# Clinician training on prelinguistic communication: Investigating techniques within an online approach

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**Abstract**

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Translating research evidence into clinical practice is a challenging process that requires careful examination through the lens of implementation science. Clinician training is one core component of implementation science research. While training can take different forms, an online, self-guided approach may be particularly advantageous for delivering training that is effective, efficient, and appealing to a large number of clinicians across a range of geographic areas. For early intervention speech-language pathologists (EI SLPs) who treat young children with physical disabilities, training is needed to support the integration of current evidence surrounding prelinguistic assessment and treatment for this complex clinical population into clinical practice. This dissertation study investigated three training techniques embedded within a self-guided, online training designed to teach EI SLPs one key ingredient (*recognizing and recording child behaviors*) of two evidence-based protocols for prelinguistic communication assessment. Forty-five EI SLPs from six states across the Pacific Northwest participated in the study. Subjects were randomly assigned to one of three practice conditions (*identification, reflection, control*), each designed to examine the differential impact of training technique on three primary outcomes: (1) *effectiveness* (measures of subjects' *knowledge* and *skill*), (2) *efficiency* (time to complete training modules), and (3) *appeal* (subjects' perceptions of training). Results indicated that overall, the training was effective in improving clinician knowledge and skill, but no statistically significant differences were observed by training condition on either measure. A significant effect of condition on time to complete training was observed, with subjects assigned to the *control* condition requiring significantly less time to complete the training than subjects in the *reflection* condition. Finally, across conditions all subjects reported high ratings on the overall *appeal* of the training. Taken together, these results document that the most efficient version of the training (no practice, *control* condition) was as effective as the more time intensive versions (practice under *identification* or *reflection* conditions), but more appealing to EI SLPs who participated in the study. Results from the present study suggest the importance of *efficiency* and *appeal* in achieving successful clinician training for moving evidence into practice. Additional considerations for designing online training are offered.

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To mom, whose faith in me has never waivered.

And to dad… this one’s for you.

## 1 Introduction

Integrating research evidence into clinical practice is a major challenge facing clinicians and researchers alike. The challenge for researchers is to design interventions that are both effective in promoting change (internally valid) and applicable to real practice settings (externally valid). The challenge for clinicians is to seek out, interpret, and apply the evidence to their own clinical caseloads. Research suggests that simply disseminating information about evidence-based protocols via traditional strategies, such as written manuals or journal publications may increase knowledge, but is not sufficient to support new skill acquisition or to foster longer term behavior change (Beidas, Edmunds, Marcus, & Kendall, 2012; Beidas, Koerner, Weingardt, & Kendall, 2011; Herschell, Kolko, Baumann, & Davis, 2010). Clinician training is required to accomplish these goals, and, ultimately, support sustained use of evidence based protocols in clinical practice (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005).

Early intervention speech-language pathologists (EI SLPs) working with young children with physical disabilities such as cerebral palsy must consider how to best translate evidence to practice that guides assessment and treatment planning for this complex population (Pennington, Goldbart, & Marshall, 2005). Young children with physical disabilities often have heterogeneous profiles of development across sensory, motor, and cognitive domains, which suggest that research-based protocols may require adaptation to meet any one child's individual skills and needs. Further, while children with physical disabilities constitute a low-incidence clinical population[1] and

[1]The Centers for Disease Control and Prevention (CDC) report that about 1 in 323 children in the United States has been identified with CP, according to estimates from the CDC's Autism and Developmental Disabilities Monitoring Network (see: http://www.cdc.gov/ncbddd/cp/data.html). The prevalence of CP in childhood ranges from 3.1 to 3.6 per 1000, according to US surveillance data (Christensen et al., 2014).

therefore may comprise a small percentage of a clinician's total caseload, they often require a substantial amount of time and effort to plan assessment and treatment.

Training is critical to support EI SLPs in their efforts to integrate the current evidence addressing prelinguistic communication for this complex clinical population into clinical practice. Given the complexity of the children's profiles and the demands on the clinicians' time, training must be effective, efficient, and appealing. Research suggests that online training for early intervention clinicians can increase knowledge and support skill acquisition (Brown & Woods, 2012; Hamad, Serna, Morrison, & Fleming, 2010). Currently however, little is known about which training techniques are necessary or sufficient to maximize learner outcomes (Becker & Stirman, 2011; Fixsen et al., 2005).

The current study examines the effectiveness of three different practice techniques within an online, self-guided training designed to teach EI SLPs to *recognize and record* prelinguistic communication behaviors, specifically gaze with or without gestures and vocalizations, produced by young children with physical disabilities. This clinical skill is one key ingredient of two evidence-based protocols for assessment of prelinguistic communication in this clinical population (Brady et al., 2012; Olswang, Dowden, et al., 2014; Olswang, Feuerstein, Pinder, & Dowden, 2013). By experimentally examining practice techniques within an online training, results from this study contribute to the growing body of implementation science literature, which is just beginning to tackle the importance of training clinicians in the use of evidence-based protocols.

The review of the literature that follows addresses: 1) a conceptual model for translational science research, 2) the role of clinician training in this model, 3) a review of the evidence for two protocols designed to assess prelinguistic communication in young children with physical disabilities.

## 2 Background & Significance

### 2.1 Translating Research Evidence into Clinical Practice

The process of moving research evidence into clinical practice presents challenges for both the researchers responsible for collecting the evidence, and the clinicians involved in translating the evidence. Researchers are charged with the job of generating clinically relevant research questions, designing experiments that adequately test hypotheses, and examining the effects of independent variables on outcomes of interest. When executed well, this process results in evidence that document an intervention's effectiveness in the context of controlled trials (Kazdin, 2008). Evidence that is accumulated under controlled conditions is critical to ensure that the variables under investigation are responsible for the observed effect on the outcomes of interest. One problem inherent to this approach is that it minimizes the importance of variables related to clinical practice settings, including: the *relevance* of the research to current issues in clinical practice, the *feasibility* of implementing components of an evidence-based protocol in an authentic practice setting, and *characteristics* of both the clinicians delivering the protocols (e.g, motivation, attitude), and the settings in which the protocols are ultimately used (e.g., available resources, support). Examining these variables earlier in the research process may provide valuable data about how evidence-based protocols can and should be designed, to better fit the communities they are intended to benefit.

Typically, evidence that has moved along the research pipeline from efficacy to effectiveness (Robey, 2004) makes its way to practicing clinicians via traditional methods of dissemination, such as manuscripts published in peer-reviewed journals or presentations delivered at professional conferences. The challenge for clinicians is to seek out, accurately interpret, and appropriately apply this evidence to their own clinical caseloads. A robust body of research suggests that while disseminating information about evidence-based protocols to clinicians via traditional strategies may increase knowledge, this approach alone is insufficient to support new skill acquisition or to foster longer term behavior change (Beidas et al., 2012, 2011; Herschell et al., 2010). Instead, the process by which evidence moves into clinical practice must be re-conceptualized, under a model that emphasizes the role of *clinician training* as key to supporting knowledge acquisition and facilitating skill application surrounding the use of evidence-based protocols (Fixsen et al., 2005).

### *2.1.1 A different model of translational research*

The University of Washington *Institute of Translational Health Sciences*[2] proposes a model for translational research, which includes the science of *dissemination* and *implementation* as one key phase. This model depicted in Figure 1-1 below, also used by the National Institutes of Health, summarizes translational research into five "T" phases: identification of basic problems (T0), discovery or foundational "bench" research (T1), efficacy research conducted in the laboratory under controlled conditions (T2), dissemination and implementation research (T3), and population-based health research (T4).

[2] The University of Washington *Institute of Translational Sciences* (ITHS) is one of 62 Clinical and Translational Science award sites across the United States, funded by the National Center for Advance Translational Sciences (NCATS), part of the National Institutes of Health (NIH). For more information, please see www.iths.org.

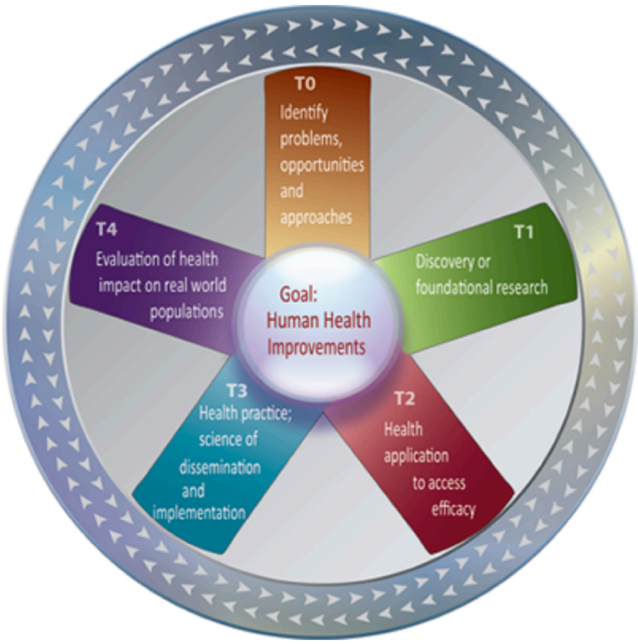


Figure 2-1: ITHS model of translational research.

In contrast to the traditional, linear pipeline of efficacy to implementation research (Robey, 2004), this circular model depicts the process of translational research as a wheel. The spokes of the wheel, which represent different phases of translational research, all converge on one primary goal: to improve human health. The arrows around the circumference are bidirectional, suggesting that research can move in either direction, beginning at one phase and moving forward or backward to other phases. Occupying a prominent place along the wheel is T3 health practice research, which is designed to tackle scientific questions related to how knowledge and information is spread (dissemination), and how evidence is integrated into clinical practice settings (implementation). Evidence that accumulates from T3 research activities can then be used to move the research process forward toward population-based studies (T4 research) or provide feedback to inform earlier phases of the research process, including generating novel questions that support basic discovery (T1 research).

### *2.1.2 The science of implementation*

Implementation science, conceptualized as part of T3 research in the model above, includes research methods used to examine the *processes* by which evidence-based information is integrated into clinical practice settings (Olswang & Prelock, 2015). Stated more formally, this type of research comprises "…the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices to improve the quality of service delivery in routine care" (Powell et al., 2012, p.124). Implementation of evidence-based protocols into practice settings is an iterative process comprised of several stages, each of which addresses different objectives along the path to full implementation and sustainability. The stages of implementation science research and related objectives, as described by Fixsen et al. (2005), are summarized in Table 2-1, below. Implementation research typically begins with *exploration and adoption*, during which researchers and clinicians work together to identify and examine the specific barriers and facilitators to implementation of a given protocol in a specific practice setting. The goal of this stage of research is to make decisions about whether or not the protocol is a good "fit" and whether or not to proceed with implementation. If the decision to go forward is made, then installation of the protocol into the practice setting begins. During *installation*, resources such as funding, staff, space, and training, which are necessary to begin implementation, are secured. With the appropriate resources in place, *initial implementation* begins, typically with a small cohort of clinicians. Over time (often years), as an evidence-based protocol is integrated into routine practice, *full implementation* is achieved. As part of this process, protocols are often modified or adapted to meet the contextual needs of individual practice settings or clinical populations. Such modifications can lead to *innovation*, during which the original protocol may be refined or expanded to incorporate these changes, when appropriate. Finally, during the stage of *sustainability,* external factors such as changes in staffing, leadership, practice requirements, and funding sources, are examined to determine the effect on implementation, and adjustments are made to support ongoing use of the evidence-based protocols.

Table 2-1: Stages of implementation science research.

| Stage | Objective |
|---|---|
| Exploration & Adoption | • Identify barriers and facilitators to implementation, for a specific practice setting<br>• Decide to proceed (or not) with implementation |
| **Installation** | • Ensure necessary resources to support implementation are in place (e.g., funding, staff, space, technology, **training**) |
| Initial Implementation | • Try the protocol with a small cohort |
| Full Implementation | • Integrate the protocol sufficiently so that it becomes part of routine practice |
| Innovation | • Examine how protocol is used, modified, and adapted to meet the needs of the practice setting<br>• Refine and expand protocol to include modifications or adaptations that improve the protocol |
| Sustainability | • Make necessary adjustments to support ongoing use of the protocol |

*Note:* Adapted from (Fixsen et al., 2005)

Developing training materials, conducting initial training, and examining the effectiveness of training is one important objective addressed in one of the early stages (installation) of implementation research. *Training* is operationalized as activities designed to support practicing clinicians in acquiring the knowledge and skills necessary to ensure that their professional behaviors are in closer alignment with evidence-based protocols (Lyon, Stirman, Kerns, & Bruns, 2011). Training is a critical part of the implementation process, because the effectiveness of an evidence-based protocol, when used in clinical practice, relies in large part upon the knowledge and skill of the clinician delivering it. Research suggests that when executed well, training can reduce variability in how clinicians deliver protocols and improve overall implementation fidelity (Becker & Stirman, 2011; Fixsen et al., 2005). Training clinicians to be competent in understanding (knowledge) and delivering (skill) the key ingredients of a protocol is therefore one of the core implementation components identified by Fixsen et al. (2005).

## 2.2 Clinician Training

Examining *clinician training* as a core component of implementation science research has only just begun to receive serious attention in the behavioral sciences (Fixsen et al., 2005). McHugh and Barlow (2010) observe, "…methods to transport treatments to service delivery settings have developed independently without strong evidence for, or even consensus on, best practices for accomplishing this task or for measuring successful outcomes of training" (p. 73). One notable exception exists in the mental health service delivery literature, which has recently addressed issues related to the science of training clinicians in evidence-based treatments (see: Becker & Stirman, 2011, for an introduction to the *Special Issue* on this topic). From this research, much can be learned and applied to the science of training SLPs in the use of evidence-based protocols. The sections that follow review what is known about training clinicians (forms of training, components of effective training, and training techniques) and identify outcomes important to measure as part of training research.

### *2.2.1 Forms of training*

Clinician training can take many forms, two of the most prominent of which include *face-to-face* and *online training*, as depicted in Figure 2-2. Face-to-face training describes training that occurs in person, such as professional presentations or workshops (Cucciare, Weingardt, & Villafranca, 2008). Research suggests that workshop-style training supports knowledge acquisition, but is less effective in facilitating longer-term behavior change in practice (Cucciare et al., 2008). Online training refers to the use of internet-based technology as a mode of instruction (Cook et al., 2008). Online training efforts can be conceptualized as spanning two broad categories, *self-guided* and *instructor-led*. *Self-guided* describes training that relies on an individual's ability to acquire information and skills through independently interacting with training materials, such as written or multi-media materials made available online (Dimeff et al., 2009). *Instructor-led* trainings describe trainings that are facilitated by an individual with knowledge or expertise, who is responsible for delivering the training material and encouraging interaction or discussion among the online learners. Online instructor-led trainings may happen *synchronously*, during which interactions occur in real time (e.g., virtual classroom discussions, video-conferencing) or they may happen *asynchronously*, during which interactions occur following some delay (e.g., email, discussion boards). Additionally, training can be a combination of one or more of these forms (i.e., *blended learning*, not depicted below).

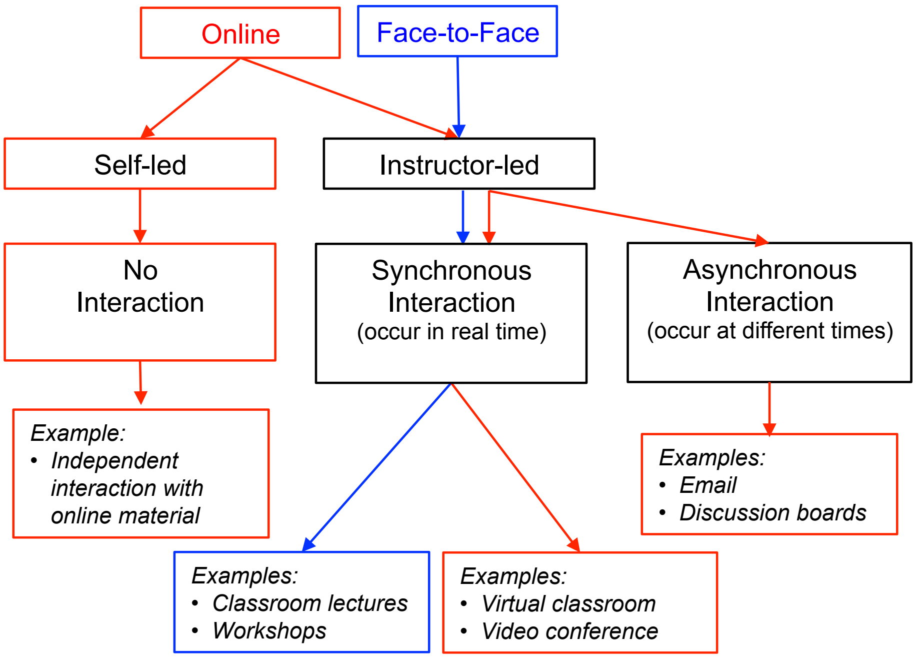


Figure 2-2: Forms of training.

When compared to traditional face-to-face training, online, self-guided training offers several advantages. First, from the learner's perspective, online training offers the opportunity to engage in training at a convenient time and place, given access to appropriate resources such as a reliable internet connection (Cook et al., 2008). Additionally, online, self-guided training allows individuals to self-pace through materials, which may be particularly appealing to adult learners (Dimeff et al., 2009). When principles of adult learning (e.g., active participation, reflection, and self-assessment of knowledge and skills) and instructional design are incorporated, online training can foster learner engagement via dynamic, interactive, and aesthetically appealing activities (Dunst & Trivette, 2012; Trivette, Dunst, Hamby, & O'Herin, 2009).

From the trainer's perspective, online training offers the opportunity to reach a larger number of learners across a wide range of geographical areas, especially rural or remote regions, and often in a more cost-effective manner than face-to-face training permits (Brouwers, Makarski, Durocher, & Levinson, 2011; Cucciare et al., 2008; Dimeff et al., 2009). Online training can be easily scaled up to include additional content or to reach larger audiences, such as adding training tasks and individual learners (Beidas et al., 2011). Additionally, training content can be either standardized *or* easily tailored to meet specific learner needs (Brouwers et al., 2011). What might constitute effective online, self-guided training is described next.

### *2.2.2 Components of effective training*

Research to date suggests that effective training, regardless of format, traditionally includes four broad components, *instruction, demonstration, practice*, and *feedback* (Beidas et al., 2011; Fixsen et al., 2005; Rakovshik & McManus, 2010), depicted in Figure 2-3, below.

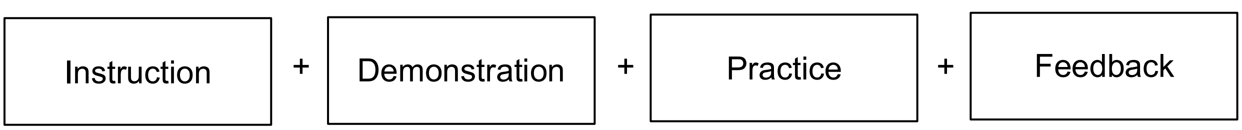

Figure 2-3: Components of training.

