The Effects of Observing Others Versus Self-Observation on Teacher Accuracy in Presenting Learn Unit Instruction

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ABSTRACT

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In Experiment I, I tested whether training teacher trainers to conduct TPRA observations to a calibrated standard by teaching them to 1) measure the accuracy of other individuals presenting learn unit instruction, then 2) measure their own accuracy in presenting learn unit instruction, would influence the accuracy of the teacher trainer’s own subsequent learn unit instruction, the accuracy of the teacher trainees’ learn unit instruction (after being trained via TPRA observations), or the numbers of objectives achieved by students, given instruction from their respective teacher trainees. The dependent variables included the accuracy of both the teacher trainers and the teacher trainees in presenting learn unit instruction, along with numbers of instructional objectives achieved by students. The independent variables included two successive treatment phases, in which the teacher trainers conducted TPRA’s on others presenting learn units, followed by TPRA’s on their own learn unit instruction. Following each intervention, the teacher trainers conducted in-situ TPRA’s with feedback on each of their respective teacher trainees. Following the in-situ TPRA’s with feedback conducted by the teacher trainers, I measured the dependent variables by conducting TPRA observations without feedback. The results indicated that both teacher trainers and teacher trainees demonstrated increased accuracy in Learn Unit presentations as a function of the treatment package. The rates of student learning also increased following the interventions. In Experiment II, I tested the effects of time, practice, and experience on the accuracy of teacher learn unit instruction. I measured teacher learn unit accuracy prior to and following a period of time that did not include any formal intervention. Additionally, I measured the numbers of in-situ TPRA’s required by each teacher to achieve mastery criteria for presenting learn units. The results showed that while each teacher demonstrated slight improvements in their learn unit delivery following practice alone, their accuracy was far from mastery criteria level. Additionally, all teachers required in-
situ TPRA’s with feedback in order to achieve mastery criteria for delivering learn unit instruction.

In Experiment III, I tested the effects of learning by observing others on teacher learn unit accuracy. Specifically, I measured teacher learn unit accuracy prior to and following a classroom training where the teachers were required to measure the accuracy of other individual’s learn unit instruction, by conducting TPRA observations on a set of standardized training videos. Additionally, I measured the numbers of post-intervention in-situ TPRA’s with feedback required by each teacher to achieve mastery criteria for presenting learn units. The results showed that two of the three teachers demonstrated improvements in their learn unit delivery following the training videos, however, their accuracy was far from mastery criteria level. Therefore, all teachers required in-situ TPRA’s with feedback in order to achieve mastery criteria for delivering learn units. In Experiment IV, I tested the effects of learning by observing videos of oneself on teacher learn unit accuracy. Specifically, I measured teacher learn unit accuracy prior to and following a classroom training where the teachers were required to measure the accuracy of their own learn unit instruction, by conducting TPRA observations on a set of pre-recorded videos of themselves delivering learn units. Additionally, I measured the numbers of post-intervention in-situ TPRA’s with feedback required by each teacher to achieve mastery criteria for presenting learn units. The results showed that all three teachers demonstrated mastery criteria for delivering learn units following the self-observation intervention. Therefore, none of the teachers required in-situ TPRA’s with feedback, as the skill was already in repertoire.
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DEDICATION

I dedicate this dissertation to Madeline; the ultimate reinforcer, the biggest and brightest light there is.
Chapter I
INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

There is a significant quantity of conceptual and empirical literature pertaining to teacher training and supervision. Behavior analytic literature, in particular, includes a great deal of empirical research regarding the relationship between teacher performance and student learning variables, along with several evidence-based methods for improving both. With regard to teacher training, many researchers have emphasized, for example, the distinct but mutual roles of contingency-shaped and verbally mediated behavior (Catania, 2007; Greer, 2009; Hayes, Zettle, & Rosenfarb, 1989; Hineline, 1983; Kantor, 1933; Ribes-Inesta, 2000; Ribes-Inesta & Martinez-Sanchez, 1990; Ryle, 1949; Skinner, 1966; Skinner, 1985), along with the importance of self-monitoring repertoires (Mead, 1934; Ribes-Inesta, 2000; Ribes-Inesta & Martinez-Sanchez, 1990; Rosenfeld & Baer, 1969; Ryle, 1949; Skinner, 1953). With regard to such distinction, both Ryle (1949) and Skinner (1966) differentiated between “knowing that” (verbally mediated or verbally governed behavior) and “knowing how” (contingency-shaped behavior). Specifically, both authors emphasized that, in relation to rules, each of the aforementioned responses are characterized by different types of understanding; rules that are constructed from interactions with contingencies, and rules that are transmitted as instructions to be followed in order to deal with a complex set of circumstances (Ribes-Inesta, 2000).

Research-based approaches to teaching and teacher training have included such things as Programmed instruction (Skinner, 1965), Opportunity to respond and active student responding (Greenwood, Delquadri, & Hall, 1984), Learn units (Albers & Greer, 1991; Bahadourian, Tam, Greer, & Rousseau, 2006; Greer, 2002; Keohane & Greer, 2005; Selinske, Greer, & Lodhi, 1991), and Teacher Performance Rate and Accuracy (TPRA) observations (Ingham & Greer, 1992; Ross, Singer-Dudek & Greer, 2005; Selinske, Greer, & Lodhi, 1991). In terms of teaching and learning, both behavior analytic and non-behavior analytic researchers and theorists have pointed to video self-monitoring as an effective means to establish or improve self-observation skills (Buggey, 1995; Deitchman, Reeve, Reeve, &
Progar, 2010; Dowrick, 1983; Pelletier, McNamara, Braga-Kenyon & Ahearn, 2010; Reamer, 1995; Ribich, 1974; Stokes & Baer, 1977; Wright, Ellis, & Baxter, 2012), which result in stronger contingency-shaped behavior.

