, 1992). Perhaps the most important clarification made at this conference was that the model is not a point on a continuum between training programs emphasizing science and those emphasizing practice, nor is it a sum of its parts. Education in only research
or practice, or both concurrently without integration does not fulfill the requirements of
the model (Belar, 2000; Belar & Perry). Attendees of this conference noted that
research skills do not necessarily lead to journal publications, but the basic requirement
of scientific practice is communicable results (Belar & Perry). Finally, scientist-
practitioner training was deemed necessary for fostering critical thinking in individuals
who may focus on science or practice (Belar; Belar & Perry).

The Gainesville conference also resulted in the specification of the four
components necessary for the training of a scientist practitioner. First, the didactic
scientific component ensures that a student masters the material within the domains of
assessment, intervention, and both normal and abnormal behavior and development.
The student also acquires knowledge of a range of individual differences including, but
not limited to ethnicity, gender, and culture (Belar & Perry, 1992; Tanner & Danielson,
2007). The material that is emphasized can vary across programs, although an
education in general psychology is fundamental (Belar & Perry). Second, the didactic
practice component educates students in the strategies and procedures of applied work,
with a specific goal to foster the conceptualization of clinical cases or problems
utilizing operational descriptions that are useful for planning interventions (Belar &
Perry). Third, the scientific experiential component should encourage students to use
their practical experiences, training, and knowledge as the focal point for research
(Tanner & Danielson). In most programs this involves the completion of a doctoral
dissertation demonstrating the student's ability to complete an independent
investigation that adds to the base of psychological knowledge (Belar & Perry). Fourth,
the professional practice experiential component focuses on the application of
knowledge from scientific domains to practice, and often involves internship or practicum experiences (Belar & Perry, Tanner & Danielson). Through the use of these four components, clinical and research work are integrated from the very beginning of a student’s training (Terry & Danielson).

Use of the model. Recently Horn and colleagues (2007) investigated the reported use of the scientist-practitioner model among graduate-training programs by surveying web-based program materials for over 300 doctoral-level programs in school, counseling, and clinical psychology. The results of this investigation indicated that more than half of these programs made specific mention of the scientist-practitioner model of training, and that nearly all referred to both scholarly research expectations and the training of practitioners. Almost two-thirds of the programs mentioned the requirement of a dissertation, and the majority indicated that students are required to participate in practica, internships, or fieldwork. Although there is little consensus on the operational definition of the model being used (Horn et al.), it is promising that a substantial proportion of graduate programs seem to have adopted this model of training. Despite these findings, critics of the model argue that it is not realistic to train students to be both scientists and researchers when many of them enter their education with a goal only to be a practitioner and not a researcher (Horn et al.). Further, Hayes et al. (1999) suggested that one of the reasons more integration of practice and research has not occurred stems from the lack of a strong link between empiricism and success in the context of practice. It has also been suggested that traditional research methodologies may be inadequate to address issues important in practice and are
therefore underutilized (Hayes et al.). Thus, a model for the use of an appropriate and practical research methodology within the practice context is required.

Applied behavior analysis. Applied behavior analysis (ABA) is a field of psychology separate from the clinical, counseling, and school psychology disciplines that have been the subject of research and discussion with respect to the scientist-practitioner-model. The model, however, is highly relevant for ABA as well. Applied behavior analysis is defined as the science in which procedures and techniques based on the principles of behavior are applied to socially significant behaviors, and experimentation is used to identify or confirm the variables controlling behavior or causing behavior change (Baer, Wolf, & Risley, 1968). Therefore, applied behavior analysts must work as both practitioners to address socially meaningful behaviors in applied settings, and as scientists in order to evaluate experimentally the procedures and interventions being used.

Malott (1992) argued that the field of ABA need not focus extensive efforts on training nearly all applied behavior analysts to be researchers when most likely become practitioners. However, he also made the point that this does not mean that practitioners should not empirically evaluate their work and make data-based decisions. Using research skills can be important for practitioners in empirically evaluating clinical procedures as well as critically examining existing research (Reid, 1992). Thus, applied behavior analysts should regularly fulfill at least the first and second roles of a scientist-practitioner previously mentioned, namely a consumer of existing research and an evaluator of interventions and procedures. In other words, practitioners need not produce new knowledge in order to practice in a scientific way, but may also advance
science by evaluating the use of existing procedures to solve a variety of clinical problems (Baer, 1992).

When applied behavior analysts do fulfill the third role of a scientist-practitioner and produce new research, most of that research utilizes single-case methodology in which each participant or case acts as its own control (Cooper, Heron, & Heward, 2007). This type of research involves repeated measures of each participant’s behavior as he is exposed to each condition of the analysis (e.g., the presence and absence of the independent variable). This methodology allows applied behavior analysts to evaluate their interventions on an on-going basis and make data-based changes as needed, helping them function as effective practitioners. It also allows them to demonstrate experimental control over behavior change. In other words, it helps applied behavior analysts function as effective scientists by confirming the variables responsible for behavior change.

**Scientist practitioners in the early and intensive behavioral intervention setting.** Many children diagnosed with autism spectrum disorders receive early and intensive behavioral intervention (EIBI) services (Green et al., 2006). Although the details of an EIBI program vary substantially from one service provider to the next, several characteristics are common across most programs, including the young age of children at the onset of treatment, the intensity of intervention (20-40 hrs/week over several years), an individualized, comprehensive, developmentally-based curriculum, a functional approach to problem behavior, and a structured learning environment (Perry et al., 2008). Teaching procedures often include discrete trials in which specific instructions are used to indicate an opportunity for the child to respond in a certain way,
and incidental teaching that involves capturing learning opportunities that occur naturally as the child interacts with his environment. Additionally, a prompting system is often incorporated to increase the likelihood of a child responding correctly and contacting reinforcement. These prompts are then systematically faded such that naturally occurring contingencies maintain the newly acquired behavior.

A common EIBI staff hierarchy involves individuals with Bachelor's degrees working directly with the children, individuals with Master's degrees supervising those staff, and one or more individuals with a Doctoral degree supervising the mid-level staff and developing curricula. Outcome research conducted with large groups of children receiving EIBI services indicates that this type of intervention demonstrates efficacy under ideal conditions (e.g., Lovaas, 1987; McEachin, Smith, & Lovaas, 1993), as when participants do not have comorbid disorders, staff are well-trained and supervised, and treatment is carefully planned and implemented with fidelity. Additionally, EIBI has been demonstrated to be effective in the real world under less-than-ideal conditions (e.g., Perry, et al., 2008), such as when evaluating a heterogeneous sample with more severe impairments, staff are less well-trained and supervised, and treatment is less controlled.

Although large-sample outcome studies provide empirical support for EIBI in general, the scientific literature supporting the specific teaching procedures used in this clinical practice is limited or equivocal. Thus, clinicians are often required to use procedures in their practice that extend beyond the reliable knowledge base of the field. For example, language acquisition programs often involve using a verbal operant with which a child has an extensive repertoire to prompt responses for a new operant, as
when tact or echoic prompts are used to teach intraverbal responding (e.g., Goldsmith, LeBlanc, & Sautter, 2007). It is unknown, however, if one type of prompt (i.e., tact or echoic) is associated with faster acquisition than the other, leaving clinicians with minimal guidance in choosing a prompting strategy. It is unreasonable to expect the large number of staff providing services in these settings to receive graduate-level training based on the scientist-practitioner model. However, without improvement in the use of this model within clinical settings, clinicians will likely be required to continue to go beyond the reliable knowledge of the field in their practice (Stricker & Trierweiler, 1995/2006). The clinical setting can be viewed as analogous to the scientific laboratory, such that an ideal model for clinical practice involves applied scientific activity in which the procedures used are dictated by sound scientific knowledge, and are approached with the same discipline, critical thinking, and rigor as more traditional research settings (Stricker & Trierweiler). This approach to psychology in practice offers some important benefits to the clinician in that the findings of research endeavors conducted in clinical settings will likely be directly applicable to clinical problems. Furthermore, the scientific approach to practice might foster scientific thinking that is useful in developing and evaluating interventions even outside a specific research protocol.

EIBI settings have several characteristics that are amenable to single-case design research, including rich staffing ratios, frequent data collection on child behavior, and data-based treatment decisions. Research is not reliably conducted in these settings, however, which could be a result of several factors. Most EIBI therapists have earned a Bachelor’s or Master’s degree, and therefore may not have received substantial training
in conducting independent research. Additionally, any research methods courses these individuals have taken may not have sufficiently addressed conducting research in clinical settings, or may have been taught by professors who have never worked in clinical settings. Further, the contingencies controlling staff behavior in EIBI settings often do not support on-the-job research. Many clinicians, for example, have large caseloads of children to manage, may not have access to supervision for research projects, and would not receive any additional compensation for completing the extra work required to conduct research. Based on the limited amount of research being conducted in EIBI settings, a method of training staff to implement single-case design research protocols outside the context of graduate-level training might improve the use of the scientist-practitioner model in these settings, potentially expanding the base of scientific knowledge in this area. Additionally, an EIBI program may benefit from research evaluating their procedures and treatments to inform decisions within the organization, regardless of whether the data are published.

**Staff Training**

Although no research has been published on training staff to conduct research within a clinical setting (which is likely a result of the limited research activity in these settings in general), a substantial literature is available on training staff to utilize other skills within the human-services industry. The following section reviews a selection of this literature relevant to the present study.

_Instruction-based training._ Some studies have evaluated the use of instruction-based approaches to training with mixed results. For example, Luiselli and Amand (2005) evaluated the use of didactic training in applied behavior analysis with staff at a
human-service agency for individuals with developmental disabilities. Three instructional modules were presented using PowerPoint slides displaying concepts, definitions, explanations, real-world applications, sample data, and examples of recording forms. The content of each module was determined through a consensus by a committee of educators and psychologists holding senior administrative roles at the agency. Acquisition of knowledge (i.e., verbal skills) was measured using paper-and-pencil multiple-choice tests that were administered before and after each training module. Although results indicated that the curriculum was effective in increasing knowledge of the relevant concepts and procedures among staff, and the improvements generally maintained at a one-month follow-up, no measures of the application of the newly acquired knowledge with clients were collected. A study conducted by Ford (1983), on the other hand, did include measures of on-the-job behavior and found that a personalized system of instruction was more effective than a traditional group lecture approach like the one utilized by Luiselli and Amand. Specifically, Ford compared a personalized system of instruction utilizing self-pacing, presentation of small sequential units of information, the option to repeat the performance evaluations for individual units, and well-defined behavioral objectives, to a traditional group lecture among staff of a large residential facility for individuals with mental retardation. Results indicated that the personalized system of instruction was more effective in increasing knowledge and use of new skills on the job, and was also more efficient in terms of the number of hours spent in training. Although Ford did not offer any speculation as to why the personalized system of instruction was superior in this study, it is possible that the self-
pacing and the option to repeat the performance evaluations within the personalized system resulted in enhanced attending and better acquisition of knowledge and skills.

*Multi-component training.* Several studies have evaluated the use of instructions combined with other training components such as performance feedback. Alavosius and Sulzer-Azaroff (1990) examined the effects of dense and intermittent feedback schedules on the acquisition and maintenance of three health-care behaviors (feeding, positioning, and transferring) among four staff in the medical services unit of a residential facility for individuals with mental retardation using a multiple-baseline design across behaviors. Instructions involved presenting staff with a written task analysis for the three work behaviors. Following the baseline and written instruction phases, intermittent feedback was provided for performance of one behavior weekly. Concurrently, dense feedback was initiated for a second behavior multiple times daily, following every one or two performances of the behavior. Intervention was not attempted on the third behavior until the end of the study but was measured to control for reactivity and the passage of time. Results indicated that all responses for which feedback was provided improved, but the behaviors for which dense feedback was provided improved more quickly. Written instructions generally resulted in weak and short-lived improvements in behavior.

Stevens et al. (1998) also evaluated the use of instructions and feedback for staff training with one additional component – a management system involving self-monitoring, supervisory monitoring, feedback and praise, and incentives. Initially, nursing assistants at a county-owned nursing home in Alabama attended a 5-hour in-service (i.e., lecture-based instruction) emphasizing the identification of factors in the
environment that can affect resident behavior, communication skills, positive reinforcement procedures, and distraction and diversion techniques. Following the in-service, nursing assistants received several weeks of on-the-job training during which the researchers observed the nursing assistants interacting with residents and provided feedback with respect to their appropriate use of the skills taught during the in-service. During this time, supervisors were also trained to conduct observations, record the nursing assistants’ behavior, and provide feedback. Following this training, the staff management system was implemented which required nursing assistants to monitor and record their own behavior with residents, and supervisors to conduct observations and provide feedback. Nursing assistants who achieved high accuracy on supervisory observations were entered into a lottery offering the choice of several rewards (e.g., free lunch, leaving work early). Results indicated that 15 of the 18 nursing assistants reached the accuracy criterion of 80% within the first three weeks of on-the-job training and that these improvements generally maintained several months later. Data on staff behavior were not presented following the implementation of each component (i.e., in-service, on-the-job training, and the management system), so the independent influence of each component cannot be determined.

Another component of staff training receiving research attention is the use of role-playing or rehearsal of the skills being trained. Gardner (1972) evaluated the effectiveness of role-playing and lectures for teaching behavior modification techniques to institutional staff enrolled in an in-service education program for new employees. The lecture component involved eight one-hour sessions designed to present important principles in everyday language, while the role-play component involved six one-hour
sessions in which behavior modification techniques were demonstrated by instructors, and then rehearsed in pairs by staff, who received feedback from instructors. Each staff member received both forms of training, with the order of training components counterbalanced across participants. Staff behavior was measured before training and following each training component using an observation-based rating scale measuring proficiency in the use of behavior modification techniques, and a true-false test measuring knowledge of important principles. Results indicated that role-playing was more relevant to training proficiency with the skills, while lectures were more relevant to training knowledge. Based on this finding, Gardner suggested that performance-based skills are best taught within a teaching framework that emphasizes performance (e.g., role-play) while verbal skills (i.e., knowledge) are best taught within a teaching framework emphasizing verbal skills (e.g., lecture). Since then, it has been reaffirmed several times within the staff training literature that verbal instructions or didactic procedures alone may change the written or vocal repertoires of trainees, but are not consistently effective for teaching trainees to use or perform the skills (e.g., Harchik, Sherman, Hopkins, Strouse, & Sheldon, 1989; Reid & Green, 1990; Reid & Parsons, 2006). Further, this literature suggests that performance demonstrations or modeling improve staff performance over instructions alone. Additionally, performance practice or rehearsal allow a trainer to ensure that a staff member can perform a new skill and increases the likelihood that the staff member will be prepared to use the new skill in the relevant setting (Harchik et al.; Reid & Green).

Based on the staff training literature evaluating multiple-component training approaches, it appears that several components (i.e., instructions, performance
demonstrations and role-play, and feedback) play critical roles and provide important benefits to the training process. The following section will describe an approach to training that incorporates all of these components.

**Behavioral skills training.** Behavioral skills training (BST) utilizes four components that help individuals acquire new skills: instructions, modeling, rehearsal, and feedback (Miltenberger, 2004). First, instructions describe the appropriate behavior for the learner, and specify the circumstances in which the learner should engage in the behavior. Such instructions are most effective when they are presented in a way that is appropriate to the learner's level of functioning and are delivered by someone who has credibility with the learner (Demchak, 1987; Miltenberger). Furthermore, written instructions (provided in addition to verbally delivered instructions) may be helpful for the learner in that they provide a permanent statement of the desired performance or skill (Reid & Green, 1990). Second, modeling demonstrates the behavior for the learner and should result in a reinforcing outcome for the model when he demonstrates correct behavior. The modeled behavior should occur in the proper context, the model should resemble the learner or should have a high status relative to the learner, and the behavior should be modeled in a variety of ways and in a variety of situations (Miltenberger). The third component, rehearsal, provides the learner with the opportunity to practice the behavior. This component is critical because without it, the teacher cannot ensure that the learner has actually acquired the relevant skill. Rehearsal provides an opportunity to reinforce the behavior and to assess and correct errors (Miltenberger). As with modeling, rehearsal should occur in the proper context, and rehearsal of correct behavior should be reinforced, while behavior that is partly correct
or incorrect should receive corrective feedback. The fourth component, feedback, involves the delivery of praise for correct performance and further instruction for incorrect performance. Ideally, feedback should always involve praise for some aspect of the behavior, and corrective feedback should not be negative, but instead should identify what aspect of the behavior the learner could improve (Miltenberger).

In order to enhance the generalization of skills acquired through BST, training should incorporate a variety of real-life situations (Miltenberger, 2004). Empirical support for this suggestion is provided by a series of studies conducted by Ducharme and Feldman (1992). In the first study, nine staff working in group homes with individuals with developmental disabilities were trained on the use of several instructional skills through various training conditions. In a multiple-baseline design across groups of staff, the researchers evaluated the effects of written instructions, single-case training in which one client program served as an example for instructional techniques, common-stimulus training in which real clients were used for modeling instructional skills, and general-case training in which multiple client programs were used as examples. The latter three approaches to training (i.e., single-case training, common-stimulus training, and general case-training) each used a combination of modeling, rehearsal, and feedback. Results indicated that the general-case strategy that incorporated multiple real-life situations produced the most generalization of skills across clients and teaching programs. During the second study, general-case training was conducted immediately following baseline with a new set of staff to determine whether the gains made in this condition during the first study relied on the combined effects of the training strategies used before it. Ducharme and Feldman found that the
general-case strategy was highly effective at producing generalization of skills across clients, settings, and programs even without the other proceeding training strategies.

**Empirical support for BST.** The BST approach has been used to successfully train staff in a wide variety of skills and across a variety of settings (Miltenberger, 2004; Reid & Parsons, 2006). For example, Sarakoff and Sturmey (2004) investigated the effectiveness of BST to train three special education teachers to use discrete-trial teaching with students with autism using a multiple-baseline design across teachers. During baseline, teachers were given a written list of definitions of 10 components of discrete-trial teaching on which they were being evaluated. During training, an experimenter reviewed each component with the teacher, and provided her with a graph of her baseline performance and a copy of the previous session’s data. Next, rehearsal was conducted during which the teacher performed three discrete trials with a student, and the experimenter provided immediate verbal feedback. After rehearsal, the experimenter modeled the specific components that the teacher had implemented incorrectly during the previous trials. Rehearsal and modeling were alternated as needed, and training sessions continued until the teacher met a proficiency criterion. After completing training, teachers were simply instructed to implement discrete-trial teaching to the best of their ability while their implementation of the 10 components was measured. This BST approach to training was successful, resulting in increases in the percentage of components implemented correctly during trials by all three teachers from averages around 45% to averages around 98%.

Wood, Luiselli, and Harchik (2007) implemented a BST program with paraprofessional service providers at a community-based group home for adults with
developmental disabilities. The authors used a multiple-baseline design across four staff to evaluate the effects of BST on the implementation of Phase-1 of the Picture Exchange Communication System (PECS) training with clients. During baseline, staff were provided with a procedural implementation form (i.e., written instructions) but no formal training. Subsequent training involved the presentation of the rationale for PECS and a review of Phase-1 PECS procedures, as well as modeling by the experimenter, rehearsal, and feedback. The training was successful in improving the accuracy of implementation of Phase-1 PECS instruction for all four staff members, and three maintained the improvement over several observations sessions. In sum, it appears that BST procedures have been successful in training staff in a wide variety of skills and can be very useful within the human services industry (Reid & Parsons, 2006).

*Behavioral skills training for groups.* In addition to the benefits of a BST approach to staff training already mentioned, Miltenberger (2004) described several additional benefits of using BST with a group of learners. First, it can be more efficient than individual BST because instructions and modeling are presented to the entire group at once. Second, group members can learn from each other during rehearsal and feedback, by evaluating the performance of other group members. Finally, generalization of acquired skills may be enhanced with a variety of group members participating in rehearsal.