*Instruction* describes the initial didactic input on underlying theory, clinical population, and intervention protocol that supports knowledge gain about the protocol. While an important and necessary component of training, instruction alone is generally not sufficient to produce sustained change in either clinician behaviors or patient outcomes (Rakovshik & McManus, 2010; Sholomskas et al., 2005). *Demonstration* includes presentation of the key ingredients of the protocol, and can be done either live or using video exemplars. *Practice* refers to engaging clinicians in the experience of using the key ingredients of the protocol. Practice is described as crucial during the stage of training in which clinician *skill* is consolidated (Rakovshik & McManus, 2010). *Feedback*, which can be immediate, delayed, and/or ongoing, provides clinicians with information about their use of the key ingredients of the protocol, in effort to help clinicians more closely align their behaviors with the protocol. Research suggests that providing a mechanism for ongoing feedback is important for supporting clinicians in sustaining new skills in clinical practice (Sholomskas et al., 2005).

Some of these components of training can be easily delivered in an online, self-guided format. Online *instruction*, for example, can be delivered using pre-recorded audio or video presentations, or by making text or multi-media materials available to clinicians for independent review. Online *demonstration* can be accomplished through use of video exemplars. *Practice* and *feedback*, however, may require more ingenuity to translate into an online, self-guided training platform. Conventional techniques used to accomplish these two components are best known through in-person training, for example, in the context of workshops or conferences. *Practice* typically requires that the clinician have the opportunity to try the key ingredients of the protocol in a training situation or apply them in clinical practice, which appears to be best suited to hands-on experience. Similarly, feedback is typically delivered in the context of one-on-one interactions, small-group discussion, or coaching, all of which occur in person or in real time. Thus, designing and investigating the effectiveness of training that delivers all four components, but particularly practice and feedback, in an online, self-guided format requires understanding the purpose of each component and considering how to best accomplish that purpose. Further understanding training techniques that can be used to deliver effective, efficient, and appealing training in an online, self-guided format is key to making training available to a large number of clinicians, across a wide range of geographical regions.

### *2.2.3 Training techniques*

Training *techniques* describe the individual actions taken by trainers in the course of training; they are numerous, can overlap across training components, and are often difficult to disentangle (see Lyon et al., 2011 for a comprehensive review). Further, training techniques are often bundled together into packaged approaches (e.g., problem-based learning, coaching, inter-professional education), making it difficult to isolate the effect of a particular technique on a specific training outcome. To date, research has examined the effect of packaged approaches on training outcomes, but data are minimal for linking individual techniques to specific training outcomes (Cook, Gelula, Dupras, & Schwartz, 2007; Lyon et al., 2011). Research that investigates individual training techniques would provide evidence for how and why we might select specific techniques to accomplish the goal of each training component, and ultimately design trainings that are effective, efficient, and appealing to practicing clinicians (Becker & Stirman, 2011; Beidas & Kendall, 2010; Beidas et al., 2011).

Training techniques amenable to online, self-guided training for delivering *instruction* and providing *demonstration* are relatively straightforward (e.g., pre-recorded lectures, and video exemplars, respectively). Techniques that provide clinicians with *practice* opportunities and deliver *feedback* on performance, in this same format, are less so. One technique for providing *practice* in online training is through use of real or hypothetical case studies, with accompanying questions that engage the clinician in practice applying the protocol to the case (Rakovshik & McManus, 2010). A case study can be presented via narrative or video, followed by questions designed to help clinicians self-check their knowledge about the protocol and practice their skills in applying the key ingredients of the protocol to the case. Practice questions can take different forms (e.g., multiple choice, open-ended), and may have differential effects on clinician learning (e.g., Cook et al., 2007).

Multiple-choice practice questions present a finite number of response options, and thus engage the clinician in practice through *identification.* Within the multiple-choice context, the correct response is present among the field of choices, and the clinician must simply identify which response best answers the question, as it applies to the case study. *Identification* questions may therefore provide an especially *efficient* means through which clinicians can self-check their knowledge and practice applying their skill to a case study. Open-ended practice questions, in contrast, do not provide response options, but instead ask the clinician to answer in his/her own words. This type of question engages the clinician in practice through *reflection* activities, which include:  articulating key concepts taught during instruction, practicing applying the key concepts to the case study, and hypothesizing about future action (Di Stefano, Gino, Pisano, & Staats, 2015). Using *reflection* questions may be a less efficient training technique than identification questions, but may prove a more *effective* context under which clinicians can self-check their knowledge and practice their skill in applying the targeted key ingredient of the protocol to a case study. In an online, self-guided training designed to teach medical students about complementary and alternative medicine, Cook et al. (2007) examined the use of these two types of practice questions. No significant differences were found in students' scores at posttest, based on practice questions. However, subjects assigned to multiple choice practice questions were permitted to submit responses until they arrived at the correct answer, and also received feedback on their performance. Subjects assigned to the open-ended practice questions submitted one response only, and received no feedback on their performance. Thus, the practice conditions differed not only on question type but also on amount and type of feedback provided. Exploring closed-ended (identification) versus open-ended (reflection) questions, while keeping feedback constant across conditions, may be one way to investigate how different types of *practice* support clinician learning in the context of an online, self-guided training.

### ***2.2.4 Measuring outcomes of training***

Evaluating the impact of training techniques, including *identification* versus *reflection* practice questions, includes examining the relative *effectiveness, appeal*, and *efficiency* of these different techniques. This information can then be used to begin to build an evidence base that supports the use of specific training techniques within self-guided, online training. Table 2-2 summarizes outcomes, definitions, and relevant approaches to measurement for variables related to training's effectiveness, appeal, and efficiency.

Table 2-2: Outcomes of training.

| | **Outcome** | **Definition** | **As Measured by…** (examples) |
|---|---|---|---|
| **Effectiveness** | *Knowledge* | Understanding of core components of an evidence-based intervention | • Questionnaires (multiple choice, true/false)<br>• Written assessments (short answer, open-ended, written |

| | | | |
|---|---|---|---|
| | | | vignettes) |
| | *Skill* | Ability to perform discreet behaviors in a test situation – measure of application or near transfer | • Assessment of the clinician's delivery of key ingredients of the protocol (checklist, rating scale, etc. applied to video or audio-recording of therapist behavior) |
| **Efficiency** | *Time* | Amount of time required to complete the training | • Total time spent<br>• Time spent per training module<br>• Number of times training is viewed/reviewed |
| **Appeal** | *Reactions* | Perceptions of:<br>• The training itself (*usability, practicality, content*)<br>• Self-learning that resulted from the training (*self-efficacy, mental effort, satisfaction*) | • Clinician self-report (Likert-type rating scales) |

*Note:* Adapted from the *Therapist Training Evaluation Outcomes Framework* (TTEOF) (Decker, Jameson, & Naugle, 2011).

As outlined above, two primary ways to examine training *effectiveness* is by measuring *knowledge acquisition* and *skill application*. Clinician *knowledge* about the protocol is typically assessed via pre- and posttest measures, and provides evidence of the training's effectiveness at increasing understanding of underlying concepts, related terminology, and key ingredients of the protocol. Measures of clinician *knowledge* may include performance scores on questionnaires or written assessments. Documenting knowledge gain is a fundamental and critical part of measuring training outcomes; it ensures that the training supports increased familiarity with the concepts and principles foundational to the targeted protocol. Clinician *skill* in applying the protocol can be assessed at posttest, and provides evidence of the training's effectiveness at supporting the application of new knowledge to either a) a controlled test situation (near transfer) or, more broadly, b) behavior change in clinical practice and the resulting impact on patient outcomes (far transfer). Measures of *skill* may also include performance scores on an assessment of the clinician's ability to accurately and competently deliver the targeted key ingredients of the protocol.

The overall *appeal* of the training can be assessed using ratings of clinicians' *reactions* to the training experience. Measures of *reactions* typically include self-reported ratings of perceptions about training itself and one's own self-learning as a result of training. Following training, for example, clinicians may be asked to rate specific characteristics of the training, such as: *usability* (ease of navigating through the technical aspects of the training); *practicality* (manageability of completing the training during the clinician's available time); *content acceptability* (relevance of the information covered in the training) (Kyzar et al., 2014). Clinicians may also be asked to rate their perceptions of their own learning as a result of the training, including: *self-efficacy* (confidence in the ability to use the knowledge and skills addressed in the training); *mental effort* (perception of amount of cognitive exertion required to complete the training), and overall *satisfaction* (gratification) with the training experience (Brouwers et al., 2011). Evaluating clinicians' reactions to training is integral to the process of implementation science research. Clinicians' perceptions provide feedback about what worked in the training and what could be improved. This information provides further insight regarding how likely clinicians may be to adopt the evidence-based protocol in their clinical practice. Thus, measures that address these training outcomes contribute directly to the iterative process required to design trainings that accomplish anticipated results (effective), require a reasonable amount of time to achieve the desired effects (efficient), and are likely to be used by the clinicians who would benefit from the training (appealing).

## 2.3 Evidence in Early Communication Intervention

Online, self-guided training may provide an especially effective and efficient way to deliver much needed training in available evidence-based protocols for assessing and treating prelinguistic communication in young children with physical disabilities. While these children constitute a low-incidence clinical population (Christensen et al., 2014), and therefore may comprise a small percentage of an SLP's caseload, they often require a substantial investment of time in thinking about how to translate evidence to practice. Young children with physical disabilities often have heterogeneous profiles of development across sensory, motor, and cognitive domains, which suggest that research-based protocols may require adaptation to meet any one child's individual skills and needs. Further, because of their motor impairments, these children face specific challenges producing clear, conventional, and consistent prelinguistic communication behaviors (Arens, Cress, & Marvin, 2005; Cress et al., 1999, 2000; Dowden & Cook, 2012), which places them at tremendous risk for being able to successfully engage with others and participate in opportunities for learning to intentionally communicate. Given such risk, targeting assessment and treatment of prelinguistic communication as part of early intervention service delivery for these children is critical.

Unfortunately, research has documented that SLPs receive little pre-service training on communication development for early intervention in general (Francois, Coufal, & Subramanian, 2014) and even less for low-incidence populations in particular (Chen, Klein, & Minor, 2009). A small number of studies have investigated online training in early communication intervention (e.g., Brown & Woods, 2012; Douglas, McNaughton, & Light, 2013; Hamad, Serna, Morrison, & Fleming, 2010; Kobak, Stone, Ousley, & Swanson, 2011; Kyzar et al., 2014; Ludlow, 2002). These studies included caregiver and clinician training, primarily targeting assessment and intervention for young children with autism spectrum disorder. Similar training techniques were employed across studies, including use of: multimodal material (text, graphics, audio) to provide *instruction*; clinical examples via video vignettes to *demonstrate* key components of the protocol; and interactive exercises during which participants *practice* their skill, self-check their knowledge, and receive *feedback*. This emerging body of research has documented that online training in early intervention can have a positive effect on knowledge gain and skill acquisition across clinicians and caregivers. Further, these studies document that learners were generally satisfied with their online training experiences. While much can be learned from these training studies, gaps in our knowledge remain.

Specifically, no study has experimentally manipulated individual training techniques to examine effects on learner outcomes. As acknowledged by Hamad et al. (2010) in their study of an online training designed to teach families and service providers the core components of behavioral intervention for young children with autism spectrum disorders, "… no effort was made to tease out contributions made by any single instructional component. Hence, the extent to which, for example, online printed lectures versus video contributed to change in learning performance remains unknown, though the need for instructional component analysis in future studies of this type is certainly recognized" (p.201). Knowing which techniques are most effective, efficient, and appealing will support the development of trainings that are evidence-based. Online training for EI SLPs could address this challenge by incorporating what are known to be essential components of online training (instruction, demonstration, practice, feedback), while experimentally manipulating training techniques within any single training component listed here. Examining training techniques for *practice* in particular will help identify the key ingredients of this component that are amenable to online, self-guided training. This training format is particularly useful in addressing the need for designing effective training that can reach large numbers of practicing SLPs from wide range of service delivery areas.

#### ***2.3.1 Current evidence-based protocols***

Clinician training for assessing and treating prelinguistic communication in young children with physical disabilities is clearly warranted. Further, the need for sensitive and objective tools for early communication assessment and treatment planning in this population, which can be easily translated to clinical practice, is well acknowledged (DeVeney, Hoffman, & Cress, 2012; Geytenbeek, Vermeulen, Becher, & Oostrom, 2015; Ross & Cress, 2006). Work in the Child Language Research Laboratory at the University of Washington, in collaboration with the University of Kansas, has addressed the dual challenge of: a) developing reliable and valid assessment protocols for prelinguistic communication in this clinical population, and b) training caregivers and clinicians and to learn the key ingredients of these protocols. Two specific assessment tools, the *Communication Complexity Scale* (CCS) and the *Dynamic Assessment for*

*Triadic Gaze* (DA for TG) were developed as objective measures of prelinguistic communication in this population of children (Brady et al., 2012; Olswang, Dowden, et al., 2014; Olswang et al., 2013). Both the CCS and the DA for TG protocols are built upon a simple, behavioral-based (antecedent-behavior-consequence) paradigm, which include key ingredients that are familiar to most practicing clinicians: provide a communication *opportunity* (antecedent), *recognize and record* the child's production (behavior), and reinforce the child's communicative attempt in the context of play (consequence). The CCS is a static, observation-based, criterion-referenced tool (see Appendix A), while the DA for TG adopts a dynamic approach assessment. The DA for TG adds *responding* to the child's behavior by *shaping* to a more sophisticated signal, as part of the dynamic protocol. Evidence supporting the key ingredients of these protocols, when delivered under controlled conditions, has been documented through a series of single-case, time-series feasibility studies (Olswang & Pinder, 1995; Pinder & Olswang, 1995; Pinder, Olswang, & Coggins, 1993) and, more recently, though a randomized control trial (Olswang, Dowden, et al., 2014; Olswang, Feuerstein, Pinder, & Dowden, 2013).

Both protocols are predicated upon an important developmental transition that occurs in the first year of life: movement from perlocutionary (preintentional) to the illocutionary (intentional) phases of communication development (Bates, Camaioni, & Volterra, 1975). In typical development, this transition occurs sometime between 7–11 months of age, as the child begins to use gaze, gestures, and vocalizations in increasingly complex productions (Bakeman & Adamson, 1984; Carpenter, Nagell, & Tomasello, 1998; Mundy et al., 2007; Mundy & Newell, 2007). Both the CCS and the

DA for TG highlight the role of gaze, specifically triadic gaze (a three-point gaze shift from adult-object-adult *or* object-adult-object), as one discreet and observable behavior signaling the emergence of coordinated joint attention (triadic focus) and thus intentional communication (Bakeman & Adamson, 1984; Bates et al., 1975; Trevarthen & Hubley, 1978). Gaze is emphasized as a particularly powerful signal for children with physical disabilities because it may be accessible when other modes of communication (gestures, vocalizations) are not. Both protocols, however, require that the clinician be able to accurately *recognize and record* a child's behaviors from a continuum, presented in Figure 2-4 below. The behaviors along this continuum range from simple, sustained gaze at objects or adults and move toward more complex gaze shifts *between* objects and adults, either produced in isolation or accompanied by gestures and/or vocalizations[3].

Preintentional

- Single focus (gaze alone)
- Single focus (gaze + gesture OR vocalization)
- Single focus (gaze + gesture AND vocalization

- Dual focus (gaze alone)
- Dual focus (gaze + gesture OR vocalization)
- Dual focus (gaze + gesture AND vocalization)

- Triadic focus (gaze alone)
- Triadic focus (gaze + gesture OR vocalization)
- Triadic focus (gaze + gesture AND vocalization)

Intentional

Figure 2-4: Communication continuum

[3] Note: the communication continuum is adapted from Brady et al. (2012), and does not represent a rigid hierarchy, but rather proposes a range of behaviors well documented in research as being produce by children as they move from preintentional to intentional communication. Not all children will produce all gaze behaviors, and not always in this exact order.

Research addressing the implementation of these two protocols has documented that some key ingredients of the protocols are more difficult to learn than others (Brady et al., 2012; Olswang, Greenslade, Feuerstein, & Dowden, 2014; Olswang, Pinder, & Hanson, 2006). Data from a caregiver training study, for example, has documented that while caregivers were able to learn to *provide communication opportunities* to their children, they were less successful in *shaping* their children's behaviors into more conventional signals (Olswang, Pinder, & Hanson, 2006). Clinicians, in contrast, appear to face challenges with different key ingredients of the protocols (Brady et al., 2012; Olswang, Greenslade, et al., 2014). Presenting structured communication *opportunities* in the context of play, for example, is a familiar and often easy to implement part of assessment and treatment delivery for practicing clinicians. In contrast, *recognizing* discreet behaviors produced by children with physical disabilities and *recording* these behaviors so that shaping may proceed appropriately, is more challenging (Olswang, Greenslade, et al., 2014). While recognizing these behaviors may appear straightforward, the nature of the children's underlying motor impairments often results in behavioral productions that are subtle, idiosyncratic, and difficult to identify as potentially communicative (Arens et al., 2005; Cress et al., 2000; Sigafoos et al., 2000). As a result, recognizing a child's potentially communicative attempts presents particular challenges for both caregivers and clinicians alike. It is particularly important that EI SLPs *recognize and record* children's communicative attempts; this skill, one key ingredient of the two evidence-based protocols, as previously described, is the foundation for making appropriate clinical decisions about what to treat (target behaviors) and how to treat (shaping strategies). Thus, effective training for clinicians to *recognize and record* child behaviors is critical, both for accurate assessment and future treatment planning.

### *2.3.2 Training clinicians in the current evidence-based protocols*

Training to date for the administration of the CCS has involved teaching research clinicians to recognize and score behaviors produced by young children with physical disabilities, from the ordinal, 11-point scale spanning preintentional to intentional communication (see Appendix A). Training has included both *self-guided* activities (e.g., review of a written manual and videotaped exemplars) and *instructor-led* activities (one-on-one meetings with discussion and feedback). Following training, interrater reliability for recognizing and recording child behaviors from videos of young children with physical disabilities was examined. Results documented that interrater reliability was good (89%, $\kappa$=.77) for behaviors assigned a score within one point of each other, but significantly lower for exact agreement on child behavior (Brady et al., 2012). These data indicate that *recognizing and recording child behaviors* is challenging even for highly trained research clinicians who are viewing discreet video exemplars in the context of a laboratory setting. Thus, this research suggests that *recognizing and recording child behaviors* requires explicit training for practicing clinicians working in early intervention settings as well.

Data from a recent pilot implementation research project confirmed this need (Feuerstein et al., 2015; Olswang, Greenslade, et al., 2014). This pilot study evaluated the process of training seven early intervention practitioners to recognize and record the same prelinguistic communication behaviors outlined by the CCS, but in the context of implementing the DA for TG protocol (Olswang, Greenslade, et al., 2014). Training included both *online, self-guided* activities (review of an online manual with video exemplars of child behaviors and supplemental readings) and *face-to-face, instructor-led* activities (didactic presentation on theory, concepts, and key vocabulary; model demonstration of skill; role-play with peers; and videotape review with group discussion and feedback). Following training, clinicians tried the DA protocol with a child on their caseloads. Clinician competence in *recognizing and recording* child behaviors was assessed via videotape review. Results of this pilot study revealed important information about learning to *recognize and record* child behaviors as one key ingredient of the protocols, and about the training process itself. First, training was successful, as documented by high fidelity on measures of overall adherence in delivering all key ingredients of the DA for TG protocol. However, overall poorer performance and greater variability was observed when clinicians were assessed on their ability to *recognize and record* child behaviors, specifically. In addition to fidelity, clinicians' reactions to the training experience were measured using a feasibility questionnaire and post-training interview. Results suggest that while clinicians found the training relevant and were willing to engage in more training, they identified several challenges to learning and using the DA for TG protocol. Notably, clinicians cited: 1) *lack of time* to dedicate to this intensive training format, and 2) difficulty in adequately *recognizing and recording* child behaviors while maintaining child engagement during the assessment session. Despite attempts to provide a short, intensive, and focused training experience, these results suggest that the training fell short in ensuring high quality in the delivery of one of the protocol's key ingredients, and maximizing clinicians' already limited time.