**Effective Teaching Practices**

While the importance of effective teaching is irrefutable, there remains little research with regard to the variables controlling that which constitutes high-quality pedagogical practice as measured by student learning outcomes.

Much of our prognosis for survival is related to environments by and for people. The development of adequate responses is, in turn, dependent on instruction that is intentional and effective. The result is that our very survival depends on the rapid development and broad application of sophisticated instruction (Greer, 1989, p. 45).

Research on the relationship between teacher skills and student acquisition of educational objectives shows that teacher performance is a fundamental component of student success (Albers & Greer, 1991; Ferguson, 2008; Ingham & Greer, 1992; Whitehurst, 2003). Chapman (2004) noted that the level of a teacher’s qualifications represents one of the most significant influences on student achievement outcomes. Similarly, Brophy (1979) wrote, “it seems intuitively obvious that educational outcomes will be determined by both what is taught (curriculum) and how well it is taught (method) and that both aspects need investigation” (p. 734). The author argued that, in addition to the complex skills required for effective teaching, teachers must also learn the appropriate circumstances in which to use a particular skill.

According to Greer (1989), pedagogy is concerned with the methods of instructional intervention that establish new environmental controls for student behavior. Within a science of behavior, pedagogy relies on procedural principles that result in those new environmental controls. Specifically, Greer (2002) referred to pedagogy, as:

The instructional operations performed by a teacher or by an automated teaching device that result in a student learning a behavior, a response class, and a repertoire. The learning must have occurred as a function (that is as a “cause”) of, or a correlate of, the instructional operations performed by the teacher. The teaching operations were either sufficient or necessary to the
learning. Without them, the student would not learn (p. 4).

According to Greenwood, Carta, and Atwater (1991), in order to adequately evaluate instruction, one must consider both the complexity of the instructional environment along with particular procedural components of the instruction.

The following areas of theory and research constitute the various positions regarding the repertoires necessary for an individual to be an effective teacher, and how effective teachers acquire such repertoires. Is effective teaching reliant upon one’s ability to self-observe, the amount of knowledge one has about the rules for effective pedagogy, or one’s contingency shaped repertoires? The focus of the current investigation is to determine the elements necessary for effective pedagogy, how each of those components influence student learning and, finally, how teachers acquire the fundamental skills of effective teaching.

Self-Observation

**Non-Behavioral Perspective.** Social psychologists generally discuss self-awareness in terms of an individual’s subjective experiences, measured via introspection (Bandura, 2001; Wicklund, 1975). However, self-awareness or self-observation—from a radical behavior perspective—is grounded in one’s social relation to others, and requires the presence of a verbal community.

Wicklund (1975) defined objective self-awareness as, “a state in which the person takes himself to be an object” (p. 234), suggesting that an individual’s objective self-awareness increases in the presence of “stimuli that remind the person of his object status” (p. 234). Wicklund (1975) explained, theoretically, any symbol or reflection of a person will cause a shift of his focus inward, and experimentally we have often used mirrors and tape recordings of the person’s voice for this purpose. Not only should symbols of oneself create self-focused attention, but the knowledge of being attended to by others should also create a set toward self-observation. Strictly speaking, the sight of an audience does not provide a symbol or reflection of oneself, but the self readily comes to the fore when the person realizes that the attention of the audience is on some feature of self (p. 234).
Radical Behavior Perspective. According to Mead (1934),

But it is where one does respond to that which he addresses to another and where that response of his own becomes a part of his conduct, where he not only hears himself but responds to himself, talks and replies to himself as truly as the other person replies to him, that we have behavior in which the individuals become objects to themselves (Mead, 1934, p. 139).

Mead (1934) described self-conscious behavior as that which enables an individual to become an object within his own environmental field and to respond to himself as he responds to other stimuli or individuals. Furthermore, “the individual organism is obviously an essential and important fact or constituent element of the empirical situation in which it acts; and without taking objective account of itself, as such, it cannot act intelligently, or rationally” (Mead, 1934, p. 138). Similarly, Skinner (1953) described self-knowledge as, “discriminative responses to one’s own behavior and to the variables of which it is a function,” (p. 423) and attributed the establishment of such repertoires, exclusively, to one’s verbal community or social environment. Specifically, Skinner (1953) stated, “whether or not our subject will be self-conscious and introspective depends upon the extent to which the group has insisted upon answers to questions such as, "What are you doing?" or, "Why did you do that?" (p. 423). Initially, the individual’s development of self-knowledge and self-descriptive behavior represent repertoires that are advantageous to the verbal community in which they were generated. Later, however, such responses enable the development of self-management and self-control and, therefore, become useful to the individual himself. Skinner (1971) also suggested that self-observation is merely preliminary to action, and the extent to which an individual should be aware of himself is dictated by the extent to which self-observation is required for effective behavior under particular circumstances.