*Purpose of the Present Study*

Based on the notion that science and practice are inseparable, and that the efforts benefiting one will also benefit the other (Witmer, 1907/1996), it may be beneficial to
develop a model for the use of an appropriate and beneficial research methodology within the practice context. The implementation of EIBI for children with autism represents a promising opportunity to conduct research on clinically relevant problems in an attempt to investigate some of the unanswered questions about which procedures are most effective and efficient. Unfortunately, most therapists providing these services have not likely received adequate training in conducting the single-case design research that is relevant to the EIBI area. Providing such therapists with the skills needed to implement single-case design research protocols could improve the use of the scientist-practitioner model in these settings and expand the base of scientific knowledge in this area. Based on the success of BST approaches to staff training across a variety of behaviors and settings (Reid & Parsons, 2004), the purpose of this study was to evaluate the use of a modified BST approach for training therapists to design and implement single-case design research protocols in a clinical setting. In other words, the training model was designed to prepare individuals to develop and conduct research protocols to answer a research question that was provided to them. Specifically, this study aimed to answer the following questions: (a) Are participants able to learn the necessary skills? (b) Are participants able to apply those skills? And (c) Are participants satisfied with the training and experience?

METHOD

Participants

Twenty-four clinical supervisors and senior therapists from a large organization providing EIBI services to children diagnosed with autism spectrum disorders in Ontario, Canada participated in this study. In general, clinical supervisors carried a
caseload of clients and were responsible for developing and supervising individual
treatment plans, while senior therapists assisted with these tasks and supervised the
instructor therapists who work directly with the clients to implement the treatment
plans. A demographic questionnaire (see Appendix A) was completed by participants
at the beginning of the study to gather information about each participant’s educational
and experiential background. Participants were also asked to provide updated
demographic information following the completion of the study to assess the number of
participants who earned degrees or certifications, or were enrolled in a research
methods course during the duration of the study. Only four participants were enrolled
in a graduate-level research methods course during the study and no other changes in
demographics were reported. See Table 1 for the results of the demographic
questionnaire as reported by participants at the beginning of the study.

Curriculum

The content of the training curriculum was organized into several training
modules based loosely on a graduate-level course in single-case research methods. A
brief description of the content of each module is outlined below:

1. Measurement. This module included content on the reasons for and importance
   of the measurement of behavior in single-case research. The aspects of a quality
   operational definition were presented along with illustrative examples. Three
   methods of measurement were also presented: event recording, momentary time
   sampling, and trial-based data collection. Recommendations for when to use
each method of data collection, as well as
Table 1. *Demographic Information*

<table>
<thead>
<tr>
<th></th>
<th>Mean (years)</th>
<th>Range (years)</th>
<th>Number of Participants</th>
<th>Percentage of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>29.5</td>
<td>25 - 39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of Experience</td>
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<td>2.9 - 9.2</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Female</td>
<td>22</td>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td></td>
<td>Clinical Supervisor</td>
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<td></td>
</tr>
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<tr>
<td></td>
<td>Bachelor's</td>
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<td></td>
<td>Master's</td>
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<td></td>
</tr>
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<td>Behavior Analysis</td>
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<td></td>
</tr>
<tr>
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<td>Linguistics</td>
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<td></td>
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<td></td>
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<td></td>
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<td>2</td>
<td>8.3%</td>
<td></td>
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<tr>
<td></td>
<td>Early Education</td>
<td>1</td>
<td>4.2%</td>
<td></td>
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<tr>
<td></td>
<td>Applied Science</td>
<td>1</td>
<td>4.2%</td>
<td></td>
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<tr>
<td></td>
<td>Special Education</td>
<td>1</td>
<td>4.2%</td>
<td></td>
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<tr>
<td></td>
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<td>4.2%</td>
<td></td>
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<td></td>
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<td>Graduate</td>
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<td>20.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Both (undergrad &amp; grad)</td>
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<td>8.3%</td>
<td></td>
</tr>
<tr>
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<td>9</td>
<td>37.5%</td>
<td></td>
</tr>
<tr>
<td>Management Training</td>
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<td>15</td>
<td>62.5%</td>
<td></td>
</tr>
</tbody>
</table>

how to report the corresponding data were provided. The content for this module is provided in Appendix D.

2. *Interobserver agreement (IOA) and procedural fidelity assessments.* The content of this module (see Appendix G) included the importance of assessing the reliability of data through IOA assessments, and methods of calculating agreement were presented with several examples. Further, the importance of measuring the procedural fidelity of a research study based on the level of
fidelity risk associated with the study was discussed. Several sample research topics within the field of EIBI were presented such that the important factors of the independent variable that ought to be measured could be identified. Finally, recommendations on the frequency with which IOA and procedural fidelity ought to be assessed, how the results of those assessments ought to be reported, and standards in terms of acceptable results were provided.

3. **Data sheets.** This module included instructions on how to develop user-friendly data sheets that include all necessary components (e.g., participant data, procedural data, IOA). The importance of testing data sheets with pilot participants was discussed. Several sample data sheets were provided. The content for this module is provided in Appendix J.

4. **Single-case designs.** This module consisted of a brief introduction to single-case design research methodology with respect to how the designs demonstrate experimental control. Three designs (i.e., reversal, multiple baseline, and alternating treatments) were presented because of their relevance to experimental EIBI research. Information regarding when each design ought to be used and how research protocols are run using each design was provided. The content for this module is provided in Appendix M.

5. **Graphing and visual inspection.** This module included step-by-step instructions for creating single-case design graphs for reversal, multiple baseline, and alternating treatments designs. Information regarding the use of visual inspection to evaluate such graphs was presented. Instructions for identifying changes in the level, trend, and variability of data in order to evaluate treatment
effects were discussed. Several sample graphs were provided in order to illustrate important features, to serve as exemplars for graphs the participants would create, and to demonstrate how to visually inspect a graph. The content for this module is provided in Appendix P.

6. Research ethics and informed consent. This module contained information on important ethical considerations of research, including the confidentiality of data, risks to participants, and falsification of data (see Appendix S). Instructions were provided regarding the development of appropriate informed consent documents and procedures for obtaining consent. Special attention was paid to the sensitive issue of conducting research with clients to whom therapists are already providing clinical services. Sample informed consent documents were provided.

7. Protocol implementation. This module served as one of the two final projects (along with Module 8) of the training. Instructions were provided regarding the details of conducting research sessions according to a research protocol (e.g., scheduling sessions, planning IOA and procedural fidelity assessments) and managing data (e.g., making data-based decisions regarding phase changes, maintaining a data spreadsheet) (see Appendix U). Following the instructions, small groups of participants (3-4) were provided with a simple research protocol and asked to run several research sessions with a client receiving services through the organization.

8. Protocol development. The final module included instructions regarding the information that ought to be included in a research protocol (see Appendix W).
The same small groups of participants who worked together for Module 7 were then provided with a research question relevant to the field of EIBI and asked to develop a detailed protocol (i.e., description of procedures) and materials (e.g., data sheets) for a research project designed to answer that question.

**Structure of Training**

During the first training session, participants met in a conference room at the corporate office of the organization and were provided with an overview of the project in a brief lecture with the aid of a PowerPoint presentation. This presentation explained the goals of the project and provided participants with an outline of the project and the activities they would be required to complete (see Appendix B). Participants were informed that the data associated with the project would be used both to assist with their training as well as to help evaluate the training for research purposes, and that they could refuse to allow their data to be used for research purposes at any time without prejudice or penalty. Additionally, it was explained that all data would remain confidential and no one other than the investigators would have access to performance data. Finally, it was explained that the clinical director signed a letter stating that the performance data would not be used for or against any participants, and that their employment would not be jeopardized in any way as a result of their performance during the training project.

Modules 1 through 6 began by having participants complete a paper-and-pencil pre-test on the material. Participants met in a conference room at the corporate office of the organization for the pre-tests and subsequent lectures. Pre-tests incorporated multiple-choice, fill-in, and short-answer questions, and required approximately 15 min
to complete. The test questions for each module are provided in Appendices C, F, I, L, O, and R. Pre-tests served as a baseline measure of participant knowledge and were scored only for that purpose. Thus, participants did not receive any feedback regarding their performance on the pre-tests. Pre-tests were not administered for Module 7 or Module 8 as these modules focused on the application of material covered in previous modules. Next, a lecture (approximately one hour in length) was presented to participants with the aid of a PowerPoint presentation. The lectures were provided by Dr. James Carr (Module 1), Dr. Linda LeBlanc (Modules 3, 5 and 7), or the author (Modules 2, 4, 5 along with Dr. LeBlanc, 6, and 8) either in person at the agency's corporate office or via video conferencing from Western Michigan University. These lectures included the presentation of relevant terminology and concepts, the rationale for engaging in various aspects of the research process, examples with respect to the behavior expected of participants (e.g., how to calculate interobserver agreement, how to develop data sheets), and sample materials (e.g., data sheets) when applicable. Thus, these lectures incorporated both instructions and modeling of the relevant skills. Participants were provided with hard copies of the PowerPoint Presentation so they had a permanent product of the information presented. Supplementary reading assignments from textbooks on applied behavior analysis (Cooper, Heron, & Heward, 1987; Cooper, Heron, & Heward, 2007) were also provided to participants following each lecture, but no contingencies were arranged with respect to these readings. Rather, these readings provided an additional source of the information presented in lectures and a resource for participants to reference when completing homework assignments.
Approximately one week after the lecture, participants were assigned a homework task related to the material presented. These homework assignments served as opportunities for participants to rehearse the skills relevant to the information presented in the most recent lecture, and also to receive feedback with respect to their performance (the homework assignments for each training module are provided in Appendices E, H, K, N, Q, T, V, and X). These assignments were emailed to participants as MS-Word documents, to be completed and submitted by a specified date 1-2 weeks later to an email address established solely for this purpose. Participants could also email questions about the homework assignments to this address before the assignment was due; questions were answered by the author. The author then scored these assignments and provided each participant with individualized feedback including praise, corrections for errors, and his or her score. The scored homework assignments were sent to each participant’s personal email address. The clinical director of the organization chose to implement a contingency regarding the timely submission of homework assignments, such that participants who did not submit their homework assignment by the specified deadline would not be eligible to participate in subsequent training modules. Exceptions were made only for extreme illnesses or emergencies. In all other cases, homework assignments were submitted before the deadline such that no participants were required to withdraw from the training project.

Approximately one week after homework assignments had been submitted and participants had received feedback on their performance, the next training session was held. At this session, participants completed a post-test that included the same items as the pre-test, but arranged in a different order. Post-tests were not administered for
Module 7 or Module 8 as these modules focused on the application of material covered in previous modules. The pre-test for the next module was then completed, and the procedures described above were repeated. The components of each training module (i.e., pre-test, lecture, homework, post-test) required approximately one month to complete.

Occasionally, participants were absent from a training session as a result of illness, inclement weather, or emergencies. For these sessions, the lectures were video recorded so that the absent participants could view the recording at a later date. A supervisor from the organization arranged a time to meet with the participants and administer the pre-test before the lecture was viewed. The absent participants were then able to complete all other components of the module with other participants.

**Evaluation of Training**

The training provided in this study was evaluated according to the rubric presented by Kirkpatrick (1967) who recommended that the evaluation of staff training involve assessments of four important components – learning, behavior, reactions, and results. A description of these components and how they were evaluated in the present study is provided below.

**Learning.** The learning component of a training project refers to the principles, facts and techniques learned. This does not include the application of those principles, facts and techniques, as that is included in the behavior component. This component was evaluated by comparing scores on the pre-tests and post-tests for each module to identify any learning that occurred as a result of the training. The questions included on the tests for each module were based directly upon the information provided in the
lecture for that module. A key for each test was developed based on the information provided in the lecture, so that the author could score tests according to the key. A second, independent rater also scored an average of 32.7% of the pre-tests (range, 29.2 to 41.7% across modules) and 30.3% of the post-tests (range, 26.1 to 31.8% across modules). Inter-rater agreement between the two raters was calculated using the point-by-point agreement method (agreements divided by agreements plus disagreements multiplied by 100%). An agreement was defined as both raters providing the same score for a given question on a given test. The average inter-rater agreement for all pre-tests was 95.1%, ranging from 87.1% to 99.0% across modules. The average inter-rater agreement for all post-tests was 95.4%, ranging from 89.8% to 97.8% across modules.

Behavior. The behavior component of a training project refers to changes in participant behavior that result from the training (Kirkpatrick, 1967). This component was evaluated based on participant performance on homework assignments. A key was developed for each homework assignment, and the scoring and assessment of inter-rater agreement on scoring followed the same procedure as previously described with respect to tests. Inter-rater agreement was assessed for an average of 32.1% of homework assignments (range, 27.3 to 40% across modules). The average inter-rater agreement for all homework assignments was 93.9%, ranging from 90.5% to 100% across modules.

1 Note that Kirkpatrick's terms learning and behavior do not correspond with behavior analysts' typical use of these terms. Rather, Kirkpatrick's learning is akin to acquisition of verbal information and behavior refers to maintenance and application of that information in a non-training environment.
Reaction. An evaluation of participants’ reactions refers to their subjective views of the training experience or how well they liked the training (Kirkpatrick, 1967). This component was evaluated using a social validity questionnaire anonymously completed by participants following the last training module. Specifically, the questionnaire (see Appendix Y) asked participants to rate their overall satisfaction with the training, the workload required, and their preference with respect to the multiple teaching strategies used (e.g., lectures, rehearsal of skills for homework assignments, feedback on homework assignments, and post-tests). Additionally, participants were allowed to provide narrative comments.

Results. The results component of training refers to tangible results of the program for the organization (Kirkpatrick, 1967). Although the current investigation will not allow for evaluation of this component, it will be evaluated during a follow-up investigation occurring approximately one year after the completion of the training. The amount of research activity participants engaged in before and after participating in the training will be compared. Specifically, at the beginning of the study, participants were asked to answer three questions regarding their involvement in research: (a) How many research projects using single-case designs were you actively involved in during the 12 months prior to the beginning of this training (including projects that may be ongoing but began prior to this training)?, (b) How many of those projects were presented at professional conferences?, and (c) How many of those projects were published, or submitted for publication in a peer-reviewed journal? During the follow-up investigation, participants will be asked to answer the same three questions, so that any changes in research involvement can be evaluated.
RESULTS

Learning

The learning component of a training project refers to the principles, facts, and techniques learned. This does not include the application of those principles, facts, and techniques, as that is assessed in the behavior component, for which the results are described later. The learning component was evaluated by comparing scores on the pre-tests and post-tests for Modules 1 through 6 to identify any verbal learning that occurred as a result of the training. Figures 1 through 6 depict individual scores and group means for the pre- and post-tests for each module. All scores represent the percentage of points earned, and only data for participants who completed both tests were included. Change scores were calculated by subtracting pre-test scores from post-test scores, and indicate an average improvement of 30.1 points (range 23.3 to 40.2) across modules. Additionally, a decrease in performance from pre-test to post-test only occurred on five occasions, with the decreases ranging from 4.6 to 15 points. Improvement in the group means following the lectures was evaluated by calculating paired one-tailed t-tests for the scores from each module. The results of these tests indicate that statistically significant improvement in the group means occurred following each of the six lectures:

Module 1 \( t = 7.1, p < 0.001 \); Module 2 \( t = 13.2, p < 0.001 \); Module 3 \( t = 14.4, p < 0.001 \);
Module 4 \( t = 5.8, p < 0.001 \); Module 5 \( t = 7.2, p < 0.001 \); Module 6 \( t = 6.1, p < 0.001 \).

Two MANOVA tests were also conducted to evaluate differences in performance between participants who had earned a Bachelor’s degree (n=13) compared to those who had earned a Master’s degree (n=5) on pre-tests and post-tests.
Figure 1. Individual scores and group means for the pre- and post-tests for Module 1.

Figure 2. Individual scores and group means for the pre- and post-tests for Module 2.
Figure 3. Individual scores and group means for the pre- and post-tests for Module 3.

Figure 4. Individual scores and group means for the pre- and post-tests for Module 4.
Figure 5. Individual scores and group means for the pre- and post-tests for Module 5.

Figure 6. Individual scores and group means for the pre- and post-tests for Module 6.
With respect to pre-tests, a significant relationship (with an effect size of .734) was found between a participant's degree and her performance, $F(6, 11)=5.062, p=0.010$. Specifically, participants who had earned a Master’s degree performed significantly better than participants who had earned a Bachelor’s degree on the pre-tests for Module 1, $F(1)=7.353, p=0.015$, Module 2, $F(1)=4.544, p=0.049$, Module 4, $F(1)=6.851, p=0.019$, Module 5, $F(1)=14.986, p=0.001$, and Module 6, $F(1)=17.063, p=0.001$.

Participants with a Master’s degree did perform better than participants with a Bachelor’s on the pre-test for Module 3 as well, but this difference was not statistically significant, $F(1)=1.941, p=.183$. No significant relationship was found between a participant’s degree and her performance on post-tests, $F(6, 11)=2.566, p=.084$.

Change scores indicate the average improvement across modules for participants with a Bachelor’s degree was 32.0 points (range 26.2 to 40.6), while the average improvement for participants with a Master’s degree was 23.7 points (range 9.0 to 40.0).

Additionally, for modules in which several participants were absent from the lecture and had to view the presentation via video at a later date (Modules 1, 2, and 5), one-tailed two-sample $t$-tests were calculated to evaluate differences in performance on post-tests between participants who were present compared to participants who were absent. None of these tests identified statistically significant differences in performance between these groups of participants (see Table 2).
Table 2. Performance Comparison for Participants Present vs. Absent for Lecture

<table>
<thead>
<tr>
<th>Module #</th>
<th>Measure</th>
<th>Participants Present</th>
<th>Participants Absent</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean (SD)</td>
<td>n</td>
<td>Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Post-test</td>
<td>20</td>
<td>80.7 (13.2)</td>
<td>4</td>
<td>71.6 (15.0)</td>
</tr>
<tr>
<td></td>
<td>Homework</td>
<td></td>
<td>91.0 (10.7)</td>
<td></td>
<td>90.0 (4.1)</td>
</tr>
<tr>
<td>2</td>
<td>Post-test</td>
<td>14</td>
<td>82.1 (15.7)</td>
<td>10</td>
<td>71.7 (20.8)</td>
</tr>
<tr>
<td></td>
<td>Homework</td>
<td></td>
<td>98.2 (2.5)</td>
<td></td>
<td>97.8 (3.3)</td>
</tr>
<tr>
<td>5</td>
<td>Post-test</td>
<td>18</td>
<td>80.1 (14.5)</td>
<td>3</td>
<td>53.3 (34.0)</td>
</tr>
<tr>
<td></td>
<td>Homework</td>
<td></td>
<td>89.2 (8.7)</td>
<td></td>
<td>58.3 (18.2)</td>
</tr>
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</table>

Behavior

The behavior component of a training project refers to changes in participant behavior that result from the training (Kirkpatrick, 1967). This component was evaluated based on participant performance on homework assignments requiring them to apply the principles, facts, and techniques presented in the lectures. A summary of participant performance on homework assignments is presented in Table 3.