Separately, each of these lines of research has explored some aspect of clinician training, and has begun to highlight the strengths and challenges of moving such protocols into practice. Combined, these studies highlight some of the known challenges related to examining clinician training as a core component of implementation science research: what training techniques are most effective, efficient and appealing when training clinicians to learn the key ingredients of protocols, and what measures best capture outcomes of clinician training? Overall these seemingly comprehensive trainings were time intensive and, in the end, did not produce high quality results with regard to learning one essential element of both static and dynamic assessment protocols: *recognizing and recording* child behaviors. As this program of implementation research moves forward and examines the process of moving the protocols (CCS and DA for TG) into practice, the need for an effective, efficient, and appealing training that targets *recognizing and recording child behaviors* seems critical. This particular key ingredient of the protocols may be especially amenable to online, self-guided clinician training. Online training would provide a platform to deliver standardized *instruction* on the operational definitions of child behaviors, *demonstration* through use of clear, discreet video exemplars of the behaviors, and the opportunity for clinicians to self-pace through the training, reviewing material as needed. Isolating and investigating which techniques work, specifically for the *practice* component of an online, self-guided training, is a logical and necessary step.

### 2.4 Specific Aim

The training study described below was designed to investigate the effectiveness, efficiency, and appeal of three different practice techniques embedded within an online, self-guided training for EI SLPs. The training addressed a single, key ingredient required for accurate and competent delivery of two protocols used in prelinguistic communication intervention: *recognizing and recording* child behaviors from a communication continuum that highlights the role of gaze production. Training EI SLPs to become competent in *recognizing and recording* prelinguistic behaviors from the communication continuum described previously is one step toward supporting the integration of the evidence-based protocols into clinical practice.

## 2.5 Research Questions

### *2.5.1 Research Question 1 – Effectiveness*

When randomly assigned to one of three practice conditions (*identification, reflection, control)*, is there a significant between-groups difference observed in training *effectiveness*, as measured by: a) *knowledge* on pre-posttest assessment, and b) *skill* in identifying early communication behaviors at posttest, using video exemplars?

### *2.5.2 Research Question 2 – Efficiency*

Is there a significant between-groups difference observed in training *efficiency*, as measured by time taken to complete the core training modules?

### *2.5.3 Research Question 3 – Appeal*

Is there a significant between-groups difference observed in training *appeal*, as measured by subject ratings on a post-training survey?

## 2.6 Significance

Research has documented the efficacy of the static assessment (CCS) and dynamic assessment (DA for TG) protocols in the context of controlled studies, but we have only just begun to examine techniques for training clinicians in their use. This study provides primary data for the effectiveness of specific practice techniques embedded within a self-guided, online training designed to teach EI SLPs to *recognize and record* child behaviors, one skill that is foundational to providing adequate assessment and treatment planning for young children with severe physical disabilities. The same rigorous criteria applied to the design of treatment efficacy studies was used to evaluate the effectiveness of this training, including: random allocation of subjects to training condition, pre-training baseline assessment, blind assessment of subject outcomes, and self-and experimenter measures. Results from this project will contribute to the larger body of implementation science research that focuses on examining training as part of the *Installation* stage, within a broader framework of implementation science research (Damschroder & Hagedorn, 2011; Dunst, Trivette, & Raab, 2013; Fixsen et al., 2005).

# 3 Method

## 3.1 Design

This study adopted a three-group, pre-posttest experimental design to examine the effect of practice techniques, used during a self-guided, online training, on three primary training outcomes: 1) *effectiveness* (clinician knowledge, skill); 2) *efficiency* (time to complete the training); and 3) *appeal* (clinician reaction to the training). Within the online training, subjects were randomly assigned to one of three conditions, each representing a different practice technique (*identification, reflection, control*), as pictured in Figure 3-1, below.

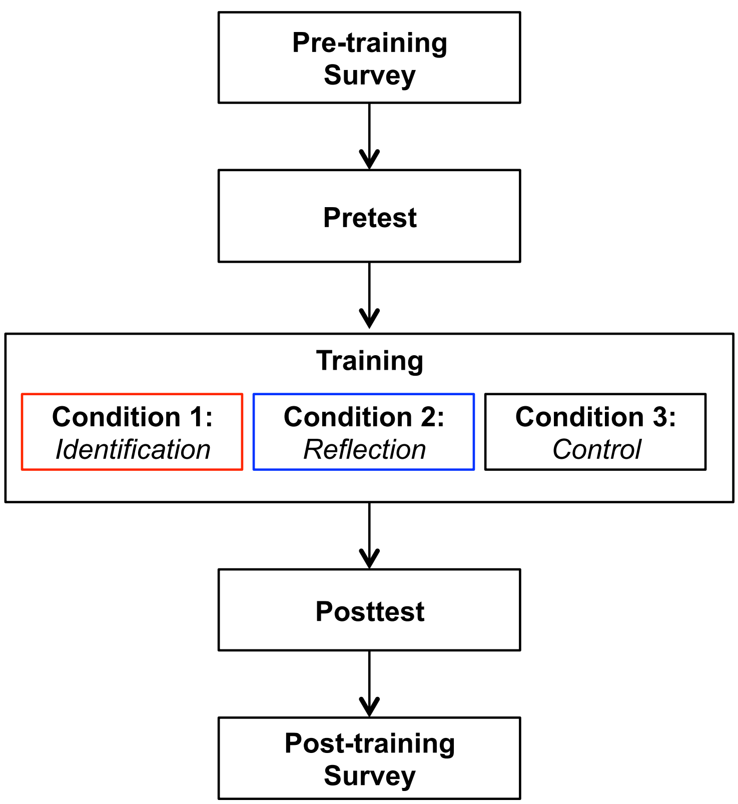


Figure 3-1: Study design

## 3.2 Participants

### *3.2.1 Recruitment*

Subjects were recruited from six states in the Pacific Northwest: Washington, Wyoming, Alaska, Montana, Idaho, and Oregon. An informational email and a recruitment flyer was sent to the following entities and/or individuals in each of these states: a) professional speech-language-hearing associations, b) early intervention agencies, c) direct service providers with publicly available contact information, and d) academic colleagues from local universities. The email and recruitment flyer provided potential subjects with contact information for the lead investigator. The lead investigator responded to all inquiries by arranging a time and date to conduct a telephone screening to determine eligibility for study participation.

### *3.2.2 Inclusionary criteria*

To be eligible for participation in this study, individuals were required to meet the following inclusionary criteria: a) hold current licensure to practice speech-language pathology in his/her work state; b) be a member of the American Speech-Language Hearing Association in good standing; c) be fluent in written and spoken English; d) have access to a computer (laptop, desktop, or tablet) with a sound card, video card, and internet connection; and e) be currently treating at least one child with physical disabilities. For purposes of this study, physical disabilities were defined as any child on the clinician’s current caseload who demonstrated a delay in *gross* motor development sufficient to qualify for early intervention services in that developmental domain.

### *3.2.3 Exclusionary criteria*

Any individuals who did not meet inclusionary criteria listed above were excluded from this study. In addition, individuals were excluded from this study if they had participated in past training for learning to administer either the *Communication Complexity Scale* (CCS) (Brady et al., 2012) or Triadic Gaze (TG) intervention (Olswang, Dowden, et al., 2014). Specifically, subjects must have never: a) received formal training on CCS procedures or TG intervention, b) read the CCS or TG intervention manual, or c) participated in CCS research or TG intervention or with any members of the University of Washington Child Language Research Laboratory.

### *3.2.4 Enrollment*

A total of 83 individuals inquired about the study. Thirty-nine inquiries (47%) came from Washington state, followed by: 25 (30%) from Oregon; seven (8%) from Alaska; five (6%) from Idaho; four (5%) from Wyoming and one (1%) from Montana. (Note: total number of inquiries does not sum to 83, as two subjects who inquired did not identify their state). Of the 83 inquiries, eight individuals did not respond to a request for a telephone screening; thus, 75 were assessed for eligibility.

Figure 3-2 presents a CONSORT flow diagram, which displays information about subject enrollment from recruitment through data analysis (Schulz, Altman, & Moher, 2010). Among those assessed for eligibility, 21 (28%) were ineligible to participate. Subjects were ineligible for the following reasons: not currently treating a child with physical disabilities (*n*=10), not holding state licensure to practice speech-language pathology (*n*=7), having previously received training on TG intervention (*n*=3), and not a speech-language pathologist (*n*=1).

Of the 54 eligible subjects, all elected to enroll in the study and received the pre-training survey. Forty-nine (91%) completed the survey and were randomly allocated to one of three training conditions. Five individuals did not complete the pre-training survey, for unknown reasons. Seventeen subjects were allocated randomly to Condition 1 (*Identification*), 15 to Condition 2 (*Reflection*), and 17 to Condition 3 (*Control*). All subjects in Condition 2 completed the training. One subject each from Condition 1 and Condition 3 did not complete the training. Subjects reported "not having enough time" as the primary reason for not completing the training.

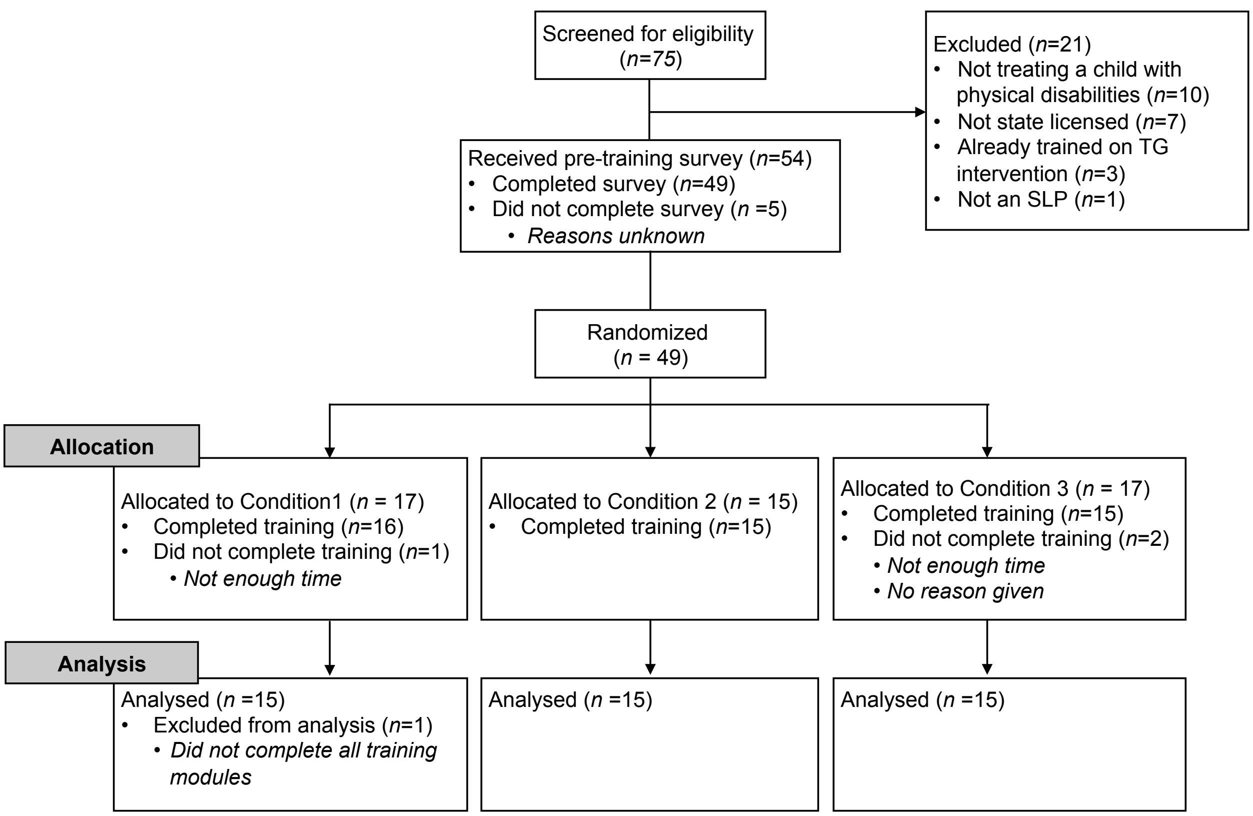


Figure 3-2: CONSORT study flow diagram.

Table 3-1 displays the distribution of subjects by state, for: number of initial inquiries, number of subjects enrolled, and number of subjects who completed the study. Note that 46 subjects completed the study, but only 45 were included in final data analysis. One subject from Condition 1 did not complete all training modules, and was therefore excluded from the final study sample used in analysis.

Table 3-1: Subject distribution by state.

| | **Washington** | **Oregon** | **Alaska** | **Idaho** | **Wyoming** | **Montana** | **TOTAL** |
|---|---|---|---|---|---|---|---|
| Inquires$^{+}$, *n* (%) | 39 (46.99) | 25 (30.12) | 7 (8.43) | 5 (6.02) | 4 (4.82) | 1 (1.20) | 83 |
| Enrolled, *n* (%) | 24 (48.98) | 14 (28.57) | 5 (10.20) | 3 (6.12) | 2 (4.08) | 1 (2.04) | 49 |
| Completed, *n* (%) | 22 (47.83) | 13 (28.26) | 5 (1087) | 3 (6.52) | 2 (4.35) | 1 (2.17) | 46 |

*Note:* $^{+}$Sum <100% because 2 inquiries (2.41%) were from unidentified states.

### *3.2.5 Final study sample*

Table 3-2 presents subject demographic variables and experience levels for the final study sample, by training condition. All subjects were women who held a Master's degree in speech-language pathology. The majority of the study sample consisted of subjects with either 0-2 years or more than 11 years of work experience (40.0% and 28.9% of the total sample, respectively). Demographic variables and experience levels for subjects, which were collected through administration of the pre-training survey, are defined and described in detail in Section 4 (Data Collection and Description of Measures). The distribution of these variables across subjects by condition was assessed through *F*-tests for continuous variables (number of children with physical disabilities on the clinician's current caseload and scores on the *Evidence-Based Practice Attitudes Scale* and the *Comfort with Online Learning Scale*) and chi-square ($\chi^2$) tests for categorical variables (all other variables, listed in the Table 3-2 below).

There were no significant differences in any of these baseline variables across subjects, by training conditions.

Table 3-2: Subject demographics.

| | Training condition | | | | | |
|---|---|---|---|---|---|---|
| | *Identification* | *Reflection* | *Control* | Total | | |
| Variable | (*n*=15) | (*n*=15) | (*n*=15) | (*N*=45) | $\chi^2$ or *F* | *p* |
| Female gender, *n* (%) | 15 (100.0) | 15 (100.0) | 15 (100.0) | 45 (100.0) | ++ | |
| Master's degree, *n* (%) | 15 (100.0) | 15 (100.0) | 15 (100.0) | 45 (100.0) | ++ | |
| Age, *n (%)* | | | | | 5.77 | 0.67 |
| 18-24 | 0 (0.0) | 0 (0.0) | 1 (6.7) | 1 (2.2) | | |
| 25-34 | 5 (33.3) | 8 (53.3) | 7 (46.7) | 20 (44.4) | | |
| 35-44 | 4 (26.7) | 4 (26.7) | 2 (13.3) | 10 (22.2) | | |
| 45-55 | 3 (20.0) | 2 (13.3) | 4 (26.7) | 9 (20.0) | | |
| 55-64 | 3 (20.0) | 1 (6.7) | 1 (6.7) | 5 (11.1) | | |
| Ethnicity | | | | | 6.78 | 0.56 |
| White or Caucasian | 11 (73.3) | 14 (93.3) | 12 (80.0) | 37 (82.2) | | |
| Hispanic or Latino | 0 (0.0) | 0 (0.0) | 1 (6.7) | 1 (2.2) | | |
| Asian/Pacific Islander | 2 (13.3) | 1 (2.2) | 2 (13.3) | 5 (11.1) | | |
| Other | 1 (6.7) | 0 (0.0) | 0 (0.0) | 1 (2.2) | | |
| Multiple | 1 (6.7) | 0 (0.0) | 0 (0.0) | 1 (2.2) | | |
| Certification, *n* (%) | | | | | 0.55 | 0.76 |
| CF-SLP | 1 (6.7) | 2 (13.3) | 1 (6.7) | 4 (8.9) | | |
| CCC-SLP | 14 (93.3) | 13 (86.7) | 14 (93.3) | 41 (91.1) | | |
| Work status, *n* (%) | | | | | 5.23 | 0.48 |
| Part-time | 4 (26.7) | 4 (26.7) | 2 (13.3) | 10 (22.2) | | |
| Full-time | 11 (73.3) | 9 (60.0) | 13 (86.7) | 33 (74.4) | | |
| Contractor | 0 (0.0) | 1 (6.7) | 0 (0.0) | 1 (2.2) | | |
| Other$^+$ | 0 (0.0) | 1 (6.7) | 0 (0.0) | 1 (2.2) | | |
| Current caseload, *M* (SD) | 5.5 (9.60) | 4.6 (3.54) | 5.5 (4.12) | 5.2 (6.24) | 0.10 | 0.91 |
| Years experience, *n* (%) | | | | | 0.67 | 0.99 |
| 0-2 | 5 (33.3) | 6 (40.0) | 7 (46.7) | 18 (40.0) | | |
| 3-5 | 4 (26.7) | 4 (26.7) | 3 (27.3) | 11 (24.4) | | |
| 6-10 | 1 (6.7) | 1 (6.7) | 1 (6.7) | 3 (6.7) | | |
| 11+ | 5 (33.3) | 4 (26.7) | 4 (26.7) | 13 (28.9) | | |
| Other certifications, *n* (%) | | | | | 9.64 | 0.14 |
| None | 8 (53.3) | 4 (26.7) | 6 (40.0) | 18 (40.0) | | |
| One | 5 (33.3) | 4 (26.7) | 7 (46.7) | 16 (35.6) | | |
| Two | 2 (13.3) | 2 (13.3) | 0 (0.0) | 4 (8.9) | | |
| More than two | 0 (0.0) | 5 (33.3) | 2 (13.3) | 7 (15.6) | | |
| Work location, *n* (%) | | | | | 11.27 | 0.08 |
| Urban | 6 (40.0) | 8 (53.3) | 5 (33.3) | 19 (42.2) | | |
| Suburban | 6 (40.0) | 6 (40.0) | 2 (13.3) | 14 (31.1) | | |
| Rural | 3 (20.0) | 0 (0.0) | 5 (33.3) | 8 (17.8) | | |
| More than one | 0 (0.0) | 1 (6.7) | 3 (20.0) | 4 (8.9) | | |
| EBPAS score, *M* (SD) | 3.4 (0.35) | 3.5 (0.30) | 3.6 (0.37) | 3.5 (0.34) | 1.43 | 0.25 |
| COLS score, *M* (SD) | 3.0 (0.62) | 3.3 (0.45) | 3.1 (0.54) | 3.1 (0.54) | 1.10 | 0.34 |

Notes:(++)=Statistic not available because variable is a constant; CCC-SLP=Certificate of Clinical Competence in Speech-Language Pathology; CF-SLP=Clinical Fellow in Speech-Language Pathology; $^+$Other=one subject worked full-time and as a contractor; Urban=population>50,000; Suburban=population 10,000-50,000; Rural=population<10,000; Current caseload=Number of children on clinician's current caseload who have physical disabilities; EBPAS=*Evidence Based Practice Attitude Scale*; COLS=*Comfort with Online Learning Scale*.