Skinner (1957) operationalized the term self-evaluation, through his identification and analysis of the self-as-own-audience repertoire. According to Skinner (1957), audience control develops as the product of one’s instructional history that includes the influence of an individual or a group of individuals over a speaker, and results in the establishment of the audience character. Audience control is a discriminative stimulus for either a) an approving audience, which reinforces behavior, or b) a critical audience, which punishes or negatively reinforces behavior. When an individual’s own behavior has
become aversive or reinforcing to him or herself, through special conditioning by the community, he/she has acquired the speaker-as-own-audience repertoire. An individual’s insensitivity to external audiences can result in decreased emission of verbal behavior, and increased emission of behavior that is automatically reinforced (i.e., self-generated stimuli such as stereotypy, daydreaming, self-talk in fantasy). Furthermore, punitive audience control results in the reduction of such target behaviors. If one’s self-as-own-audience repertoire controls the punitive audience, then one will not require the presence of a specific audience in order to emit appropriate behavior across settings.

Additionally, Skinner (1953) wrote,

One of the most striking facts about self-knowledge is that it may be lacking. . . A man may not know that he has done something. He may have behaved in a given way . . and nevertheless be unable to describe what he has done. . . A man may not know that he is doing something. These phenomena are often viewed with surprise. How can the individual fail to observe events, which are so conspicuous and so important? But perhaps we should be surprised that such events are observed as often as they are. We have no reason to expect discriminative behavior of this sort unless it has been generated by suitable reinforcement. Self-knowledge is a special repertoire. The crucial thing is not whether the behavior, which a man fails to report, is actually observable by him, but-- whether he has ever been given any reason to observe it. Self-knowledge may, nevertheless, be lacking where appropriate reinforcing circumstances have prevailed (pp. 288-290).

Catania (2007) referred to autology as, “the scientific study of the self. Cf. private events” (p. 379), and proposed that learning to discriminate properties of one’s own behavior, verbal or otherwise, occurs in the context of learning to discriminate the behavior of others. Consequently, “it follows that what we know about ourselves is a social product. We don't see ourselves as others see us; instead, we see ourselves as we see others” (Catania, 2007, p. 231). Nevertheless, effective responding to particular audiences would seem to require observing oneself as others do, as in writing such that a reader responds as the writer intends (Broto & Greer, 2014; Greer & Ross, 2008; Greer & Speckman, 2009). Another example is learning generalized imitation from mirror training, where observing and kinesthetic responding are joined (Du & Greer, 2015).

Kantor (1933) conceptualized the “reactional biography” as the basis for all psychological phenomena, and attributed an individual’s development of such responses to contact with the various
objects in his environment. As such, Kantor (1933) concluded, “that all the psychological responses that we ever perform must arise in the course of our behavior history. It means also that all our abilities and capacities must similarly be developed during our individual behavior lives” (p. 58).

According to Skinner (1974), the characterization of the term “consciousness,” as a product of social contingencies established by a verbal community that enabled an individual to “see that he is seeing an object,” facilitated its study by a science of behavior. However, Skinner (1953) also noted that, given the special nature of self—knowledge, including the particular reinforcement contingencies required for its development and maintenance—that some individuals might not acquire all of the corresponding component behavior.


Skinner (1985) explained that behavior is either shaped and maintained directly by contingencies of reinforcement, or controlled by verbal descriptions of those contingencies, and offered the following representation of the difference between the two types of behavior:

When we learn to drive a car, for example, we begin with responses to verbal stimuli. Our behavior is rule-governed. We flip switches, push pedals, and turn the wheel as we are told to do. But consequences follow, and they begin to shape and maintain our behavior. When we have become skillful drivers, the rules no longer function. When contingencies are not adequate, however, we return to the rules (Skinner, 1985, p. 249).

Hayes, Zettle, and Rosenfarb (1989) categorized rules as antecedent events, suggesting that it is the consequences of rule following that influences the future likelihood that a particular rule will function as an antecedent for rule following behavior. However, the authors emphasized that the history of the individual listener determines the present value of those particular rules as antecedents for rule following.

Kantor (1933) characterized perfect learning as habit formation, or the integrated connection of stimuli and responses. In addition, Kantor (1933) suggested that the establishment of a novel response to a new stimulus function characterized the most fundamental type of learning. The author noted that such connections become clear when one considers undesirable behavior, or habitual reactions, “when the
wrong response is strongly integrated with a stimulus there is great difficulty in breaking the connection . . . In considering the accuracy of habitual behavior we discover that it depends upon building up stable and steady performances” (Kantor, 1933, p. 247).

According to Skinner (1985), the study of rule-governed behavior often involves descriptions of settings or situations in which one is asked to imagine oneself and to say what one would do, and where contingent consequences are suggested rather than delivered; however, “descriptions of settings are never quite accurate or complete, what people say they will do is not always what they actually do, and a description of contingencies seldom has the same effect as exposure to the contingencies” (Skinner, 1985, p. 294).

According to Greer (2009) verbally governed pedagogy refers to the process of a teacher following written or spoken directions to engage in teaching new operants. Verbally governed behaviors include those that entail following a particular verbal algorithm for solving learning problems scientifically, or following instructions for using a particular teaching tactic. When a teacher delivers learn unit instruction, her teaching procedures are, initially, controlled by verbal stimuli in the form of instructions. However, given sufficient practice, the teacher acquires fluency and begins to deliver learn units with automaticity, by contacting environmental contingencies; at this point, her teaching is contingency-shaped. In addition, Greer (2002) noted:

Teachers who are not taught to use contingency-shaped repertoires based on the best scientific practices by specially designed classroom experiences typically learn to: present flawed antecedents or instructions; neglect to allow the student the opportunity to respond; neglect to reinforce or correct the target response; do not remediate learning problems immediately; do not present learn units; do not teach to mastery; and presume that their lectures function to teach (pp. 43-44).