Table 3. Performance on Homework Assignments

<table>
<thead>
<tr>
<th>Module #</th>
<th>Assignment</th>
<th>n</th>
<th>Mean Score (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measuring behavior &amp; reporting data</td>
<td>24</td>
<td>90.8 (9.9)</td>
</tr>
<tr>
<td>2</td>
<td>Calculating &amp; evaluating IOA</td>
<td>24</td>
<td>98.0 (2.8)</td>
</tr>
<tr>
<td>3</td>
<td>Creating a data sheet</td>
<td>24</td>
<td>85.5 (11.3)</td>
</tr>
<tr>
<td>4</td>
<td>Matching research questions with designs, formulating example questions for designs</td>
<td>22</td>
<td>84.5 (13.7)</td>
</tr>
<tr>
<td>5</td>
<td>Creating several graphs</td>
<td>22</td>
<td>84.8 (14.5)</td>
</tr>
<tr>
<td>6</td>
<td>Developing application materials for institutional review board</td>
<td>20</td>
<td>93.8 (4.7)</td>
</tr>
<tr>
<td>7</td>
<td>Conduct several research sessions following a protocol</td>
<td>18</td>
<td>85.5 (3.0)</td>
</tr>
<tr>
<td>8</td>
<td>Develop a protocol to answer a research question</td>
<td>18</td>
<td>93.6 (2.8)</td>
</tr>
</tbody>
</table>
Although there was some variability in performance between individual participants and across the various assignments, participants generally performed quite well, with group means on all assignments above 84%. Of particular interest are the scores earned on the two final projects for the training – the homework assignments for Modules 7 and 8. For Module 7 participants were asked to implement two phases of a research protocol with a client, assess interobserver agreement and procedural fidelity, and submit all data and a graph. For Module 8 participants were asked to write a research protocol designed to answer a given research question, and submit the protocol with a sample graph and all necessary data sheets. Both of these assignments required participants to apply knowledge and skills addressed in all previous modules – a task that participants performed well.

A MANOVA test was also conducted to evaluate differences in performance between participants who had earned a Bachelor’s degree (n=13) compared to those who had earned a Master’s degree (n=5) on homework assignments. No significant relationship was found between a participant’s degree and her performance on homework assignments, $F(6,11)=2.196, p=.122$.

As with the evaluation of learning, for modules in which several participants were absent from the lecture and had to view the presentation via video at a later date (Modules 1, 2, and 5), one-tailed two-sample $t$-tests were calculated to evaluate differences in performance on homework assignments between participants who were present compared to participants who were absent. None of these tests identified statistically significant differences in performance between these groups of participants (see Table 2).
Reaction

An evaluation of participants' reactions refers to their subjective views of the training experience, or how satisfied they were with training (Kirkpatrick, 1967). This component was evaluated using the social validity questionnaire voluntarily and anonymously completed by 12 participants (50%) following the last training module (see Appendix Y). The results of this questionnaire are presented in Table 4.

Overall, participants valued the goal of the training project highly, and were generally satisfied with the teaching procedures used, as well the knowledge and skills they gained. Additionally, the majority of participants felt that the training substantially improved their knowledge and skills with respect to conducting single-case research and would definitely recommend the training for other staff in the organization.

The largest proportion of participants preferred the lectures as a teaching method, but found the homework assignments to be the most helpful component of the training. Although the majority of participants rated the workload required for participation in this training to be heavy, several participants provided written comments explaining that the workload required for the training itself was not too heavy, but that it was difficult to complete the work in addition to their regular job requirements.

Results

The results component of training refers to tangible results of the program for the organization (Kirkpatrick, 1967). This component will be evaluated following the completion of the follow-up investigation by comparing the amount of research activity participants engaged in before and after participating in the training. Only 2 out of 24 (8.3%) participants reported being involved in research projects prior to the training,
Table 4. *Results of Social Validity Questionnaire*

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th># of Participants</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Value of goal</td>
<td>Highly</td>
<td>11</td>
<td>91.7%</td>
</tr>
<tr>
<td></td>
<td>Somewhat</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>2 Satisfaction with knowledge and skills</td>
<td>Very satisfied</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Somewhat satisfied</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td>3 Satisfaction with teaching procedures</td>
<td>Very satisfied</td>
<td>5</td>
<td>41.7%</td>
</tr>
<tr>
<td></td>
<td>Somewhat satisfied</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Somewhat dissatisfied</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>4 Rating of workload</td>
<td>Heavy</td>
<td>7</td>
<td>58.3%</td>
</tr>
<tr>
<td></td>
<td>Reasonable</td>
<td>5</td>
<td>41.7%</td>
</tr>
<tr>
<td>5 Improvement in knowledge and skills</td>
<td>A lot</td>
<td>7</td>
<td>58.3%</td>
</tr>
<tr>
<td></td>
<td>Somewhat</td>
<td>5</td>
<td>41.7%</td>
</tr>
<tr>
<td>6 Helpful training component</td>
<td>Lectures</td>
<td>5</td>
<td>41.7%</td>
</tr>
<tr>
<td></td>
<td>Homework</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Readings</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td></td>
<td>Final projects</td>
<td>5</td>
<td>41.7%</td>
</tr>
<tr>
<td>7 Preferred teaching method</td>
<td>Lectures</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Rehearsal</td>
<td>4</td>
<td>33.3%</td>
</tr>
<tr>
<td></td>
<td>Feedback</td>
<td>4</td>
<td>33.3%</td>
</tr>
<tr>
<td>8 Recommendation for other staff</td>
<td>Definitely</td>
<td>12</td>
<td>100%</td>
</tr>
</tbody>
</table>

and only one (4.2%) participant reported being involved in a project presented at a professional conference. With such limited research activity occurring prior to the training, there was clearly substantial room for improvement within this component. The follow-up investigation to be completed approximately one year after the completion of this study will help evaluate any changes in participant research following participation in the training.
DISCUSSION

The clinical environment in which EIBI services are provided represents a particularly conducive setting in which to conduct research on clinically relevant problems and questions, yet most therapists working in these settings have not likely received adequate training in conducting relevant single-case design research. Therefore, providing the necessary training outside the context of attending a formal graduate program might improve the use of the scientist-practitioner model in these settings and expand the scientific knowledge base on EIBI practices. The purpose of this study was to evaluate the use of a modified BST approach for training therapists to design and implement single-case design research protocols in a clinical setting. Generally, results were positive in that participants were able to successfully learn and apply the relevant skills. The results with respect to the specific questions the study sought to answer will be discussed in the following sections.

Were Participants Able to Learn the Necessary Skills?

Statistically significant improvements in the scores on tests for Modules 1 through 6 following the lectures indicate that participants were able to learn the skills that this training sought to provide. It is important to remember that this learning refers only to the acquisition of verbal knowledge, but this background knowledge makes it much easier for an individual to take part in research. Most of the information taught, for example, could be acquired through reference materials (e.g., ABA textbooks) or peer-reviewed journal articles, yet having to search for all of this information within the process of conducting research could quickly become a daunting task that therapists may avoid. Having this background knowledge, then, makes becoming involved with
research a bit easier and less overwhelming, and may increase the likelihood that therapists in EIBI settings actively seek out opportunities to be involved in research.

Analyses comparing the performance of participants who had earned a Bachelor’s degree prior to participating in this training with those who had earned a Master’s degree indicate that the different educational background between therapists was only associated with different levels of performance with respect to pre-tests. This would suggest that participants who had previously earned a Master’s degree entered the training with more background knowledge of the relevant material, allowing them to earn higher scores on pre-tests. The training provided, however, brought the performance levels of all participants to a relatively similar level, (perhaps serving as a refresher for participants with previous graduate training, while teaching new knowledge to those without previous graduate training) resulting in a higher average change score for participants with Bachelor’s degrees. It is possible that the different educational background between participants will be correlated with different levels of research involvement, as measured by the follow-up investigation. Specifically, the participants who have additional training and experience with research in the context of graduate school may be more likely to become involved in research projects after this study, if the graduate training has helped the individual become better prepared or more interested in being involved with research.

Analyses comparing the performance of participants who were present for the lectures with those who were absent and had to view a video recording of the lecture at a later date indicate that a participant’s presence or absence at the lecture was not associated with statistically different performance on the post-test. It is important to
note that participants who were absent from the lecture for a given module still had access to a paper copy of the PowerPoint presentation, and could discuss the materials with other participants or have questions answered by the author via email. This may have mitigated any difficulty associated with being absent from the lecture in terms of performing well on the post-test. However, the relatively small sample size must be considered when evaluating the results of these analyses and the analyses previously mentioned with respect to the relation between educational background and performance. It is possible that a relation does exist between educational background or absence from a lecture and performance, but it simply was not detected as a result of the sample size in this study.

Were Participants Able to Apply the Skills?

Generally, high average scores on all homework assignments indicate that the participants were able to apply the skills taught in the lecture portion of each module. These homework assignments did not occur within the context of implementing an actual research protocol (with the exception of Module 7), but all assignments required participants to engage in the same, or very similar behavior that implementing research would entail. Thus, the rehearsal of these skills during the completion of homework assignments is directly applicable to using those skills when involved in research. This finding is promising, in that the rehearsal component of any BST program is vital to preparing the learner to use the new skills in the relevant environment.

The high scores observed on the assignments for Modules 7 and 8 were especially positive as these assignments required the application of all skills and techniques addressed in previous modules and allowed participants to rehearse a variety of important research behaviors in the appropriate context. It is important to keep in
mind, however, that there were no pre-training measures of performance on homework assignments. Thus, it can only be inferred that the performance of participants on these assignments was a function of the training provided in the lectures. Additionally, the possibility remains that some of the skills addressed by the homework assignments were already in the participants’ repertoires, especially given the overlap with the clinical procedures used in their jobs.

Some variability was observed in the performance on homework assignments, both between participants and across assignments. Variability across assignments was not unexpected, given the variation across modules in the specific skills required to complete the assignment and the difficulty. Variation between participants was also expected, given the variation in prior exposure to the material. The variability in performance on both homework assignments and tests may also be explained by the fact that no organizational contingencies were in place with respect to a participant’s performance. Other than the scores and feedback provided, there were no consequences, positive or negative, for performance at any level. Under such conditions, variability is expected based on differences in previous experience, motivation, the time available to devote to the training, and so forth.

In spite of this variability, it is interesting to note that no significant relationship was found between the degree a participant had earned prior to participating in this training and performance on homework assignments. Additionally, no significant relationship was found between a participant’s presence or absence at the lecture and homework performance. Although the relatively small sample size must be considered when evaluating these analyses (i.e., relations may have been present and simply were
not detected), these findings suggest that the between participant variability in homework performance might be a result of individual differences in prior exposure to the material or effort. It should be noted that participants were able to discuss assignments and help each other, which may have decreased the variability somewhat, and potentially inflated the scores above the levels of performance associated with strictly individual work. However, conducting research is always a collaborative effort, such that the potential teamwork among participants does not hinder the validity of the findings.

*Were Participants Satisfied with the Training and Experience?*

Given that participants were able to both learn and apply the skills targeted by the training provided in this study, it is promising to find that participants were also generally satisfied with the training and experience. Perhaps most promising is the finding that the majority of participants felt that their knowledge and skills with respect to the curriculum were substantially improved by the training, and that all of them would recommend this training for other staff in their organization. In other words, it seems that participants perceived the training as an effective and worthwhile experience. With respect to the specific teaching methods and training components, it is interesting that the largest proportion of participants preferred the lectures as a teaching method but rated the homework assignments as the most helpful component. These results suggest that although participants prefer lectures as a means to access the relevant information, the application required by the homework assignments is a vital component of the training. Finally, is it not surprising that such a large proportion of participants rated the workload required for this project as heavy, given that they were
required to maintain their everyday job tasks during the training. The fact that the great majority of participants continued to participate throughout the entire training project and completed almost all tests and assignments in spite of this workload speaks to the level of motivation among participants and the value they placed on the curriculum.

Implications

Several implications of the findings of this study are worth noting. First, the participants represented a heterogeneous group of staff with a variety of educational backgrounds and training histories. Therefore, the results of this study might be reasonably generalized to other similar groups of staff working in similar organizations.

It should be noted that the organization employing the participants values research very highly and provides a supportive environment for being involved in research. Specifically, the organization has an agency-wide statement of clinical principles that guides both clinical practice and research activity. This statement specifies that all clients are best served through evidence-based practices, which currently encompasses research-validated, field-tested, and promising practices. The organization recently established a Research and Evaluation Department as well as an internal research review board, and has been undergoing a clinical transformation to only support evidence-based practices. Thus, research has had a relatively high profile within the organization over the past few years. Additionally, staff research activity plays an important role in the decision-making process with respect to who attends professional conferences, and all staff are actively encouraged to get involved in research. As a result of this culture, many staff view the opportunity to participate in the research process as a reward, and have even asked supervisors to use the
opportunity get involved in ongoing research projects as reinforcers for meeting monthly goals related to clinical practice. Therefore, it is possible that some participants were eager to learn and get involved in research and sought out additional resources (e.g., journal articles) during the course of the training. In sum, this study was conducted within an organization that highly values and actively encourages research activity, with participants who are very motivated to be involved in research projects. This organizational culture must be considered when evaluating the external validity of the results of this study. It is possible that providing the same training to a group of staff that work within an organization without the same supportive research-oriented environment would produce very different results. Irrespective of participants’ motivation to receive the training, however, it is likely that the skills acquired during training will better enable the staff to contribute to the agency’s research mission.

Second, the success of this study in training a group of therapists providing EIBI services to conduct research in the clinical environment in which they work addresses the lack of this training for staff without requiring participation in a formal graduate-level coursework. Since it is unreasonable to expect all EIBI therapists to acquire graduate training, the success of this approach could potentially have a large impact on the amount of research published in EIBI settings and help answer many of the questions that remain unanswered with respect to the specific procedures used in those settings. This type of research, along with large-sample outcome studies on the efficacy and effectiveness of EIBI (e.g., Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Perry et al., 2008) would greatly enhance the empirical support for this approach to teaching young children diagnosed with autism spectrum disorders.
Third, outside the realm of research, the skills addressed in this study may impact the clinical practice of the participants with respect to the verbal behavior and technical procedures they learned. Many of the modules addressed skills that are relevant to data-based clinical practice as well as research, such as operationally defining behavior, creating data sheets, methods of data collection, graphing, and so forth. Therefore, even if some participants are not interested in or do not have the opportunity to get involved in research, the training may still be beneficial in terms of improving the clinical services they provide. Future replications of this study might benefit from formally evaluating this potential impact on the services provided by the organization.

**Limitations**

Despite the strength of the present study in demonstrating that a modified approach to BST was successful in training a group of staff, there are several important limitations that must be noted. First, as participants were required to maintain all of their typical employment tasks while participating in the study, training took a relatively long time to complete, with approximately 12 months elapsing between the implementation of the first and last modules. As with any study of this duration, there is the potential for attrition and a decrease in the motivation of participants. Although some attrition occurred in this study, it was minor and did not substantially affect the composition of the group of participants. Further, no detectable decrease in motivation occurred, as evidenced by continued high performance throughout the duration of the study. This is likely explained by the fact that participants voluntarily took part in the training knowing that it would require work in addition to their general job tasks. From
an organizational perspective, however, the duration of the training and the time required to conduct research creates a relatively long delay in terms of results for the organization (i.e., an increase in research activity among staff).

Second, the development of the materials required for training, grading of tests and homework assignments, and providing feedback to all participants was relatively labor intensive. Therefore, if a similar approach to training were to be attempted within another organization, the effort would need to be strongly supported by the administration and adequately resourced. Additionally, as a result of the extensive work required to implement this training, no measure of treatment integrity was conducted with respect to the content of the lectures being delivered as specified, or the type, quantity, quality, and consistency of feedback provided. However, with the highly detailed PowerPoint slides used to guide lectures, and keys used to grade tests and homework assignments, this study can be classified as relatively low-risk with respect to treatment integrity errors.

Finally, the rehearsal of the skills being taught was somewhat atypical for BST. Typically, when utilizing BST, the teacher would directly observe the learner rehearsing the skills and then provide relatively immediate feedback. In this study, however, logistics prevented the participants from being directly observed when rehearsing the skills relevant to each module (i.e., when completing the homework assignments). Thus, feedback was based on the products of behavior rather than the behavior itself.

Future Research

In order to refine the methods used in this study to train staff in an EIBI setting to conduct research with clients and improve the use of the scientist-practitioner model
in clinical settings in general, future research should address a number of issues. First, the follow-up investigation with the participants of this study will help evaluate any changes in research involvement following completion of the training. When that study has been completed, it would be beneficial to replicate this study within a different EIBI organization and include measures of treatment integrity. Additionally, based on the overlap between the knowledge and skills addressed by this training and the clinical skills required to work in an EIBI setting, it would be valuable to directly measure the impact of the training on the quality of clinical services provided by participants.

Future studies evaluating this approach to training may also attempt to improve the effects of the training by including a mastery component allowing participants to continue rehearsing the relevant behaviors and re-take tests until a pre-determined mastery criteria has been met.

Since the work required to design and implement the training provided in this study was substantial, future research may try to decrease the work required by creating videos for all of the lectures and comparing results to this study in which lectures were provided live. Thus far, existing literature comparing live and video instruction has provided mixed conclusions regarding efficacy and consumer satisfaction. For example, one study suggested that the learning outcomes perceived by students are similar for both modes of instruction, but that learners report feeling less connected to video lectures and are less likely to prefer that approach to teaching (White, Sartore, Gallate, Cartwright & Curthoys, 2006). However, another study indicated that both perceived and actual learning as well as motivation are higher with live instruction (Carrell & Menzel, 2001). The data from the present study suggest that the use of video
instruction may be successful as there were no significant differences in performance between participants who were present for the lecture and those who were absent and viewed the recorded lecture at a later date. The videos used in the present study, however, were recorded during a live, interactive lecture, and therefore may have been more effective than a pre-recorded lecture with no audience or interactive component. These hypotheses need to be empirically confirmed, however, as it is possible that the organizational culture discussed previously, the materials provided to participants, or the perceived value of the training over-powered any effects that being absent from a lecture may have had.

Finally, some additional research would enhance the scientific literature on staff training and the use of the scientist-practitioner model in clinical settings. For example, it would be beneficial to revise the curriculum used in this study for use in other ABA settings (e.g., day programs for adults with developmental disabilities) and re-evaluate the effects of the training. Additionally, it would be valuable to apply this approach to training with more senior staff (e.g., clinical supervisors within the organization involved in this study) to address higher-level research skills, such as identifying gaps in research literature and developing relevant research questions.

The training model used in the present study was designed to prepare individuals to develop and implement research protocols to answer a research question that has been provided to them. Consequently, this model may be sufficient for organizations in which individuals are present who are capable of generating and developing viable research questions. However, if such individuals are not present in the organization, staff would need to be trained in these skills, or individuals already possessing those
skills would need to be hired in order for the organization to benefit from the training model in the present study. Thus, a curriculum focused on the higher-order skills required for developing research questions would represent a good extension of the existing model.
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1907.)

paraprofessional service providers at a community-based habilitation setting.
*Behavior Modification, 31*, 847-855.
Appendix A

Demographic Questionnaire
Name: ___________________________  Age: ________

1. Sex: [ ] Male    [ ] Female

2. What is your position at CEAP?
   [ ] Senior Therapist
   [ ] Clinical Supervisor
   [ ] Other: _____________________________

3. What is the highest degree you have earned?
   [ ] High school diploma
   [ ] Bachelor's Degree
   [ ] Master's Degree
   [ ] Ph.D.

4. What discipline was that degree earned in?
   [ ] Psychology    [ ] Special Education
   [ ] Behavior Analysis    [ ] Early Education
   [ ] Education    [ ] Behavioral Science Technology
   [ ] Other: _____________________________
   [ ] N/A, I have earned a high school diploma.

5. What level of certification have you earned from the Behavior Analysis Certification Board?
   [ ] BCABA
   [ ] BCBA
   [ ] None

6. Have you taken a behavioral research methods course (covering single-case designs, interobserver agreement, etc.)?
   [ ] Yes, at the undergraduate level.
   [ ] Yes, at the graduate level.
   [ ] No.