Following training completion, subjects responded to questions about *when* they completed the training. Of the 45 subjects, 32 (71%) completed the training during non-working hours, 11 (24%) during working hours, and 2 (4%) at another specified time (e.g., while taking sick leave). Of the 43 subjects who responded to questions about *where* they completed the training, 29 (67%) reported completing the training at home, 12 (28%) at work, and 2 (5%) elsewhere (e.g., while traveling).

## 3.3 Technology

Two online software applications were used for study procedures and data collection: Catalyst Web Tools ® and Canvas Learning Management Software ©.

### *3.3.1 Catalyst Web Tools ®*

The Catalyst Web Tools are a set of web-based applications that support teaching, learning, and research activities for students, staff, faculty, and researchers at the University of Washington ("Using the Catalyst Web Tools for Research Activities," 2013). Catalyst WebQ, one of the tools from this set of web-based applications, was used to create the pre- and post-training surveys, described below. Once logged into Catalyst WebQ, subjects were randomly assigned a unique and confidential eight-digit Catalyst code for each survey. Only the lead investigator and research assistants had access to the link between each subject's login name and her confidential Catalyst code. The lead investigator received an automated email notification from Catalyst WebQ each time a new subject completed either the pre-training or post-training survey.

### *3.3.2 Canvas Learning Management System ©*

Canvas Learning Management System by Instructure ©, the official online learning management system application of the University of Washington was used to develop and deliver the online training ("Canvas Learning Management System," 2015). Subjects were required to log into the Canvas training site using a unique login name.

### *3.3.3 Subject access to training*

Each subject was required to establish a unique login name to access the Catalsyst WebQ surveys and the Canvas training site. Subjects were able to login through use of either: a) a GoogleID (i.e., Gmail address) if the subject had one and chose to use it for this study, or b) a University of Washington NetworkID (UW NetID). Of the 46 subjects who completed the study, 25 (54.3%) elected to use their own Google ID and 21 (45.7%) chose to establish a UW NetID.

### *3.3.4 Use of video*

Video clips of young children with physical disabilities demonstrating prelinguistic communication behaviors (preintentional and intentional) were used throughout the training. All videos used in this training were taken from a larger bank of videos collected as part of previous research conducted by the University of Washington Child Language Research Laboratory. Institutional Review Board (IRB) application #30063 documents approval for videotaping and video usage, including: keeping the videos indefinitely after study completion and using portions of the videos for educational purposes (IRB Title, "Treatment for Triadic Gaze," Lead Investigator: Lesley Olswang). Only videos from families who gave permission to use videotape segments of their children for demonstration purposes were used in the present study. Further, the names of the children and their caregivers were not disclosed in the videos. Video clips were de-identified, beyond that which could be ascertained by visual recognition alone. All videos included children aged 10 – 24 months, who presented with varying degree of physical disability secondary to a variety of etiologies (e.g., cerebral palsy, Down syndrome). Children were shown during structured play interactions with a research SLP. Each video included the research SLP offering a communication opportunity to the child, by presenting two toys and asking, "*Which one do you want?*" The videos showed the children producing gaze, gesture and/or vocal behaviors that ranged from preintentional to intentional, in response to the clinician's question. For videos used in the posttest skill assessment (described in Section 4.3, below) each video ended before the onscreen clinician named the specific behavior produced by the child.

### 3.4 Training Procedures

All subjects participated in a self-guided, online training, comprised of three core modules. Figure 3-3 outlines the content of the core training modules. The training was designed to be completed within two hours, including the core training modules (pictured below) and the pre- and post-training assessments (not pictured below). All subjects received the same *instruction*, *demonstration*, and *feedback*. Subjects engaged in different *practice* activities depending upon the condition to which they were assigned.

**Training**

**Module 1: Instruction**
- Watch PowerPoint presentation describing key content and core concepts

**Module 2: Demonstration**
- Review video exemplars of behaviors along communication continuum

**Module 3: Practice + Feedback**
- All subjects: watch case study video
- Within case study, practice identifying child behaviors, under one of the following three practice conditions:

| Condition 1: *Identification* | Condition 2: *Reflection* | Condition 3: *Control* |
|---|---|---|

- All subjects: receive feedback

Figure 3-3: Training modules.

Subjects received access to the training site via URL sent by email, and were asked to login and complete the training within one week of receiving the email. Thirty-seven of the 45 subjects (82%) logged in and completed the training on the same day they were given access to the training site. An additional four subjects (8.9%) logged in and completed the training within one day of receiving access. The remaining four subjects took five or more days to login and complete the training (*range* 5-13 days).

Once logged into the training site, subjects were required to move through the training modules sequentially. Modules were locked, such that subjects could not access a later occurring module without first completing the preceding module(s). Subjects were asked to complete all modules plus the pre-and post training assessments in one sitting, taking breaks *between* modules as needed. Thirty-two of the 45 subjects (70%) finished in one sitting, nine subjects (20%) in two sittings, and four subjects (9%) in more than two sittings. Thirteen of the 45 subjects (29%) took no breaks during the training, while 19 (42%) took one break, 6 (13%) took two breaks, and one (2%) took more than two breaks. Six subjects (13%) did not report the number of breaks taken.

The training opened with a *Welcome* page, which thanked subjects for their time and participation in the research, and displayed the following information: a description of the training objectives, an outline of the content to be covered in the training, a reminder about total participation time, a brief description of the Canvas platform, and instructions for whom to contact should the subject encounter any technical difficulties during the training. During the training, only two subjects (4%) required technical assistance.

### *3.4.1 Training module 1: Instruction*

Module 1 was designed to provide all subjects with instruction on key content and core concepts relevant to the key ingredient (*recognizing and recording child* behaviors) of the two evidence-based protocols (CCS and DA for TG). All subjects viewed a 21-minute, pre-recorded PowerPoint presentation created by the lead investigator. The content and organization of the PowerPoint presentation resulted from presentations delivered by members of the University of Washington Child Language Research Laboratory at numerous peer-reviewed conferences over the previous decade. The PowerPoint presentation was designed to: 1) review prelinguistic communication development, 2) describe characteristics of young children with physical disabilities, and 3) introduce a continuum of early communication behaviors that included gaze, gestures and vocalizations, based on work by Brady and colleagues (Brady et al., 2012). Each of these sections is described in detail, below.

In the first section of the PowerPoint presentation, prelinguistic communication was reviewed, focusing specifically on behaviors produced during the transition from the perlocutionary (preintentional) to the illocutionary (intentional) phases of communication development (16 slides). Subjects were introduced to key terms and provided with references from the extant literature. Video clips were provided to demonstrate specific behaviors (gaze, gestures, and vocalizations) that children with typical development produce during the perlocutionary and illocutionary phases.

In the second section, characteristics of young children with physical disabilities were described, with particular emphasis on children who do not yet use clear signals of intentional communication (10 sides). The complex and heterogeneous profiles of development across sensory, motor, vision/hearing, and physical health domains, which characterize this clinical population, were reviewed. A short video clip (45 seconds) of one young child with cerebral palsy, engaged in a communicative interaction with his speech-language pathologist, was presented. The video was used to highlight the impact of physical disability on: overall development, play, and production of clear signals of intentional communication in this clinical population.

In the final section, the continuum of communication behaviors described earlier in this document was introduced (see Figure 2-4). The continuum emphasized gaze, ranging from simple to more complex gaze shifts, produced in isolation, or with accompanying gestures and/or vocalizations (10 slides). Three broad categories of gaze behavior (single focus, dual focus, and triadic focus), and three discreet behaviors within each category (gaze alone, gaze + gesture OR vocalization, gaze + gesture AND vocalization) were described, for a total of nine communication behaviors targeted.

Subjects were instructed that this continuum was meant to reflect a range of prelinguistic behaviors of increasing complexity, which a child may produce as he/she moves toward more clearly intentional communication. Simple schematic images were presented to illustrate the differences among single, dual, and triadic gaze productions. Appendix B provides operational definitions and schematic representations of the child behaviors from the communication continuum.

### *3.4.2 Training module 2: Demonstration*

Module 2 provided all subjects video exemplars and operational definitions for each of the behaviors outlined in Figure 2-4. Subjects were permitted to spend as much time as they felt necessary to review these operational definitions and watch the corresponding video exemplars. A total of nine video exemplars were available for review, one video for each of the behaviors along the communication continuum. Each of the nine videos were selected from the pool of videos collected as part of prior research conducted by the University of Washington Child Language Research Laboratory, as described previously. The videos were previously coded for child behaviors using the communication continuum, by two independent coders. Only videos for which 100% agreement was documented were used as exemplars. In addition, one additional expert coder reviewed the nine videos and further verified the child behavior for each video exemplar. Videos from seven different children were used to represent these nine communication behaviors (video from one child was used three times to represent three different behaviors, one behavior from each of the broad categories - single focus, dual focus, triadic focus).

### *3.4.3 Training module 3: Practice + Feedback*

Module 3 was designed to give subjects the opportunity to *practice* recognizing and recording the communication behaviors, and receive feedback on their performance. The *practice* component of this module presented a video case study of one expert EI SLP (a member of the UW Child Language Lab research team) conducting an intervention session with a young child with cerebral palsy. The case study intervention session was divided into three two-minute segments. *All* subjects viewed *each* video segment, and then engaged in a different form of practice at recognizing and recording the child's communication behavior, depending upon the condition to which they were assigned. Figure 3-4 displays a schematic of Training Module 3.

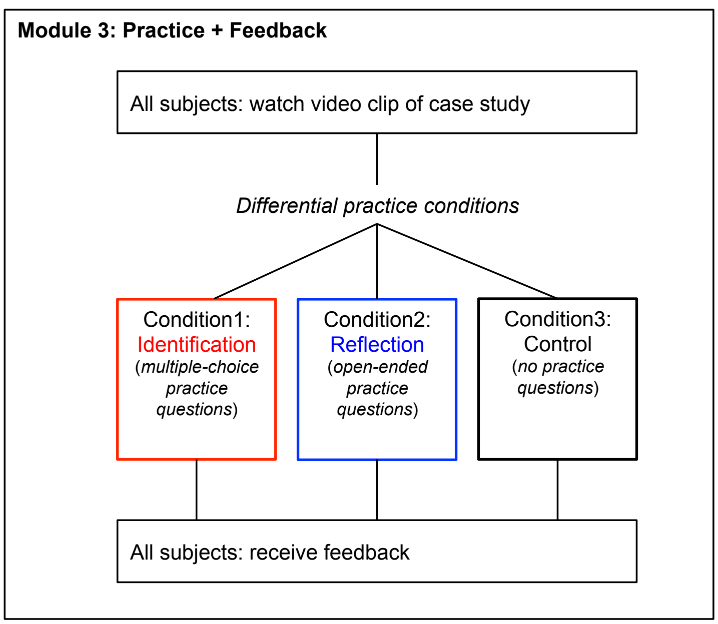


Figure 3-4: Practice conditions

### *3.4.3.1 Training Condition 1: Identification*

Subjects assigned to the *identification* condition viewed each case study video, and were then asked to identify the child's behaviors from the communication continuum, presented in multiple-choice format. The identification condition engaged subjects in direct practice of the targeted skill (*recognize and record child behaviors*). This condition mimicked the format of the posttest skill assessment (described in section 4.3, below), and was thus used to investigate if simply providing clinicians with practice of the exact behavior to be assessed would be sufficient for skill attainment. Figure 3-5 shows a screenshot example of the *identification* practice condition[4].

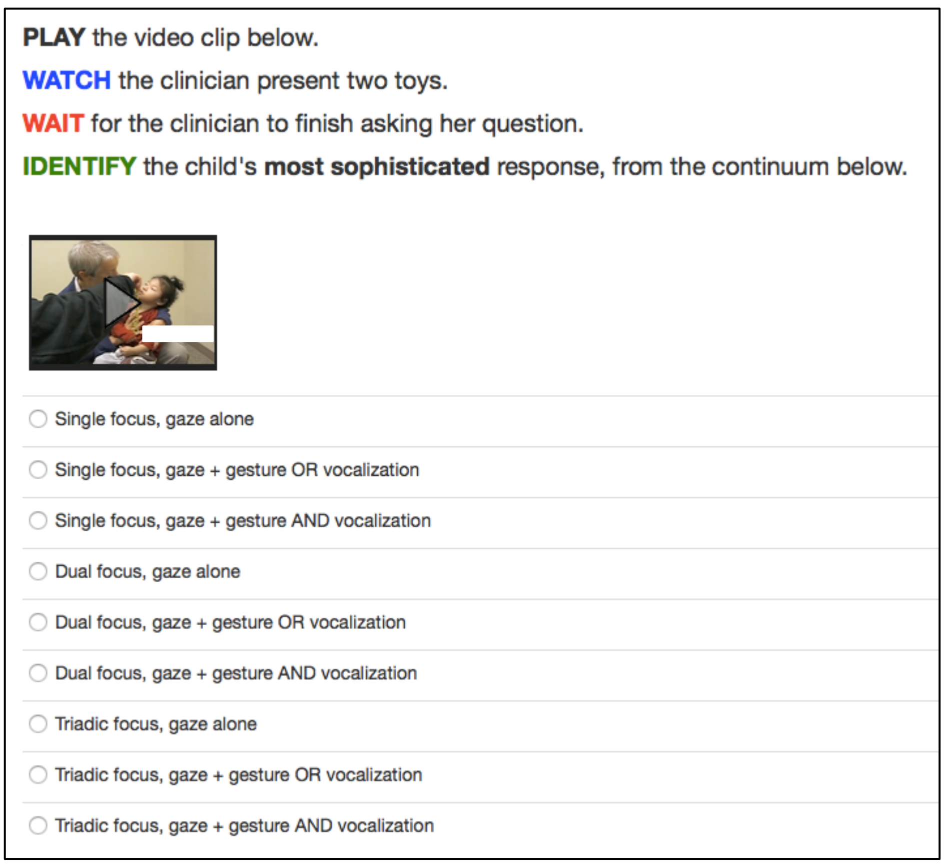


Figure 3-5: Identification condition, screenshot.

[4] Note that in this and subsequent images, the child's eyes are concealed to protect his/her privacy, but were not in the online training modules.

Recall, it was hypothesized that the identification condition would be more effective but less efficient than the no practice condition (*control*), and less effective but more efficient than the alternate practice condition (*reflection*).

*3.4.3.2 Training Condition 2: Reflection*

Subjects assigned to the *reflection* condition viewed the same case study videos, but were then asked to respond to a series of open-ended reflection prompts. Each prompt targeted a specific component of reflective practice. For example, subjects were first asked to identify the communication behavior(s) that the child produced. This prompt engaged subjects in *practicing* the key ingredient of the protocols targeted in the training (*recognize and record child behaviors*). Subjects were next asked to describe what was challenging about identifying this child's communication behaviors**.** This prompt engaged subjects in *articulating* key concepts targeted by the training, namely, reflecting on characteristics of children with physical disabilities and the challenges they face in producing clear and consistent signals of intentional communication. Finally, subjects were asked to discuss what they might do similarly or differently, to encourage the child's communication. This prompt engaged subjects in *hypothesizing* about a course of action that is based on comparing the expert SLP's actions to their own experiences as an EI SLP working with similar children. Figure 3-6 shows a screenshot example of the *reflection* practice condition.

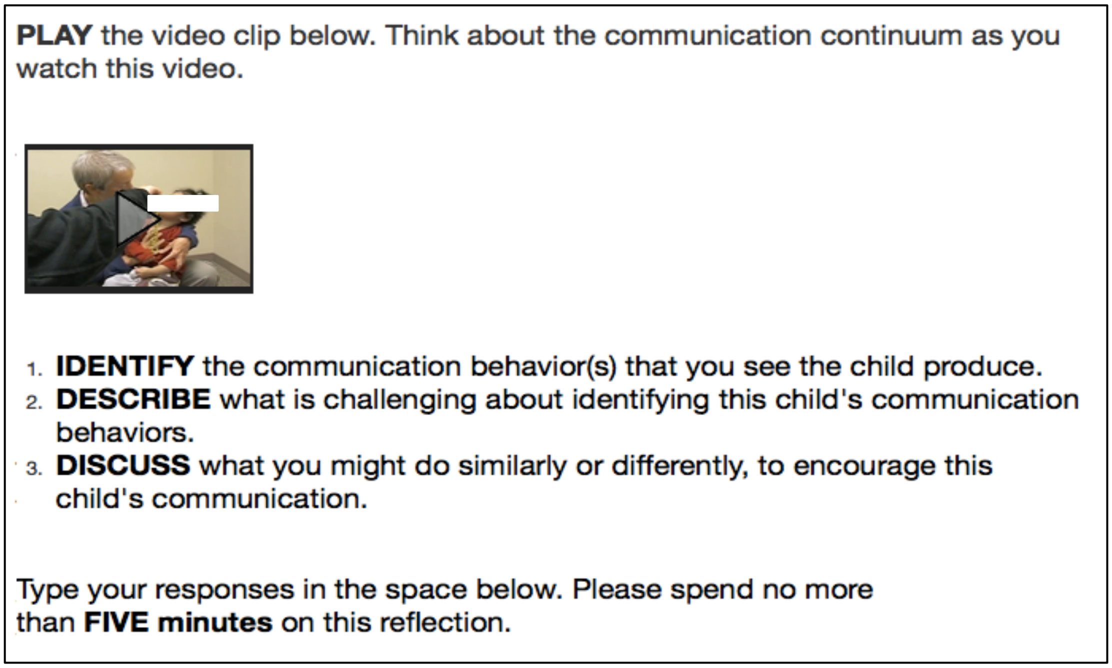


Figure 3-6: Reflection condition, screenshot.

Recall that the open-ended reflection prompts were designed to push the subject to connect new knowledge with past experience, and synthesize the two, thus potentially creating a more robust learning experience than identification alone. It was hypothesized that the reflection condition would be more effective but less efficient than either the no practice (control) condition or the alternate practice (identification) condition.

#### *3.4.3.3 Training Condition 3: Control*

Subjects assigned to the *control* condition viewed the same case study videos, but were presented with no practice questions. Instead, subjects passively observed the case study videos and moved directly on to receive feedback (described below). Recall, it was hypothesized that the control condition would be the least effective, but perhaps most efficient condition.

*3.4.3.4 Feedback*

After each of the three case study video segments, all subjects, regardless of assigned condition, received the same feedback about the behaviors produced by the child within that segment. Figure 3-7 displays screenshots of feedback provided during one case study video segment. Feedback was multimodal, and included a replay of the communication exchange between the expert SLP and the child, with text overlaid onto the video that labeled the important events within the communication exchange. The following events were identified: presentation of toys, presentation of the communication opportunity, and each behavior the child produced during the short exchange. At the end of the video replay, a question appeared on the screen, "*Child's most sophisticated communication behavior?*" followed by a five-second pause, and then a still image of the child's most sophisticated behavior, with written text overlaid on the image that labeled that behavior.

