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The Blended and Online Learning Design Fellows Program: Developing Teacher-Researchers in Communication Sciences and Disorders

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Cover Page Footnote

We extend sincere appreciation to the parents and children who contributed to the video clips as well as to Rhett McDaniel and Danielle Picard who contributed to module development. We also thank Lillian Brown and Allison Walker for their contributions to data entry.

Authors

Laurel Teller, Jena McDaniel, C. Melanie Schuele, and Cynthia J. Brame

Just as speech-language pathologists (SLPs) and audiologists strive to implement evidence-based clinical practices, instructors must seek also to implement evidence-based teaching practices in the pre-professional preparation of SLPs and audiologists (Ginsberg et al., 2012). To develop the evidence base for teaching practices, instructors must seek to advance the scholarship of teaching and learning (SoTL) within Communication Sciences and Disorders (CSD). Research doctoral (i.e., PhD) training programs present an opportunity for graduate students to integrate pedagogical and research training to advance their knowledge of and contributions to evidence-based teaching practices. As PhD students prepare for teaching-research careers, universally they develop pedagogical and research skills. In contrast, it is less common for PhD students to develop SoTL skills (Ellis & Crumrine, 2010). Examples of experiences by which CSD programs can integrate SoTL into the PhD curriculum may help to advance the universality of SoTL training as well as to build the SoTL evidence base. In this article we describe one such experience – the Blended and Online Learning Design (BOLD) Fellows Program at Vanderbilt University, a program that promotes graduate students' development of SoTL skills as they create and evaluate online instructional modules. We aim to encourage CSD PhD programs to develop experiences that prepare teacher-researchers who can engage in SoTL to advance evidence-based teaching practices in CSD. After describing the BOLD Program, we provide a case example of our SoTL project – development and evaluation of an online instructional module for advancing pre-professional students' knowledge and skills related to intentional communication in very young children.

Blended and Online Learning Design (BOLD) Fellows Program at Vanderbilt University

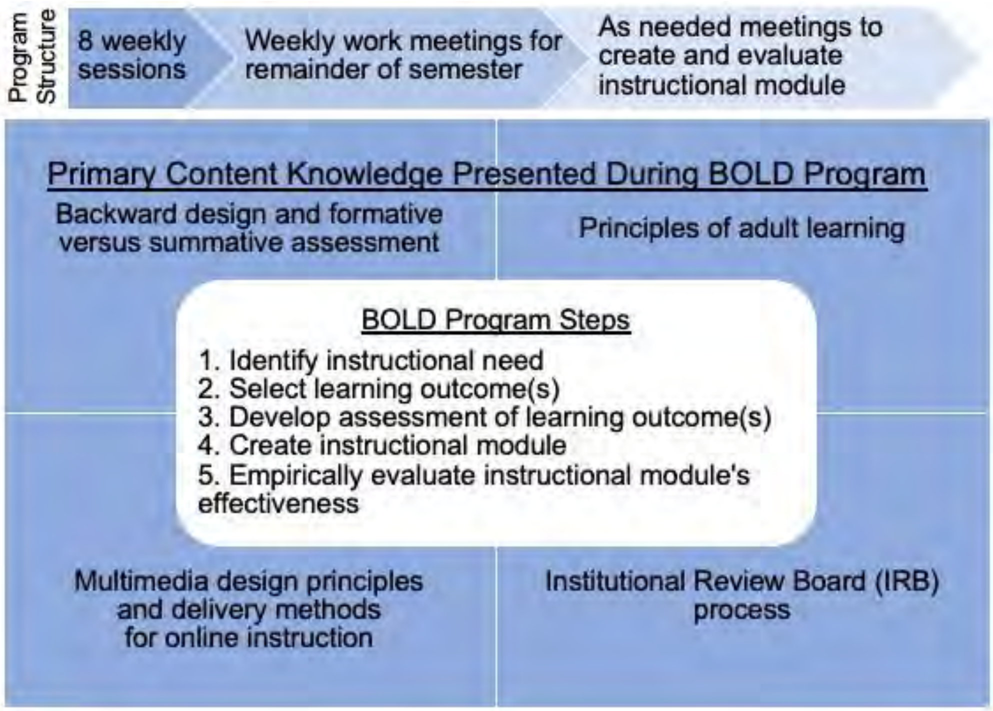
The BOLD Fellows Program at Vanderbilt University's Center for Teaching is a yearlong fellowship designed to "help graduate student/faculty teams build expertise in developing online instructional materials grounded in good course design principles and [an] understanding of how people learn" (Vanderbilt University Center for Teaching, 2022). The BOLD Program fills an important need in the doctoral curriculum by providing students an opportunity to engage in SoTL by applying research principles to teaching practices (Austin & McDaniels, 2006; Gale & Golde, 2004; Smith-Olinde & Ellis, 2018). Integrating teaching and research within doctoral preparation may support scholars' continued contribution to SoTL as well as a career-long connection with campus centers for teaching and learning.

When the first and second authors participated in the BOLD Fellows Program, it was sponsored externally by the Center for the Integration of Research, Teaching, and Learning and the National Science Foundation; the program was implemented by Vanderbilt's Center for Teaching. Subsequently the program became supported internally by the University. Matriculation in the BOLD Program follows a competitive application process. Student applicants along with a faculty mentor develop an application that describes a discipline-specific classroom need that can be addressed via an online instructional module. Each BOLD cohort includes graduate students from varied disciplines (e.g., chemistry, engineering, history, psychology).

Students are supported in two ways. The Center for Teaching faculty and staff supply expertise and resources in curricular design and educational technology. The faculty mentor supplies expertise in discipline-specific knowledge. The program begins with the BOLD cohort attending eight weekly sessions at the Center for Teaching (see Figure 1). After these sessions, the cohort meets weekly at the Center for Teaching for the remainder of the semester and then periodically for the remainder of the academic year for discussion specific to the development and evaluation of each student's instructional module.

Figure 1

BOLD Program Structure



The BOLD program supports fellows' development of their online instructional module by following the steps of backward design (e.g., Lemoncello, 2015; Wiggins & McTighe, 2005). First, fellows refine the departmental instructional need that they proposed in their application. Second, they select learning outcome(s) that address their identified instructional need. Third, fellows develop a plan to assess whether students meet the learning outcome(s). Fourth, they create their instructional module. Additionally, fellows design an empirical SoTL evaluation that evaluates the effectiveness of their instructional module in meeting the learning outcome(s) and conceptualized more broadly, as the solution to the departmental instructional need.