7. Did you participate in Dr. John Austin’s Performance Management training?
   [ ] Yes.
   [ ] No.

8. How long have you worked in the area of behavioral interventions for individuals with autism?
   _________ years, _________ months
Appendix B

Overview PowerPoint Presentation
CEAP Research Training

James Carr
Linda LeBlanc
Jessa Love
Western Michigan University

Why are we here?

- Many children with autism are now receiving early and intensive behavioral intervention
- The literature base supporting the procedures used in this clinical practice is relatively small
- At CEAP, many trained clinicians are available to conduct research, and many children are available to serve as participants

What is our goal?

- To provide you with the skills necessary to investigate some of the unanswered questions by conducting research through CEAP
- We recognize that some of you have had some research training – our goal with this training is to prepare everyone to be involved in the research process

2 Phases of Training:

- Phase 1
  - Train senior therapists and clinical supervisors to design and implement single-case design research protocols
  - Goal: When given a research question, staff will develop a detailed protocol, create materials, conduct research sessions, and manage data

2 Phases of Training:

- Phase 2
  - Train clinical supervisors to develop research ideas and questions
  - Examples:
    - If a child acquires an intraverbal response to a token antecedent, will that response transfer to question antecedents?
      - A dog is a ...animal vs. What is a dog?
      - Animal
    - Do echoic or tact prompts lead to faster acquisition of intraverbal responses?
    - Does forward or backward chaining result in faster acquisition of self-help skills?

Phase 1: 9 Training Modules

- 1. Measurement
  - Why measurement of behavior is important, operational definitions, methods of data collection
- 2. Interobserver Agreement (IOA)
  - Measuring the reliability of data, methods of calculation, guidelines for data collection
- 3. Procedural Integrity Assessments
  - Measuring the fidelity of the independent variable, collecting secondary (IOA) data, guidelines for data collection
Phase 1: 9 Training Modules

- 4. Data sheets
  - How to create user-friendly data sheets that include all necessary components
- 5. Single-case designs
  - How and when to use common single-case research designs
- 6. Graphing
  - Step-by-step instructions for creating graphs, visual inspection

Phase 1: 9 Training Modules

- 7. Research ethics, informed consent & procedural integrity information
  - Ethical considerations, developing consent documents and obtaining consent, ensuring the fidelity of the independent variable
- 8. Protocol implementation
  - Conducting research sessions, managing data
- 9. Protocol development
  - Using a research question to develop a detailed protocol and research materials

Structure of Each Module:

- Pre-training quiz
- Reading assignments
- Instruction (in person or video)
- Homework assignments
  - Feedback will be provided, with an opportunity to revise your work
- Post-training quiz
  - Will be completed during the instruction of the next module

Any Questions?
Appendix C

Module 1 Test Questions
1. Which of the following aspects of measurement are fundamental features of applied behavior analysis?
   A. assigning numbers and units to events
   B. direct and frequent measurement
   C. quantifying mental events
   D. using consensus-based rules to label events

2. Behavior analysts use measurement to detect and compare the effects of ___________________________ on ___________________________

3. What types of mistakes in the practice of applied behavior analysis can measurement prevent?
   A. continuing an ineffective intervention
   B. discontinuing an effective intervention
   C. Both A and B
   D. None of the above

4. What are the three important features of a good operational definition?
   1. ___________________________
   2. ___________________________
   3. ___________________________

5. What types of target behaviors can be measured using frequency counts?

6. If observation periods for collecting frequency data are all of the same length, how should you report the data?
   A. number of occurrences per unit time
   B. percentage of observations with target behavior
   C. number of occurrences
   D. percentage accuracy

7. If observation periods for collecting frequency data vary in length, how should you report the data?
   A. number of occurrences per unit time
   B. percentage of observations with target behavior
   C. number of occurrences
   D. percentage accuracy

8. Provide an example of a target behavior that could be measured using a frequency count.
9. Momentary time sampling (MTS) requires observers to record the occurrence of
target behavior ____________________.
   A. at the beginning of each interval
   B. throughout the entire interval
   C. at any point during the interval
   D. at the end of each interval

10. What types of target behaviors can be measured using MTS?

11. How should you report MTS data?
   A. number of occurrences per unit time
   B. percentage of observations with target behavior
   C. number of occurrences
   D. percentage accuracy

12. Provide an example of a target behavior that could be measured using MTS.

13. Trial-based data collection must be used when the target behavior is a
    ____________________.

14. Provide an example of a target behavior that could be measured using trial data.

15. Write an operational definition for one of the following behaviors:
   A. nail biting
   B. aggression - hitting
   C. waving
Appendix D

Module 1 PowerPoint Presentation
**Module 1: Measurement**

James Carr  
Linda LeBlanc  
Jessa Love  
Western Michigan University

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**What is measurement?**
- Assigning numbers and units to features of objects or events
- Direct and frequent measurement is the foundation of applied behavior analysis  
  - We use measurement to detect and compare the effects of environmental events on behavior

---

**Why is measurement important in research?**
- Describes phenomena in precise, consistent, and publicly verifiable ways
- Decreases subjectivity and prejudices of the researcher
- Provides reliability - measures are consistent and repeatable
- Provides validity - the extent to which a measure of X actually measures X and not Y

---

**Why is measurement important in practice?**
- Provides valuable information:  
  - During baseline, before intervening  
  - During intervention, allowing for modification  
  - After intervention, on effectiveness
- Prevents important mistakes:  
  - Continuing an ineffective intervention  
  - Discontinuing an effective intervention

---

**What is an operational definition?**
- Defines a behavior in terms that are precise so the behavior is measurable and an occurrence can be agreed upon by two or more observers
- In general, the more detailed the operational definition, the better

---

**A good operational definition is:**
- Objective  
  - Defines behavior in terms that are observable  
  - Does not make inferences about mental status or processes (e.g., the person's intention)
- Clear  
  - Unambiguous
- Complete  
  - Includes examples and non-examples of the target behavior
How can we evaluate an operational definition?

- Test it with multiple observers - when they are able to agree on occurrences and non-occurrences of the target behavior, the operational definition is sufficient.

Let's try an example:

- Define hand raising:
  - lifting one arm...
  - so the arm is straight (elbow and wrist are not bent)...
  - the bicep is level with the ear...
  - and the hand is open (fingers are not bent)...
  - for a maximum duration of 5 s or until the child's name is called
  - only code during an instructional session

How do we select the dimension of behavior to measure?

- This will depend on the research question
- What aspect of the behavior are you trying to change?
  - Example: If you are trying to decrease how often a problematic behavior occurs, you would want to measure and record how often the behavior occurs (frequency)

Methods of Data Collection:
Frequency or Rate

- **Event recording** - count each response as it occurs
- **Requirements for use:**
  - Target behavior is discrete, or countable
  - Target behavior does not happen too frequently (extremely high rate behavior can be difficult to count accurately)

Methods of Data Collection:
Frequency or Rate

- **Examples:**
  - Rate of aggressive behavior during one-on-one teaching (occurrences of aggression per minute)
  - Rate of social initiations made during group play (initiations per hour)
### Methods of Data Collection: Frequency or Rate

#### Sample data:

<table>
<thead>
<tr>
<th>Participant</th>
<th>Observer</th>
<th>Data</th>
<th>Start time</th>
<th>Stop time</th>
<th>Number of occurrences</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1/31/08</td>
<td>9:00am</td>
<td>9:30am</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
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<td>1/32/08</td>
<td>10:00am</td>
<td>10:30am</td>
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<td>1/33/08</td>
<td>9:00am</td>
<td>9:30am</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

#### Frequency:
- Sidener et al. (2006)

#### Rate:
- Esch & Carr (in press)

### Methods of Data Collection: Momentary Time Sampling (MTS)

- Record occurrences of the target behavior only at the end of brief intervals during a longer-duration observation period
- When to use:
  - Target behavior has a longer duration, not readily countable
  - Target behavior occurs at a high rate
  - You do not have the means to observe the target behavior continuously

### Methods of Data Collection: Momentary Time Sampling (MTS)

#### Examples:
- Out-of-seat behavior during one-on-one teaching
- Engagement in interactive play with peers during group play
Methods of Data Collection: Momentary Time Sampling (MTS)

- Procedure:
  - Divide the observation period into equal intervals (at least 10) and set a timer to indicate the end of the interval.
  - Watch for target behavior at the end of the interval.
  - Ignore occurrences DURING the interval.
  - At the end of the interval:
    - Record "Y" if the behavior occurred at the moment the interval ended.
    - Record "N" if the behavior did not occur at the moment the interval ended.
  - The timing device should automatically restart.

Methods of Data Collection: Momentary Time Sampling (MTS)

- How are data reported?
  - Count the number of observations during which the target behavior occurred and divide by the total number of observations/Intervals.
  - Report as percentage of observations/Intervals with target behavior.

Methods of Data Collection: Trials

- Measures whether a target behavior occurs following the relevant opportunity or instruction.

- When to use:
  - Target behavior is a restricted operant - the occurrence of the target behavior is limited to when trials are presented.

Methods of Data Collection: Trials

- Examples:
  - Limiting the motor behavior of a teacher when instructed to do so.
  - Responding correctly to questions about personal information.
Methods of Data Collection: Trials

- Procedure:
  - Present the relevant instruction or opportunity to engage in the target behavior
  - Record "Y" if the target behavior occurs
  - Record "N" if the target behavior does not occur

Methods of Data Collection: Trials

- Sample data:

<table>
<thead>
<tr>
<th>Participant</th>
<th>Observer</th>
<th>Target behavior</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial #</td>
<td>Independent</td>
<td>Trial #</td>
<td>Independent</td>
</tr>
<tr>
<td>1</td>
<td>Y (35)</td>
<td>6</td>
<td>Y (45)</td>
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<tr>
<td>2</td>
<td>Y (35)</td>
<td>7</td>
<td>Y (45)</td>
</tr>
<tr>
<td>3</td>
<td>Y (35)</td>
<td>8</td>
<td>Y (45)</td>
</tr>
<tr>
<td>4</td>
<td>N (25)</td>
<td>9</td>
<td>Y (45)</td>
</tr>
<tr>
<td>5</td>
<td>Y (35)</td>
<td>10</td>
<td>N (25)</td>
</tr>
</tbody>
</table>

Total Y%: 5 Percentage 20%

Methods of Data Collection: Trials

- How are data reported?
  - Percentage accuracy: report the percentage of correct responses out of the total number of opportunities, or out of a block of trials
  - Trials-to-criterion: report the number of trials needed to reach a predetermined level of performance

Methods of Data Collection: Trials

- Sample data:

<table>
<thead>
<tr>
<th>Participant</th>
<th>Observer</th>
<th>Target behavior</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial #</td>
<td>Independent</td>
<td>Trial #</td>
<td>Independent</td>
</tr>
<tr>
<td>1</td>
<td>Y (35)</td>
<td>6</td>
<td>Y (45)</td>
</tr>
<tr>
<td>2</td>
<td>Y (35)</td>
<td>7</td>
<td>Y (45)</td>
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<tr>
<td>3</td>
<td>Y (35)</td>
<td>8</td>
<td>Y (45)</td>
</tr>
<tr>
<td>4</td>
<td>N (25)</td>
<td>9</td>
<td>Y (45)</td>
</tr>
<tr>
<td>5</td>
<td>Y (35)</td>
<td>10</td>
<td>N (25)</td>
</tr>
</tbody>
</table>

Total Y%: 5 Percentage 20%

Percentage Accuracy: Chong & Carr (2005)

Trials to Criterion: Lechago et al. (2008)

Practical Tips: Collecting data live vs. from video

- Live
  - Can the individual implementing the intervention record data while doing so?
  - Is a second observer available periodically to collect secondary data?
  - If "yes" to both, live data collection should work well.
Practical Tips:
Collecting data live vs. from video

- Video
  - Will the participant demonstrate reactivity to the camera?
    - If yes, score data live if possible, or allow the participant to habituate to the presence of the camera before beginning data collection
  - Will the camera pick up sufficient noise to record behavior? (example: when the target behavior is a vocal response and the child is typically very quiet)

Practical Tips:
Collecting data live vs. from video

- Do you need to record multiple dimensions of behavior?
  - If yes, collecting data from video is likely the best option.
  - Do you have the resources to score videos quickly?

Practical Tips:
Collecting data live vs. from video

- Both (primary live, secondary from video)
  - Will someone watching the video have the same viewpoint as a live observer?
  - This approach will not work with some target behaviors
    - Example: eye contact is very difficult to score from video

Practical Tips:
Data Collection System

- Practice applying the operational definition and using the data sheets before beginning the protocol
  - Can multiple observers agree on the occurrence and non-occurrence of the target behavior based on the definition?
  - Do the data sheets include all necessary components in a user-friendly manner?
    - If so, you should be in good shape to begin
    - If not, identify the problems and fix them

Practical Tips:
Considerations with human observers:

- Accuracy may change over time (observer drift)
- Reduce observer drift by:
  - Good operational definitions
  - Good training before the observer starts
  - Periodic retraining
  - Monitor interobserver agreement (module 2)

Practical Tips:
Considerations with human observers:

- Reactivity: a participant's behavior may change when being watched
- Minimize by:
  - Allowing participants to "get used to" the observer (habituation)
  - Observe from an unobtrusive/hidden location
Readings:

  - Ch. 4: Measuring and Recording behavior.
  - We have not covered latency recording (pp. 65) or measuring the magnitude of a response (pp. 76), but these topics are covered in the reading.
Appendix E

Module 1 Homework Assignment
Note: This homework requires you to watch two short video clips and record data based on the behavior in those clips. URL's are provided for the location of the clips online. We recommend collecting data on a separate sheet of paper while you are watching the video clips, and then entering the data into this form afterwards.

Part 1: Momentary Time Sampling

Video: http://jam-lab.com/MTS-flapping.wmv

Audio cues have been included with this clip to signal the end of each interval – record data based on the behavior that is occurring at the time of the audio cue.

Target Behavior: Hand Flapping

Operational Definition: Instances of hand flapping involve a flapping of one or both hands with a back-and-forth motion with the arm(s) slightly bent and the hand(s) raised near the shoulders. Raising of the hands without a flapping motion does not represent an occurrence of hand flapping.

<table>
<thead>
<tr>
<th>Interval #:</th>
<th>Target Behavior? (Y or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<td>17</td>
<td></td>
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<tr>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

How would you report these data?
Part 2: Frequency Count

Video: http://jam-lab.com/Frequency-mands.wmv

Target Behavior: Manding (picture exchange)

Operational Definition: The occurrence of a mand involves the child taking a picture card off a wooden rectangle and reaching it towards the snack box on the table. Specifically, the edge of the picture card must cross the plane of the edge of the snack box in order for the response to qualify as a mand.

Total occurrences:

If all of our observation periods were of the same duration, how would you report these data?

If our observations periods varied in length, how would you report these data?

Part 3: Operational Definition

Please write an operational definition for ONE of the following behaviors. It might be helpful to have a specific child in mind when writing these definitions.

Swiping instructional materials from a table during instruction
Gross motor imitation of hand clapping
Following the instruction “line up” when other children have already formed a line
Appendix F

Module 2 Test Questions
1. It is recommended that interobserver agreement (IOA) be assessed for ____ of research sessions, and that a minimum average IOA of ____ be accepted.
   A. 10-15%, 75%
   B. 25%, 80%
   C. 30%, 95%
   D. 20-25%, 95%

2. Interobserver agreement is the degree to which __________ observers agree on the __________ and __________ of behavior.

3. List 2 of the 3 important aspects of research that IOA helps evaluate.

4. Total agreement IOA calculations should be used with which type of data collection?
   A. Event/frequency recording
   B. Momentary time sampling
   C. Trials-to-criterion
   D. Interval recording

5. Point-by-point IOA calculations should be used for data collected using ____________ or _____________. (Hint: methods of data collection)

6. What two aspects of IOA assessments should be reported for a research study?

7. Procedural integrity is ________.
   A. The degree of support for a given intervention based on the current research literature
   B. The quality of the research procedures in terms of a successful treatment outcome
   C. The reliability of the research procedures
   D. The degree to which the research procedures were implemented as intended

8. Occurrence agreement should be used with ________________ behavior so IOA calculations are not inflated.

9. List 3 of the 4 factors that can influence IOA assessments.

10. It is most important to have measures of procedural integrity for ________
    A. Low risk studies
    B. High Risk Studies
    C. Low rates of problem behavior
    D. High rates of problem behavior
11. Non-occurrence agreement should be used with ____________ behavior so IOA calculations are not inflated.

12. List 2 of the 4 ways to improve the accuracy of observers.

13. It is recommended that procedural integrity be assessed during __________ of research sessions, and that you assess __________ on procedural integrity data as well.

14. Calculate point-by-point agreement for the data provided below.

<table>
<thead>
<tr>
<th>Interval #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observer 1</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Observer 2</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Appendix G

Module 2 PowerPoint Presentation
What is interobserver agreement?
- The degree to which independent observers agree on the occurrence and non-occurrence of behavior
- Helps answer the question "Is that what I would have seen if I had been there?"

Why is IOA important?
- Evaluates 3 important aspects of research:
  - Operational definition
  - Detects bias, observer drift
  - Competency with which the definitions are used
  - Believability of the data and the intervention effects

Agreement ≠ Accuracy!
- Two observers may have high agreement but the data may be inaccurate
- How do we improve accuracy?
  - Use a good operational definition
  - Train observers
  - Conduct frequent checks during data collection
  - Use an appropriate data collection system

Recommendations for Research
- Assess IOA for 25% of sessions
- Accept a minimum average IOA of 80%
- Determine the primary and secondary observers before sessions
  - Observers must be independent!
- If IOA is low for a single session:
  - Train!
  - You can discard these data ONLY if you have set a rule before data collection began

IOA Calculations: Total Agreement
- Use this with event recording (frequency counts)
- \[ \text{IOA} = \frac{\text{lower frequency}}{\text{higher frequency}} \times 100\% \]
- Note: This does not tell us whether the observers actually agree on when the behavior did and did not occur
**IOA Calculations: Total Agreement**

- Example:
  
  Observer 1: 23 mands  
  Observer 2: 25 mands  
  
  IOA: \( \frac{23}{25} * 100\% = 92\% \)

**IOA Calculations: Point-by-Point**

- Use this for MTS & trial data (when specific records can be compared on a point-by-point basis).
- Score each interval or trial as an agreement or disagreement between observers.
  - IOA = \( \frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \) \times 100\% 

**IOA Calculations: Point-by-Point**

- Example:

<table>
<thead>
<tr>
<th>Int. #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs 1</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Obs 2</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>IOA</td>
<td>A</td>
<td>D</td>
<td>A</td>
<td>A</td>
<td>D</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>
  
  IOA: \( \frac{8}{10} * 100\% = 80\% \)

**IOA Calculations: Point-by-Point**

- Occurrence agreement - only score intervals in which at least one observer scored an occurrence.
- Use with low-rate behavior so IOA is not inflated.

**IOA Calculations: Point-by-Point**

- Non-occurrence agreement - only score intervals in which at least one observer scored a non-occurrence.
- Use with high-rate behavior so IOA is not inflated.