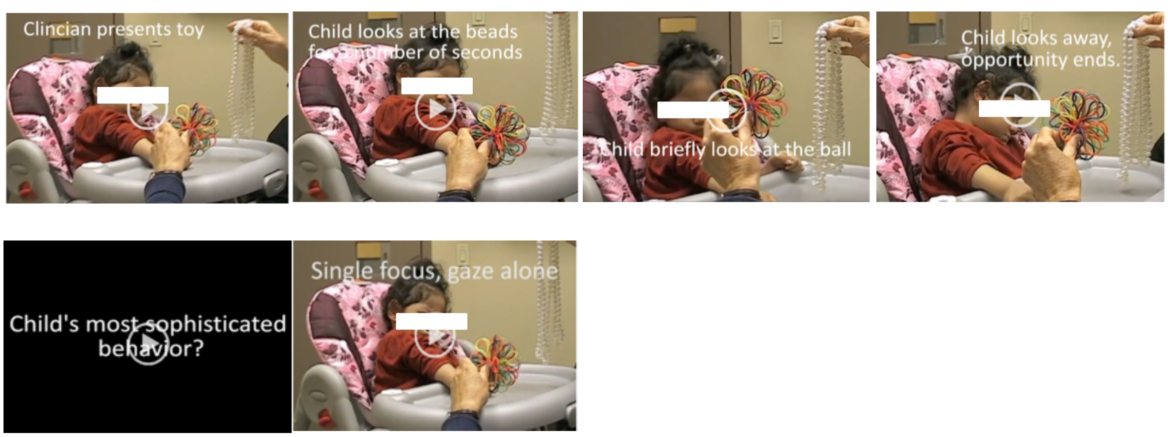


Figure 3-7: Feedback, screenshot.

# 4 Data Collection & Description of Measures

Data were collected at the following time points: 1) pre-training survey, 2) pretest, 3) posttest, 4) training modules, and 5) post-training survey. A schematic overview of the data collection time points and the measures used at each point is outlined in Figure 4-1, below.

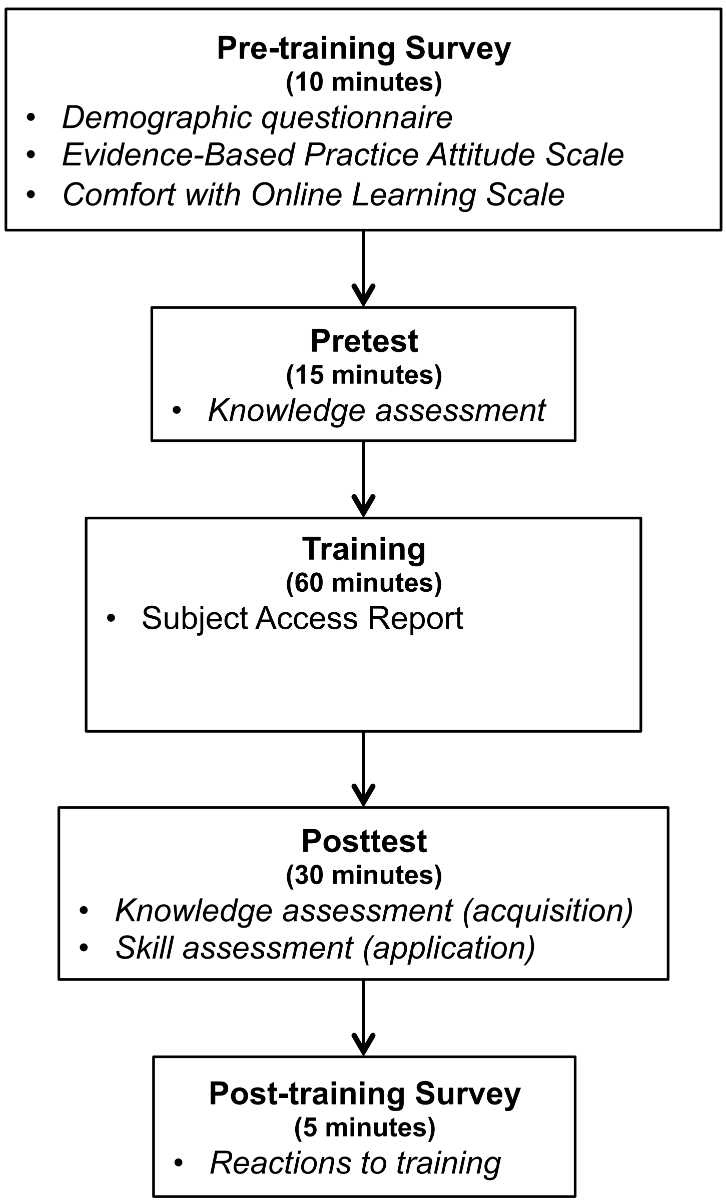


Figure 4-1: Data collection and measures.

### 4.1 Pre-training survey

The pre-training survey was designed to collect baseline information about subjects, which was then used to characterize the study sample and to assist with matching subjects across training conditions on specific variables of interest (listed below). The survey consisted of: a demographic questionnaire; the *Evidence Based Practice Attitude Scale* (EBPAS) (Aarons, 2004; Aarons et al., 2010; Aarons, Cafri, Lugo, & Sawitzky, 2012); and a *Comfort with Online Learning Scale* (COLS). See Appendix C for a copy of the pre-training survey.

The first section of the pre-training survey included 10 items designed to gather basic demographic information about each subject. Items included questions that asked about each subject's: age, gender, race/ethnicity, educational background and special certifications (if any), number of years clinical work experience, number of children with physical disabilities on his/her current cased, anticipated number of children with physical disabilities on his/her caseload in six months from the time of survey completion, and the geographical characteristics of the subject's work location (urban, suburban, rural, other – defined by population parameters provided to the subject).

The second section of the pre-training survey asked subjects to complete the EBPAS. The EBPAS is a 15-item scale that targets provider attitudes about the adoption of new treatments, interventions, and practices. Subjects were presented with a series of statements and were asked to indicate the extent to which she agreed with each statement, using a 5-point Likert scale (0 = Not at all, 1= To a slight extent, 2 =To a moderate extent, 3=To a great extent, 4=To a very great extent). The EBPAS items cluster across four dimensions of attitudes toward the adoption of EPBs:  *appeal* of evidence-based practices (4 items), likelihood of adopting an evidence-based practice given *requirements* to do so (3 items), *openness* to new practices (4 items), and perceived *divergence* of usual practice with research-based or academically developed interventions (4 items).

The third section of the pre-training survey included five items, and was designed to gather information about each subject's comfort with technology for purposes of online learning. Subjects were presented with a series of statements and were asked to indicate the extent to which they agreed with each statement, using the same 5-point Likert scale described above. Statements on this section of the pre-training survey were adapted from a commonly used readiness for online learning questionnaire ("The Pennsylvania State's Online Learning Readiness Questionnaire," 2015).

Subject responses were recorded automatically via Catalyst WebQ. The lead investigator received an email notification each time a subject completed the pre-training survey. Within 24 hours of receiving this notification, the lead investigator accessed the survey data, and randomized the subject to a training condition, matching across training conditions for number of years work experience, attitudes about EBPs (EBPAS score), and comfort with online learning (COLS score).

### 4.2 Knowledge assessment

The knowledge assessment was designed to capture each subject's conceptual understanding of communication development from the perlocutionary to illocutionary phases, both for typical development broadly and for young children with physical disabilities specifically. The knowledge assessment consisted of 20-items, and was administered at pretest and posttest. Items targeted three content areas: a) early communication development (7 items), b) characteristics of children with physical disabilities (7 items), and c) early communication behaviors from the continuum described previously (6 items). Items consisted of open-ended (e.g., short answer) and closed-ended (e.g., true/false, multiple choice) questions. The knowledge assessment included a balanced number of total items per content area, and number of item types per content area. Items were piloted on a group of eight graduate students from the Department of Speech and Hearing Sciences. Students demonstrated a mean score of 51.4% correct (*range*: 38.9–72.2%, *SD*=10.6%) on the pilot test. Only one item was changed significantly from pilot to final assessment protocol.

For each administration of the knowledge assessment (pretest and posttest), items were presented in random order and, for multiple-choice questions response options were also presented in random order. Subjects were required to progress through the knowledge assessment one item at a time, and were not permitted to go back and change an answer to any previously completed items. Subject responses were scored as correct or incorrect by Canvas and a total score was calculated. Subjects were not provided with feedback about their responses to individual items while taking the test. A final score was displayed upon completing the knowledge assessment.

### 4.3 Skill assessment

The skill assessment was designed to capture each subject's ability to apply the knowledge learned in the training to a test situation. This assessment was administered at posttest only, and thus served as a measure of near transfer or immediate generalization. Each of the nine behaviors from the communication continuum was represented in three different videos, for a total of 27 videos (9 behaviors x 3 different video exemplars = 27 total items). Videos from 11 different children were used. Video from a single child was used no more than four times in the skill assessment (*M*=2.5, *range*=1-4). Each video was approximately 15 – 30 seconds in duration.

Each of the 27 videos was selected from a pool of videos collected as part of prior research conducted by the University of Washington Child Language Research Laboratory, as described previously. These videos were previously coded for child behaviors using the communication continuum, by two independent coders. Only videos for which 100% agreement was documented were used as stimuli for the skill assessment in this study. Further, each of the 27 videos was again reviewed by the two expert coders, plus a third individual who had scored CCS and DA videos in previous research. Only videos on which two of three coders agreed on the child behaviors were used in the skill assessment. These codes served as the gold standard against which the subject responses were compared.

Subjects were asked to complete the skill assessment in a quiet location, using headphones if available. Subjects were permitted to watch each video more than once, but were instructed to complete the assessment in on sitting taking no more than 30 – 40 minutes to complete all 27 videos. Videos were presented in random order. For each video, subjects were asked to *recognize and record* the child's most sophisticated behavior, by selecting that behavior from a multiple-choice list representing the communication continuum taught previously. Subjects were reminded that a child's most sophisticated response could occur at any moment in the video clip (beginning, middle, or end). Subjects were not permitted to go back and change a response to any item as the assessment progressed. Subject responses were scored automatically by Canvas as correct or incorrect, and a total score was calculated. Again, subjects were not provided with feedback on their responses to individual videos, but a final score was displayed upon completing the skill assessment.

### 4.4 Post-training survey

The post-training survey was designed to capture each subject's self-rated perceptions about the training, and was completed immediately following the skill assessment. Subjects were provided access to the post-training survey via a URL link at the conclusion of the training. Catalyst WebQ recorded subject responses to the post-training survey and the lead investigator received an email notification each time a subject completed the survey. The post-training survey consisted of total of 27 items presented in two sections.

The first section of the post-training survey included 20 items designed to capture subjects' reactions to the training. This survey was designed to serve as a preliminary examination of subjects' overall perceptions about the training. The psychometric properties of the survey were not investigated as part of the current study procedures. Instead, survey items were adopted from two measures used in previous research: the *Workshop Evaluation Form* (WEVAL) described by Bartholomew, Joe, Rowan-Szal, & Simpson (2007) and the *Satisfaction* survey described by Kyzer and colleagues (2014). Survey items were grouped conceptually into the following subscales, defined previously: *usability* (3 items), *practicality* (2 items), *content acceptability* (5 items), *self-efficacy* (4 items), *mental effort* (2 items), and *overall satisfaction* (4 items) with the training experience. Subjects were asked to rate how strongly they agreed with each statement, using a 5-point Likert type rating scale (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree).

The second section of the survey included four questions designed to capture additional details about the manner in which each subject completed the training (e.g., time, location, number of breaks taken) and three open-ended questions, which asked about motivation for participating in the training, and requested feedback regarding the most and least helpful components of the training. A copy of the post-training survey is included in Appendix D.

### 4.5 Subject access reports

Subject Access Reports, generated automatically by the Canvas, were used to measure each subject's activity on the training site. These reports documented the following activity for each subject: a) month, day, year, and time of day that each subject accessed each training module, and b) number of times each subject viewed the content of an individual training module. Table 4-1 below summarizes the measures used for data collection at different study time points.

Table 4-1: Data collection.

| Study Time Point | Measure Used | Data Collection Tool |
|---|---|---|
| Pre-training | *Demographic questionnaire* | Catalyst WebQ |
| | *Evidence Based Practice Attitude Scale* | |
| | *Comfort with Online Learning Scale* | |
| Pretest | *Knowledge assessment* | Canvas |
| Training Modules 1-3 | *Training time* | Subject Access Reports |
| Posttest | *Knowledge assessment* | Canvas |
| | *Skill assessment* | |
| Post-training | *Reactions survey* | Catalyst WebQ |

## 5 Data Reduction & Analysis

The approach to data reduction and analysis is summarized in Table 5-1, and described for each research question separately, below.

Table 5-1: Data reduction and analysis.

| | Research Question | Dependent Variable | Data Reduction | Data Analysis |
|---|---|---|---|---|
| **Effectiveness** | 1a. Knowledge | Performance on the *Knowledge Assessment* | • Mean number of items correct | 2 (time) x 3 (condition) Repeated Measures ANOVA |
| | 1b. Skill | Performance on the *Skill Assessment* | • Mean percent correct, calculated for *absolute* and *category* agreement | Two, separately run, one-way ANOVAs |
| **Efficiency** | 2. Time | Time taken to complete training | • Mean number of minutes spent on all three training modules<br>• Mean number of minutes spent per individual module | One-way ANOVA |
| **Appeal** | 3. Appeal | Ratings on the Post-Training survey | • Total appeal score (mean ratings across all survey items, by condition)<br>• Mean ratings for items grouped into subscales, by condition | • Kruskall-Wallis H test<br>• Visual inspection of subscale ratings, by condition |
| | | Subjects' responses to open-ended survey questions | • Number of subjects who identified a specific training component as either *contributing to* or *detracting from* learning, divided by total responses to the survey question | • Descriptive comparison of training components identified by subjects as useful/not useful |

## 5.1 Research Question 1 – Effectiveness

### *5.1.1 Knowledge*

Subject responses to each item on the knowledge assessment were scored as "1" for correct or "0" for incorrect, yielding a total possible score of 20 (range 0-20). Data were reduced as number correct for each time point (pretest, posttest). A 2 (time) x 3 (condition) repeated measures analysis of variance (ANOVA) was conducted to determine if scores were significantly different at pretest versus posttest, or if there was a significant time x condition interaction.

### *5.1.2 Skill*

For each video on the skill assessment, subjects were asked to identify the most sophisticated communication behavior produced by the child. Subject responses to each video were scored in two ways: *absolute agreement* and *category agreement*. For *absolute agreement*, each video was scored "1" if the subject's response agreed with expert coders on the *exact* behavior produced by the child, or "0" if the subject's response disagreed with expert coders on the *exact* behavior produced by the child. Percent correct was calculated as # agreements/total items (27/27=100%).

For *category agreement*, each item was scored "1" if the subject's response agreed with expert coders on the *category* of behavior produced by the child (single focus, dual focus, triadic focus), or "0" if the subject's response disagreed with expert coders on the *category* of behavior produced by the child. Again, percent correct was calculated as # agreements/total items (27/27=100%).

Two separate one-way ANOVAs using Fisher's *F*-test were conducted to determine if any of the scores (percent correct) obtained for any of the three groups was statistically significantly different from any of the other groups, on measures of either *absolute agreement* or *category agreement*.

## 5.2 Research Question 2 – Efficiency

Subject access reports were generated by Canvas, and provided a log of each subject's activity on the training site. This log documented the *most recent* time (month, day, year, and time of day in hours::minutes) each subject accessed a training module. Time spent on each module was calculated by subtracting the time at which the subject began a module from the time at which the subject completed that same module, in number of minutes. For each subject, *total training time* was calculated as the sum of the number of minutes spent on the three core training modules (instruction + demonstration + practice and feedback). Note that time spent on the pre-/post-training surveys, pre-posttest knowledge assessments, and the posttest skill assessment was not included in this calculation. Time spent on these assessments was excluded in effort to isolate the amount of time each subject spent engaged in the core training modules alone.

Two post-baccalaureate students from the Department of Speech and Hearing Sciences reduced these data. The lead investigator conducted a reliability check on 20% of the sample (3 subjects randomly selected per condition for a total of 9 subjects). The lead examiner reviewed the subject access report for each of these nine subjects, and re-calculated the time each subject spent on each of the three training modules. Thus, a total of 27 data points were examined (9 subjects x 3 modules per subject = 27 data points). The lead investigator's calculations agreed with the students' calculations for 93% of the data examined (25/27 data points). For the two disagreements, the lead investigator's calculations were within one – two minutes of the students' calculations. Errors in calculations were corrected prior to analysis.

As described above, the subject access reports documented only the *most recent* activity on the training site. Thus, if a subject accessed a module on more than one day, any activity that occurred *prior to* the most recent date listed on the report was not available for review. The access reports for these subjects could not be considered a reliable report of activity on the training site, and were therefore excluded from analysis. Section 6.2 (Results for Research Question 2) describes data that was excluded from analysis for this reason.

A one-way ANOVA using Fisher's *F*-test was conducted to determine if the total time taken to complete all three core training modules obtained for any of the three groups was statistically significantly different from any of the other groups. Follow-up comparison tests using Tukey's HSD were conducted to determine where the differences, if any, existed.

### 5.3 Research Question 3 – Appeal

The post-training survey consisted of 20 items. Subjects' ratings for each item were collected by Catalyst. A *total appeal score* for each subject was calculated as the mean of ratings to all items on the survey. For the two survey items related to *mental effort* (described below), reverse scoring was used to calculate the *total appeal score*. A Kruskall-Wallis H-test was used to examine if the *total scores* on the post-training survey were statistically significantly different for any of the groups. The Kruskal-Wallis H test is a rank-based, non-parametric analysis appropriate for use with ordinal level data (as is generated from Likert-scale ratings), and is considered a nonparametric alternative to the one-way ANOVA. This test first ranks *all* subjects' ratings, from the highest survey rating to the lowest survey rating. The test then calculates a mean rank for each *condition*, which is based on this overall ranking of *all* subjects' survey rating scores. Thus, the mean ranks reflect each subject's rating's relative position, in comparison to other subjects' ratings.

Because the psychometric properties of this survey were not examined as part of the present study (e.g., factor loadings of items onto the proposed subscales, Chronbach's alpha calculations, etc.), items on the survey were grouped conceptually into subscales, based on use of these items in prior research (Bartholomew et al., 2007; Kyzar et al., 2014). Six subscales were proposed, as defined previously: *usability* (3 items), *practicality* (2 items), *content acceptability* (5 items), *self-efficacy* (4 items), *mental effort* (2 items), and *overall satisfaction* (4 items). Scores for each subscale were calculated as the mean of the items related to that subscale. Descriptive statistics were used to examine subjects' ratings on the proposed subscales, by condition.

Finally, at the end of the post-training survey, subjects were asked to write about: which aspects of the training *contributed most* to their learning, and which aspects of the training *detracted least* from their learning. Subjects' written responses were reviewed and words that described specific components of the training (*instruction, demonstration, practice, feedback*) were identified. Across all subjects, the number of times a specific training component was cited in response to either question was counted. The percent of subjects who identified a specific training component as either *contributing to* or *detracting from* their learning was calculated. For example, if *Instruction* was cited by five subjects as contributing most to learning, and all 45 subjects responded to the survey question, *Instruction* was reported as being identified by 20% (5/45) of the study sample.

# 6 Results

The section that follows outlines the results for each of the research questions separately, which were designed to assess training *effectiveness* (knowledge, skill), *efficiency* (time to complete training modules), and *appeal* (perceptions of training).

## 6.1 Research Question 1 – Effectiveness

Training effectiveness was assessed by evaluating subject performance on: a) the *knowledge* assessment, administered at pre-and posttest, and b) the *skill* assessment, administered at posttest. Results are reported for each analysis, below.