Hineline (1983) distinguished between, “knowing that,” which involves rule-governed behavior under the control of verbal tacts, and “knowing how,” which does not necessarily involve a verbal repertoire. In cases where one “knows that…,” one can describe relevant relationships, which can, in turn, function as discriminative stimuli for the subsequent behavior of a listener (Skinner, 1969) or for oneself as listener. On the other hand, “knowing how…” includes both the actions of the corresponding
repertoire, along with the relevant conditions in which the repertoire occurs.

According to Hineline (1983),

Concatenations of these “knowing” locutions also identify specific behavior/environmental relationships. For example, consider “He knows that they don't know that she knows how to drive a snowmobile.” Such relationships, carefully stated, are consistent with precise behavioral analysis: 1) Her repertories include effective snowmobile driving, irrespective of whether her verbal tacts are consistent with that fact…2) Their tacts are not under reliable functional control of her repertories relevant to snowmobiling, 3) His tacts are under reliable functional control of both 1) and 2) (p. 184).

According to Catania (2007), skilled performances involve repertoires of behavior that remain sensitive to momentary consequences and, therefore, must be contingency-shaped. Further, Catania (2007) stated, “We must learn by doing in such cases; instructions can’t substitute for the subtleties of direct contact with contingencies” (p. 267). On a similar note, Skinner (1957) suggested that the success of an individual’s verbal mediation is limited by the degree of behavior change required and, as a rule-governed algorithm becomes increasingly complex, a point is reached at which the listener is unable to respond accurately. Likewise, according to Ryle (1949), one must learn how to do something before one learns how to describe his own performance. In order to construct verbal descriptions of the current contingencies, an individual must observe his own successful behavior (Ribes-Inesta, 2000). Furthermore, Ribes-Inesta suggested that, “self-instructing consists of a self-regulated shaping based on the individual's history of interaction with a particular class of contingencies. Thus, self-instructions may facilitate (or interfere) with relevant effective behaviors in a new problem situation, to the extent that instructions increase the likelihood of the relevant responses” (pp. 51-52). However, self-descriptions generated after a performance don’t reliably correspond to the actual behavior, or to the variables acting upon the individual (Ribes-Inesta & Martinez-Sanchez, 1990). In addition, Rosenfeld and Baer (1969) pointed out that there is nothing to support the claim that observation of another person’s behavior, or following rule-like verbal instructions, are sufficient to correlate to an individual’s performance or self-descriptions of their performance.
Proactive Inhibition

Given the role of contingency-shaped behavior in skill acquisition (Catania, 2007; Ribes-Inesta, 2000; Ryle, 1949), it is important to consider the potential influence of faulty prior learning or ineffective contingency-shaped teaching repertoires on an individual’s performance during the acquisition of new skills.

According to Atwater (1953), “proactive inhibition (PI) may be deemed as a decrement in the recall of a learning task as a result of the prior learning of some other task” (p. 400). Underwood (1945) distinguished between proactive inhibition in learning (associative inhibition), which refers to an impedance in one’s learning of a particular response as a function of having engaged in prior activity, and proactive inhibition in retention, which characterizes the reduction in one’s recall of a response as a function of having previously learned a different response. Similarly, Postman (1961) attributed instances of proactive inhibition, or forgetting, to “interference from stable language habits with which the subject entered the experimental situation” (p. 167). Furthermore, the author suggested that in order to acquire the prescribed association, or target response to the experimental stimulus, an individual must unlearn the pre-experimental association (or previously learned response to the experimental stimulus) through extinction. Specifically, Postman (1961) explained,

The extinguished habit, A-B, will gradually recover as a function of time and compete with A-C at the time of recall. If A-B is a stable language habit, its pre-experimental strength was undoubtedly much greater than that imparted to A-C during the experiment. Thus, A-B will readily recover sufficient strength to compete effectively with A-C. Of course, if A-B is practiced after the end of the experiment, the process of recovery is speeded up and the probability of effective competition is increased (p. 167).

Donahoe and Palmer (2004) discussed proactive effects as resulting from events that occurred prior to the presentation of the stimulus in question, which influence one’s response to that stimulus. Depending on the specific situation, such effects may interfere with or facilitate retention. Additionally, conducting analyses of ongoing behavior in terms of the stimuli one encounters at a particular moment is difficult, given that the present environment acts on behavior of the individual that has been changed by the selection of past environments. Furthermore, Donahoe and Palmer (2004) pointed out that, “although
the environment of the moment remains necessary for the interpretation of complex behavior, it becomes increasingly insufficient, as the selection history grows more extensive” (p. 237).

Research-Based Approaches to Teaching

While a number of researchers found that simply training teachers to use self-monitoring strategies resulted in increased procedural integrity (Belfiore, Fritts, & Herman, 2008; Plavnick, Ferreri, & Maupin, 2010), others have argued that training should involve self-monitoring components in conjunction with supervisor feedback (Pelletier, McNamara, Braga-Kenyon & Ahearn, 2010; Richman, Riordan, Reiss, Pyles, & Bailey, 1988; Stokes & Baer, 1977).