**How are IOA data reported?**

- Report the mean, minimum & maximum:
  - Mean IOA 99\% (range, 82\% to 100\%)
- Report these values for each behavior and for each participant.
- Where applicable, report overall, occurrence, and non-occurrence agreement.
- Example:
  - "Interobserver agreement (IOA) on the rate of aggression was assessed during 27\% of sessions with Joey, with a mean IOA of 90\% (range, 82\% to 100\%)."
## Factors influencing IOA

### Observer Reactivity
- Observers aware their observations will be checked might score behavior differently
- Prevent this by watching from an unobtrusive location, using someone naturally in the environment to observe, or by watching often

### Observer Drift
- Observers might gradually change what they measure
- Prevent this by providing good training, periodic retraining, good operational definitions, spot checks

### Complexity of Measurement System
- If observers are recording too many behaviors or too many participants you may get low IOA
- If data sheets are too complicated you may get low IOA
- Keep data collection and data sheets as simple as possible

### Observer Expectations
- Observers may be biased and record what they think should happen
- Prevent this by using observers blind to purpose of study, not reinforcing the reporting of data that meet expectations

## What is procedural integrity?

- The degree to which the procedures are implemented as intended
- Operationalize some aspect of the procedures (e.g., therapist behavior) and collect data on the implementation

## Why are procedural integrity assessments important?

- Without a measure of procedural integrity:
  - We cannot specify the aspect of the intervention that caused a behavior change
  - We cannot determine why a behavior change did not occur (no effect vs. poor implementation)

## Low-risk vs. High-risk Studies

### Low-risk Studies
- For low-risk studies, some evidence of procedural integrity is helpful, but don’t use lots of resources to do it
  - Mechanical interventions
  - Computerized interventions
  - Very simple treatments

### High-risk Studies
- High-risk studies require procedural integrity assessments
  - Lengthy, complicated treatments
  - Controversial treatments
  - Treatments implemented by individuals without much training
  - Treatments implemented by individuals who have not “bought in” on it, but must implement it because it is their job to do so
Example: What therapist behaviors should be assessed?
- Teaching intraverbal responses
- Did the therapist:
  - Provide the appropriate antecedent (e.g., verbal stimulus)?
  - Provide an echoic prompt according to the prompting procedure?
  - Provide the appropriate consequence (e.g., reward, praise)?
  - Conduct an appropriate interspersal trial?

Example: Echoic vs. Tact Prompts for Intraverbal Acquisition
- What level of risk is associated with this study?
- What therapist behaviors should be assessed?

Example: Full-session vs. Interval DRO for reducing high-rate mands
- What level of risk is associated with this study?
- What therapist behaviors should be assessed?

Recommendations for Research
- Assess procedural integrity when you assess IOA (25% of sessions)
- Any time someone collects data, you need IOA!
  - Assess IOA on procedural integrity data during 25% of procedural integrity assessment sessions (about 6% of total sessions)

Recommendations for Research
- Report the average procedural integrity score, as well as the IOA on procedural integrity
- Example
  - "Procedural integrity was assessed during 27% of sessions with a mean score of 94%. IOA on procedural integrity data was assessed during 25% of those sessions, with a mean IOA of 97% (range, 90% to 100%)."

Reading:
  - Ch. 5: Planning & Directing Observational Procedures
  - Pages 81 - 103
Appendix H

Module 2 Homework Assignment
The data set below provides frequency data for two independent observers from a variety of sessions. Calculate the IOA for each session.

<table>
<thead>
<tr>
<th>Session #</th>
<th>Observer 1</th>
<th>Observer 2</th>
<th>IOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4</td>
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</tr>
<tr>
<td>45</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Calculate the mean and range of the IOA for this data set. Mean: (calculate mean)
Range: (calculate range)

Would the mean IOA score be considered acceptable? Why or why not?

Were enough IOA checks conducted for this data set? (Note: there were 45 sessions) Why or why not?

The data set below provides frequency data for two independent observers from a variety of sessions. Calculate the IOA for each session.

<table>
<thead>
<tr>
<th>Session #</th>
<th>Observer 1</th>
<th>Observer 2</th>
<th>IOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
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<tr>
<td>51</td>
<td>62</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Calculate the mean and range of the IOA for this data set. Mean: (calculate mean)
Range: (calculate range)

Would the mean IOA score be considered acceptable? Why or why not?

Were enough IOA checks conducted for this data set? (Note: there were 51 sessions) Why or why not?
The data set below provides MTS data for two independent observers during one session.
(Y = occurrence, N = non-occurrence)
Calculate point-by-point agreement for this data set.

<table>
<thead>
<tr>
<th>Session #</th>
<th>Observer 1</th>
<th>Observer 2</th>
<th>Session #</th>
<th>Observer 1</th>
<th>Observer 2</th>
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</thead>
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<td>Y</td>
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<td>13</td>
<td>Y</td>
<td>N</td>
<td>28</td>
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<td>29</td>
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<tr>
<td>15</td>
<td>Y</td>
<td>Y</td>
<td>30</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Overall agreement:
Occurrence agreement:
Non-occurrence agreement:
Appendix I

Module 3 Test Questions
Attached is a data sheet for use in teaching gross motor imitation responses to children with autism. Evaluate this datasheet in terms of the components included and its ease of use. There are 16 ways in which this data sheet could be improve that generally focus on these 5 areas: identifying information, participant behavior, therapist behavior, IOA, and organization. Provide us with a list of improvements or changes that should be made to this datasheet. Please word your responses in terms of specific changes that should be made (e.g., "Component X should be included/added") rather than aspects of the datasheet that are incorrect or not ideal (e.g., "X is not clearly indicated by the datasheet"). In other words, please provide us with thorough instructions as to how this datasheet should be improved, rather than simply pointing out what is wrong with it. 

Please write legibly!!! (Use the back of this page if you need more space to write.)

1. 

2. 

3. 

4. 

5. 

6. 

7. 

8. 

9. 

10. 

11. 

12. 

13. 

14. 

15. 

16.
Condition: ___________________ Target behavior: ________________

Participant behavior:

<table>
<thead>
<tr>
<th>Trial #</th>
<th>Response (Independent, Prompted, Error)</th>
<th>Trial #</th>
<th>Response (Independent, Prompted, Error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>6</td>
<td></td>
</tr>
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<td></td>
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<tr>
<td>5</td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Percentage Correct: ___________________

Therapist behavior:

<table>
<thead>
<tr>
<th>Trial #</th>
<th>Correct? (yes or no)</th>
<th>Trial #</th>
<th>Correct? (yes or no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>4</td>
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<td>9</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Percentage Correct: ___________________

Interobserver agreement

<table>
<thead>
<tr>
<th>Trial #</th>
<th>Agree or Disagree?</th>
<th>Trial #</th>
<th>Agree or Disagree?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>7</td>
<td></td>
</tr>
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<td>3</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Percentage Agreement: ___________________
Appendix J

Module 3 PowerPoint Presentation
Module 3: Data Sheets

Linda LaBlanc
Jessa Love
James Carr
Western Michigan University

Why are data sheets important?
- There is no research without data
- You make data-based decisions throughout research - you need an effective data collection system
  - Good data sheet = good data
  - Bad data sheet = errors, missed or wrong data
- They play an important role in the IOA for your data

Creating user-friendly data sheets:
- Make it as simple as possible to capture all of the information you want
- Data sheets should prompt your observers' behavior
  - Inadequate prompts could lead to inaccurate observing or observer drift
- Try it out a few times:
  - With observers who did not create it (so are less familiar with it)
  - With potential participants or similar individuals
- Be prepared to make changes as needed

General Guidelines:
- Minimize the writing required
  - Provide words or codes to circle wherever possible
- Group all of the recording required for each trial/occurrence together whenever possible
  - e.g., child behavior, therapist behavior, IOA
  - This will prevent the observer from having to "jump around" the datasheet when recording

Components to Include:
- Identifying information
  - Participant ID, observer, condition, date, time, target behavior, session number
- Indication of primary vs. secondary data
- Participant behavior:
  - Operational definitions & instructions for recording
  - A place to write the summary measure (e.g., percentage correct)
- Therapist behavior (procedural integrity):
  - Operational definitions and instructions for recording each relevant behavior, for example:
    - Presenting appropriate stimuli
    - Instructions
    - Prompting
    - Reinforcement
    - Task interspersal
  - A place to write the summary measure (e.g., percentage correct)
Components to Include:

- IOA assessments
  - On "primary" data sheets, you will score your IOA and calculate the summary measure
  - Indicate the formula used to calculate IOA
  - The place to record this may be incorporated into the sections for participant and therapist behavior
  - Be sure to include a place to score IOA on all behavior (e.g., participant behavior(s) and therapist behavior(s))

Tips to promote accurate use of your data sheet:

- Something should be recorded in every box/blank
- Use intuitive abbreviations/codes that are not too similar
- When using time-based data collection (MTS) develop a salient cue to signal data collection that won’t disrupt the learner
  - Watching a watch, audio cue, etc.
- Think about likely errors in data collection and try to prevent them

Example: Frequency Data (Excel)

Example: MTS (Mega)

Example: Trials (Excel)

Example: Procedural Integrity (Excel)
### Example: Paired-Stimulus (Excel)

**Participant:**

Date: Primary / Secondary (circle one)

Child the number corresponding to the item selected for each trial.

Check any predefined behaviors during the trial.

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

Score each trial as Y or N for each trial.

### Example: MSWO (Excel)

**Participant:**

**Date:**

**Observer:**

Primary / Secondary (circle one)

Number the order in which the animal were selected for each array.

<table>
<thead>
<tr>
<th>Animal</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
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<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

Score each behavior as Y or N for each trial.

### Example: Safety Skills (Excel)

**Participant:**

**Date:**

**Observer:**

Primary / Secondary (circle one)

<table>
<thead>
<tr>
<th>Task</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

### How can this data sheet be improved?

- **Organization**
  - Provide abbreviations to circle for therapist behavior and IOA.
  - Combine tables so all recording for each trial is in one place.

- **Coding:**
  - How can this be improved?
  - Provide abbreviations to circle for therapist behavior and IOA.
  - Add codebook for each trial.

- **Data:**
  - How can this be improved?
  - Provide abbreviations to circle for therapist behavior and IOA.
  - Add codebook for each trial.

- **Additional:**
  - How can this be improved?
  - Provide abbreviations to circle for therapist behavior and IOA.
  - Add codebook for each trial.

### How can this data sheet be improved?

- **Coding:**
  - How can this be improved?
  - Provide abbreviations to circle for therapist behavior and IOA.
  - Add codebook for each trial.

- **Data:**
  - How can this be improved?
  - Provide abbreviations to circle for therapist behavior and IOA.
  - Add codebook for each trial.

- **Additional:**
  - How can this be improved?
  - Provide abbreviations to circle for therapist behavior and IOA.
  - Add codebook for each trial.
Appendix K

Module 3 Homework Assignment
Create a data sheet to be used in a research study evaluating the acquisition of tacting (i.e., labeling) colors in children with autism. This study will use 10-trial blocks, errorless prompting (i.e., full verbal prompt, partial verbal prompt, no prompt), and will involve three conditions: baseline, teaching with flashcards, and teaching with 3D objects. Please refer to the lecture for this module for guidelines and examples. Be sure to include the following components:

1. Identifying information
2. A section for participant behavior (vocal tacting/labeling)
3. A section for all relevant therapist behaviors (e.g., providing appropriate stimuli, instructions)
4. A section for IOA assessment and calculation

You may use Microsoft Word or Excel to create your data sheet.
Appendix L

Module 4 Test Questions
1. When using a single case design, a participant is exposed to _________ condition(s).
   A. One
   B. Several
   C. Every
   D. Two

2. In single case design research, each ________________ serves as its own control.

3. Phase changes should be made when the data are ________________.

4. List two of the four general characteristics of single case design research.

5. List the three types of multiple-baseline designs. (Hint: multiple-baseline across ______)

6. The reversal design cannot be used when:
   A. The participant exhibits problem behavior
   B. The independent variable involves programmed reinforcement
   C. Comparing multiple interventions
   D. The effects of the independent variable cannot be withdrawn

7. The alternating-treatments design demonstrates experimental control when:
   A. Different levels of responding are reliably produced by the different treatments or conditions
   B. Substantial overlap is present between the two data paths
   C. Two different conditions are compared following a baseline phase
   D. Similar levels of responding are reliably produced by the different treatments or conditions

8. When using a multiple-baseline design, the same ________________ is applied to every baseline.

9. How is experimental control demonstrated when using a multiple-baseline design?

10. The behaviors measured when using a multiple-baseline design across behaviors should be functionally ________________.

11. What two things should you do if your data are not stable?
12. If a researcher wanted to evaluate the effects of functional communication training (FCT) used with punishment as a treatment for problem behavior by comparing the rate of the behavior when both treatments are implemented, to the rate of the behavior when the punishment component is withdrawn, which single-case design would be best to use?

A. Multiple-baseline design

B. Reversal design

C. Alternating treatments design

13. A researcher wants to compare the effects of differential reinforcement and non-differential reinforcement on the rate of skill acquisition by teaching a child two new skills – one using each type of reinforcement. This researcher should use a ____________ design.

14. A researcher wants to evaluate the efficacy of FCT to teach one child three new mand. This researcher should use a ____________ design to evaluate this.

15. List two of the three potential explanations for substantial overlap in the data paths when using an alternating-treatments design.
Appendix M

Module 4 PowerPoint Presentation
Module 4:
Single Case Designs

Jessa Love
James Carr
Linda LeBlanc
Western Michigan University

What are single case designs?
- Each case serves as its own control
- Different from group designs with a control group
- Behavior of each participant is measured repeatedly as he/she is exposed to each condition
- Provides the basis for comparing the effects of the IV as it is presented or withdrawn in subsequent conditions

General Characteristics:
- #1: Repeated Measures
  - Behavior is measured repeatedly across different phases
  - Phase = series of observations under same conditions
  - Baseline phase = no treatment/intervention
  - Notation: A = baseline, B = treatment/IV #1, C = treatment/IV #2, etc.

Why measure behavior repeatedly?
- Assess variability or obtain stable responding
- Study acquisition of responding (learning)

General Characteristics:
- #2: Visual Inspection (Module 5)
  - Graphical not statistical analysis
  - Evaluate changes in level, trend, and variability over time
  - Allows comparison of behavior between baseline and intervention conditions
General Characteristics:

- #3: Experimental Control is demonstrated within each case
- Evaluates behavior of the individual
- Not the average of groups
- Group-average effects can be misleading
- There is no “average” person

- AB designs are not recommended because they DO NOT demonstrate experimental control

General Characteristics:

- #4: Responding is analyzed at a steady state (little variability on the measured dimension)
- Stability criteria can be used to provide an objective rule to determine when data are stable
- Must have at least 3 data points in each phase to demonstrate stability

What should you do when data are not stable?

- Run it out! Be patient and continue collecting data in the current phase
- Look for patterns in the inconsistency (e.g., cyclical patterns)

When should you make phase changes?

- When responding is stable
- When responding is not already changing in the desired direction

Reversal Design

- AKA "Withdrawal Design"
- Researcher attempts to verify the effect of the IV by "reversing" responding to a level obtained in a previous condition
- The effect can then be replicated by re-implementing the IV (A-B-A-B), or by replicating across people (A-B-A)
Reversal Design: Experimental Control
- Demonstrated when responding "reverses" back to baseline levels upon removal of the IV
- Strongest design

Reversal Design: Issues to Consider
- Ethical issues - how important is the information from the reversal?
  - Not all interventions can be withdrawn
    - Rule-governed behavior
    - Acquisition of skills - Behavior will not reverse
    - Dangerous behavior - Treatment cannot be withdrawn

Reversal Design: Variations
- A-B-A-B

Reversal Design: Variations
- A-B-A-C-A: Used to compare interventions
  - Problems: exposure to one treatment may alter the effect of the other treatment (sequence effects)
  - Possible solutions:
    - Counterbalance across participants: A-C-A-B-A
    - Replicate both treatments with one participant: A-B-A-C-A-B-A-C

Reversal Design: Example Research Topics/Questions
- Evaluations of:
  - FCT as a treatment for attention maintained problem behavior
  - Effects of a certain schedule of reinforcement for academic tasks on problem behavior during instruction
  - Comparing teaching allowing children the choice of tasks to teaching with no choices in terms of the effects on problem behavior

Multiple-Baseline Design
- Behaviors, Settings, Participants
  - No need to withdraw treatment
  - Treatment is implemented on baselines in a staggered fashion (e.g., on one behavior while another remains in baseline)
  - Baselines have different lengths
Multiple-Baseline Design

- Once change has been noted in the first behavior, treatment is implemented on subsequent behaviors
- The different baselines serve as a control for each other
- The same IV is applied to every baseline

Multiple-Baseline: Experimental Control

- Demonstrated when each behavior shows similar changes when, and only when, the treatment is implemented
- This graph demonstrates experimental control

Multiple-Baseline: Issues to Consider

- Behaviors/Settings/Participants:
  - Must be functionally independent
  - Must be similar enough that each will change with intervention
- Choose behaviors/settings/participants carefully so you do not observe unwanted generalization

Multiple-Baseline: Variations

- Multiple Probe Design
  - Use infrequent probes to establish baseline
  - Once treatment is implemented, you need more probes to demonstrate experimental control
- Use this when:
  - You can be confident that the behavior is not in the repertoire
  - You are worried about the reactivity of assessment
Multiple-Baseline: Example Research Topics/Questions
- Evaluations of:
  - The generalization of mands for information across establishing operations
  - The acquisition of a novel mand across settings
  - Transfer from tact training to receptive behavior and vice versa (across behaviors)

Alternating Treatments Design
- Two or more conditions are alternated (e.g., on alternating sessions or days) independent of the level of responding
- Differences in responding between conditions are evaluated

Alternating Treatments: Experimental Control
- Demonstrated when objective evidence displays that different levels of responding are predictably and reliably produced by the different treatments
- Clear demonstration of experimental control - no overlap between the data paths for two treatments

Alternating Treatments: Issues to Consider
- May use previously neutral stimuli to help differentiate conditions & enhance stimulus control
  - Must be included in baseline to show that the different stimuli do not produce different baseline data

- Multiple Treatment Interference
  - With rapid alternation, the participant may not have time to adjust and show a change in behavior
  - Significant overlap in data paths may mean:
    - One treatment has a residual effect on data in second condition
    - Confound affected behavior in both conditions

- If you think that different treatments may have the same effect, don't use ATD!
Alternating Treatments: Variations

- Single-phase without a no-treatment control condition

- Single-phase with a no-treatment control condition

- Two-phase with baseline

- Three-phase with baseline, comparison of two treatments, and final phase with most effective treatment

Alternating Treatments: Example Research Topics/Questions

- Comparisons of:
  - Most-to-least vs. Least-to-most prompting for skill acquisition
  - Punishment vs. extinction for problem behavior
  - Tact vs. echoic prompts for acquisition of intraverbal responses

Any questions?
Appendix N

Module 4 Homework Assignment
Part 1:
For each of the 6 example research questions/topics listed below, please indicate which single case research design discussed in the lecture for this module (i.e., reversal, multiple baseline, alternating treatments) would be most appropriate. Next, explain why that design is most appropriate.

1. A researcher wants to evaluate the effects of a differential reinforcement of low-rates (DRL) procedure for reducing high-rate mands by comparing the rates of mands during a DRL condition to the rate during a baseline condition.
   Which design should be used?
   Why?

2. A researcher wants to evaluate the effects of differential reinforcement on vocal responding during circle time for three children. The researcher would like to measure each child’s behavior individually.
   Which design should be used?
   Why?

3. A researcher wants to evaluate a functional communication training (FCT) intervention with and without extinction as a treatment for escape maintained problem behavior. Specifically, the researcher would like to compare the rates of problem behavior during a condition with both treatment components, to the rates of problem behavior during a condition in which extinction is withdrawn.
   Which design should be used?
   Why?

4. A researcher would like to compare FCT and noncontingent reinforcement (NCR) as potential treatments for problem behavior.
   Which design should be used?
   Why?