### *6.1.1 Knowledge*

A 2 (time – *pretest/posttest*) x 3 (condition – *identification, reflection, control*) repeated measures ANOVA was conducted to evaluate subjects' performance on the pre-/posttest *knowledge* assessment. Results indicated a statistically significant effect for time [$F_{(1)}$=280.46, $p$<.001, $\eta^2$=.87], with a large effect size. This indicates that on average, subjects scored significantly higher on the knowledge assessment at posttest ($M$=16.62, $SD$=1.45) than at pretest ($M$=10.71, $SD$=1.94). In contrast, there was no statistically significant interaction of time x condition [$F_{(2)}$= 0.19, $p$=.84]. Table 6-1 displays the results of this analysis and Figure 6-1 displays the mean scores (± 1 SEM) on knowledge assessment, at pretest and at posttest, by condition.

Table 6-1: Repeated Measures (2x3) ANOVA results for *knowledge*

| *Source* | *Sum of Squares* | *df* | *Mean Square* | *F* | *p-value* | $\eta^2$ |
|---|---|---|---|---|---|---|
| *Between subjects* | | | | | | |
| Condition | 1.27 | 2 | 0.63 | 0.19 | 0.83 | 0.01 |
| *Within subjects* | | | | | | |
| Time | 786.18 | 1 | 786.18 | 280.46 | 0.00 | 0.87 |
| Time x condition | 1.1 | 2 | 0.54 | 0.19 | 0.82 | 0.01 |

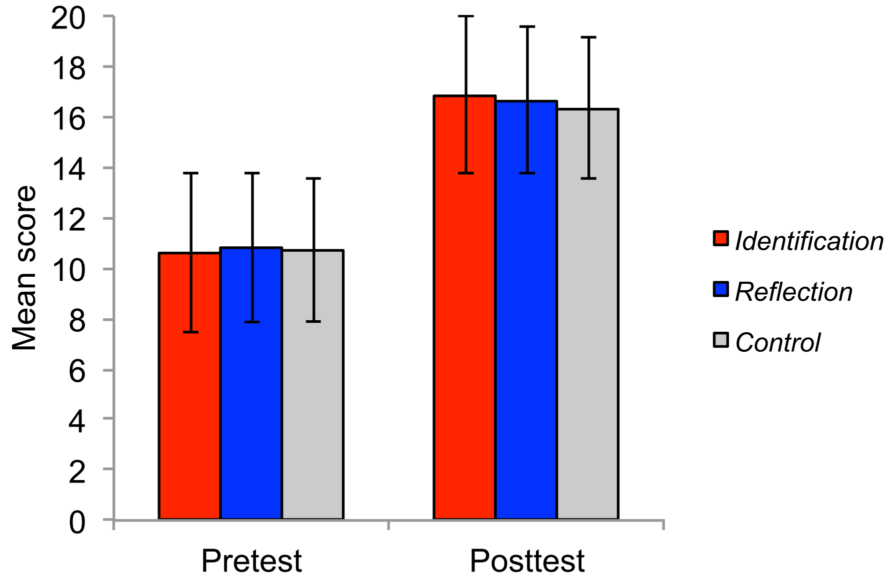


Figure 6-1: Mean scores (± 1 SEM) on knowledge assessment, at pretest and at posttest, by condition.

### *6.1.2 Skill*

Two scores were calculated to assess subject performance on the skill assessment. First, *absolute* agreement was calculated as the percent agreement between subjects' and experts' coding of *exact* child behaviors. Second, *category* agreement was calculated as the percent agreement between subjects' and experts' coding based on the *category* of the identified child behavior (single focus, dual focus, triadic focus). Two separately run, one-way ANOVAs were conducted to determine if there were any statistically significant differences on subject performance on the skill assessment among the training conditions for either *absolute* or *category* agreement. Results indicate no statistically significant effect of condition on percent correct on the skill assessment, for either *absolute* agreement [$F_{(2)}$= 0.11, $p$=0.90] or *category* agreement, [$F_{(2)}$= 0.72, $p$=0.50]. Table 6-2 A & Table 6-2 B display the results of this analysis. Figure 6-2 displays the mean percent correct (± 1 SEM) for *absolute* and *category* agreement on the skill assessment, by condition.

Table 6-2: A. One-way ANOVA results for mean percent correct for *absolute* agreement on the skill assessment. B. One-way ANOVA results for mean percent correct for *category* agreement on the skill assessment.

**A. Absolute agreement**

| *Source of Variance* | *df* | *Sum of Squares* | *Mean Square* | *F* | *p-value* |
|---|---|---|---|---|---|
| *Between groups* | | | | | |
| Practice condition | 2 | 0.00 | 0 | 0.11 | 0.90 |
| *Within groups* | | | | | |
| Error | 42 | 0.52 | | | |
| Total | 44 | 0.52 | | | |

**B. Category agreement**

| *Source of Variance* | *df* | *Sum of Squares* | *Mean Square* | *F* | *p-value* |
|---|---|---|---|---|---|
| *Between groups* | | | | | |
| Practice condition | 2 | 0.01 | 0.01 | 0.72 | 0.50 |
| *Within groups* | | | | | |
| Error | 42 | 0.01 | | | |
| Total | 44 | 0.36 | | | |

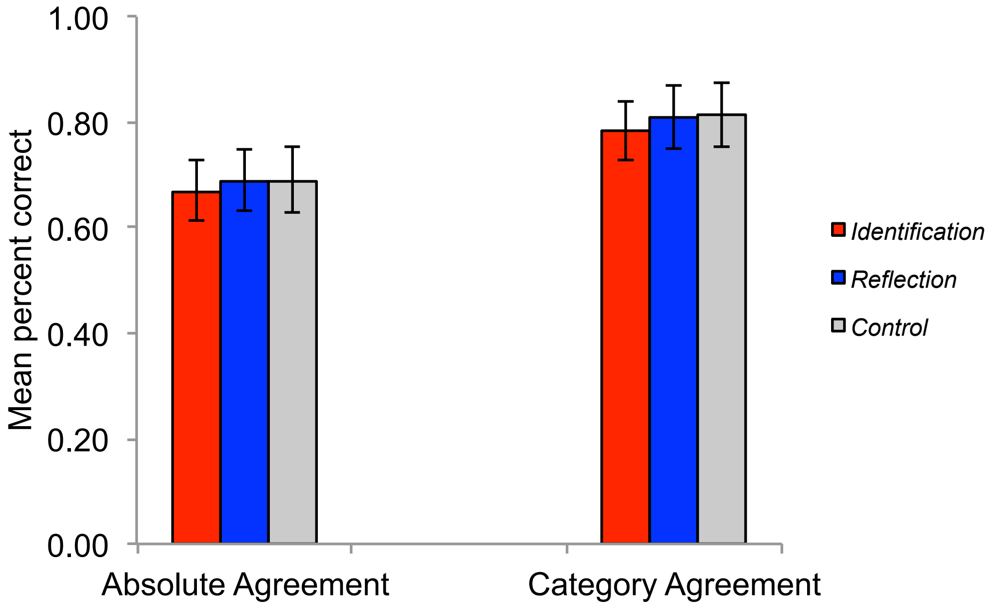


Figure 6-2: Mean percent correct (± 1 SEM) for *absolute* and *category* agreement on the skill assessment, by condition.

*6.1.2.1 Post-hoc follow-ups*

Two post-hoc follow-up assessments were conducted. First, we examined if there was a statistically significant difference in percent correct on the skill assessment when scores were calculated as *absolute* versus *category agreement.* Then, we examined the relationship between subjects' scores on the posttest knowledge assessment and their scores on the posttest skill assessment. Results for each analysis are reported below.

As described in the review of the literature, past training to teach clinicians to *recognize and record child behaviors* has documented that clinicians' scores were typically higher when *category* agreement was calculated versus *absolute* agreement (Brady et al., 2012). Therefore, a post-hoc analysis was conducted on these data to determine if percent correct was significantly higher when calculated as *category* agreement versus *absolute* agreement for subjects as a whole, regardless of condition. A follow-up, paired samples *t*-test indicated a statistically significant difference in percent correct on the skill assessment when scores were calculated as *category* agreement (*M*=0.80, *SD*=0.09) versus *absolute* (*M*=0.68, *SD*=0.11) agreement [$t_{44)}$=14.37, *p*<0.01,*d*=2.14], with a large effect size (Cohen, 2009). Across all subjects, scores on the posttest skill assessment were, on average, 12% higher (*SD*= 5.6%) when calculated as *category* agreement versus *absolute* agreement.

Finally, we were interested in documenting if knowledge skill at posttest was correlated with performance on the sill assessment (for either absolute or category agreement). We hypothesized that subjects with higher scores on the posttest knowledge assessment would preform better on the skill assessment. A Pearson product-moment correlation revealed no statistically significant relationship between posttest knowledge score (*M*=16.6, *SD*=1.45) and performance on the posttest skill assessment using *absolute* agreement (*r*=-0.05, *p*=0.72) or *category* agreement data (*r*=0.10, *p*=0.50). Table 6-3 displays the descriptive statistics and Pearson product-moment correlation coefficients for these variables.

Table 6-3: Descriptive statistics and Pearson product-moment correlation coefficients for posttest knowledge assessment scores and posttest skill assessment scores

| | | | Correlations | | |
|---|---|---|---|---|---|
| | *N* | *M* (SD) | 1 | 2 | 3 |
| 1. Knowledge assessment, posttest score | 45 | 16.6 (1.45) | 1 | | |
| 2. Skill assessment, absolute agreement | 45 | 0.68 (0.11) | -0.05 | 1 | |
| 3. Skill assessment, category agreement | 45 | 0.80 (0.09) | 0.10 | 0.86** | 1 |

*Note:* (**)=correlation is significant at the *p*<0.01 level.

### 6.2 Research Question 2 – Efficiency

Training efficiency was evaluated by examining the mean number of minutes taken to complete all three core training modules, by condition. Two subjects, one from the *identification* condition and one from the *control* condition, spent almost three times as many minutes on Module 1 than mean for all other subjects in the study combined (118 minutes and 92 minutes, respectively). These two subjects were therefore considered extreme outliers and excluded from data analysis[5]. Three remaining subjects, one from each condition, spend significantly less time on training Modules 2 and 3 than mean for all other subjects in the study combined (0 or 1 minute per module, for each subject). These three subjects were also considered extreme outliers and therefore excluded from data analysis[6]. As a result, data for the remaining 40 subjects, on whom complete and reliable data were available, were included in this analysis.

A one-way ANOVA was conducted to determine if there was a statistically significant difference in the mean number of minutes spent on the core training modules, by condition. Results indicated a statistically significant effect of condition on mean number of minutes taken to complete the training modules, [$F_{(2)}$= 6.31, $p$<.01]. Post-hoc analysis using Tukey's HSD indicated that subjects in the *control* group required significantly less time (19.64 fewer minutes, on average) to complete the training modules ($M$=52.08, $SD$=13.42) than subjects in the *reflection* group ($M$=71.71,

[5] Based on review of the Subject Access Reports, it is likely that these two subjects viewed the 21-mintue PowerPoint presentation in Module 1 and then left their respective browser windows open for an extended length of time, without logging out, resulting in the number of minutes spent on module 1 far exceeding the mean for all other subjects.

[6] Based on review of the Subject Access Reports, it is likely that these three subjects completed Modules 2 & 3, and then returned to those modules very briefly on a separate day. Because the Subject Access Reports record time for *most recent* activity only, the number of minutes spent on Modules 2 & 3 for these subjects is therefore considered an inaccurate representation of time spent on these modules.

*SD*=14.62). This difference was statistically significant ($p$<0.01). Table 6-4 displays the results of this analysis. Figure 6-3 below displays the data for mean number of total minutes (± 1 SEM) taken to complete the training modules (± 1 SEM), by condition.

Table 6-4: One-way ANOVA results for time to complete training

| *Source of Variance* | *df* | *Sum of Squares* | *Mean Square* | *F* | *p-value* |
|---|---|---|---|---|---|
| *Between groups* | | | | | |
| Condition | 2 | 2601.69 | 1300.84 | 6.31 | 0.00 ** |
| *Within groups* | | | | | |
| Error | 37 | 7628.09 | 296.17 | | |
| Total | 39 | 10229.78 | | | |

** $p$ < .001

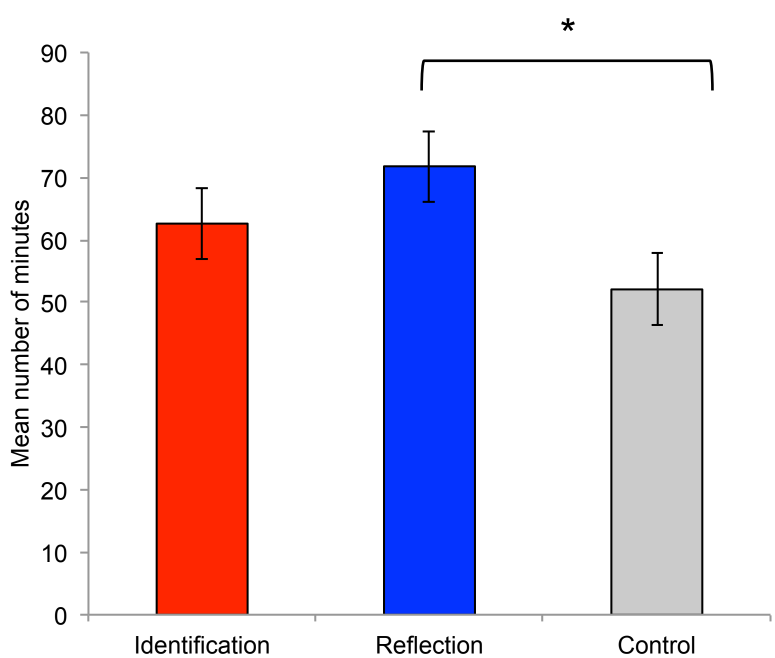


Figure 6-3: Mean number of total minutes (± 1 SEM) taken to complete training modules, by condition; (*)=$p$<0.01.

*6.2.1.1 Post-hoc follow-up*

A post-hoc follow-up analysis was conducted to determine if, across all subjects, there was a relationship between number of minutes spent on training and performance on the posttest skill assessment. The hypothesis was that, regardless of condition, subjects who spent more time on the training modules would also perform better on the posttest skill assessment. A Pearson product-moment correlation was used to examine the relationship between number of minutes spent on the core training modules and posttest performance on the skill assessment. Results indicated no statistically significant correlation between total time spent on the core training modules ($M$=62.4, $SD$=16.2) and performance on the posttest skill assessment using *absolute* agreement ($r$=0.13, $p$=0.43) or for *category* agreement data ($r$=0.18, $p$=0.28). Table 6-5 displays the descriptive statistics and Pearson product-moment correlation coefficients for these variables.

Table 6-5: Descriptive statistics and Pearson product-moment correlation coefficients for time spent on training and posttest skill assessment scores

| | | | Correlations | | |
|---|---|---|---|---|---|
| | *N* | *M* (SD) | 1 | 2 | 3 |
| 1. Training time, number of minutes | 40 | 62.4 (16.2) | 1 | | |
| 2. Skill assessment, absolute agreement | 45 | 0.68 (0.11) | 0.13 | 1 | |
| 3. Skill assessment, category agreement | 45 | 0.80 (0.09) | 0.17 | 0.86** | 1 |

*Note:* (**)=correlation is significant at the $p$<0.01 level.

## 6.3 Research Question 3 – Appeal

Training appeal was evaluated by examining subject responses to a 20-item post-training survey. Three different analyses were conducted. First, a nonparametric analysis was conducted to determine if there were any statistically significant differences among subject ratings by condition, for the *total score* on the post-training survey. Second, visual inspection of the data was conducted to examine if any trends emerged by condition, when survey items were grouped into the six proposed *subscales* described previously. For both analyses, data for three subjects (*n*=2 from the *identification* condition and *n=1* from the *control* condition) were excluded from the analysis due to subjects not responding to one or more items on the survey. Finally, the percent of subjects who identified a specific training component as either *contributing to* or *detracting from* their learning in response to open-ended survey questions was calculated. The results of each of these analyses are reported separately, below.

### *6.3.1 Total appeal score*

A Kruskal-Wallis H test (nonparametric analysis) was conducted to determine if there were statistically significant differences in post-training survey ratings among the different practice conditions for *total appeal score.* Mean ranks for the total appeal score on the post-training survey were highest for subjects in the *control* condition (25.25), followed by subjects in the *reflection* condition (20.73), and lowest for subjects from the *identification* condition (18.35). However, the differences among groups were not statistically significantly different, ($\chi^2_{(2)}$=2.23, $p$=0.33). Figure 6-4 displays the mean ratings (± 1 SEM) for total appeal score on the post-training survey by condition, for ease of interpretation.

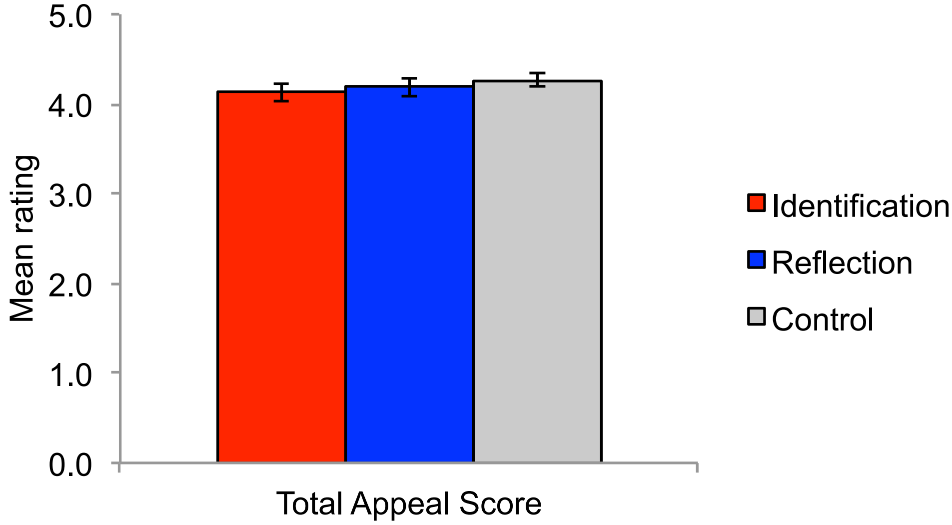

Figure 6-4: Mean ratings (± 1 SEM) for total appeal score on the post-training survey, by condition

### *6.3.2 Subscales*

Subject responses to the post-training survey were plotted for items grouped into proposed subscales, to further examine differences in subject responses by condition. Figure 6-5 displays the mean ratings (±1 SEM) for the post-training survey subscales, by condition. Visual inspection of the data reveals interesting, though not statistically significant, trends. First, no clear differences are observed for subjects' perceptions of *content acceptability*, *satisfaction,* or *self-efficacy* by condition. All subjects reported high ratings on these subscales, regardless of condition. However, trends are observed by condition among subjects' perceptions of training *usability*. On the *usability* subscale, subjects in the *control* and *identification* groups appeared to report slightly higher ratings than subjects in the *reflection* group. Similarly, differences are observed by condition among subjects' perceptions of training *practicality*. On the *practicality* subscale, subjects in the *control* condition appeared to report slighter higher ratings than subjects in either the *identification* or *reflection* conditions. Finally, the opposite trend is observed in subjects' ratings of items related to *mental effort*. Note that for this subscale, lower mean scores indicate better ratings. For items grouped into the *mental effort* subscale, subjects in the r*eflection* condition appeared to report lower ratings, suggesting less effort required to complete the training, than subjects in either the *identification* or *control* conditions.