Online Instructional Modules in Pre-Professional Education

The evaluation of computer-based, asynchronous instructional modules relevant to clinical knowledge and skills represents a growing evidence base in pre-professional education (Gaetke-Udager et al., 2018; Velan et al., 2002). In CSD, instructional modules have increased clinical skills and the inclusion of evidence-based practices in clinical settings (Kelley et al., 2018; Krimm et al., 2017). Well-designed instructional modules promote student learning by providing flexible and effective instruction (Gaetke-Udager et al., 2018; Goff et al., 2018). The completion of instructional modules prior to face-to-face instruction allows students to "catch-up" on specific clinical skills to create a common knowledge base for real-time activities and discussions that develop higher-level knowledge and skills (Krimm et al., 2017; Tattersall, 2015). Furthermore, asynchronous instructional modules can provide additional exposures to course content via focused, self-paced clinical skill practice that is not practically available within real-time instruction or that is limited in clinical placements (Ramshaw et al., 2001; Winder et al., 2017). Instructional modules also can be available to students for review as needed, such as immediately before performing a clinical skill in a real-practice setting (Gaetke-Udager et al., 2018; Goff et al., 2018; Prober & Khan, 2013).

Case Example: An Intentional Communication Instructional Module and Assessment of Student Learning

Our experience with the BOLD Program involved the development and evaluation of an instructional module on intentional communication in very young children. We first describe the development of our instructional module and the learning assessment. We then detail the empirical SoTL investigation in which we evaluated the effectiveness of our instructional module with entry-level master's students in speech-language pathology. The details we provide regarding backward design, instructional module design, and research design and procedures each demonstrate how the BOLD Program guided our development as teacher-researchers.

Identified Instructional Need. We identified an instructional need in the graduate language acquisition course in the master's SLP program at Vanderbilt, identification and classification of intentional communication in infants and toddlers, as a foundational topic for developing clinical observational skills. Vanderbilt graduate students who matriculate without having completed a language acquisition course enroll in a graduate language acquisition course in the first semester of graduate school. Knowledge and skills are developed through assigned readings, course lectures, and clinical skills-based labs. At the time of our BOLD project, the language acquisition course included only one lab experience dedicated to observation of children in the prelinguistic communication period. Because few students had prior experience with prelinguistic communication, the lab provided only a cursory introduction. We hypothesized that for this group of students the identification and classification of various aspects of prelinguistic communication may represent a skill best mastered through self-paced practice and repetition that is not practically available within the classroom. Further, developing these skills asynchronously would allow the face-to-face prelinguistic lab experience to be reconfigured to develop more advanced clinical skills. Graduate students in CSD must quickly improve their observational skills upon program entry for immediate use in clinical placements. More experience with prelinguistic communication would provide the students with a stronger foundation for clinical practicum experiences and in their future careers.

Intentional communication in infants typically emerges around nine months of age and is defined by three features: (a) vocal or motoric acts (e.g., gestures, vocalizations, verbalizations/words) that are (b) directed toward the communication partner (e.g., adult or another child) and that (c) await a response from the communication partner (Harding, 1984; Sugarman, 1984; Wetherby et al., 1988). This three-fold definition forms the basis for communication act identification targeted in the instructional module. Communication acts can be classified further by their communicative function and communicative means. Infants and toddlers generally communicate for three functions: (a) to regulate the behavior of others by protesting or asking for objects or actions, (b) to engage in joint attention, often by commenting about something in their environment, or (c) to engage in social interaction (Wetherby et al., 1988). Communication acts in infants and toddlers are conveyed by three communicative means, in isolation or in combination: (a) gestures (e.g., point), (b) vocalizations (e.g., speech sound combinations such as /ba/ that are not words), and (c) verbalizations (i.e., spoken or manual word[s]).

Learning Outcomes. We identified two skill-based student learning outcomes: (a) demonstrate improved identification and classification of intentional communication and (b) identify and classify intentional communication acts at a criterion level of 90% accuracy. These learning outcomes encompass three clinical skills – first, identifying an instantiation of a communication act; second, classifying the function of the communication act; and third, classifying the means of the communication act. The two student learning outcomes allowed for measuring student change simply as improved accuracy over time as well as via a student meeting an established performance criterion. In tandem, these outcomes can provide two perspectives on a student's next steps for learning.

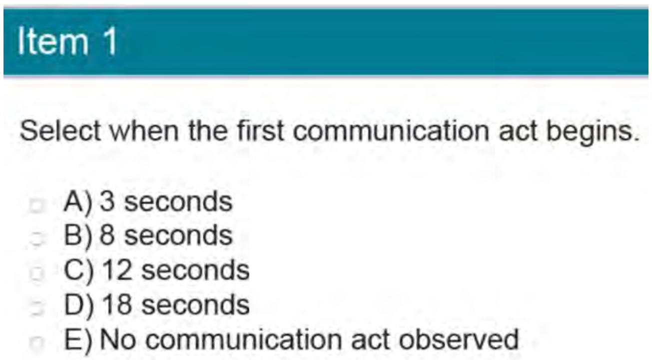
Assessment of Learning Outcomes. We designed a two-part, online learning assessment that integrated multiple-choice items with video clips using Adobe Captivate (i.e., a slide-based presentation format) – part one for identification of communication acts (i.e., did one occur) and part two for classification (function, means) of communication acts. Each student individually completed the learning assessment. Our assessment required the student to identify and classify communication acts in brief (i.e., less than one minute) video clips. These video clips were chosen from parent-child and experimenter-child video-recorded interactions, with a single 24-month-old child with typical development, that were recorded specifically for the development of the assessment. For each clip selected for the assessment, the first and second authors agreed on the coding for identification and classification. The third author who has extensive training in communication act identification using the Communication and Symbolic Behavior Scales affirmed the coding (Wetherby & Prizant, 1993).

Following the principles of backward design, we aligned our assessment with our learning outcomes. Our decision to use video clips in our assessment allowed us to evaluate whether students met the learning outcomes with real-life exemplars. We chose to use video clips from a single 24-month-old child as a convenience sample and because we expected that a 24-month-old child would demonstrate a wider range of communicative functions and means from which to assess student learning than would a younger child. We acknowledge that an assessment with a single, relatively older toddler may be a less challenging task than an assessment with younger children, multiple children, and/or children with atypical communication development. To account for this possibility, we set the aforementioned accuracy criterion relatively high at 90% so that students would demonstrate a high level of performance with a toddler with typical development prior to setting and addressing more challenging learning outcomes. Potentially more challenging exemplars (e.g., multiple children under 1 year or children with atypical communication development) could be addressed during classroom instruction or in subsequent instructional modules.