5. A researcher would like to compare the use of behavior specific (e.g., “Good job touching your nose!”) and non-behavior specific praise (e.g., “Good job!”) for the acquisition of receptive identification of body parts. Specifically, the researcher would like to teach one body part using specific praise, and another using non-specific praise, and then compare the rates of acquisition.
   Which design should be used?
   Why?

6. A researcher would like to evaluate the effects of a group NCR intervention on the rates of problem behavior displayed by clients at a day program. Specifically, the researcher would like to evaluate the effects of this intervention across two times of day – morning and afternoon.
   Which design should be used?
   Why?
Part 2:
For each of the three single case designs presented in the lecture for this module, please provide one sample research question/topic that could be evaluated using that design. Next, explain why that design is appropriate for the question/topic you provided.

7. Reversal Design
   Example research question/topic:
   Why is that design appropriate for this question/topic?

8. Multiple baseline design
   Example research question/topic:
   Why is that design appropriate for this question/topic?

9. Alternating treatments design
   Example research question/topic:
   Why is that design appropriate for this question/topic?
Appendix O

Module 5 Test Questions
1. *Visual inspection* is:
   A. A method of data collection
   B. A technique to ensure treatment integrity
   C. A systematic method of interpreting graphical data
   D. A method of organizing raw data

2. The three aspects of data that are evaluated during visual inspection are __________, __________, and __________.

3. List **two** of the things you should look at when examining a graph, *BEFORE* you evaluate the data.

4. Does the graph below demonstrate a treatment effect?
   A. Yes
   B. No

![Graph](image)

5. On a graph, the ratio of the length of the y-axis to the x-axis should be approximately __________ to avoid inflation or deflation of the data.

6. *Level* refers to:
   A. The value on the x-axis around which the data converge
   B. The number of data points on a graph
   C. The value on the y-axis around which the data converge
   D. The amount of change between baseline and treatment phases

7. When presenting multiple graphs, do not equalize the __________ because we do not make between participant comparisons in single case design research.

8. *Trend* refers to:
   A. The overall direction taken by a data path
   B. A prediction of future behavior
   C. An estimate of the average measure of behavior
   D. How quickly behavior changes after a phase change
9. Does the graph below demonstrate a treatment effect?
   A. Yes
   B. No

10. What two questions do we aim to answer through visual inspection of a graph?

11. Variability refers to:
   A. The overall stability of the data
   B. How often and the extent to which multiple data points differ
   C. How much the independent variable differs from the intended intervention
   D. The amount of change between baseline and treatment phases

12. A level-exception graph does/does not (circle one) demonstrate a treatment effect, even though there was a change in ____________ between conditions.

13. Does the graph below demonstrate a treatment effect?
   A. Yes
   B. No

14. Visual inspection is a more ________________ method of evaluating treatment effects than ________________.
Appendix P

Module 5 PowerPoint Presentation
Module 5: Graphing & Visual Inspection

Linda LeBlanc
Jessa Love
James Carr
Western Michigan University

What are the functions & benefits of a graph?
1. Organize & store data
2. Continuously monitor behavior
3. Make decisions
4. Interpret data
5. Communicate findings

Interpreting Data
- Before evaluating a graph's data, read all labels and figure captions and look at the scales on the x and y axes
- Questions to ask:
  - Was responding stable?
  - Did the author demonstrate experimental control?
  - Did a meaningful change take place?
  - Requires visual inspection of the data

What is Visual Inspection?
- Systematic examination of graphical data
  - More conservative way to evaluate treatment effects than statistical analysis
- Seeks to answer two questions:
  - Did behavior change in a meaningful way across phases?
  - If so, to what extent can that change be attributed to the independent variable?

What is Visual Inspection?

3 Aspects of Data are Evaluated During Visual Inspection:
- **Level** - the value on the vertical axis around which the data converge
- **Trend** - the overall direction taken by a data path
- **Variability** - how often and the extent to which multiple data points differ

Visual Inspection: A Primer
- Please follow along on your visual inspections job-aid
  - This tutorial will expose you to the step-by-step process of inspecting AB graphs
    - AB comparisons are the basis for most visual inspection comparisons (except ABO graphs)
    - E.g., an AABAB graph includes 3 of these comparisons
  - Eventually you will become fluent with this process and will not need the job-aid
Step 1: Level

**Practice:** What is the mean level?

1. Draw a straight horizontal line with your eyes that leaves approximately half of the data points above it and half below. What y-axis number does this line equal? _____

**Treatment:** What is the mean level?

1. Draw a straight horizontal line with your eyes that leaves approximately half of the data points above it and half below. What y-axis number does this line equal? _____

---

Step 1: Level

Is the level (y-axis value) of the data path in Treatment different than in Baseline? Yes [No]

- Baseline: y-axis value = 5
- Treatment: y-axis value = 5

No, they are the same.

---

Step 2: Trend

**Baseline:** Is there an obvious trend in the data?

1. Draw a trend line with your eyes that represents the direction (up, down, flat) that leaves approximately half of the data points above it and half below.

2. What is the trend?
   - ascending (up)
   - descending (down)
   - no trend (flat)

**Treatment:** Is the trend in Treatment different than in Baseline? Yes [No]

- Baseline: No trend (flat)
- Treatment: Ascending (up)

Yes, they are different.
Step 2: Trend

Is the trend steeper, flatter, or neither steeper nor flatter in Treatment than in Baseline?

Trend in treatment steeper

Trend in treatment flatter

Trend in treatment neither steeper nor flatter

Step 3: Variability

Baseline: How far away from your imagined trend line are most of the data points?

- Very near: 1
- 2
- 3 = Very far

The trend is steeper in Treatment.
Step 3: Variability

**Baseline**

```
| Vary Near | 1 | 2 | 3 - Very Far |
```

**Treatment**

Is the variability in Treatment different than in Baseline? **Yes**

- Baseline: variability = 1
- Treatment: variability = 1

No, they are the same.

Step 4: Make a Decision

**Summarize**

How much did level change?

- **No change**
- a little
- a lot

Baseline: y-axis value = 5
Treatment: y-axis value = 5
Step 4: Make a Decision

Summarize

How much did variability change?
- no change
- a little
- a lot

Baseline: Very Near - 1 2 3 - Very Far
Treatment: Very Near - 1 2 3 - Very Far

Step 4: Make a Decision

LEVEL EXCEPTION

If level was the only dimension that changed, AND the trend was the same in baseline and treatment (ascending or descending, NOT flat), it is a Level Exception graph.

The questions on the next slide and on your job aid will help you determine if the level exception applies.

These are level exception graphs:

- Level is different, trend is the same
- Level is different, trend is different
- Level is the same, trend is different

Step 4: Make a Decision

1) Was level the only dimension that changed? Yes / No
2) Was trend the same in baseline and treatment? Yes / No
3) Were trend ascending or descending in both baseline and treatment? Yes / No
4) If you ignore the phase line on the graph, does it look like the data points are part of the same data path? Yes / No

If YES in 1, 2, 3, and 4, answer NO in (c) below.

(c). Did behavior change from Baseline to Treatment? Yes / No

Our Example

Did behavior change from Baseline to Treatment? Yes / No

Because we answered 'a lot' for the trend change AND it is not a Level Exception graph because level was not the only dimension that changed (in fact, level did not change).
Our Example

Compare the last few points of Baseline to the first few points of Treatment. Was there an immediate change in level between phases? (Yes) No

The last few points in Baseline are at a different level than the first few points in Treatment.

Our Example

How confident are you in your decision that behavior changed or did not change?

Very Unconfident - 1 2 3 4 (5) Very Confident

We are very confident because we answered "a lot" for the trend change, AND it is not a Level Exception graph because level was not the only dimension that changed.

Let's do another example...

Here is the graph:

Step 1: Level

Baseline: What is the mean level? 7

Step 1: Level

Treatment: What is the mean level? 5

Step 1: Level

Is the level (y-axis value) of the data path in Treatment different than in Baseline? (Yes) No

- Baseline: y-axis value = 7
- Treatment: y-axis value = 3

Yes, they are different.
Step 2: Trend
Baseline: What is the trend? 
- Steeper (down)
- Flatter (flat)
- Neither

Treatment: What is the trend? 
- Steeper (down)
- Flatter (flat)
- Neither

Is the direction of the trend in Treatment different than in Baseline? Yes / No

Step 2: Trend
Baseline: Steeper, Flatter, or neither steeper nor flatter than in Treatment than in Baseline?

Baseline
Treatment

Step 2: Trend
Both trends are descending at approximately the same steepness.

Step 3: Variability
Baseline: How far away from your imagined trend line are most of the data points? 
- Very near
- Somewhat near
- Very far

Treatment: How far away from your imagined trend line are most of the data points? 
- Very near
- Somewhat near
- Very far

Step 3: Variability
Is the variability in Treatment different than in Baseline? Yes / No

Step 4: Make a Decision
How much did mean change? 
- No change
- A little
- A lot

How much did trend change? 
- No change
- A little
- A lot

How much did variability change? 
- No change
- A little
- A lot

LEVEL EXCEPTION
If level was the only dimension that changed, AND the trend was the same in Baseline and Treatment (ascending or descending, NOT flat), it is a Level Exception graph.

The questions on the next slides and on your jobaid will help you determine if the level exception applies.

These are level exception graphs:

(Level is different, trend is the same)
Step 4: Make a Decision

If you remove the phase line, a level exception graph will look like the data paths could be part of the same line, like the graph on the right.

Step 4: Make a Decision

1) Was level the only dimension that changed?  
   Yes/No  If No, answer YES in (a) below.
2) Was trend the same in baseline and treatment?  
   Yes/No  If No, answer YES in (b) below.
3) Was trend ascending or descending in both baseline and treatment?  
   Yes/No  If No, answer YES in (c) below.
4) If you take away the phase line on the graph, does it look like the data points are part of the same data path?  
   Yes/No  If No, answer YES in (d) below.

If YES in 1, 2, 3, and 4, answer NO in (c) below.

(c). Did behavior change from Baseline to Treatment?  
Yes/No

Step 4: Make a Decision

Compare the last few points of Baseline to the first few points of Treatment. Was there an immediate change in level between phases?

No, the level is approximately the same.

Step 4: Make a Decision

How confident are you in your decision that behavior changed or did not change?

Very Unconfident - 1  2  3  4  5  Very Confident

We are very confident that behavior did not change because level was the only dimension that changed and the trend was the same, so it is a Level Exception graph.

Let's do one more...

Here is our graph:

Step 1: Level

Baseline. What is the mean level? __5.5__
Step 1: Level

**Treatment**: What is the mean level? 5.5

Is the level (y-axis value) of the data path in Treatment different than in Baseline? Yes (No)

- Baseline: y-axis value = 5.5
- Treatment: y-axis value = 5.5

No, they are the same.

Step 2: Trend

**Baseline**: What is the trend?
- Ascending (up)
- Descending (down)
- Even trend (flat)

**Treatment**: What is the trend?
- Ascending (up)
- Descending (down)
- Even trend (flat)

Is the direction of the trend in Treatment different than in Baseline? Yes (No)

The trend is flat in both treatment and in baseline.

Step 3: Variability

**Baseline**: How far away from your imagined trend line are most of the data points?
- Very near - 1
- Somewhat - 2
- Very far - 3

**Treatment**: How far away from your imagined trend line are most of the data points?
- Very near - 1
- Somewhat - 2
- Very far - 3

Is the variability in Treatment different than in Baseline? Yes (No)
Step 4: Make a Decision

How much did level change? **No change**
How much did trend change? **No change**
How much did variability change? **No change**

(You answered 'no change' for all, so there is no immediate change in level between phases.)

No, the level is approximately the same.

Step 4: Make a Decision

Let's try a few more examples without following the job-aid steps:

- Does this graph demonstrate a treatment effect?

We are very confident that behavior did not change because none of the dimensions (level, trend, variability) changed.
Does this graph demonstrate a treatment effect? For which treatment?

Graphing in Excel: Reversal Design

1. Open a new Excel worksheet and enter your data:
   - To get Excel to leave spaces at phase changes place data for different phases in different columns
2. Highlight your data, then click on the chart button (looks like a bar graph)

Graphing in Excel: Reversal Design

3. A chart wizard window will pop up - select line graph and click next.

Graphing in Excel: Reversal Design

4. Excel will ask you to confirm that your data series are in columns - click next.

Graphing in Excel: Reversal Design

5. Excel will then allow you to do some formatting:
   - Enter titles for the x-axis and y-axis
   - Under the "Gridlines" tab, deselect "Major Gridlines"
   - Under the "Legend" tab, deselect "Show Legend"
   - Click next, and then finish, and your graph will appear in the worksheet window.
Graphing in Excel: Reversal Design

When it first appears, your graph will look like this:

You will need to do some more formatting to make the graph look professional.

Graphing in Excel: Reversal Design

6. Formatting:
a. Move your mouse to the grey "plot area" surrounding the data path. Right click once and choose "format plot area" from the menu that appears.
b. Under "Border" and "Area" select "none" and click OK.
c. Right click once on the y-axis and select "Format axis." Choose the "Scale" tab and type in the maximum value you want your y-axis to have where is says "Maximum" and click OK.

Graphing in Excel: Reversal Design

6. Formatting:
d. Right click once on your data path and select "Format data series." Change the line color, and data point foreground and background color to black. Change the marker style to it is the same for the entire data path across all phases.

Your graph should now look like this:

Graphing in Excel: Alternating Treatments

1. Open a new Excel worksheet and enter your data:

   - The two baseline data paths will be entered into columns A & B, and the two treatment data paths will be entered into columns C & D
   - Leave empty cells so that the data points display the alternation between conditions

2 - 6. Same as instructions for reversal design graph.

Graphing in Excel: Alternating Treatments

- More Formatting:
  1. Connect data points across the empty cells where there is no data:
     1. Click on the graph
     2. From the "Tools" menu, select "Options"
     3. From the "Active Chart" menu, select "Interpolated" under the "Plot Empty Cells As" area.
     4. Click OK
Graphing in Excel: Alternating Treatments

- More Formatting:
  - Use one style of data marker for one condition, and another for the other condition (Right click on data path, select "Format Data Series")
  - Making one filled in and the other "open" will make the two data paths easily discriminable ("open" = white background)
  - Indicate which data path corresponds to each condition using text boxes, and lines with arrows on the end (double-click on line, select arrow end-style)

- Once you've done all the formatting, your graph should look like this:

Graphing in Excel: Multiple Baseline

1. Open a new Excel worksheet and enter your data:
   - Enter all data for the top panel first, then the data for the second panel.

2. Follow the same as instructions for reversal design graph, except:
   - Use only the data for the top panel
   - Do not add axis titles

- Once you have done that, your graph will look like this:

Graphing in Excel: Multiple Baseline

- The easiest way to ensure that the different panels are equivalent is to create one, copy and paste it, then change the data in the second panel
  - Select the first panel by clicking on it once
  - Copy and paste it into the document
  - Click once on the data series for the second panel
  - Change the data string (at the top of your screen) to reflect the new range of data
  - You'll need to do this for the baseline and treatment data paths

- Drag the second panel into vertical alignment with the top panel
  - Remove tick mark labels from every panel except the bottom one:
    - Double click on the relevant x-axis
    - A formatting window will pop up
    - Under the "Patterns" menu, select "None" for "Tick Mark Labels"
    - Click OK
Graphing in Excel: Multiple Baseline

- Add x-axis and y-axis labels using text boxes
  - To change the alignment of the y-axis label, double-click on the text box, under the "Alignment" menu, select the vertical, right-align orientation, click OK
- Use the line tool to draw phase change lines, and the lines connecting the panels
- Add phase labels, and labels for each panel using text boxes

Graphing in Excel: Multiple Baseline

- Once you have done that, your graph will look like this:

General Tips & Recommendations:

- Formatting Guidelines:
  - The ratio of the length of the y-axis:x-axis should be 2:3 or 3:4 (to avoid inflation or deflation of data)

General Tips & Recommendations:

- Formatting Guidelines:
  - When presenting multiple graphs within an article, for multiple participants - DO NOT equalize the y-axes
  - We do not make between participant comparisons in single case research
  - However, Kennedy (1993) suggests that the axes should be equalized to allow for more appropriate conclusions - so be careful when drawing your conclusions about the size of the effect

General Tips & Recommendations:

To move a graph created in Excel into a word document:

1. Select all components of the graph (i.e., graph, phase change lines, text boxes).
2. Click on the "Draw" button on the drawing toolbar, it looks like this: 
3. Click on "Group" - this will group all of the components into one object to cut and paste.
4. Select the newly grouped object, then click on "Edit," then "Copy"
5. In Word, click on "Edit," "Paste Special," then paste as a picture and your graph will show up

Any questions?

Readings for this Module:

- Cooper, Heron, & Heward (2007)
  - Ch. 9: Constructing and Interpreting Graphic Displays of Behavioral Data
  - Ignore the instructions about raising the zero on the y-axis!
Appendix Q

Module 5 Homework Assignment
Part 1: Graphing

For each of the three data sets provided below, create a graph using Excel. Be sure to include the following components:

- Accurate data (matches data provided)
- Axis labels
- Phase change lines
- Phase titles (e.g., Baseline, Treatment)
- Condition/data path labels (e.g., Treatment 1), for ATD graph
- Arrows for condition labels, for ATD graph
- Panel labels for multiple baseline graph

Also be sure to do the following formatting:

- No shading or borders
- Black and white data paths & markers
- Consistent data markers throughout graph

Once you have created your graphs, copy and paste them into a new word document as a picture. Use one word document for all three graphs. Please make the graphs fill at least half of the page in the word document so they will be large enough to view and score.

ABAB Reversal Design

- x-axis = Sessions
- y-axis = Responses per Minute
- Data:
  - First baseline phase: 4, 5, 4, 2, 4, 6, 7
  - First intervention phase: 10, 12, 14, 11, 10, 16, 15
  - Second baseline phase: 4, 2, 1, 3, 4, 2
  - Second intervention phase: 7, 5, 8, 10, 16

Alternating Treatments Design

- x-axis = Sessions
- y-axis = Responses per Minute
- Data
  - Baseline: 7, 5, 4, 8, 4, 5, 7
  - Alternating Treatments phase:
    - Treatment 1: 7, 6, 4, 3, 7, 5, 8
    - Treatment 2: 16, 14, 15, 20, 13, 14, 16

Multiple Baseline Design

- x-axis = Sessions
- y-axis = Responses per Minute
- Data
  - Behavior 1 Baseline: 4, 5, 1, 4, 2, 5, 3
  - Behavior 1 Intervention: 0, 1, 0, 1, 2, 2, 3, 2, 3, 1, 0, 3, 0
  - Behavior 2 Baseline: 4, 8, 4, 6, 8, 7, 5, 8, 5, 8, 9, 7, 5
  - Behavior 2 Intervention: 1, 2, 2, 3, 2, 0
Part 2: Visual Inspection

- For each of the following graphs, indicate whether a treatment effect is demonstrated.
- Also indicate which of the three aspects of the data changed from baseline to intervention phases.

Is a treatment effect demonstrated in the graph above?  

Which of the following aspects of the data changed between baseline and intervention phases? Check all that apply.
- Level
- Trend
- Variability
Is a treatment effect demonstrated in the graph above?  □ Yes  □ No
Which of the following aspects of the data changed between baseline and intervention phases? Check all that apply.
□ Level  □ Trend  □ Variability

Is a treatment effect demonstrated for Treatment 1 in the graph above?  □ Yes  □ No
Which of the following aspects of the data changed between baseline and intervention phases for Treatment 1? Check all that apply.
□ Level  □ Trend  □ Variability

Is a treatment effect demonstrated for Treatment 2 in the graph above?  □ Yes  □ No
Which of the following aspects of the data changed between baseline and intervention phases for Treatment 2? Check all that apply
□ Level  □ Trend  □ Variability
Appendix R

Module 6 Test Questions
1. List two benefits of the research review process – one for participants and one for researchers.