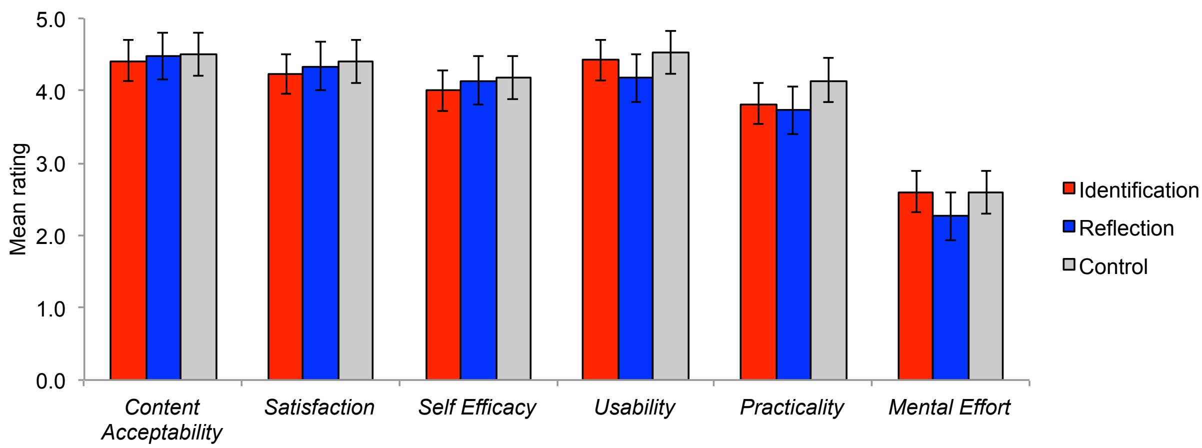


Figure 6-5: Mean ratings (±1 SEM) for post-training survey subscales, by condition. Lower mean scores for *Mental Effort* indicate better ratings.

### *6.3.3 Open-ended questions*

In response to the two final open-ended post-training survey questions, 20 of the 45 subjects (44%) named *demonstration* and 19 (42%) identified *feedback* as *contributing most* to their learning. Only 12 (27%) of subjects cited the PowerPoint *instruction* as significantly contributing to their learning[7]. Of the 30 subjects allocated to either the *identification* or *reflection* conditions, 11 (37%) cited *practice* as contributing most to their learning. Of the 45 subject responses to the question about which aspects *detracting from* to their learning, 16 (36%) reported "nothing." Six subjects (13%) named

[7] The sum of percentages is greater than 100 because some subjects identified more than one component of the training as either *contributing to* or *detracting from* their overall learning.

*instruction* and 5 (11%) cited *demonstration* as contributing least to their learning. Four subjects (9%) noted a desire for more *feedback*, either during the practice videos or as a request to make feedback part of the final posttest skill assessment. Overall, subjects' comments appear to reflect that a majority found *demonstration* and *feedback* as contributing most to their learning. Far fewer subjects found *instruction* or *practice* useful, and some identified *instruction* and *demonstration* as actually detracting from their learning.

# 7 Discussion

## 7.1 Introduction

The aim of this study was to investigate the *effectiveness*, *efficiency*, and *appeal* of three different practice techniques embedded within an online, self-guided training for early intervention speech-language pathologists (EI SLPs). The training targeted a single key ingredient of two evidence-based protocols, *recognizing and recording child behaviors*, which is required for accurate and competent delivery of both the *Communication Complexity Scale* and the *Dynamic Assessment for Triadic Gaze*. Recognizing and recording child behaviors is an especially important clinical skill for assessment and treatment of prelinguistic communication that targets gaze production as one clear signal of intentional communication for many young children with physical disabilities. Forty-five EI SLPs participated in this research, with an equal number of subjects randomly allocated to three practice conditions. Practice conditions were designed to examine the differential impact of different training technique on: clinicians' learning (effectiveness), time to complete training (efficiency), and perceptions of the training experience (appeal). The following sections discuss the results for each research question, separately. An integrated discussion of the results is presented in Section 7.5 (Summary and Interpretation).

## 7.2 Research Question 1 – Effectiveness

The first research question addressed training effectiveness, by examining subject performance on a knowledge acquisition assessment and a skill application assessment. Each is discussed, in turn.

### *7.2.1 Knowledge*

Results from the knowledge assessment document several interesting findings. First, across all conditions, subject scores on the knowledge assessment were low at pretest. At pretest, subjects answered only approximately half of the knowledge assessment items correctly, on average. These results support observations made in the extant literature, which argue that clinicians receive little pre-service training on communication development for early intervention in general (Francois et al., 2014) and even less for low-incidence populations in particular (Chen et al., 2009). Second, results from this study document that all subjects made statistically significant gains from pretest to posttest in their knowledge regarding the key content targeted in this training, including review of: prelinguistic communication development, characteristics of young children with physical disabilities, and specific prelinguistic communication behaviors (gaze, gestures and vocalizations). This finding suggests that the instruction provided to the subjects during this training was effective at teaching the core concepts that provide the foundation for the two prtocols. While statistically significant differences in knowledge scores from pre- to posttest by condition were not observed, this finding was expected. All subjects received the same *Instruction* on the core concepts in training Module 1 (Power Point presentation) and had access to the same *Demonstration* of child behaviors in training Module 2 (video exemplars and operational definitions for each behavior). Taken together, results from the knowledge assessment suggest that following a relatively short review of instructional material and when provided with video demonstration of behavioral exemplars, a group of EI SLPs who were experienced in working with this clinical population were able to demonstrate statistically significant gains in knowledge acquisition, thus providing evidence for the effectiveness of the online training.

### *7.2.2 Skill*

The second research question further examined training *effectiveness* by investigating the relative impact of three different training techniques on subjects' abilities to *apply* their knowledge to a test situation, as a measure of near transfer. Skill was measured as percent correct between subjects' responses and expert coders for *absolute* agreement on exact child behaviors and *category* agreement for groupings of child behaviors (single focus, dual focus, triadic focus). Results from the skill assessment document several interesting findings.

First, across all three conditions, subjects' performance was relatively low when percent correct was calculated as *absolute* agreement, but significantly higher when percent correct was calculated as *category* agreement. On average, subjects' achieved less than 70% correct on the posttest skill assessment when subjects' responses were compared to expert coders for agreement on the *exact* behavior produced by the child. When scoring criteria were broadened to consider the *category* of behavior produced by the child, subjects' scores increased significantly, to an average of 80% agreement between subjects' responses and expert coders. The greater degree of agreement observed for *category* of child behaviors is not surprising. This finding is consistent with previous research, which has documented that coding child behaviors is more reliable and agreement is better achieved when behaviors are examined across broad categories versus by individual, discrete behaviors (Brady et al., 2012). Because this training was designed to highlight the importance of gaze production, with or without accompanying gaze and gestures, as a signal of intentional communication in young children with physical disabilities, the unique contributions of gestures and vocalizations may have been under-emphasized. As a result, agreement between subjects' responses and expert coders' responses for *exact* child behavior, which required precise agreement on presence or absence of gesture and/or vocalizations, may have been more difficult to achieve than agreement for broad *category* of child behavior. Given these results, one obvious question remains: which level of agreement should be emphasized when training EI SLPs to *recognize and record child behaviors* from the communication continuum? The goal of such training is to support clinicians in better recognizing and recording a child's current level of performance for planning treatment. Thus, an argument could be made that clinicians need to be aware of *all* potentially communicative behaviors. Yet accurately identifying all behaviors during assessment is clearly challenging. Balancing the need for observing detail with the reality of recognizing and recording that detail during assessment is a real practice challenge, and one that clearly needs further exploration, particularly in the context of clinician training.

A second important finding documented no statistically significant effect of practice condition on the skill assessment for percent correct, measured either as *absolute* or *category* agreement. These results indicate that all subjects reached a commensurate degree of accuracy in *recognizing and recording* child behaviors, regardless of training condition or how agreement was calculated (*absolute* or *category* agreement). This finding was surprising; we hypothesized that subjects assigned to the reflection condition would perform significantly better in *recognizing and recording child* *behaviors* on the skill application assessment at posttest. This hypothesis was based on the extant literature that supports the use of reflection in consolidating clinician skill (Brookfield, 1998; Di Stefano et al., 2015; Mann, Gordon, & MacLeod, 2009). The lack of significant differences found at posttest among subjects assigned to different practice conditions may be attributed to a number of factors. First, it is possible that the key ingredient of the two protocols targeted by this training, *recognizing and recording child behaviors*, is sufficiently straightforward, such that for experienced EI SLPs, direct practice of the targeted key ingredient is not necessary. Instead, simply receiving in instruction about the key concepts and viewing video exemplars that demonstrate the discrete behaviors may be sufficient. Alternatively, it is possible that the training techniques, although designed to maximally differentiate one practice condition from the next, were not in fact mutually exclusive. Therefore, allocation to different practice conditions did not result in differential effects on subjects' posttest performance on the skill assessment.

Finally, the manner in which the feedback was delivered during the training, which all subjects received regardless of practice condition, may alone have been sufficient to support skill application on the posttest skill assessment. Recall, the feedback included: presentation of a short clip extracted from the case study video, followed by the question, "*Child's most sophisticated behavior?*" and a five-second pause. During the pause, subjects were able to think about and generate a response to the question, before the correct answer was displayed on the video clip. This sequence, including the prolonged pause, may have provided sufficient time for all clinicians, regardless of assigned condition, to practice their skill in recognizing and recording child behaviors. Additional, deliberate practice, as presented in the *identification* and *reflection* conditions, may not have been necessary. Possibly, practice need not be a separate part of this training, and is worth further investigation.

In summary, subjects in this study made statistically significant gains in knowledge and achieved a high degree of agreement with expert coders on *recognizing and recording child behaviors* when *category* agreement was calculated, regardless of the practice condition to which they were assigned. Given that the training techniques investigated in this study did not have a differential impact on subject performance on either the knowledge or skill assessment, the role of training *efficiency* and *appeal* should be strongly considered, and are discussed in the sections that follow.

### 7.3 Research Question 2 – Efficiency

The second research question addressed training *efficiency* by examining the total time spent completing all three core training modules, by condition. Results indicated that there was a statistically significant effect of condition on total time spent, and follow-up tests documented that subjects assigned to the *control* condition spent significantly less time on the core training modules than subjects assigned to the *reflection* condition. Thus, these results document that the no practice, *control* condition was the most efficient version of this online training. Combined with the results reported previously, which document no significant differences in performance on the posttest skill assessment by condition, these results further suggest that the more efficient, no practice, *control* condition produced results comparable to the more time intensive *identification* or *reflection* conditions.

Subjects in the control condition did not engage in any *practice* activities during Module 3 by design, and therefore were likely to spend less time on Module 3 compared to subjects in either the *identification* or *control* conditions. However, all subjects, regardless of condition, were permitted to spend as much time as they wished reviewing all other components of the training (*instruction, demonstration,* and *feedback*). It was therefore feasible to expect variability in the amount of total time spent on the core training modules across subjects, regardless of condition. Therefore, the relationship between the amount of time spent on all three training modules and performance at posttest was examined in a post-hoc follow-up test, to determine if subjects who spent more time on the training, regardless of condition, demonstrated higher skill in *recognizing and recording child behaviors* on the posttest skill assessment. Results indicated no statistically significant relationship between the amount of time spent on the training and performance at posttest. Spending more time on the training did not correlate with higher scores at posttest, suggesting that the most efficient version of the training may be sufficient to support subjects' learning the key ingredient of the protocols targeted in this training. Given these results, we now turn to a discussion of the subjects' self-rated perceptions of the training experience.

### 7.4 Research Question 3 – Appeal

The third and final research question addressed training *appeal,* by examining subjects' responses to a post-training survey. The post-training survey asked subjects to rate their level of agreement, on a 5-point Liker-type scale, to 20 items grouped conceptually into six subscales (*usability, practicality, content acceptability, self-efficacy*, *mental effort*, and *overall satisfaction)*. This survey also posed two open-ended questions to subjects, asking them to identify which components of the training *contributed most* to their learning and which components *detracted most* from their learning.

Results documented that the *total appeal score* computed for all subjects was high (4.0 or greater), and no statistically significant differences for *total appeal score* on the post-training survey were observed by condition. These results suggest that overall, the EI SLPs who participated in this study perceived the training as easy-to-use, reported that the content covered by the training to be relevant to the children on their clinical caseloads, and were satisfied with the training experience overall.

Visual inspection of subject ratings across the proposed subscales, however, revealed some interesting trends in subject responses by condition. Specifically, differences in subject ratings of *practicality* were observed by condition. Notably, a trend toward subjects in the *control* condition rating the training as more *practical* than subjects either practice condition was observed. Survey items that addressed *practicality* included statements such as: *The length of the training is reasonable* and *Completing the training was feasible within my regular workweek.* Given that subjects in the control condition spent less time on the training overall, and significantly less time on the training than subjects in the *reflection* conditions specifically, the responses to statements about training practicality are not surprising. We would expect subjects who spend less time in the training to find the training length more reasonable, and thus completing the training more feasible.

Finally, responses to the open-ended questions suggested that subjects' found specific components of the training more or less valuable in contributing to their learning. Overall, a majority of subjects identified *demonstration* and *feedback* as contributing most to their learning. While most subjects did not identify any component of the training as detracting from their learning, those that did named *instruction* and *demonstration*. Data that document subjects' perceptions about the appeal of the training, such as those reported here, must be considered in the context of the data that document the relative effectiveness of the training techniques under investigation, and the efficiency in which the training is accomplished.

### 7.5 Summary and Interpretations

The results of this study document that the online, self-guided training was effective both in supporting clinician knowledge acquisition and skill application related to learning one key ingredient of two evidence-based protocols for prelinguistic communication intervention. While the study failed to uncover an effect of training technique on clinician knowledge acquisition or skill application, differences in training efficiency and appeal were observed. Notably, results documented that the most efficient version of this training (no practice, *control* condition) was as effective as the more time intensive versions of the training (practice under *identification* or *reflection* conditions). Further, survey results suggest that subjects in the *control* condition found the training more practical (easier to complete within a regular workweek) than subjects in either the *identification* or *reflection* conditions. Finally, when asked to report on which aspects of the training most contributed most to their learning, the majority of the subjects, regardless of condition, cited *demonstration* and *feedback,* while only a small number named *instruction.* Further, no correlation was found between subject scores on the knowledge assessment and performance on the posttest skill assessment, thus calling into question the value of the *instruction* component in training clinicians to *recognize and record child behaviors*.

Clinician training is a core component of implementation science research, and necessary to support the integration of current research evidence into clinical practice. Online, self-guided training is one strategy for delivering training that can reach a large number of clinicians from a wide range of geographical regions. For such training to have maximum impact however, it must not only be *effective* (evidence-based), but also maximally *efficient* and *appealing* to clinicians who already have a number of demands on their limited time. As highlighted at the onset of this paper, the challenge for researchers is to design trainings that are both effective (internally valid) and feasible in practice (externally valid). Implementation science research highlights the importance of engaging stakeholders in the research process, which includes considering the many variables associated with individuals and practice settings that ultimately influence the success of training. The results of this study highlight the particular importance of *efficiency* and *appeal*, from the perspective of EI SLPs for whom the training was designed. Given these results, design of future trainings should emphasize components that were found to be most *efficient* at achieving the desired results and identified as most *appealing* to practicing clinicians, and minimize components that were not. For example, data from this study suggests that subjects found *demonstration* and *feedback* most useful to their learning, while *instruction* less so. This information, paired with the data that suggest the *practice* conditions did not produce significantly differential effects on clinician learning, provides a direction for how we may design future trainings. For example, an ideal online, self-guided training that targets the specific skill of *recognizing* *and recording child behavior* may require only brief demonstration of the discrete behaviors and minimal or no *instruction* on the core concepts underlying the protocols. Training could then proceed to short video clips that ask the clinician to recognize and record the behavior, followed by immediate feedback on their response. Additional practice, as was provided by the *identification* and *reflection* conditions investigated in this study, may not be required. These ideas are explored further in Section 7.7 (Future Directions).

## 7.6 Limitations

As with all research, several study limitations must be considered; those that have the greatest potential impact on the present findings (subject selection, order effects, challenges inherent to online research, and the experimental conditions) are discussed below.

### *7.6.1 Subject selection*

The study adopted a three-group, pre-posttest experimental design, with 15 subjects allocated to each condition, for a total of 45 subjects who completed the study. Additional subjects per group were desired, and may have improved our ability to detect differences between groups. As part of the inclusionary criteria for this study, all subjects were required to hold current licensure to practice speech-language pathology in his/her work state (either as a CCC-SLP or CF-SLP). Several individuals who inquired about participating in the study, who met all other eligibility criteria, were excluded from participation on the basis of not being a licensed speech-language pathologist. The exclusion of these individuals may represent a *selection bias* in our sampling procedure. This inclusionary criterion was established to ensure that all subjects enrolled in the study had a commensurate background level of education (i.e., holding a license to practice speech-language pathology requires successful completion of a Master's degree from an accredited institution). However, in doing so we may have excluded otherwise experienced clinicians who work with this clinical population in early intervention (e.g., SLP-As). Future training may address this limitation by expanding study inclusionary criteria to include recruitment of individuals from within the discipline in of speech-language pathology and across early intervention disciplines (e.g., special educators, occupational therapists, physical therapists). Additionally, as with most research, the subjects who participated in this study did so on a volunteer basis and therefore may be different from other EI SLPs who chose not to or were unable to participate in the study. For example, this study sample may represent a group of highly motivated EI SLPs, with positive and open attitudes about integrating research evidence into practice, who also had sufficient time to participate in research. Finally, every effort was made to recruit subjects equally from all six states in the Pacific Northwest region. Despite these efforts, the study sample was heavily weighted toward subjects recruited from Washington and Oregon. This uneven distribution of subjects may reflect differences in how early intervention service delivery is structured across states. Future scale-up research could address this limitation by engaging stakeholders earlier in the implementation science research process (exploration & adoption), to better understand the practice demands of different geographical services delivery areas, which ultimately may facilitate or impede EI SLPs' participation in research and in training.

### *7.6.2 Order effects*

Two types of order effects had the potential to impact the results of this study: *practice* effects, or improvement in performance due to repeated exposure or practice with a task and *fatigue* effects, or decline in performance due to subjects becoming tired or bored with a task. In effort to make the training feasible to complete for practicing SLPs, for example the knowledge assessment pre-/posttest were necessarily administered in close temporal sequence. As a result, it is possible that subjects' performance improved at posttest simply as a result of having been exposed to the knowledge assessment items previously, at pretest. Efforts were made to reduce the potential impact of practice effects, including random presentation of items during each administration of the knowledge assessment, as well as random shuffling of response options for multiple-choice items within the assessment.

The skill assessment was administered as a single posttest measure. By design, this assessment served as a measure of near transfer, or immediate generalization, of subjects' abilities to *apply* the knowledge gained during the training to a controlled test situation. Administering a pretest skill assessment would have increased subjects' exposure to the child behaviors being assessed. As a result however, it remains impossible to know if exposure alone, through administration of a pretest followed by posttest, would have been sufficient to train the targeted skill (*recognize and record* child behaviors). Additionally, the skill assessment was the longest in duration and the last administered. Although subjects were permitted to take breaks during the training, as needed, subject fatigue may have impacted performance on the skills assessment.