For the identification of communication acts assessment, we integrated 10 video clips with 10 multiple-choice items. Each item was worth one point (max score = 10). Each video clip included a running timer embedded on the slide. Each student viewed the video clip and on the next slide the student was asked to select the time of the communication act from a field of five choices including an option for no communication act (see Figure 2 for an example slide). For the first eight items, we asked the student to identify the first displayed communication act; for the last two items we asked the student to identify the second displayed communication act.

Figure 2

Sample Identification Assessment Item

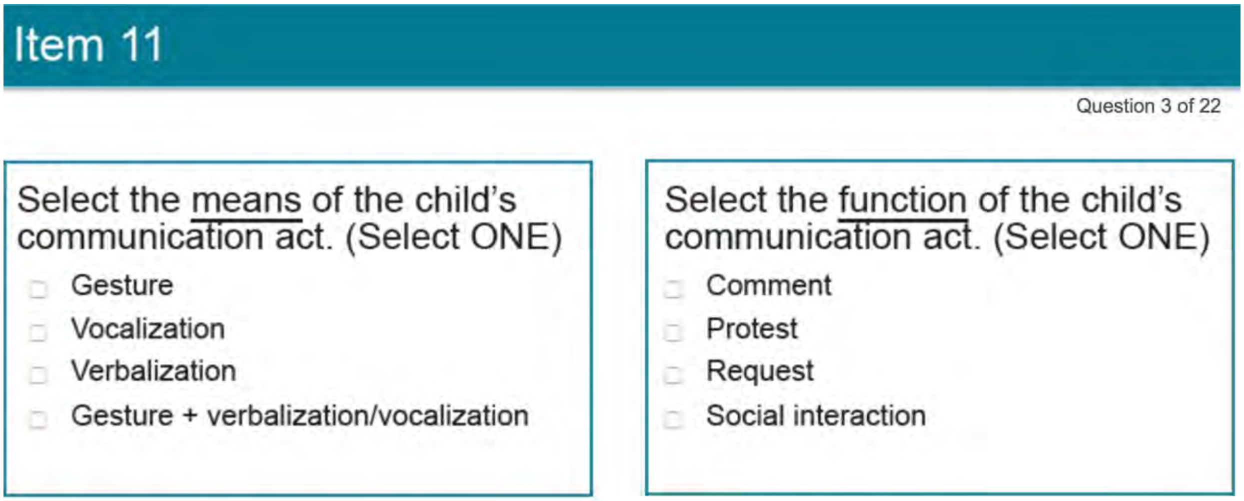


For classification of communication acts, we integrated 10 video clips with 20 multiple-choice items: 10 items for means and 10 items for function. Each function classification item was worth one point (max score = 10) and each means classification item was worth one point (max score = 10). For each video clip, the student viewed the video and on the next slide was asked to select a means from a field of four choices (i.e., gesture, vocalization, verbalization, gesture + verbalization/vocalization) and a function from a field of four choices (i.e., comment, protest, request, social interaction) for the single communication act (see Figure 3 for an example slide). The assessment scores allowed us to measure student performance on our two learning outcomes of improved accuracy and achievement of a performance criterion.

Instructional Module. The design of multimedia instructional materials is informed by multimedia design principles. In the next two sections we describe our instructional module and then explain how multimedia design principles inform instructional module design. The two-part instructional module, constructed using Adobe Captivate, integrated video clips with guiding questions and information about communication acts. The instructional module video clips were chosen from parent-child and/or examiner-child video-recorded interactions with seven 8- to 22-month-old infants and toddlers with typical development. The interactions were recorded specifically for the development of the instructional module with assistance from families within the community. The instructional video clips did not include the child from the assessment video clips.

Figure 3

Sample Classification Assessment Item



The first part of the instructional module facilitated learning about communication act identification. Each student sequentially viewed 19 video clips, with each clip viewed alongside four guiding questions on an Adobe Captivate slide, as illustrated in Figure 4: (a) Is there a communication act?, (b) Did the child do something (gesture, vocalize, verbalize)?, (c) Was communication directed to another person?, and (d) Was the purpose of the communication clear? (e.g., Wetherby et al., 1988). The student was instructed to answer the questions and optionally view the clip again before advancing to the next slide by choosing "click for answer." Upon advancing to the next slide the student saw, as illustrated in Figure 5, the answer to each guiding question and heard voice-over with clip-specific information. Additionally, the student had an opportunity to re-watch the video clip. The first part of the instructional module ended with the student sequentially viewing five additional video clips each alongside a multiple-choice item that was similar to the learning assessment identification questions, but with immediate feedback (i.e., *try again* or a description of why the selected answer was correct).

The second part of the instructional module facilitated learning about communication act classification. The format for the second part was the same as the first part. Each student sequentially viewed 25 video clips, with each clip viewed alongside three guiding questions on an Adobe Captivate slide, as illustrated in Figure 6: (a) Is this a communication act?, and if so, then (b) How does the child communicate (communication means)?, and (c) What is the purpose of the communication (communication function)? On the subsequent slide the student had clip-by-clip access to answers to the guiding questions, a voice-over with clip-specific information, and an opportunity to re-watch the video clip, as illustrated in Figure 7.