2. Ethical research with human participants requires a balance between the ________________ and ________________ of participation.

3. True or False: (Circle one) Your plans for recruiting participants for research and recruitment materials must be approved by the committee reviewing your research protocol.

4. When a child participating in your research is also a client receiving clinical services, it is important to ensure that their time spent in research sessions does not ________________

5. When the participants of your research are children, the parent or guardian must provide ________________ and the child must provide ________________ to participate.

6. It is the responsibility of ________________ to ensure that all research procedures are understandable by potential participants when obtaining consent or assent.

7. True or False: (Circle one) Changes to a research protocol that do not affect the risks to participants need not be submitted and approved by the review committee.

8. When conducting research with clients receiving clinical services, research data must be stored separately from ________________.

9. List 3 of the 5 types of scientific misconduct relevant to research.

10. In order to maintain confidentiality, ________________ should be used instead of names or initials to refer to participants in conference presentations or publications.

11. It is important to explain to parents that their decision to decline participation in research will not affect the services their child receives, so that no ________________ is involved in the informed consent process.
12. During the course of providing clinical services to a client, you realize you now have some interesting data that you would like to present at a conference. You will not use the client’s real name or other identifying information in the presentation, so that confidentiality is maintained. Do you need to obtain consent from the parents of this client before presenting the data?
   A. No
   B. Yes

13. True or False: (Circle one) If you are conducting research within an organization that does not have an internal research review committee, you do not need to worry about adhering to the ethical guidelines for behavior analysts.

14. List two of the situations in which a child’s participation in a research project should be terminated.
Appendix S

Module 6 PowerPoint Presentation
Module 6: Ethics & Informed Consent

Jessa Love
James Carr
Linda LeBlanc
Western Michigan University

What are ethics?

- Ethics = principles of conduct
- Research ethics = principles of conduct with respect to conducting research with humans, confidentiality, presenting results, etc.
  - NOTE: These principles are important even if you won't publish or present your data

History of the Ethics Code

- APA developed a code following increased public visibility after WWII
- BACB develop its own code in 2004
  - Partially motivated by critical incidents involving the abuse of individuals with developmental disabilities & the recognized inadequacy of the APA code

Core Ethical Principles for Behavior Analysts:

- Do no harm
- Respect autonomy
  * Promote independence or self-sufficiency
- Benefit others
- Be just
  * Golden Rule

Core Ethical Principles for Behavior Analysts:

- Be truthful
- Accord dignity & respect
- Treat others with caring & compassion
- Pursue excellence
- Accept responsibility

Supplemental materials:

- Approved application & protocol for a study from WMU
- Your application for Kinark may differ somewhat, but the content will be basically the same

Supplemental reading:

- Cooper, Heron & Heward (2007) – Ch. 29
- “Ethical Considerations for Applied Behavior Analysts” (pp. 659-678)
Core Ethical Principles of Research:

• Design, conduct, and report research in accordance with recognized standards of scientific competence and ethical research.

• Conduct research with human and non-human participants according to the proposal approved by the local human research committee and Institutional Review Board.

  - The IRB requirement does not apply in Canada, but these principles are still relevant. Many organizations will still have some type of review committee.

Benefits of the Review Process

• Protect research participants from unethical treatment, establish the trust of potential research participants

• Protect researchers, provide consultation

  - If a lawsuit arises, and the researcher was following an approved protocol, the organization should support the researcher.

Requirements for Ethical Human Research

• Balance between risks and benefits

• Independent ethical review

• Informed Consent

• Valid methodology (discipline specific)

• Valid and important research question

What is included in an review application?

• Summary of purpose of study

• Plan for recruitment

  - Flyers and/or scripts

What is included in an review application?

• Summary of purpose of study

• Plan for recruitment

  - Flyers and/or scripts

• Plan for obtaining informed consent

  - Forms, scripts, plans for assent from child
Informed Consent Process

Due to the age and cognitive abilities of the participants, informed parental/guardian permission and child assent will be obtained. Parents will be provided with the informed consent and this form will be reviewed with them in detail by research staff, either in person or via a telephone conference. Parents will have the opportunity to ask any questions and these questions will be answered to the satisfaction of the parent before proceeding. Next, the parent/guardian will be asked to watch the research staff interact with the child in an attempt to obtain verbal consent and to indicate whether their child's current behavior indicates consent. Verbal (or gestural) assent will be obtained from the child in the presence of the parent/guardian who will sign a statement that they witnessed assent. The research staff will note: "We would like to work with you for a while. During our time together, we are going to play with some toys and talk. Do you want to?" Examples of positive indicators of assent include but are not limited to "ok-ok," reaching for the materials, smiling, and nodding. The parent or guardian will sign both the permission and assent forms and be given copies of both.

What is included in an review application?

- Summary of purpose of study
- Plan for recruitment
  - Flyers and/or scripts
- Plan for obtaining informed consent
  - Forms, scripts, plans for assent from child
- Plan for data collection, storage, analysis
- Description of risks & ways risks will be minimized

Informed Consent for Subjects

We anticipate minimal risks to participants during this experiment (i.e., those involved to participate). We do not expect that there will be any risk to participants beyond those normally experienced in a typical educational environment. For example, participation may experience code/content being presented with language-related risks. (In contrast, this consent form will be a written consent.) In addition, the experiment will subsequently obtain written parental and written statement of the child.

We do not expect children will become active participants in this investigation, at least in its initial, the session will be terminated and the child and parent/guardian will be verbally contacted that the subject will be discontinued participation at any time. The experiment will identify risk factors of the child or the child and written consent will be obtained. (In contrast, this consent form will be a written consent.)

Since the participants for this study will have minimal verbal abilities, we consider the child's parent or guardian for operational definitions of "consent," and "voluntariness to participate." Once five consecutive sessions are completed, the child’s parent will be consulted regarding whether participation. If a child is excluded from the study or if the family decides to discontinue, it will be with the consent. Any other unforeseen problems will be addressed on an as-needed basis.

Confidentiality of Data

Any information obtained in connection with this study that can be identified with a participant will remain confidential. Information collected in this study will be disclosed in professional journals and at professional conferences. But all information presented in such venues will be anonymous (e.g., via pseudonyms) to ensure confidentiality. Statements will be videotaped for the purpose of instruction only. All data will be collected using data sheets containing sufficient numbers instead of names for identification purposes. All information and videotapes will be stored for at least 3 years at locked file cabinets at the Clinical Behavior Research Laboratory 1113 Wood Hall at St. James Care’s office (175I Wood Hall) at WMU and then destroyed. A master for with participant number and names will be kept separate from other data in a locked cabinet in Dr. Care’s office and will be destroyed at the conclusion of the study, and any documentation or videotapes recorded will be stored in a locked file cabinet at the research site during the data collection phase of the study (i.e., for 2-4 weeks). Following the completion of data collection, all documents and videotapes will be transferred to the Clinical Behavior Research Laboratory at WMU by Jason Love (student investigator) in her personal capacity. No other individuals will have access to these materials during transport.
Informed Consent Process

• Potential participants learn about project, potential risks and benefits, and procedures to protect their safety and privacy
• Provides potential participants an opportunity to ask questions
• This process is ALWAYS required!

What is covered in an informed consent document?

• A description of the research process, including the time commitment for participation
  - **A child’s time in research sessions must not adversely affect clinical services!!!**

For sessions not during your child’s normal school hours, your child might also lose some instructional time. The research sessions, however, will be very similar to your child’s typical program in terms of learning opportunities.

What is covered in an informed consent document?

• Inform participants they are free to participate, decline, or withdraw
• Explain the foreseeable consequences of declining or withdrawing
• Inform participants of facts that may influence their willingness to consent (i.e., risks, discomfort, limitations of confidentiality)

When seeking informed consent, ensure:

• The participant has the legal and mental capacity to give consent
  - Typically a parent/guardian for your research
• The participant has ample opportunity to consider participating
• The possibility of coercion or undue influence is minimized
  - Clinical services will not be adversely affected if they decline participation

When seeking informed consent, ensure:

• The language of your description & the informed consent document is understandable
  - In general, write at the reading level of a 12 year-old
• The participant understands the entire research process
  - Flowcharts or diagrams may be helpful

Special Consent Issues

Conducting Research with Clients:

- A child’s time in research sessions must not adversely affect clinical services!!!
- Clinical services will not be adversely affected if they decline participation
  - Really emphasize this during the consent process - parents may experience coercion since their child is already receiving services
  - "It is really OK for you to say no, it won’t affect your child’s services in any way."
  - Research data must be stored separately from clinical data.
Special Consent Issues:
- Assent of children should be documented
  - Follow a script to obtain assent from the child
  - Parent/guardian should observe this and sign a form to confirm assent was given by their child
  - Discontinue research if the person gives clear signs of unwillingness to continue participation
  - Termination criteria should be specified in your review application

Remember!
- The consent process includes recruitment AND comprehension when obtaining informed consent.
  - Recruitment procedures and materials must be approved by the review committee
  - Consent is not valid unless the consentee understands
  - It is your responsibility to make the process understandable

Researcher Responsibilities:
- Conduct research according to an approved protocol
  - Any changes must be submitted to the committee for review
  - Do not initiate changes without review & approval, except when necessary to eliminate immediate harm to participants
  - Report any unexpected incidents or risks

Scientific Misconduct - what is it?
- Falsification of data
- Fabrication of data
- Dishonest reporting of results
  - Selective reporting of data
- Plagiarism – use of another’s ideas, results, concepts, without credit
- Improper authorship
  - Give credit when due, discuss this before beginning research and revise if needed

Scientific Misconduct - Recommendations
- Never fabricate or falsify data
- Never discard data from a report (unless you have specified criteria to do so before beginning research, as with low IQA)
- Keep old data

Researcher Responsibilities:
- Ensure participants understand the nature of the research & their participation
- Provide a copy of the approved consent document to each participant
- Retain signed consent forms & data for 3 years
  - Your review committee will likely have rules for how these documents must be stored
### Case Example – Has an ethical violation been committed?

Susan was a graduate student working as a behavior specialist. She planned to do her dissertation with adolescents who were physically abused. She was assigned to work with Sara, and interesting, verbal 14-year-old who was eager to describe her history of abuse for anyone who would listen. Susan decided to videotape an interview with Sara, and one year later she used the tape as part of a conference presentation. One of the people in the audience knew Sara's mother and had the mother she had been shown. The author was extremely upset and called Dr. Susan. Susan explained that this was an acceptable practice because she did not reveal Sara's last name or the name of her parents in the presentation.

If the identity of clients is protected (i.e., their names are not used), is it acceptable to present their cases, videotapes, audiotapes, etc?

### Using Confidential Information for Instructional Purposes:

- When writing articles or presenting research at a conference, do not disclose confidential or personally identifiable information concerning your participants or clients unless the person has consented in writing.
- Use pseudonyms.

### Future Use of Data:

- Inform participants of any anticipated future use of the data (conference presentations, publication) and explain how confidentiality will be maintained.
- If photos or video clips will be used, a consent form for this must be approved by the review committee and signed by the participant.

### Post-hoc Permission to Use Data

- Inform participants of how the data will be used (conference presentations, publication) and explain how confidentiality will be maintained.
- A consent document covering this information must be signed before the data can be used.

### Deception in Research:

- Do not conduct a study involving deception unless it is justified based on the potential scientific or applied value of the study, and alternative procedures without deception are not feasible.
  - Debriefing may be necessary after the study.
- NEVER deceive participants about factors that would affect their willingness to participate (e.g., physical risks, discomfort).

### Any Questions?
Appendix T

Module 6 Homework Assignment
Imagine you are conducting a study on the acquisition of tact responses for 2D and 3D objects. Please develop an appropriate informed consent document for this study. Feel free to reference the supplemental materials provided during the lecture for this module as an example.

Adhere to the following guidelines:

- Language in the form of an invitation to participate AND at a reading level appropriate for the participants (At a reading level appropriate for a 12 year-old)
- Do not include phrases like "I am aware" or "I understand" anywhere in the document.
- Do not include language that would absolve the researcher of responsibility for negligence

Include the following components:

- A header that includes the name of the organization, principal investigator, and title of the study.
- The nature, purpose, and duration of the study
- Procedures to be employed in the research; exactly what the participant is expected to do
- Risks (hazards, inconveniences, discomforts) the participant may undergo, so far as they are known, and how any risks will be minimized
- Benefits to the subject (and to the general subject population)
- How confidentiality will be maintained and any limits to confidentiality
- Statement that the participant can refuse to participate; stop participating at any time; or refuse to answer any question without prejudice, penalty, or risk of any loss of service he/she would otherwise have
- The researchers’ names and telephone numbers (a fake one is fine) as well as the following statement: “You may also contact the Human Subjects Institutional Review Board (XXX-XXXX) if questions or problems arise during the course of the study.”
- A place for date and signature of participant and a witness line, if required (e.g., with subjects who are not legally competent); a place for date and signature of translator, if applicable; a place for date and signature (or initials) of individual obtaining the consent, if applicable
- The following statement must be included in all consents: “This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.”
- Since there is the possibility of accidental physical injury, include the statement: “As in all research, there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to you except as otherwise stated in this consent form.”
• Since the research is therapeutically related, disclose alternate procedures the subject might choose. For example, the child would still receive appropriate language training even if the parent declines to participate.
• Circumstances under which the researcher may terminate the participant’s participation
• Consequences of the participant’s withdrawal from the study

Also, develop a document to be used in obtaining child assent. Include the following components:

• A description of the procedure the researcher will follow when obtaining assent.
• A list of potential indicators of assent.
• A place to indicate whether assent was given.
• A place for the parent/guardian to sign and date the document confirming that assent was provided.
• A place for the researcher to sign and date the document.
Appendix U

Module 7 PowerPoint Presentation
Module 7: Implementing a Research Protocol
Linda LaBlanc
Jessica Love
James Carr
Western Michigan University

Purposes of this Module:
• To provide instructions on running research sessions according to a written protocol
• To provide an opportunity for you to practice implementing an existing research protocol
  - Note: The next and final module will cover the development of research protocols for specific experimental questions

Purpose of this Lecture:
• Supply you with a written protocol
• Present and discuss each section of the protocol, discussing the relevant research behaviors for each step

Research Protocol vs. Teaching Program
• In general, research protocols are more specific and include information a teaching program may not:
  - Research design
  - Very detailed procedural instructions
  - Instructions for data collection in addition to data on child behavior (e.g., IOA)

Sample Protocol: Tact Training
• You have been provided with a tact training research protocol to conduct with one of your clients
• The protocol is organized into the following sections:
  - Purpose — Termination Criteria
  - Design — Phase Changes
  - Target Behaviors — Data Collection
  - Materials — Graphing
  - Procedure

Your Participant:
• Select a child for whom tact training is a clinically relevant skill
  - Child can have some tact responses already in his/her repertoire
  - Child should not be such an advanced learner that new tact responses are acquired in only a few trials
• Parental consent is not needed for this project as long as it is reasonable for your client to acquire additional tacts
The following steps should occur before beginning research sessions:

#1: Read through the entire protocol and ask for any clarification needed.
- Let’s do that right now for the tact training protocol

#2: Prepare all materials that will be required for sessions
- Teaching materials
- Data sheets (make copies) & pens
- Identify an area in which to conduct sessions
  - e.g., child appropriate table & chairs, free from distractions
- Programmed consequences - preferred edibles/tangibles (conduct preference assessments before sessions)

#3: Prepare an Excel file for data
- Organize the spreadsheet for target behaviors, IOA, and procedural integrity data
- Let’s look at some examples. (These also appear in the “Submission Materials” section of the protocol).

Sample Data Worksheet (Excel)

The following steps should occur before beginning research sessions:

#3: Prepare an Excel file for data
- Organize the spreadsheet for target behaviors, IOA, and procedural integrity data
- Plan ahead as to how you will graph data as you go (by hand or in Excel) so you can quickly make data-based phase-change decisions
The following steps should occur before beginning research sessions:

#4: Assign tasks to group members
- Who will serve as the therapist?
- Who will collect primary target behavior data, IOA data, procedural integrity data, and IOA on procedural integrity data?
- Let's work this out for one group right now. Would a group like to volunteer?
- Remember to consider logistics (e.g., you will not be videotaping sessions, so the person collecting IOA data must be present for some proportion of sessions).

#5: Schedule sessions & data collection
- Schedule research sessions so that they do not interfere with your client's daily teaching activities.
- Plan ahead with respect to the sessions during which IOA and procedural integrity data will be collected, so you measure these during an appropriate percentage of sessions.
  - Let's look at a sample schedule illustrating the distribution of IOA and PI checks.

Sample Schedule for Data Collection:

<table>
<thead>
<tr>
<th>Day</th>
<th>1st Target</th>
<th>2nd Target</th>
<th>3rd Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tue</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Wed</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Thu</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fri</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Tips for Success:
- Practice running sessions and collecting data with each other before starting sessions with your client.
- Refer to materials from previous modules as needed.
  - M2: Guidelines for IOA & Procedural Integrity
  - M4: Info about multiple baseline design
  - M5: Instructions for graphing & visual inspection

Dealing with Errors During Sessions:
- Try to prevent errors by being familiar with procedures, practicing beforehand, etc., but some errors are bound to occur.
- One reason we measure procedural integrity is to keep tabs on these errors.
- Most minor errors will not drastically affect the validity of the data, but some errors can be fatal, such that a data set must be discarded.

Tips for Success:
- Have the protocol readily available before and during sessions so you can refer to it if you have any questions.
- Update your graph after each session — this will help you make data-based decisions.
  - When can we start the teaching phase for the first target?
  - How long should we stay in baseline for the second target?
Dealing with Errors During Sessions:

- If an error occurs that makes a causal statement about the effects of the IV on the DV questionable
- Or if the number of errors committed with a single participant accumulates to an unacceptable level
- The data set may need to be discarded
  - The specifics will depend on the research question and procedures

Tips for Future Research Projects:

- When beginning a new research project, run a pilot participant to test out your procedures and make any necessary changes
- Respect the sanctity of the research protocol – changes should not be made on the fly, but only after the current phase has been run to stability

Dealing with Errors During Sessions:

- Can set criteria before beginning research about when data will be discarded, for example:
  - If IOA for a given session is lower than 50%
  - If procedural integrity data are lower than 80%
- We won't be using such criteria for this project as we want to see all of your data

Any Questions?
Appendix V

Module 7 Homework Assignment
Sample Research Protocol: Tact Training

**Purpose:** To teach a single participant a pair of new tact responses (verbal responses in the presence of non-verbal stimuli) while practicing the implementation of all aspects of a single-case design research protocol.

**Design:** A multiple-baseline design across behaviors will be used. For the purposes of this assignment, the A phase will be a baseline phase in which the participant's existing tact responses will be evaluated, and the B phase will be a teaching phase in which a new tact response from a single program area will be taught.

- The first and second target responses will be taught in different research sessions (i.e., blocks of 10 tact-training trials).
- The independent variable (tact training) will be applied to one target first, while the other target remains in baseline.
- The independent variable will be applied to the second target in a staggered fashion.

**Target Behaviors:** Please select ONE of the following program areas to teach your participant based on the child’s individual level of functioning, so that the targets being taught represent clinically appropriate skills. If none of the program areas are relevant for the child you will be working with, please contact Jessa as soon as possible via email so that a new program area can be selected. If a program area is appropriate for the child you will be working with, but the specific targets are not, feel free to select two different targets to teach within the program area. Be sure that it is clear which two targets were taught.