Teaching as Applied Behavior Analysis. According to Skinner (1965), in order to apply operant conditioning to teaching, one must arrange the contingencies of reinforcement needed for student learning. Likewise, Greer and Ross (2008) noted that, through precise and explicit environmental arrangements, it is possible to provide an individual with the experiences necessary for the acquisition of missing verbal repertoires. Children will learn in the absence of teaching, through natural contingencies in the environment, however, teaching enables one to accelerate the pace of student learning.

Programmed instruction. Skinner (1965) described four different types of programmed instruction. The first type includes the generation of new patterns of behavior: the teacher selects responses to be reinforced and the student moves gradually through a series of stages until he or she achieves the terminal response. The second type of programming involves altering the frequency or temporal properties of a repertoire. The third type is concerned with establishing stimulus control for the student’s responses. The fourth type is concerned with the maintenance of behavior under natural or infrequent schedules of reinforcement. For each type of programming identified above, responses may be taught as chains with each prior response functioning as the antecedent for the next response in the sequence. More complex programming involves an analysis of the contingencies between two or more organisms under interlocking schedules of reinforcement.

Opportunity to respond and active student responding. Greenwood, Delquadri, and Hall (1984) defined opportunity to respond “as the interaction between (a) teacher formulated instruction . . .
(the materials presented, prompts, questions asked, signals to respond, etc.), and (b) its success in establishing the academic responding desired or implied by materials, the subject matter goals of instruction” (p 64). Further, the term opportunity to respond presumes an analysis of the environment in which contingencies are arranged to promote academic responding. This includes the identification of antecedents to occasion responding, consequences to reinforce accurate emission of the target behavior or to correct inaccurate responses, along with instructional tactics to remediate learning. Another critical component is active responding rather than passivity. Based on this research, a number of effective instructional procedures have been developed, along with systems to analyze and record a teacher’s three-term contingencies. (Greer, McCorkle, & Williams, 1989; Selinske, Greer, & Lodhi, 1991). Active student responding (ASR) refers to a student’s response to an instructional antecedent, which can be measured using a frequency count. Heward (1994) identified the following as advantages to increasing ASR: 1. More learning occurs; 2. Provides feedback to the teacher, and; 3. ASR is correlated with more on-task behaviors.

**Learn units.** Greer (2002) described the learn unit as a countable component of instruction, which includes a single, potential three-term contingency for the student and two or more three-term contingencies for the teacher, and predicts new stimulus control for the student. The learn unit measures the responses emitted by both the teacher and the student and, ultimately, changes their subsequent responses in either an individual or a joint manner. The teacher’s operant behavior must interlock with the student’s three-term contingency under conditions that serve to motivate the student, within a functional and behavior-specific context. In other words, in order for a particular operant to emerge as part of one’s functional repertoire, instruction must occur under conditions similar to those in which one will require use of that operant. In addition to serving as a measure for student learning, learn units enable teachers to perform theoretical contingency and functional analyses of instructional problems, which involve analyzing the data pattern and/or instructional history of a particular student in order to select an appropriate, evidence-based tactic. Furthermore, learning outcomes for a given student are explicit, since they correspond directly to the number of instructional objectives achieved by that student.
According to Greer (2002), skilled teachers produce better outcomes for students and, “greater numbers of learn unit presentations, as opposed to presentations that are not learn units, result in significantly higher rates of correct responses and higher numbers of instructional objectives for students” (p. 24). Singer-Dudek, Speckman, and Nuzzolo (2010) noted that, “learn units-to-criterion, or simply put the number of instructional units it took for a student to meet one instructional objective, may be the single most important indicator of effective instruction in schools” (p. 258).

In the first study of its kind, Albers and Greer (1991) tested the rate of presentation of the three-term contingency trial (i.e., learn unit) on instructional effectiveness, by combining antecedent conditions, student responding, and teacher consequences into a single unit. The results showed that the participants emitted higher numbers of correct responses as a function of the instructor’s increased rate of learn unit presentation. Albers and Greer noted that the learn unit functioned as an objective tool, which enabled an observer to discriminate between effective and ineffective instruction. Based on their findings, the authors concluded that the learn unit was a predictor of student learning.

Keohane and Greer (2005) found that after teachers were trained to analyze instructional problems and to make rule-governed instructional decisions using the learn unit, their respective students demonstrated fewer learn units to criteria (i.e., increased rate of learning). Specifically, after they received training on how to apply rule-governed strategies to instructional decision-making, the teachers demonstrated increased accuracy in their decisions regarding the selection of instructional tactics. Additionally, all of the teachers showed fewer instructional decision errors. The authors proposed that, “the supervisor’s verbally governed series of questions served over time to provide the teachers with a framework in which to ‘think’ strategically through instructional problems” (Keohane & Greer, 2005, p. 267).

Greer (2002) suggested that many teachers deliver instruction without considering the operant. Incomplete operants are apparent, for example, in a lecture comprising many instructor antecedents without corresponding opportunities for student responses. Unless explicitly trained to present antecedents, provide response opportunities, then deliver consequences, teachers generally do not provide
units of instruction that are complete operants. Using research-based procedures, a trained observer can detect the presence or absence of learn units in any instructional setting or scenario. In addition, the observer can measure whether the learn units are intact—by identifying the presence or absence of three-term contingencies for both the student and teacher, and whether or not those operants interlock. “Learn units, whether planned or incidental, are found in effective instruction in various conformations, but are not found in ineffective instruction” (Greer, 2002, pg. 30). Furthermore, Greer and Higin-McDonough (1999) indicated that effective instruction is characterized by high rates of learn units and that, in conjunction, the number and rate of interlocking operants (e.g., learn units) between a teacher and student serves as a measure of teaching that predicts instructional outcomes.