Figure 4

Communication Act Identification Training: Sample Slide Displaying Guiding Questions

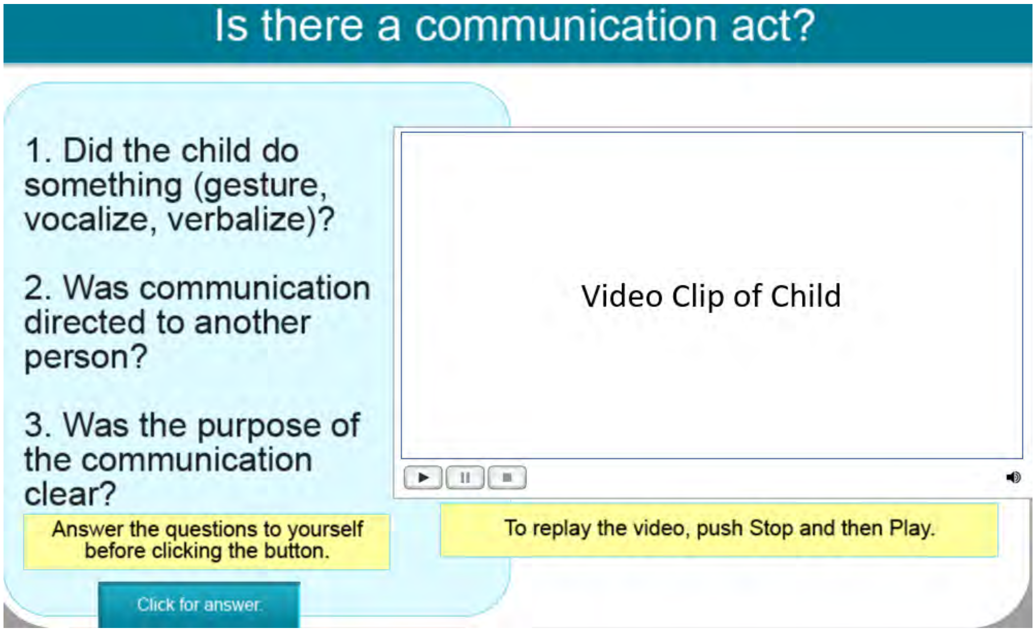


Figure 5

Communication Act Identification Training: Sample Slide Displaying Guiding Questions with Answers

Figure 6

Communication Act Classification Training: Sample Slide Displaying Guiding Questions

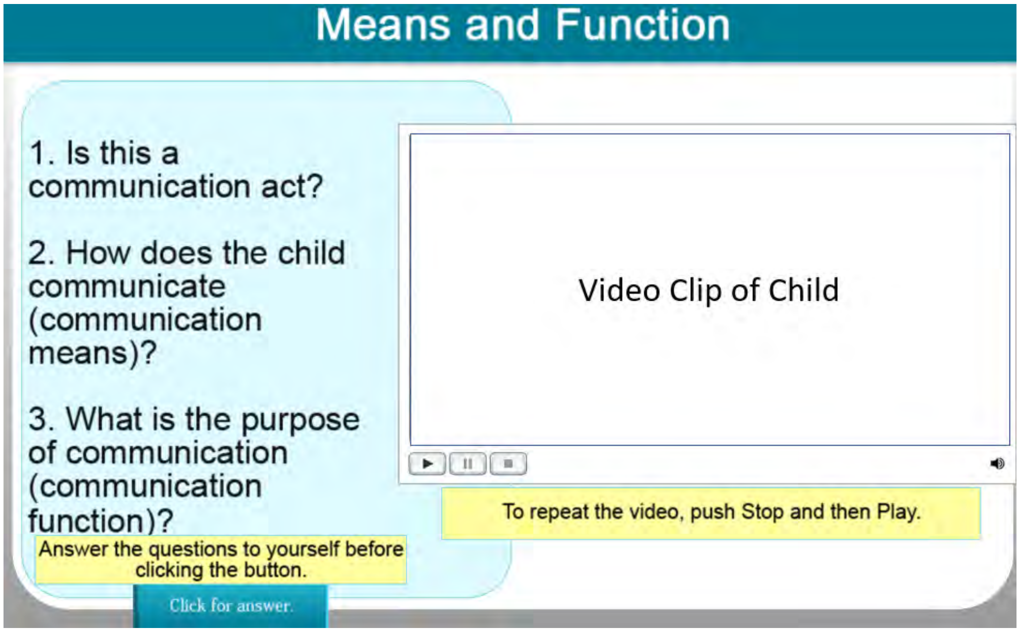
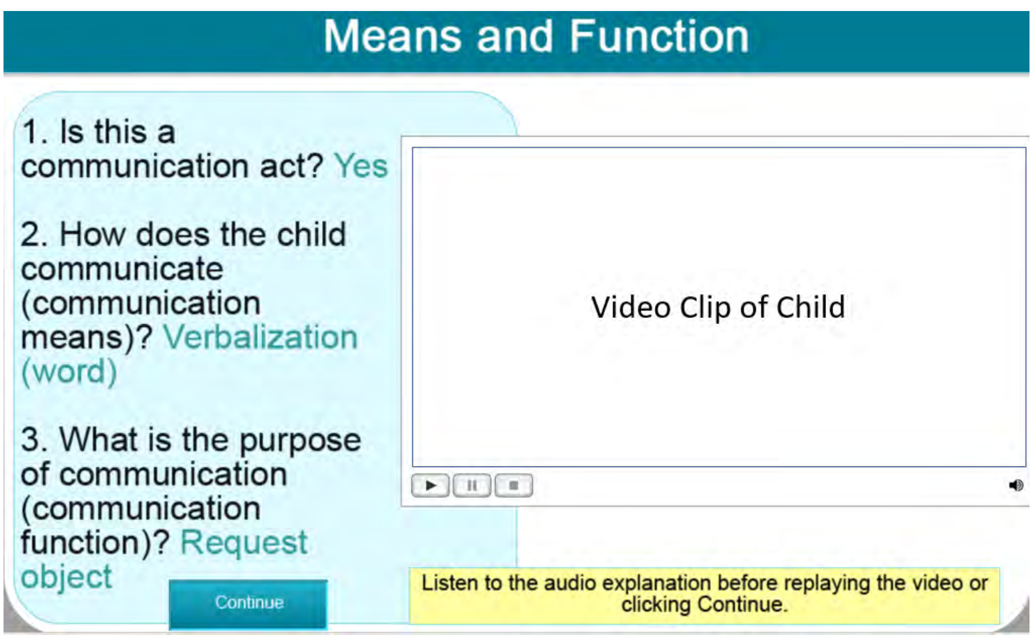


Figure 7

Communication Act Classification Training: Sample Slide Displaying Guiding Questions with Answers



Multimedia Design Principles. Evidence-based multimedia design principles, which are informed by the Cognitive Theory of Multimedia Learning (Mayer, 1996, 2001) and Cognitive Load Theory (e.g., Sweller et al., 1998), informed the design of the instructional module. We summarize the relevant pieces of each theory to explain how they informed instructional module design.