1. **Basic shapes from picture cards:** Upon presentation of an index card with a basic shape on it and the verbal stimulus “What shape is this?” the child will independently and correctly tact (vocally or with sign language) the shape presented within 5 seconds. For a child’s response to be considered correct and independent, it must occur without any therapist prompts, and must be recognizable to the therapist as the correct word or sign in terms of articulation or fine motor movement.
   a. Targets: circle, square

2. **Common foods from pictures:** Upon presentation of a photograph of a common food item and the verbal stimulus “What is this?/What is this called?/What food is this?” the child will independently and correctly tact (vocally or with sign language) the food presented within 5 seconds. For a child’s response to be considered correct and independent, it must occur without any therapist prompts, and must be recognizable to the therapist as the correct word or sign in terms of articulation or fine motor movement. **NOTE** – be sure not to use apple or crackers as a reward for independent responses if teaching these targets.
   a. Targets: apple, cracker

3. **Body parts from a live person:** When the therapist points to a body part on herself/himself and presents the verbal stimulus “What is this?/What is this called?/What body part is this?” the child will independently and correctly tact
(vocally) the body part presented within 5 seconds. For a child’s response to be considered correct and independent, it must occur without any therapist prompts, and must be recognizable to the therapist as the correct word in terms of articulation.

a. Targets: eyes, nose

4. **Actions from a live person:** When the therapist models an action and presents the verbal stimulus “What am I doing?” the child will independently and correctly tact (vocally) the action presented within 5 seconds. For a child’s response to be considered correct and independent, it must occur without any therapist prompts, and must be recognizable to the therapist as the correct word in terms of articulation.

   a. Targets: clapping, waving

5. **Emotions from pictures:** Upon presentation of an index card with a picture of a human face displaying the relevant emotion, and the verbal stimulus “How does he/she feel?” the child will independently and correctly tact (vocally or with sign language) the emotion presented within 5 seconds. For a child’s response to be considered correct and independent, it must occur without any therapist prompts, and must be recognizable to the therapist as the correct word or sign in terms of articulation or fine motor movement.

   a. Targets: happy, sad

**Materials:** Based on the specific program area that you select, you will need to prepare the following materials before beginning to run sessions:

1. **Basic shapes from picture cards:** Two equal sized white index cards, each with one shape (circle, square) drawn on it with black marker. The shapes should be approximately equal in size.

2. **Common foods from pictures:** Two equal sized white index cards, each with a photograph of one food item (apple, cracker) glued on. The photographs should be clear pictures in which the food item takes up the majority of the picture and there are no distracter items present in the picture.

3. **Body parts from a live person:** None.

4. **Actions from a live person:** None.

5. **Emotions from pictures:** Two equal sized white index cards, each with a photograph of a human face displaying one emotion (happy, sad). The photographs should be clear pictures in which the face takes up the majority of the picture, and the same person’s face should be used for all three pictures.

In addition to the program materials, you will need data sheets (see attached), a pencil, a work area with a table and chairs, and preferred edibles or tangibles to provide as rewards for correct responses. Use the same work area for each session.

**Procedure:**

**Pre-Baseline Assessment:** Conduct a brief assessment to determine if the tact responses you will be teaching are in your participant’s repertoire.
• Present the verbal instruction & visual stimulus (e.g., picture card, in vivo model) relevant to the target response and allow the child 5 seconds to respond.

• Do not provide any consequences for any response from the child.

• Conduct two trials of the pre-baseline assessment for each teaching target before beginning baseline.

• If the child does not respond correctly on either trial for a given target, you may proceed to the baseline phase.

• If the child does respond correctly on any pre-baseline assessment trials, you will need to select a new target response and conduct another assessment for that response.

Baseline:
• Present the verbal instruction & visual stimulus (e.g., picture card, in vivo model) relevant to the target response and allow the child 5 seconds to respond.

• Do not provide any consequences for any response from the child.

• Intersperse these trials with trials for other mastered skills after every 1-2 tact trials (i.e., no more than two tact trials should be conducted before implementing an interspersal trial).
  o Correct responses on interspersal trials for mastered skills should receive only verbal praise.
  o Data will not be collected on the interspersal trials.

• If your participant acquires the target response during baseline, discontinue that target and begin again with a new target (Contact Jessa at ceapresearchtraining@gmail.com if this occurs and you are concerned about completing the project on time).

Tact Training:
• Before each training session (i.e., block of 10 tact-training trials), conduct a brief preference assessment to identify the rewards to use during that session.
  o Identify three preferred edibles OR three preferred tangibles for your participant, based on your experience with him/her.
  o Present the three items to the child, all approximately equal distance away.
  o Prompt the child to look at all three items presented, and then ask the child the pick one.
  o The first item the child selects AND consumes (i.e., eats or interacts with) should be used as the reward for independent responses during the subsequent session.
• Present the verbal instruction & visual stimulus (e.g., picture card, in vivo model) relevant to the target response and allow the child 5 seconds to respond.
  
  o If the participant responds correctly within the 5 seconds, provide 15 seconds of access to a preferred item as well as verbal praise (i.e., “Good job, that’s right!”). This trial should be scored as “I” for independent.

  o If no response is made in the 5 seconds, provide an echoic or physical prompt for the correct answer. Correct imitation of the prompt will receive only (relatively non-enthusiastic) verbal praise. This trial should be scored as “NR” for no response.

  o If the participant responds incorrectly during the 5 seconds, represent the verbal instruction and visual stimulus with an immediate prompt as an error correction. Again, correct imitation of the echoic prompt will receive only verbal praise. This trial should be scored as “E” for error. 
  
  (Note – the child’s imitation of the error correction prompt should not be recorded on the datasheet, only the initial error).

• Intersperse these trials with trials for other mastered skills after every 1-2 tact trials (i.e., no more than two tact trials should be conducted before implementing an interspersal trial).

  o Correct responses on interspersal trials for mastered skills should receive only verbal praise.

  o Data will not be collected on the interspersal trials.

  o The table below displays a sample trial order for one 10-trial block:

    \[
    \begin{array}{cccccccccccc}
    \text{Trial #} & 1 & 2 & \text{INT} & 3 & \text{INT} & 4 & 5 & \text{INT} & 6 & \text{INT} & 7 & \text{INT} & 8 & 9 & \text{INT} & 10 \\
    \end{array}
    \]

• Mastery criteria: 4 consecutive correct and independent responses across 2 sessions. Separate sessions occurring on the same day by at least 15 minutes.

Termination Criteria: If your participant displays undue stress for more than 2 minutes at a level higher than the minor frustration that may be evident during teaching, terminate the research sessions. If five consecutive sessions are terminated, terminate the participant’s involvement in the project. (Contact Jessa at ceapresearchtraining@gmail.com if this occurs and you are concerned about completing the project on time).

Phase Changes:

• A minimum of three data points are required to determine the stability of a data path. Therefore:

  o At least three data points should be collected during the baseline phase for the first target before moving to the teaching phase.
At least three additional data points should be collected during the baseline phase for the second target, before moving to the teaching phase. In other words, if you have three data points in the baseline phase for the first target, you’ll need at least 6 data points in the baseline phase for the second target.

**Data Collection:** Use the attached data sheet to take trial-based data on the relevant participant response, and 4 therapist behaviors. Participant, IOA, and procedural integrity data can all be collected using this datasheet. The therapist behaviors that require measurement include:

- **Visual stimulus** – did the therapist present the appropriate visual stimulus (i.e., flash card or physical demonstration) for the target response?

- **Vocal instruction** – did the therapist present the appropriate vocal instruction for the target response?

- **Prompt** – did the therapist provide a prompt, if needed, as specified in the procedures above? NOTE – A score of “Yes” on this measure does NOT necessarily mean the therapist provided a prompt, instead it means the therapist did the correct thing in terms of prompting based on the participant’s response.

- **Consequence** – did the therapist provide the appropriate consequence, as specified in the procedures above? NOTE – A score of “Yes” on this means the therapist provided the correct consequence based on the participant’s response.

**Graphing:** The data should be graphed in a two-panel multiple baseline graph, with the x-axis representing trials, and the y-axis representing the cumulative number of independent responses. That is, any trial scored as “Independent” will be displayed as an increase in the value of the data point in reference to the previous data point. Any trial scored as “No Response” or “Error” will be displayed as no change in the value of the data-point in reference to the previous data point (horizontal line). See the single-panel graph below for an example of what your panels should look like. Please refer to the materials from Module 5 to ensure that you include all the necessary components in your graph.
Submission Materials

- Computer files should be submitted as attachments.
  - Excel file with all data (participant, IOA, procedural integrity) and graph
  - All data should be organized and clearly labeled, so I will know exactly which data I am looking at.
  - Here is a sample of how I organized the data from a previous study that also utilized a multiple-baseline design in which data were presented as the cumulative number of correct responses. Data for the first teaching target (Dog-Animal) are on the left, data for the second teaching target (Apple-Food) are on the right:

- Here is a sample of how I organized the IOA and procedural integrity data for that same study. (This was a different worksheet within the same excel file).

- The graph should be presented in finished form according to the instructions provided in Module 5.
• Summary statements for IOA (for participant & procedural integrity data) & procedural integrity (can be included in Excel file)
  o Provide a few sentences summarizing these data, in terms of the percentage of sessions for which IOA and procedural integrity data were collected and what the mean and range values were.
  o The percentage of sessions in which these are monitored (IOA on participant data, procedural integrity, IOA on procedural integrity) should adhere to the guidelines presented in Module 2.
  o Sample summary statement for IOA: Interobserver agreement was evaluated during 26% of research sessions, and the mean IOA was 92% (range, 80-100%).
• Completed datasheets should be submitted at the meeting for Module 8.
Appendix W

Module 8 PowerPoint Presentation
Module 8: Developing a Research Protocol

Jessa Love
Linda LeBlanc
James Carr
Western Michigan University

Purposes of this Module:
- To provide instructions on developing a research protocol, given a research question
- To provide an opportunity for you to practice developing a research protocol
  - Working with the same group as Module 7

Purpose of this Lecture:
- Supply you with the assignment for this module, including the research question
- Discuss each section of the protocol you will develop, highlighting the important components for each section

Develop a research protocol to answer the following research question:

When teaching new intraverbal responses to children diagnosed with autism, do echoic (providing a vocal response to imitate) or tact (providing a picture of the appropriate response to label) prompts lead to faster acquisition?

Protocol Sections: Purpose

- What is the purpose of your study?
  - The research question being asked
  - Any new skills that the participants will be taught

Protocol Sections: Design

- What single-case design will be used?
- What phases will be involved?
  - Specific procedural information about the different phases/conditions need not be included here, just a brief description of the phases that will be included.
  - Example: Phase 1 will be baseline, in which...Phase 2 will be...
Protocol Sections: Design Example from Module 7:

Design: A multiple-baseline design across behaviors will be used. For the purposes of this assignment, the A phase will be a baseline phase in which the participant's existing target responses will be evaluated, and the B phase will be a teaching phase in which a new target response from a single program area will be taught. 4

- The first and second target responses will be taught in different research sessions (i.e., multiple of treatment phases). 5
- The independent variable will be applied to one target at a time, with the other target remaining as baseline. 6
- The independent variable will be applied to the second target in staggered fashion. 9

Protocol Sections: Target Behaviors Example from Module 7:

- What intraverbal responses will be taught?
- What antecedent stimuli will be presented by the researcher?
- What response is required from the participant?
- Which responses will be taught under each condition?

Protocol Sections: Materials

- Describe all of the materials that will be required for your study:
- Teaching materials (e.g., picture cards for tact prompts)
- Other materials needed to run sessions (e.g., data sheets, aspects of the work area)
- Description must be sufficiently detailed so anyone reading the protocol could prepare appropriate materials.

Protocol Sections: Procedures

- Provide a detailed description of every phase of the study
- Include pre-experimental assessments
- Should provide specific instructions for exactly what the researcher should do throughout the study, with respect to...

Protocol Sections: Materials Example from Module 7:

1. Basic shapes from picture cards: Two equal sized white index cards, each with one shape (circle, square) drawn on it with black marker. The shape should be approximately equal in size. 5

In addition to the program materials, you will need data sheets (see attached), a pencil, a work area with a table and chair, and preferred objects or toys/props to provide as rewards for correct responses. Use the same work area for each session. 5
**Protocol Sections: Procedures**

- **Antecedents:** What instructions or antecedent stimuli should be presented during each condition, and how should they be presented?
- **Prompting:** What prompting procedure will be used to teach the new responses?
- **Researcher Behavior:** How should the researcher respond if the child’s response is correct? Is incorrect? What if the child does not respond?
- **Consequences:** What consequences will be provided for the participant’s behavior? If using preferred tangibles/edibles, how will they be identified?
- **Interspersal:** Will teaching trials be interspersed with trials of mastered skills? If so, what should the ratio of teaching:mastered trials be?
- **Mastery:** What is the mastery criteria for the responses being taught? Be sure this matches your data collection system.
- **Session Schedule:** How often should sessions be run? How long should sessions last? How many trials should be conducted during each session?
- **Note:** The procedural information need not be organized into these sections – instead organize it in a simple, logical format.

**Protocol Sections: Termination Criteria**

- Under what conditions should a research session be terminated?
- Under what conditions should the child’s participation be terminated from the protocol?

**Termination Criteria:** If your participant displays unsafe stress for more than 2 sessions in a row, higher than the minor frustration that may be evident during teaching, terminate the research session. If the consecutive sessions are terminated, terminate the participant’s involvement in the project. Contact [name] at [e-mail] immediately if this occurs and you are concerned about completing the project on time.

**Protocol Sections: Phase Changes**

- When will phase changes be made?
- How will the stability of the data be evaluated (e.g., stability criteria, visual inspection)?
- It should be clear to someone reading your protocol what their decision to make phase changes should be based on.
### Protocol Sections: Data Collection

- Data sheets
- What type of data collection will be used (e.g., trial-based, interval, momentary time sampling)?
- What behaviors will be measured for participants and the researcher?
  - Include operational definitions
- For what percentage of sessions should IOA, procedural integrity, and IOA on procedural integrity be assessed?

### Protocol Sections: Graphing

- How will the data for your study be graphed?
  - What will the x-axis and y-axis represent?
- Develop a sample graph with hypothetical data

### Tips for Success:

- Have someone who was not involved in writing the protocol read it
  - They will help identify areas that may be unclear or confusing
- Use materials from earlier modules as resources

### Any Questions?
Appendix X

Module 8 Homework Assignment
Develop a research protocol (similar to the one you were provided with for Module 7) to answer the following research question:

*When teaching new intraverbal responses to children diagnosed with autism, do echoic (providing a vocal response to imitate) or tact (providing a picture of the appropriate response to label) prompts lead to faster acquisition?*

Your protocol should include the following components:

**Purpose:** What is the purpose of your study? This should include both the research question being addressed and any new skills that the participants will be taught.

**Design:** What single-case design will be used? What phases will be involved? (Specific procedural information about the different phases/conditions need not be included here, just a brief description of the phases that will be included.)

**Target Behaviors:** Indicate exactly which intraverbal responses will be taught in your study (e.g., fill-in-the-blank, personal questions). What are the relevant antecedent stimuli and what are the target responses of the participant? If different responses will be taught during the different conditions, please indicate which responses will be taught for each condition.

**Materials:** Describe all of the materials that will be required for your study. This should include a description of the teaching materials required (e.g., picture cards for tact prompts) that is sufficiently detailed so anyone reading the protocol could prepare appropriate materials. You should also include a list of any other materials that will be needed to run research sessions (e.g., data sheets, aspects of the work area).

**Procedure:** Provide a *detailed* description of every phase of the study. This should include any pre-experimental assessments that need to be conducted. This section should provide specific instructions for exactly what the researcher should do throughout the study. Be sure to consider the following questions:

- **Antecedents:** What instructions or antecedent stimuli should be presented during each condition, and how should they be presented?

- **Prompting:** What prompting procedure will be used to teach the new responses? Be sure to describe this clearly enough that someone reading your protocol could implement the prompting procedure correctly.

- **Researcher Behavior:** How should the researcher respond if the child’s response is correct? What if they child’s response is incorrect? What if the child does not respond?

- **Consequences:** What consequences will be provided for the participant’s behavior? If using preferred tangibles/edibles, how will they be identified?

- **Interspersal:** Will teaching trials be interspersed with trials of mastered skills? If so, what should the ratio of teaching:mastered trials be?

- **Mastery:** What are the mastery criteria for the responses being taught?

- **Session Schedule:** How often should sessions be run? How long should sessions last? How many trials should be conducted during each session?
Termination Criteria: Under what conditions should a research session be terminated? Under what conditions should the child's participation in the protocol be terminated?

Phase Changes: When will phase changes be made? How will the stability of the data be evaluated (e.g., stability criteria, visual inspection)? It should be clear to someone reading your protocol what their decision to make phase changes should be based on.

Data Collection:

- Create and include all necessary data sheets with your protocol. Within the protocol, specify the type of data collection that will be used (e.g., trial-based, interval, momentary time sampling).

- Specify what behaviors will be measured for both the participant and the researcher. Provide operational definitions for all behaviors being measured – participant and researcher behaviors!

- Indicate the percentage of sessions for which IOA, procedural integrity, and IOA for procedural integrity should be measured.

Graphing:

- Explain how the data for your study should be graphed, including what the x-axis and y-axis will represent.

- Provide a sample graph with hypothetical data. You may include this in the word document with your protocol, or in a separate Excel file.

Submission Materials

- All files should be submitted as attachments.
Appendix Y

Social Validity Questionnaire
Please help us evaluate the training project you participating in by providing your opinion on the following questions. You are not required to complete this questionnaire – you may turn the form back in blank if you chose to. Alternatively, you may skip any questions you do not want to answer, although any answers you can provide will be greatly appreciated. All responses will remain anonymous.

1. How highly do you value our goal of providing you with the skills needed to empirically investigate some of the unanswered questions in the field of early and intensive behavioral intervention for children with autism by conducting research with clients?
   - Highly
   - Somewhat
   - Not at all

2. Overall, how satisfied are you with the knowledge and skills you gained by participating in this project?
   - Very Satisfied
   - Somewhat Satisfied
   - Neutral
   - Somewhat Dissatisfied
   - Very Dissatisfied

3. Overall, how satisfied are you with the teaching procedures used during this project?
   - Very Satisfied
   - Somewhat Satisfied
   - Neutral
   - Somewhat Dissatisfied
   - Very Dissatisfied

4. How would you rate the workload required for participation in this project?
   - Heavy – It was difficult to complete assignments and projects on time.
   - Reasonable – I did not have substantial difficulty completing assignments and projects on time.
   - Light – I could have completed more assignments or projects without substantial difficulty.

5. How much do you think this experience improved your knowledge and skills with respect to conducting single case research?
   - A lot
   - Somewhat
   - A little
   - Not at all
6. Which component of the training was the most helpful for you?
   - Lectures
   - Homework Assignments
   - Tests
   - Supplementary Readings
   - Final projects — designing and implementing a research protocol

7. Which teaching method did you prefer?
   - Lectures
   - Feedback on homework assignments and tests
   - Rehearsal of skills through homework and final projects

8. Would you recommend this training for other staff at CEAP?
   - Definitely
   - Maybe
   - Neutral
   - Probably not
   - Definitely not

Please feel free to provide us with any additional comments or suggestions you might have regarding your experience with this training project:
Appendix Z

Approval Letter From the Human Subjects Institutional Review Board
Date: January 30, 2008

To: James Carr, Principal Investigator  
    Linda LeBlanc, Co-Principal Investigator  
    Jessica Love, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number: 08-01-18

This letter will serve as confirmation that your research project entitled “Training Single-Case Design Research Skills in a Clinical Setting” has been approved under the exempt category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly as the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

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

Approval Termination: January 30, 2009