According to Selinske, Greer, and Lodhi (1991), teachers determine criterion-referenced instructional objectives based on the identification of assets and deficits within a student’s academic repertoire. Rate of learn unit presentations, in conjunction with criterion-referenced objectives, function as the fundamental measure of teaching and as the nucleus or core component for instructional analysis. In general, the mean numbers of learn units required by a student to achieve an instructional objective is a direct measure of the teacher’s instructional expertise.

Bahadourian, Tam, Greer, and Rousseau (2006) compared the effects of instruction that contained written learn units, with lecture-based instruction in university classes that did not contain learn units, on the academic achievement of undergraduate students. The results showed that student performance increased by a mean of 10-15 points in response to the learn unit instruction. The authors noted that, despite the numerous suggestions that are available with regard to improving learning outcomes, none have incorporated all of the critical components, which include the identification of: an absolute measure of teaching that predicts learning with reliability and validity, and; specific teacher responses that are functionally related to measurable improvements in student learning. With regard to their own study, the authors concluded that the results contributed to the database of evidence that demonstrates the utility of the learn unit as a micro-analytic measure of teaching and learning, along with an effective independent variable for both students with disabilities and typically developing students in higher education settings.
**Learn Unit Context.** Greer (2002) described the learn unit context as encompassing all of the factors that contribute to and affect student learning outcomes. In addition, the learn unit context includes the potential sources of difficulty that hinder or prevent student learning. The four broad sources for problems are: 1) the way in which the student is currently taught or components of the learn unit itself (i.e., materials, pedagogy); 2) the setting events or events preceding the learn unit presentation; 3) the way in which the student was taught in the past or his instructional history (i.e., the existing skills in the child’s repertoire); and 4) phylogenetic and physiological factors (Greer, 2002, p. 63). Given each of those factors, Greer (2002) suggested that in order to identify verbally mediated solutions to such learning problems, one must look to the following: 1) the prerequisite repertoires of the student; 2) the target antecedent for the student in the learn unit; 3) the student’s response component in the learn unit; 4) the consequence for the student in the learn unit; 5) the motivational setting in which the learn unit is presented; and 6) physiological and anatomical conditions affecting the control of any part of the learn unit and its context (p. 63). Furthermore, identifying solutions to student learning difficulties requires the scientific teacher to ask a series of strategic questions regarding each of the abovementioned components.

**Teacher performance rate and accuracy (TPRA).** The Teacher Performance Rate and Accuracy (TPRA) tool enables direct measurement of student and teacher responses during learn unit instruction. During TPRA observations, a trained observer measures each component of the three-term contingency in order to determine functional relationships between teacher behavior and student learning. Research shows correlations between regular (weekly) TPRA observations and increased student learning (Ross, Singer-Dudek & Greer, 2005). Additionally,

Improved TPRA scores suggest the following: 1) shorter latent time periods between learn units to students which translates into greater amounts of instruction, 2) fluent teacher presentations, and 3) increased contingency-shaped behaviors instead of rule-governed behaviors (i.e., teachers who emit automatic behaviors instead of accessing procedures to instruct). For both teachers and students, accurate rates should increase, inaccurate rates should decrease, and changes in students’ performances should be analogous to changes in teachers’ performances (Ross, Singer-Dudek & Greer, 2005, p. 418).

Ingham and Greer (1992) introduced the first experiment that tested the effectiveness of the
Teacher Performance Rate and Accuracy (TPRA) measure, which functioned as an observational procedure for collecting simultaneous data on student responses and teacher behavior. The TPRA provided a tool, through which researchers identified functional relations and monitored the effectiveness of teacher performance. According to Greer (2002), TPRA observations provide the key to effective behavior analytic teaching practices in the classroom and, as such, are essential in training contingency-shaped teaching repertoires that coincide with behavior principles and tactics. TPRA observations enable one to eliminate teacher error as the potential source for student learning problems (Greer, 2002).

Selinske, Greer, and Lodhi (1991) found correlational and functional relationships between TPRA observations and increased accuracy of responses emitted by teachers and students during instruction. Follow-up data showed increases in the delivery of instructional trials, correct student responses, and objectives achieved.

According to Greer (2002), the TPRA observations function to teach the teacher how to present accurate learn units. In general, the TPRA observations are the first line of defense against student learning difficulties, as they enable one to rule out teacher errors as the likely source of learning problems. When a teacher demonstrates flawless learn unit presentations across repeated TPRA observations, it is possible to rule out faulty instruction as the source of the student’s learning difficulty. Greer (2002) stated,

Once the teacher’s delivery of the scripted procedures is ruled out as a variable for a particular students difficulty, the teacher and supervisor can pursue problems associated with inappropriate fit of the scripted or programmed instruction to the individual student. If the teacher’s presentation is errorless, then the locus of the problem resides with the instructional program per se, the context or motivational setting, or the student’s history and rarely phylogenic variables (p. 221).

**Teacher Self-Evaluation in Teacher Training**

A multitude of researchers have emphasized the importance of accurate and objective self-evaluation, suggesting that such repertoires were among the most critical in terms of improving teacher effectiveness, such as: Aubertine (1967) with regard to microteaching; Ahnell and Hawn (1973), regarding self-evaluation, in general; along with, Ribich (1974), and Medley and Mitzel (1963), who
combined rating scales with self-evaluation procedures.