The Cognitive Theory of Multimedia Learning makes three assumptions: (a) multimedia information is processed in dual visual/pictorial and auditory/verbal channels, (b) each channel has a limited capacity to process incoming information, and (c) students actively participate in selecting, organizing, and integrating incoming information (Mayer, 2001). The Cognitive Load Theory posits that instructional activities evoke three types of cognitive load (i.e., required cognitive resources) from students: (a) intrinsic load, (b) extraneous load, and (c) germane load (e.g., Ibrahim et al., 2012; Sweller et al., 1998). Intrinsic load involves the cognitive resources required to understand the instructional content. Content that is more challenging for a student has a higher intrinsic load (e.g., calculus for most students). Extraneous load involves the cognitive resources lost to distracting aspects of the instructional activity that detract from student learning, such as irrelevant content (e.g., Brame, 2016; Mayer et al., 2001). Germane load relates to aspects of the instructional activity that help a student attend to and process the content more fully, such as visual highlighting of relevant content (e.g., Brame, 2016). Taken together the two theories emphasize the importance of designing instructional materials that consider learners' limited processing capacity and that promote active participation in learning.

Adherence to three key multimedia design principles yields learning activities that manage the three types of cognitive load (Brame, 2015; Ibrahim et al., 2012; see Table 1): (a) segmenting, (b) weeding, and (c) signaling. *Segmenting* manages intrinsic load by allowing the learner to control the rate of the learning activity. Rather than creating one lengthy learning activity (e.g., video), the learning activity can be broken into shorter segments (e.g., video clips) for brief learning episodes. We created a self-paced instructional module with brief video clips, which allowed the learner to control re-watching for further clarification. *Weeding* minimizes extraneous load by removing distracting elements, such as irrelevant animations or content. We minimized extraneous load by maintaining the same simple slide format throughout both parts of the instructional module. *Signaling* increases germane load by directing a student's attention to important content. We strategically placed content summary slides throughout the instructional module. Additionally, we addressed students' active participation by using guiding questions that focused students on organizing the incoming information (i.e., all presented content) around the definitions of communication acts, functions, and means.

Delivery Method. Our learning assessment and instructional module were housed on a secure website for online delivery method so that students had access from any location with an internet connection. The website comprised three sections: (a) overview, (b) assessment, and (c) training. The overview section identified the learning outcome for the instructional module and related the learning outcome more broadly to the use of observational skills in clinical decision making. The assessment section provided basic information about intentional communication and links to the learning assessment. The basic information was provided via text (not video) and included a definition of communication acts alongside several descriptions and non-examples of communicative functions and means (i.e., information similar to what might be provided on a class handout). The training section provided links to the instructional module as well as a brief text description of how the functions and means of intentional communication are used throughout the lifespan. This description was intended to provide a rationale for all students to develop the targeted observational skills, regardless of whether they planned for a career focused on young children.

Table 1

Multimedia Design Principles

Principle	Description	Selected Evidence
Segmenting	Breaking information into short, manageable pieces (e.g., short video clips; Brame, 2016; Guo et al., 2014; Ibrahim et al., 2012; Zhang et al., 2006).	The median amount of time students watched videos of varying lengths in online courses was 6 minutes (Guo et al., 2014).
Weeding	Removing extraneous and/or redundant information that distracts attention from the learning outcome (e.g., music, distracting background scenes; Brame, 2015; Ibrahim et al., 2012).	College students who viewed irrelevant video clips interspersed in a multimedia learning activity performed more poorly than students who did not view irrelevant video clips (Mayer et al., 2001).
Signaling	Highlighting main ideas with cues, such as key words or color change (Brame, 2016; de Koning et al., 2009; Ibrahim et al., 2012; Mayer & Johnson, 2008).	Undergraduates who viewed a slide presentation with a few words highlighting important elements in diagrams outperformed a control group on a test of retention of the presented material (Mayer & Johnson, 2008).
Guiding questions	Questions that facilitate student interaction with the material during the learning activity (e.g., questions about video content; Brame, 2016; Lawson et al., 2006).	Students who answered guiding questions during a learning activity correctly answered more video-related assessment questions than a control group (Lawson et al., 2006).

SoTL Methods: Evaluation of the Online Instructional Module

The Vanderbilt University Institutional Review Board approved all study methods. We asked two research questions to empirically evaluate the effectiveness of the instructional module for achieving the learning outcomes:

1. Do participants who have completed the instructional module demonstrate greater gains over pre-test performance on identification and classification (function, means) of communication acts as compared to participants in a delayed-treatment condition?
2. What percent of participants in each group (treatment, delayed treatment) meet the criterion of at least 90% accuracy for identification and classification of communication acts?

The outcome measures for both research questions are useful for assessing the effectiveness of teaching practices within a SoTL framework.

A small body of evidence has demonstrated the effectiveness of online instruction for improving clinicians' and caregivers' knowledge and skills relevant to early intervention (see Feuerstein & Olswang, 2020). For example, online instruction has led to improved observational skills relevant to intentional communication in practicing early interventionists (Brown & Woods, 2012). To our knowledge the effect of online instructional modules on SLP graduate students' ability to make observations about intentional communication in infants and toddlers has not been evaluated. Thus, the development and evaluation of an instructional module on this topic expands the literature on instructional modules in CSD.

Participants. All participants consented to study procedures. Participants included one cohort of students admitted to the Master of Science in Speech-Language Pathology program at Vanderbilt University ($n = 17$). Participant demographic information was collected using REDCap electronic data capture tools (Harris et al., 2009). All students were white females aged 20 - 25 years old who spoke English as their primary language, per self-report. Eleven students (65%) had an undergraduate degree in CSD. The remaining students had undergraduate degrees that were broadly related to language and communication (e.g., English, foreign languages, journalism, linguistics, child development, cognitive science, psychology). Fifteen students (88%) reported prior coursework in child development or developmental psychology and 16 students (94%) reported prior coursework in language development. Four students were identified as needing to complete the graduate language acquisition course[1], which was the target course of our instructional need. Thirteen students had fulfilled their language development course requirement but were included in the empirical evaluation to increase sample size. These students presumably had begun to develop observational skills relevant to the instructional module learning outcomes; we expected, however, that they could still benefit from practice with observational skills for intentional communication. Because Vanderbilt University does not have an undergraduate major in speech-language pathology, we could not evaluate the module with a large group of students enrolled in a language development course.