### *7.6.3 Online research*

Some limitations were related to the nature of conducting online (remote) research, which cannot be avoided. In this training study the variables under experimental control included: the order in which subjects completed the training modules, the number of times subjects were allowed to take the assessments, the order in which items and reposes options were presented within assessments, and the amount and type of feedback provided to subjects during the assessments. However, a number of variables remained beyond the scope of our control, including, for example, *how* subjects interacted with the training site. For example, subjects were asked to take breaks *between* training modules, and to log in and out each time they did so. However, it became clear that this was not the case for at least two subjects based on the site activity as documented by the subject access reports. Similarly, we asked that all subjects access the training on only one browser window at a time, and not keep the training site open on multiple browsers or in multiple windows within the same browser. However, there was no way to document subject compliance with this request. As a result, it is possible, for example, that subjects could keep the training content open in one window while simultaneously proceeding with assessments in another window. Finally, we could not control for time of day during which subjects completed the study (e.g., prior to beginning work, at the end of a long workday, over a weekend) or characteristics of the environment in which subjects completed the study (e.g., quiet versus noisy room). Each of these variables introduces potential subject-to-subject variability with regards to the conditions under which study participation was completed. Despite these challenges, one strength of conducting training research remotely, in an online, self-guided platform, lies in its ability to be executed in the context of real world conditions under which these subjects typically work.

#### *7.6.4 Experimental conditions*

Finally, this study examined two different practice techniques in the context of an on-line, self-guided training. These techniques reflected the literature that had demonstrated the importance of *practice* as an integral component of face-to-face training. The practice conditions (identification and reflection) in this on-line training presented two different ways clinicians could be actively involved with the task of *recognizing and recording child behaviors*. The conditions were designed to simulate the face-to-face training experience. As discussed above, these on-line practice versions may have been less distinct than thought, or perhaps altogether unnecessary. The opportunity to "practice" through the feedback component of the training module may have been sufficient. The degree to which practice needs to be a separate part of training needs further exploration.

## 7.7 Future Directions

#### *7.7.1 The iterative process of implementation science research*

As discussed at the beginning of this document, implementation science research involves stages of activities that contribute an overall, iterative process of inquiry. Results obtained from one stage directly inform activities in other stages. This dissertation study targeted one specific research activity (clinician training), which typically occurs during one of the earliest stages of implementation research (installation). Results from this study could be used to either inform earlier stages of implementation research (e.g., exploration and adoption), or to direct activities that might occur in later stages (e.g., initial implementation). Potential future directions for this line of research are discussed below, in the spirit of keeping with the iterative process inherent to a program of implementation science research.

#### *7.7.1.1 Looking back: exploration and adoption*

The earliest stage of implementation science research targets research activities related to exploration and adoption. Recall that during this stage, researchers and clinicians work together to identify and examine the specific barriers and facilitators to implementation of a given protocol in a specific practice setting. The goal of this stage of research is to make a decision about whether or not the protocol is a good "fit" to proceed with implementation of the protocol. Looking back to explore research activities within this stage of implementation science research may help address some of the limitations that arose in the present study. For example, for states in which we found low responsivity, we might investigate any one of the following questions: Did the recruitment strategy succeed in reaching the target audience, or is a revised approach warranted? Does the training for the protocol address a real practice need for that community? What are the potential barriers (and/or facilitators) to implementation of the protocol? The answers to these questions would provide important data that could guide decision making both about *when* it is appropriate to move forward with clinician training, and *how best* to engage the individuals from a community in participating in this part of the research process.

#### *7.7.1.2 Further investigating the current training protocol*

Finally, results from the current study provide direction for further investigation of the training protocol that was used. As indicated previously, one fundamental question remains: In the context of an online, self-guided training designed to teach one single key ingredient of the protocols, are all training components (*instruction, demonstration, practice, feedback*) necessary? Results of this study call two specific components into question: instruction and practice. With regards to *instruction*, results of this study indicated that scores on the knowledge assessment were not correlated with percent correct on the skill assessment, calling into question the added value of this component in training this skill. Additionally, subjects found the *instruction* least helpful in facilitating learning. With regard to *practice, r*esults from the present study indicate that the *identification* and *reflection* practice conditions did not differentially impact subject performance. Further, subjects in the no practice, *control* condition performed equally as well as subjects assigned to either of the two practice conditions. These results suggest that the practice afforded by the *feedback* alone may be sufficient. A future training study could experimentally manipulate the different training components (e.g., practice vs. no practice, instruction vs. no instruction) included in the protocol, and examine the effects on clinician learning. Such data would inform us about which components are both necessary and sufficient (i.e., the key ingredients), and contribute to the design of a training protocol that is optimally efficient and maximally appealing to practicing clinicians.

# 8 Concluding Remarks

The field of communication sciences and disorders has amassed an impressive amount of evidence to guide intervention for individuals with communication disorders, based upon decades of basic and clinical research (see: “ASHA Practice Portal,” 2015). Our field now faces a new challenge: understanding how to integrate this evidence into clinical practice, making it both useful and feasible for clinicians who wish to improve the lives of the individuals they treat. Dissemination alone is insufficient; researchers must actively engage with clinicians to accomplish this task. Partnering with clinicians to design trainings that are effective, efficient, and appealing will ensure that the best research evidence from our field is adopted into routine clinical practice. Implementation science provides the research methods to evaluate this process, and represents an important, new research direction in our field.

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# 10 Appendices

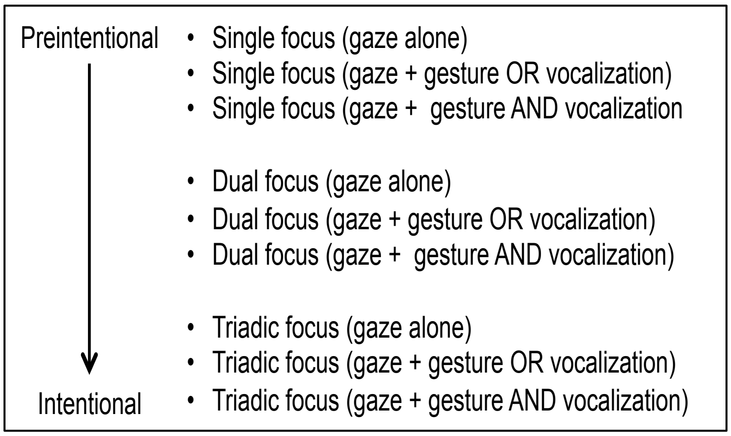
## 10.1 Appendix A: Communication Complexity Scale

| Complexity Scores | | | |
|---|---|---|---|
| | **0** No Response | **Intentional Non-Symbolic** | **6** Triadic orientation (e.g. eye gaze or touch from object to person and back) |
| | **1** Alerting - a change in behavior, or stops doing a behavior | | **7** Dual orientation + 1 PCB (e.g., dual focus + gesture) |
| **Pre-Intentional** | **2** Single orientation only -- on an object, event or person; can be communicated through vision, body orientation, or other means. | | **8** Dual orientation + 1 or more PCB (e.g., dual focus + gesture + vocalization, switch closure) |
| | **3** Single orientation only + 1 other PCB (potentially communicative behavior) | | **9** Triadic orientation + 1 PCB (e.g. triadic + vocalization) |
| | **4** Single orientation only + more than 1 PCB | | **10** Triadic orientation plus 1 or more PCB* (e.g. triadic plus vocalization and differential switch closure) |
| | **5** Dual orientation - shift in focus between a person and an object, between a person and an event using vision, body orientation, etc. or between object and object (with or without PCB) | **Intentional Symbolic** | **11** One-word verbalization, sign or AAC symbol selection |
| | | | **12** Multi-word verbalization, sign or AAC symbol selection |

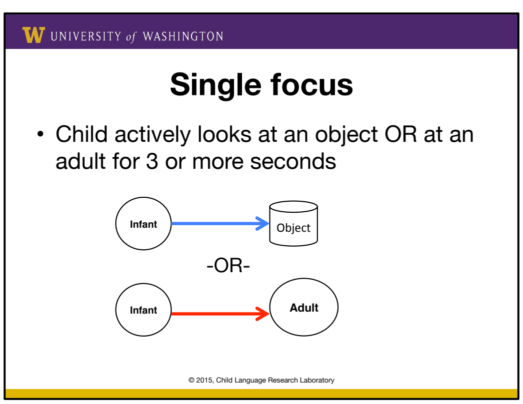
(Brady et al., 2012)

## 10.2 Appendix B: Child Behaviors

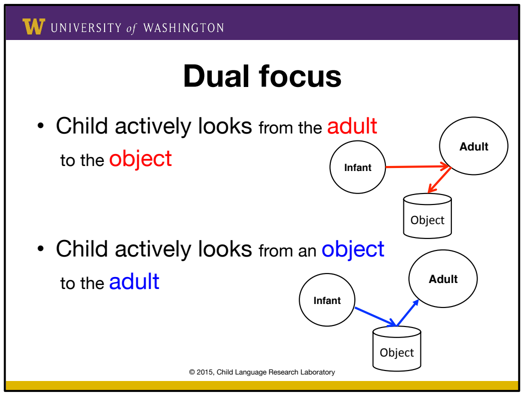
The following operational definitions (and schematics) were provided to all subjects during the PowerPoint presentation, delivered as part of training Module 1 (*instruction*), and reviewed through use of video exemplars in training Module 2 (*demonstration*).



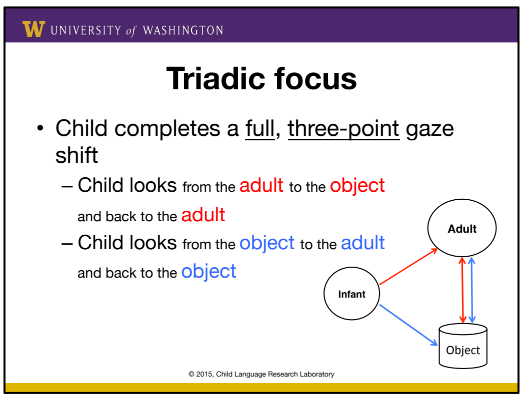

**Communication Continuum:** The communication continuum begins with single focus behaviors, starting with gaze alone, and then gaze in combination with gestures and/or vocalizations. Early gestures may include actions such as leaning and reaching. Early vocalizations may include cooing or crying. Typically dual focus behaviors follow, again often beginning with gaze alone. Gaze productions then become more robust as children expand and add gestures and vocalizations to their gaze shifts. Gestures may expand to now include actions such as leaning, showing, giving, or pointing. Vocalizations may develop to now include different consonant vowel combinations as heard in reduplicated and variegated babbling. Finally, one hallmark of the transition to the illocutionary or intentional phase of communication development includes triadic focus behaviors, again often beginning with triadic gaze alone, and then adding gestures and vocalizations to gaze shifts.




**Single focus:** Single focus occurs when a child actively looks at an object OR at an adult, for approximately 3 or more seconds. There is a sense of *persistence* in the looking. Note that single focus gaze behaviors are very different from "passive" looking around the environment to explore. Here, the child is *actively* focusing on the object OR adult, in an engaged manner. Importantly, when the child has a single focus of attention, she is gazing at either the object or the adult *separately,* and is not yet linking the two in an observable way. The child may add a gesture OR a vocalization to her looking. Later, the child may add BOTH a gesture AND a vocalization to her looking, making this signal even more purposeful.




**Dual focus**: Dual focus occurs when a child actively looks from an adult to an object OR from an object to the adult (CLICK), in a two-point gaze shift. Note that the while the child is now focusing on the object and the adult, she is not yet completing a full, three-point gaze shift. Dual focus is an important accomplishment, as the child is now beginning to shift her gaze from adult to object or object to adult, beginning to link the two, the child may add a gesture OR a vocalization to this two-point gaze shift. Later, the child may add BOTH a gesture AND a vocalization to her looking, making this signal even more purposeful.




**Triadic focus**: Triadic focus occurs when the child completes a full, three-point gaze shift. This can happen in one of two ways: the child may look from an adult, to an object, and then back to the adult OR the child may look from an object, to the adult, and then back to the object. In either case, triadic focus represents and important and exciting development in the child's communication abilities: the child is now beginning to demonstrate the capacity for coordinated joint attention and more clearly intentional communication. A child may add a gesture OR a vocalization to her three-point gaze shift. Later, the child may add BOTH a gesture AND a vocalization to her looking, making this signal even more purposeful.

### 10.4 Appendix C: Pre-Training Survey

**Instructions:** Thank you for taking the time to complete this short survey about your clinical practice! Your participation is entirely voluntary. You can decide to withdraw your consent and stop participating in the research at any time, without any penalty. You may also refuse to answer any item. The survey contains three parts. It should take no longer than 20 minutes to complete.

**Part 1.**The following questions are designed to gather demographic information about you and your current practice. There are 10 items in this section. You may decline to answer any item in this section.

**Question 1.** Age

18-24 years old
25-34 years old
35-44 years old
45-54 years old
55-64 years old
65-74 years old
75 years or older

**Question 2.** Gender **(**Select one)

Female
Male

**Question 3.** Ethnicity (Select any/all that apply)

White or Caucasian
Hispanic or Latino
Black or African American
Native American or American Indian
Asian / Pacific Islander
Other:

**Question 4.** Highest Degree Earned (Select one)

Bachelor of Science (B.S.)
Bachelor of Art (B.A.)
Master of Science (M.S.)
Master of Art (M.A.)
Doctor of Philosophy (Ph.D.)

**Question 5.** Current status of clinical certification:

I am completing my Clinical Fellowship Year (CFY)
I hold a current Certificate of Clinical Competence in Speech-Language Pathology (CCC-SLP)
If completing the CFY, please provide the anticipated date of completion:

**Question 5.** Nature of current position. (Please select all that apply.)

Part-time provider
Full-time provider
Contractor
Other:

**Question 6.** Years experience in current position:

0-2
3-5
6-10
11+

**Question 7.** How many children have physical disabilities on your **current** caseload?

**Question 8.** How many children with physical disabilities do you anticipate will be on your caseload in **six months**?

**Question 9.** How would you describe the geographical region in which you currently provide services? Please select all that apply.

Urban (population >50,000)
Suburban (population 10,000-50,000)
Rural (population <10,000)
Other:

**Question 10.** Do you have any special certifications? (e.g., PROMPT, Hanen, NDT, etc.) Please note any special certifications below.

**Part 2.** The following questions ask about your feelings about using new types of therapy, interventions, or treatments. Your responses are confidential.
*Manualized therapy* refers to any intervention that has specific guidelines and/or components that are outlined in a manual and/or that are to be followed in a structured/predetermined way. There are 15 items in this section. You may decline to answer any item. (Adapted from: Aarons, G. A. (2004). Mental health provider attitudes toward adoption of evidence-based practice: The Evidence-Based Practice Attitude Scale. Mental Health Services Research, 6(2), 61-74.)

**Indicate the extent to which you agree with each item using the following scale:**

0 - Not at All
1 - To a Slight Extent
2 - To a Moderate Extent
3 - To a Great Extent
4 - To a Very Great Extent

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1. I like to use new types of therapy/interventions to help my clients. | O | O | O | O | O |
| 2. I am willing to try new types of therapy/interventions even if I have to follow a treatment manual. | O | O | O | O | O |
| 3. I know better than academic researchers how to care for my clients. | O | O | O | O | O |
| 4. I am willing to use new and different types of therapy/interventions developed by researchers. | O | O | O | O | O |
| 5. Research based treatments/interventions are not clinically useful. | O | O | O | O | O |
| 6. Clinical experience is more important than using manualized therapy/treatment. | O | O | O | O | O |
| 7. I would not use manualized therapy/interventions. | O | O | O | O | O |
| 8. I would try a new therapy/intervention even if it were very different from what I am used to doing. | O | O | O | O | O |

**For questions 9-15:** If you received training in a therapy or intervention that was new to you, how likely would you be to adopt it if:

| | | | | | |
|---|---|---|---|---|---|
| 9. it was intuitively appealing? | O | O | O | O | O |
| 10. it “made sense” to you? | | | | | |
| 11. it was required by your supervisor? | O | O | O | O | O |
| 12. it was required by your agency? | | | | | |
| 13. it was required by your state? | O | O | O | O | O |
| 14. it was being used by colleagues who were happy with it? | O | O | O | O | O |
| 15. you felt you had enough training to use it correctly? | O | O | O | O | O |

**Part 3.** The following questions are designed to gather information about your feelings regarding online learning. There are 5 items in this section. You may decline to answer any item in this section.

**Indicate the extent to which you agree with each item using the following scale:**

0 - Not at All
1 - To a Slight Extent
2 - To a Moderate Extent
3 - To a Great Extent
4 - To a Very Great Extent

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1. I feel confident in my knowledge and skills of how to manage software for online learning. | O | O | O | O | O |
| 2. I feel confident in using the internet (e.g., Google, Yahoo) to find or gather information for online learning. | O | O | O | O | O |
| 3. I am not distracted by other online activities when learning online (e.g., instant messages, Internet surfing) | O | O | O | O | O |
| 4. I can learn from things I hear, like audio recordings or podcasts. | O | O | O | O | O |
| 5. I can learn from things I read, like lecture slides or online text. | O | O | O | O | O |

### 10.5 Appendix D: Post-Training Survey

**Instructions:** Thank you for participating in the training! The following survey is designed to gather information about your training experience. Your participation is voluntary. You may refuse to answer any item. This survey should take 10-15 minutes to complete. Thank you for your time!

Please rate how strongly you agree or disagree with each of the following statements:

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 1. The navigation controls were consistently easy to find and operate. | O | O | O | O | O |
| 2. I was able to view and hear all videos and audios. | O | O | O | O | O |
| 3. I was able to access the training with no difficulty. | O | O | O | O | O |
| 4. The length of the training is reasonable. | O | O | O | O | O |
| 5. Completing the training was feasible within my regular workweek. | O | O | O | O | O |
| 6. The content of the training was relevant to my job. | O | O | O | O | O |
| 7. I found the training content to be interesting. | O | O | O | O | O |
| 8. I will remember the content of the training 6 months from now. | O | O | O | O | O |
| 9. The training has increased my knowledge of early signals of communication. | O | O | O | O | O |
| 10. The information in the training was logically grouped together. | O | O | O | O | O |
| 11. I am confident in my ability to recognize early signals of communication in young children with physical disabilities. | O | O | O | O | O |
| 12. I am confident in applying my new skills. | O | O | O | O | O |
| 13. I believe that if I use the skills I learned, child and family outcomes will be enhanced. | O | O | O | O | O |
| 14. I will use the training as a | O | O | O | O | O |

| | | | | | |
|---|---|---|---|---|---|
| decision-making guide in my everyday practice. | | | | | |
| 15. The training was mentally demanding. | O | O | O | O | O |
| 16. At the end of the training, I was discouraged. | O | O | O | O | O |
| 17. The training was conveyed at the appropriate level. | O | O | O | O | O |
| 18. The training was a valuable learning experience. | O | O | O | O | O |
| 19. The training was relevant to my practice goals and my learning needs. | O | O | O | O | O |
| 20. I would recommend the training to other clinicians. | O | O | O | O | O |

Note: Items 1-3 = *Usability;* Items 4-5=*Practicality*; Items 6-10=*Content Acceptability;* Items 11-14=*Self-efficacy*; Items 15-16=*Mental effort;* Items 17-20=*Satisfaction*.

**When** did you complete the training? (Please select all that apply.)

During work hours
During off-work hours
Other (please specify):

**Where** did you complete this training? (Please select all that apply.)

Home
Work
Car
Other (please specify):

**How** did you complete this training?

In one sitting
In more than one sitting (indicate how many)

Did you take **breaks** during the training?

Yes
No
If "Yes," how often?

**Why** did you choose to participate in this training?

Which aspects of this training **contributed most** to your learning?

Which aspects of this training **detracted most** from your learning?