With regard to teacher and therapist training programs, Follette and Callaghan (1995) reported that rules compete with one’s attention to actual events and detract from one’s ability to respond to contingencies as they occur. Specifically, the authors suggested that, “complex social skills are taught not merely by a process of rule giving but by a process of having one's behaviors shaped by the contingencies that operate in any interaction” (p. 415). Furthermore, while real time supervision is considered an essential component in any teacher or therapist training program, Follette and Callaghan (1995) argued that, “the liability with those approaches is that supervision may result in giving direct instruction to the therapist that the therapist subsequently turns into a rule (p. 415).” The authors offered an approach to therapist training that involved a supervisor observing a therapist through a one way mirror, and providing real time feedback through a video monitor, visible to the therapist, that showed a supervisor-controlled rising and falling light.

Ribich (1974) trained a panel of experts to use the Teacher Performance Appraisal Scale (TPAS) (Johnson, 1969) as a criterion measure of teacher performance and teacher self-evaluation of their own performance. Specifically, the TPAS evaluations, which resulted in scores across teacher self-perception of performance, observer perception of teacher performance, and level of agreement between teacher and observer, enabled observers to deliver corrective feedback to the practicing teacher participants. In addition, the evaluator and practicing teacher participants watched video tapes of the corresponding teaching session. The results showed that the participants demonstrated increased accuracy across the subjective measures (i.e., perception and evaluation of their own teaching performance) and the objective measures (i.e., improvements in their actual teaching performance, as measured by the observer).

Buggey (1995) examined the effects of a video self-modeling intervention on the subsequent acquisition, generalization, and maintenance of a target verb form, among preschool-aged participants with language delays. The results showed that all of the participants demonstrated gains in their acquisition and use of the specified target verb form. However, it is important to note that the video-self modeling procedure in their study included only positive exemplars of the target behavior, in order to ensure that, “the idealized
view of the individual is perceived as attainable” (Buggey, 1995, p. 434). Similarly, Dowrick (1983) edited the participants’ videos in order to eliminate instances of non-target behavior, and to ensure that the participants only observed themselves emitting behavior at or above their current performance levels. Referring to this process as “feedforward,” Dowrick (1983) aimed to provide the participant with opportunities to see himself as others might see him.

Reamer (1995) reported that after an intervention package comprised of video self-monitoring, self-assessment, and behavioral rehearsal, para-educators demonstrated increases in appropriate teaching behavior, such as delivering contingent positive feedback. Additionally, the para-educators completed higher numbers of instructional tasks with students, and reduced their delivery of vocal reprimands. Following the completion of the video-based interventions, the para-educators continued to show generalization of the target skills across untrained tasks and scenarios.

Wright, Ellis, and Baxter (2012) investigated the effects of a video-based, self-evaluation procedure on teachers’ use of praise in a preschool setting. Fifty-one teachers were assigned, at random, to one of three conditions: immediate self-evaluation, delayed self-evaluation, or control. The independent variable comprised a treatment package that included training in observation skills and self-evaluation. While the frequency of praise statements remained low in the control group, participants in both of the self-evaluation groups demonstrated significant increases in their emission of praise.

Pelletier, McNamara, Braga-Kenyon, and Ahearn (2010) reported the effects of a video self-monitoring treatment package that incorporated observation, direct feedback, and self-monitoring components, on the level of procedural integrity with which paraprofessionals implemented behavioral programs. Specifically, the researchers trained the participants to record procedural integrity data on themselves by completing a checklist while watching pre-recorded videos of their own instructional sessions. Following the procedural integrity with video self-monitoring intervention, all three paraprofessionals demonstrated increased accuracy in implementing student behavior plans. Furthermore, the authors suggested that their findings added to the research surrounding the inadequacies of traditional approaches to staff training with regard to measures of procedural integrity, which include, for example,
the provision of written and/or verbal instructions that contain guidelines for implementing behavioral programs. Given the limitations of their findings, such as the concurrent implementation of multiple independent variables (i.e., observation, direct feedback, and self-monitoring), the authors called upon future researchers to conduct a component analysis, in order to determine the effects of each variable in isolation.

Stokes and Baer (1977) implemented a procedure that included video self-monitoring along with trainer feedback, in order to teach parents to deliver instructional trials that contained all components of a three-term contingency. Specifically, the participants watched videos of their own instructional presentations and evaluated the accuracy of each trial component (i.e., antecedents and consequences), then discussed their own evaluations with those of the trainer. The results indicated that, following the daily video-self monitoring sessions, each of the participants demonstrated accuracy in their delivery of instructional trials using a three-term contingency, across both setting and context. In a similar study, Harden (1998) reported the effects of a training video on participant generalization of behavior management strategies to their respective home settings. The video training included the following components: (1) an overview of basic tactics from research in applied behavior analysis; (2) procedures for recording data; (3) the design of instructional objectives based on educational goals, along with the procedures for collecting, graphing, and evaluating data; and, (4) presentation of an individualized training with video feedback. Each participant was the parent of a child, aged 18 months to three years, and diagnosed with autism. The results of the video training plus subsequent immediate feedback, indicated that each participant demonstrated increased accuracy in implementing behavior management procedures.