Students were assigned quasi-randomly to the treatment group ($n = 9$) or the delayed-treatment group (i.e., control; $n = 9$). Prior to random assignment, students were divided by whether they had an undergraduate degree in CSD (yes, $n = 11$; no, $n = 7$). The treatment group comprised five students with an undergraduate degree in CSD and four students without one. The delayed-treatment group comprised six students with an undergraduate degree in CSD and three students without one. One student without an undergraduate degree in CSD in the treatment group did not complete all study activities. She was excluded from all analyses, leaving eight students in the

[1] At Vanderbilt University a matriculating class in the graduate SLP program typically includes 20 students. Recently the number of students who enrolled in the graduate language acquisition course has varied from 4 to10.

treatment group. Two of the four students who were enrolled in the language acquisition group were assigned to the treatment group and two were assigned to the delayed-treatment group.

Procedures. To empirically evaluate the effectiveness of the module using SoTL principles, we employed a delayed-treatment design over a seven-week period. This research design allowed all students to participate in the learning experience while maintaining experimental control. Students completed the learning assessment (3 times) and the instructional module one time in the summer months prior to fall semester graduate school matriculation. Summer completion allowed students exposure to class content prior to beginning graduate school and, for the purposes of our evaluation, limited the opportunities for students to discuss the learning assessment or instructional module among themselves. We explicitly asked students to refrain from discussing their experiences until they were given clearance to do so (i.e., at the end of our study).

The impact of the instructional module was evaluated via students' performance on the learning assessment. Each participant completed the learning assessment three times. The treatment group students completed the instructional module after they completed the first administration of the learning assessment, and the delayed-treatment group completed the instructional module after they completed the second administration of the learning assessment (see Table 2 and the following paragraph for study schedule details). Prior to each study activity (i.e., assessment [three times], instructional module [one time]), students received an email with instructions on which part of the study to complete and a password to access the relevant website section. The assessment and training sections, unlike the overview section of the website, were password-protected so that students' access was limited to only the website pages necessary to complete each of their sequentially-assigned study activities.

Table 2

Study Design

	Study Week				
Group	Week 1	Weeks 2 – 3	Week 4	Weeks 5 – 6	Week 7
Treatment	Assessment 1 (Pre-training 1)	Training	Assessment 2 (Post-training)	No training	Assessment 3 (Maintenance)
Delayed Treatment	Assessment 1 (Pre-training 1)	No training	Assessment 2 (Pre-training 2)	Training	Assessment 3 (Post-training)

Immediately prior to the first administration of the learning assessment (i.e., Assessment 1) all students had access to the website's overview section as well as the basic information about intentional communication in the assessment section. Thus, the delayed-treatment group participated in a business-as-usual condition rather than a no-treatment condition; recall that the assessment section provided access to basic information about intentional communication with examples of each communicative function and means. All students completed Assessment 1 within a one-week period to evaluate pre-test skill level. Then, the treatment group accessed the training section of the website to complete the instructional module within a two-week period. The delayed-treatment group did not complete any study-related activities within that two-week period. All students then completed the learning assessment again (i.e., Assessment 2) within a one-week period to evaluate change. Then, the delayed-treatment group accessed the training section of the website to complete the instructional module within a two-week period. The treatment group did not complete any study-related activities within that two-week period. In the final week of the study all students completed the assessment a final time (i.e., Assessment 3).

Learning Assessment Results

Primary analyses reflect between-group comparisons of individual difference scores from Assessment 1 to Assessment 2 (see Table 3 for descriptive statistics by participant group). This type of analysis provides a more stringent test of the impact of the instructional module than a within-group comparison of pre- and post-training assessments. Difference scores show the amount of change from the completion of Assessment 1 to Assessment 2. A positive score indicated that the participant scored higher on Assessment 2 than Assessment 1.

Table 3

Descriptive Statistics by Participant Group

Group	Treatment Group				Delayed-Treatment Group			
Assessment Variable	Mean	SD	Median	Range	Mean	SD	Median	Range
Identification 1	7.71	0.76	8.00	7 – 9	7.22	2.05	8.00	3 – 9
Identification 2	8.57	0.79	8.00	8 – 10	6.78	1.48	7.00	3 – 8
Identification 2 minus 1	0.86	1.21	0.00	0 – 3	-0.44	1.13	-1.00	-2 – 2
Identification 3	8.14	1.68	9.00	5 – 10	7.78	1.56	8.00	5 – 10
Function 1	7.50	1.20	7.50	6 – 9	7.00	1.50	7.00	4 – 9
Function 2	9.00	1.41	9.50	6 – 10	7.33	1.66	8.00	4 – 10
Function 2 minus1	1.50	1.51	1.50	0 – 4	0.33	1.41	0.00	-2 – 2
Function 3	9.25	0.71	9.00	8 – 10	8.67	1.12	9.00	7 – 10
Means 1	7.75	1.16	7.50	6 – 9	7.89	1.05	8.00	6 – 9
Means 2	7.63	1.19	8.00	6 – 9	7.44	0.73	8.00	6 – 8
Means 2 minus 1	-0.13	0.99	0.00	-2 – 1	-0.44	1.42	0.00	-2 – 2
Means 3	7.38	1.19	8.00	6 – 9	8.11	0.78	8.00	7 – 9

Note. Maximum score for Identification, Function, and Means = 10 points; 1 = Assessment 1 which was pre-training assessment for both groups; 2 = Assessment 2 which was post-training for treatment group and no-training for the delayed-treatment group; 2 minus 1 = difference scores between Assessment 2 and Assessment 1; 3 = Assessment 3 which was maintenance for treatment group and post-training for the delayed-treatment group. Number of participants: for identification, Treatment n = 7, Delayed Treatment n = 9; for function and means, Treatment n = 8, Delayed Treatment n = 9.

Due to the small sample size and non-normal distribution of data, the Mann-Whitney U test (i.e., the non-parametric alternative to an independent t-test) was used for between-group comparisons. Statistical analyses were completed using IBM SPSS Statistics (Versions 23-26). Due to the potential effect of small sample size on obtaining statistically significant results, effect sizes are included for all statistical tests. Effect sizes were calculated using Hedge's g, which adjusts Cohen's d for sample size (Hedges, 1981). Effect sizes were interpreted with values between 0.20 and 0.50 being small, values between 0.50 and 0.80 being moderate, and values of 0.80 or greater being large (Cohen, 1988). At Assessment 1 there were no between-group differences for identification ($U = 31.5$, $n_{Treatment} = 7$, $n_{Delayed\ Treatment} = 9$, $p = 1.00$), function ($U = 30$, $n_{Treatment} = 8$, $n_{Delayed\ Treatment} = 9$, $p = .610$), nor means ($U = 33.5$, $n_{Treatment} = 8$, $n_{Delayed\ Treatment} = 9$, $p = .823$).

Our first research question asked whether completion of the instructional module improved graduate students' identification and classification (function, means) of intentional communication acts; the treatment group was compared to the business-as-usual delayed-treatment group. For identification, one treatment group participant was excluded from the analysis due to an assumed technology malfunction that resulted in a substantial and highly improbable decrease in accuracy from pre- to post-training. Using the Mann-Whitney *U* test there was a significant between-group difference for difference scores from Assessment 1 to Assessment 2 ($U = 11.5$, $n_{Treatment} = 7$, $n_{Delayed\ Treatment} = 9$, $p = .035$). The treatment group showed improved identification of communication acts over the delayed-treatment group. Between-group difference scores ($M_{Treatment} = 0.86$, $M_{Delayed\ Treatment} = -0.44$) for identification yielded a large effect size of $g = 1.05$. This effect size equates to an improved identification score of 1.23 points (out of 10 total possible points) for the treatment group over the delayed-treatment group. Improvement was calculated by multiplying the pooled standard deviation for the treatment and delayed-treatment groups by the effect size.

Using the Mann-Whitney *U* test, there was not a significant between-group difference for the difference scores for function ($U = 21$, $n_{Treatment} = 8$, $n_{Delayed\ Treatment} = 9$, $p = .158$) nor means ($U = 30$, $n_{Treatment} = 8$, $n_{Delayed\ Treatment} = 9$, $p = .590$). Between-group difference score effect sizes were moderate for function ($M_{Treatment} = 1.50$, $M_{Delayed\ Treatment} = 0.33$, $g = 0.76$), but small for means ($M_{Treatment} = -0.13$, $M_{Delayed\ Treatment} = -0.44$, $g = 0.24$). The effect size equates to an improved score of 1.11 points for classification of function and 0.30 points for classification of means for the treatment group over the delayed-treatment group.

Our second research question asked what percent of students met the 90% criterion for accuracy of identification and classification of communication acts (function, means). To answer this question, we calculated the percent of students who met the 90% criterion by each time point cumulatively (i.e., inclusive of previous assessments; see Table 4). We calculated a cumulative percent because in coursework and clinical placements if a student met a criterion on one occasion, that student may not be required to repeat the assessment of that skill.

Table 4

Percent of Cumulative Students Who Met 90% Criterion by a Given Time Point by Group

	Treatment Group			Delayed-Treatment Group		
Skill	Assessment 1	Assessment 2	Assessment 3	Assessment 1	Assessment 2	Assessment 3
Identification	14%	43%	71%	33%	33%	67%
Function	25%	75%	88%	11%	22%	67%
Means	38%	38%	38%	33%	33%	44%

Note: For the treatment group Assessment 2 was the post-training assessment. For the delayed-treatment group Assessment 3 was the post-training assessment.

For identification, the percent of students in each group who met the 90% criterion increased substantially upon completion of the instructional module (i.e., at Assessment 2 for treatment group and Assessment 3 for delayed-treatment group). Importantly, the percent for the treatment group who met this criterion increased dramatically immediately following module completion (i.e., Assessment 1 to Assessment 2) whereas the percent did not change for the delayed-treatment group in the absence of instruction. In addition, the percent of the treatment group reaching criterion increased from Assessment 2 to Assessment 3, despite not completing any additional instruction. At Assessment 3 the two groups had a comparable percent reaching criterion for identification.

For classification of function, the outcomes were similar to identification (again, see Table 4). The percent of the treatment group meeting criterion increased substantially immediately after completion of the instructional module. This change for the treatment group at Assessment 2 was accompanied by negligible change for the delayed-treatment group at Assessment 2. By Assessment 3, 67% or more of the students in each group met the 90% criterion for identification and function.

In stark contrast, the percent of students meeting the 90% criterion showed little change for classification of means, regardless of group and time of assessment. At Assessment 1, about one-third of the students in each group met the 90% criterion. Following completion of the instructional module, there was no increase in the percent of students meeting the 90% criterion in the treatment group and negligible change for the delayed-treatment group. At Assessment 3 less than half of the students in each group met the 90% criterion.

SOTL Discussion

The BOLD Fellows Program is designed to develop graduate students' SoTL skills through the creation and evaluation of online instructional modules. Here we present a discussion specific to the evaluation of our online instructional module. This discussion highlights our deepening ability as PhD students to critically evaluate our teaching practices and informs future SoTL evaluations of instructional modules. We then conclude with an overall discussion focused on how the BOLD Program fills a need in the doctoral curriculum by fostering SoTL skills and evidence-based teaching practices in CSD.

In our case example we evaluated the effectiveness of the instructional module for increasing clinical SLP graduate students' identification and classification (function, means) of intentional communication acts using a delayed-treatment design. Between-group analyses revealed that the treatment group's identification of communication acts improved upon completion of the instructional module relative to the delayed-treatment group. However, between-group differences were not significant for classifying function and means. These results demonstrate a positive effect of the instructional module on communication act identification, but the findings are tempered with non-significant results for classification. The effect size for classification of function suggests that our study was underpowered to detect effects of the instructional module for this outcome.

In addition to evaluating between-group differences, we reported the percent of students who met the 90% criterion for identification and classification of communication acts. This analysis can be a considered relevant within a competency-based curriculum. The percent of students in each group who met this criterion increased markedly for communication act identification and classification of functions upon module completion. Prior to the instruction, fewer than one-third of all the students reached the 90% criterion for communication act identification and classification of function. But by the end of the study, when all students had completed the instruction, two-thirds or more of the students in each group had reached this criterion for identification and classification of function. In contrast, the instruction had little to no influence on competency for classification of means when measured by percent of students reaching the 90% criterion.

Implications for the Development and SoTL Evaluation of Future Instructional Modules

Our findings inform future SoTL research on instructional modules in several ways. First, although instructional modules support multiple learning outcomes relevant to clinical skills and knowledge of pre-professional students, some clinical skills (e.g., communication act identification) may be better supported by instructional modules than others (e.g., classification of means; Gaetke-Udager et al., 2018; Velan et al., 2002). Instructors cannot assume that instructional modules will lead to improvement in all student outcomes. The creation of instructional modules is labor intensive (Velan et al., 2002). Thus, instructors must use SoTL methods to identify which learning outcomes are most efficiently met via instructional modules and which learning outcomes are more efficiently met via other less time intensive but equally effective teaching methods.

Second, our findings demonstrate the utility of evaluating learning outcomes that target improved accuracy as well as achievement of an established criterion. Demonstrating improved accuracy alone does not sufficiently quantify student competency. Between-group differences for accuracy are thus, well supplemented by an outcome measure that demonstrates the percent of students who have met an *a priori* established criterion for a given skill. Evaluating performance with an established criterion is a relevant learning outcome within a competency-based curriculum. Both learning outcomes (i.e., change, criterion) allow instructors to triangulate data to inform future instructional decisions.

Third, our findings highlight the need of an iterative process to develop valid and reliable assessments of student learning outcomes. For example, our learning assessment included only 10 items to represent each skill. To align our learning assessment with student learning needs, we could use item analysis to refine and expand assessment items. We could then benchmark the refined learning assessment with other participant samples from multiple varied CSD programs and early childhood professionals with a range of work experience. The development of assessments with empirically-based benchmarks has the potential to tailor instruction to students' learning needs by determining whether instruction at a given skill level is required (Brouwers et al., 2011) and whether initial skill level moderates the effectiveness of the learning activity.

Additionally, our learning assessment included only one 24-month-old child with typical development. We expect that inclusion of assessment items with video clips from multiple children, younger children, and/or children with impaired communication skills would have increased the complexity of our learning assessment. Such an assessment might illuminate important differences in student skills despite comparable performance on the current learning assessment. As such, a more complex assessment might have acted as a formative assessment that could guide plans for further student learning. Likewise, we could align our instructional module to include a greater frequency and variety of examples that ranged sequentially from easier to more challenging opportunities to identify and classify communication acts.

Limitations

When completing a SoTL evaluation, it is important to critically evaluate potential study limitations using research principles because these limitations may affect study results and thus, future instructional decisions. We acknowledge three limitations in the evaluation of our instructional module. First, because our learning assessment's test-retest reliability is unknown, we do not know the stability of students' baseline skills. This is a practical limitation of our SoTL evaluation; within academic courses there may not be sufficient time to establish baseline stability. However, despite potential variation in baseline skills, the effect of the instructional module was evident. Second, mean scores for the three variables at Assessment 1 clustered around the upper end of the assessment score range for both groups, suggesting possible ceiling effects on the learning assessment that may have restricted the assessment's sensitivity to change. This finding is somewhat unsurprising based on the percent of participants who had completed language development coursework and may not be indicative of initial performance in other groups. However, despite adequate initial performance, improvement was still evident upon completion of the instructional module indicating continued opportunity for growth. Third, our students comprised a small, convenience sample of demographically homogeneous graduate students. It is possible that other samples of speech-language pathology students or professionals in related fields may demonstrate greater performance variation at pre-training assessment. To investigate the consistency of the instructional module's effectiveness and to generalize findings to other student populations the evaluation should be replicated with a larger, more diverse participant sample. Together these limitations promote careful consideration of the psychometric properties of assessments as well as sampling effects when completing future SoTL evaluations.

Strengths

Additionally, when completing a SoTL evaluation it is important to critically evaluate potential study strengths using research principles. We acknowledge two strengths in the evaluation of our instructional module. First, we stringently assessed gains with a delayed-treatment design with quasi-randomized group assignment. This design accounts for selection bias and provides experimental control that is not present in less stringent designs (e.g., pre-post design with a single group). Completion of this research study with a delayed-treatment design prior to students' matriculation into graduate school provided experimental control and enabled all students to participate in the learning experience. Second, both groups accessed information about intentional communication prior to the initial assessments. Therefore, the delayed-treatment group participated in a business-as-usual condition rather than a no-treatment condition providing a more stringent test of the hypothesized effect of the instructional module. These strengths demonstrate the feasibility of the careful evaluation of teaching practices using rigorous research principles.

General Discussion: Lessons Learned from BOLD Fellows Program Participation

Evidence-based teaching practices are integral to the development of pre-professional students' knowledge and skills in CSD. The evidence base for teaching practices in CSD will grow as scholars engage in SoTL research. Integrating teaching and research within PhD studies using experiences like the BOLD Fellows Program may support scholars' continued contribution to SoTL across their academic careers. PhD students develop skills and lines of inquiry that they can further expand on as early-career teacher-researchers. PhD students also develop skills to mentor future undergraduate- and graduate-level students in the SoTL research process, which promotes further contributions to SoTL.

In recent years doctoral programs across disciplines have begun to put greater emphasis on formal teaching instruction. Specific to CSD, Smith-Olinde and Ellis (2018) reported that 13 of 19 surveyed CSD research doctoral programs stated that they infused SoTL into the curriculum. However, the understanding of SoTL, operationally defined as a research domain, may be limited and even confused with skilled, reflective, and evidence-based teaching (Ellis & Crumrine, 2010; Smith-Olinde & Ellis, 2018). The BOLD Fellows Program, thus, fills an important need by modeling what SoTL is and how SoTL can be feasibly and practically infused into the research doctoral curriculum. Additionally, SoTL experiences may fill a perceived gap in teaching opportunities within the doctoral curriculum (see Crais, 2020) by promoting deeper discussions about teaching effectiveness between PhD students and between PhD students and their mentors.

As BOLD Fellows we first built our foundation for SoTL as well as evidence-based teaching practices by engaging in discussions and readings that provided an opportunity to think critically about teaching practices and adult learning principles. We then learned about multimedia design principles. Finally, we engaged in SoTL by evaluating the effectiveness of our online instructional module. In this process we learned how to apply intentional research decisions to our instruction in a feasible manner. Additionally, we learned how to critically evaluate the potential promise and limitations of online instructional modules as well as how student performance informs the refinement of assessments and teaching practices. Through the BOLD Program and subsequent dissemination of our findings we gained a knowledge of the cross-disciplinary SoTL literature, which as CSD faculty we can now apply to SoTL research and our use of evidence-based teaching practices.

The critical evaluation of instruction is integral to continued improvement of teaching practices in CSD. Programs like the BOLD Program have the potential to further the development of teacher-researchers who can contribute to that continued improvement. With appropriate critical thinking and evaluation, intentional decisions in instructional design have the potential to improve graduate student learning and ultimately the services provided to children and adults with communication disorders and their families.

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