Deitchman, Reeve, Reeve, and Progar (2010) combined video-feedback with self-monitoring instruction, in order to teach students with autism to initiate social interactions with peers in the general education setting. During the baseline conditions, the participants demonstrated the target responses in the instructional setting but not in the non-instructional/generalized setting. The results indicated that, following the intervention, the participants showed increased numbers of social initiations across settings.
and peers, and in the absence of direct reinforcement for social initiations in the general education setting. Additionally, follow-up measures showed that two of the participants maintained the target skill in the absence of video-self monitoring. The authors concluded that the participants may have developed self-mediated covert discriminative stimuli (Stokes & Osnes, 1989) regarding their own correct and incorrect social initiations—which, in turn, occasioned the emission of appropriate behavior in the generalization setting—as a function of the various settings and social situations across which they learned to evaluate their own behavior during video-feedback sessions.

Bishop, Snyder, and Crowe (2015) tested whether video self-monitoring with graduated training and feedback would effect the accuracy with which preschool teachers presented instructional learning trials, along with the accuracy with which the teachers monitored their own presentation of instructional learning trials. The teachers watched videos of their own instruction and measured their accuracy using a coding form. The researchers varied the levels of prompting provided on the coding forms, along with the form and type of feedback and training provided to the teachers across the different conditions. Specifically, in the video self-monitoring condition 1 (VSM-I), the researchers provided the teachers with a coding form, and required the teachers to watch themselves in the videos while answering open ended questions aimed to guide the teachers in identifying and describing the presence or absence of instructional trial components. This condition did not include any specific training on how to present instructional trials. During the VSM-II condition, the researchers trained the teachers on how to deliver accurate instructional trials, while also providing training on how to measure accurate versus inaccurate teacher instruction. This condition included a more focused and systematic method for measuring instructional accuracy. During this training, Bishop, Snyder, and Crowe (2015) did the following:

For each component of a trial, the trainer (a) gave the teacher a definition of the component, (b) explained coding rules to help the teacher identify when the component was occurring and whether it was implemented with fidelity, (c) showed a video clip of the component being implemented correctly and a video clip of the component being implemented incorrectly or not at all, (d) modeled how to record the occurrence and accuracy of the component on the coding form, (e) brainstormed with the teacher what the component might look like relative to her child’s target behavior, and (f) answered questions the teacher had about coding the component” (p. 174).
Thereafter, the teachers practiced coding independently while watching videos of others presenting instruction, followed by videos of him or herself presenting instruction. During the VSM-III condition, the teachers continued to use the same coding system to self-monitor their own trial implementation. In addition, the researchers provided ongoing feedback to the teachers on their self-monitoring accuracy. In order to measure self-monitoring accuracy, the researchers compared their own data on the accuracy of the instructional trials with the teachers’ self-monitoring data. The results of the study showed that the collective use of training, coding forms containing prompts for the components of the learning trials, along with external feedback, led to increased accuracy in self-monitoring for two of the three teachers. Additionally, the abovementioned interventions resulted in increased fidelity of learning trial presentations. The authors noted that, while such interventions were effective for increasing accuracy of learning trial presentations, systematic training and feedback were also essential in order to ensure accuracy in self-monitoring responses.

Research Questions and Rationale for the Current Study

Despite the abundance of literature available on different approaches to teacher training, the benefits of video-self monitoring interventions, along with the effects of video self-monitoring on teacher behavior (Bishop, Snyder, & Crowe (2015), Buggey, 1995; Deitchman, Reeve, Reeve, & Progar, 2010; Dowrick, 1983; Pelletier, McNamara, Braga-Kenyon & Ahearn, 2010; Reamer, 1995; Ribich, 1974; Stokes & Baer, 1977; Wright, Ellis, & Baxter, 2012), there is a shortage of well controlled, empirical research, that incorporates video self-monitoring with previously established, evidence-based measures of teacher effectiveness.

While Bishop, Snyder, and Crowe (2015) demonstrated the effectiveness of video self-monitoring using a standardized coding form, their procedure included a combination of many different variables within a single condition, or a treatment package, which does not enable one to conclude that the video self-monitoring alone was responsible for the teachers’ increased instructional accuracy. The researcher implemented the current study in order to answer the following questions:
1) Will training teacher trainers to conduct TPRA observations to a calibrated standard influence (a) accuracy of the teacher trainer’s own subsequent learn unit instruction, (b) accuracy of the teacher trainee’s learn unit instruction (after being trained via TPRA observations), or c) the numbers of objectives achieved by students, given instruction from the teacher trainees in (b)?

2) Will training teacher trainers to conduct TPRA observations on their own instructional delivery using video-self monitoring, influence (a) accuracy of the teacher trainer’s own subsequent learn unit instruction, (b) accuracy of the teacher trainee’s learn unit instruction (after being trained via TPRA observations), or c) the numbers of objectives achieved by the target students, given instruction from the teacher trainees in (b)?

Overview of Participants in Experiments I, II, III, and IV

The Teachers Trainees (Experiment I) and Teachers (Experiments II, III, and IV) were individuals who were hired as behavior interventionists at an agency providing special education and ABA (Applied Behavior Analysis) services to children with autism and other disabilities. Teacher Trainees and Teachers held the same position and were labeled differently within this paper for the purpose of clarity in each of the corresponding experiments. Behavior interventionists (teacher trainees and teachers) held at least a bachelor level degree. Teacher Trainers (Experiment I) were managers or supervisors within the same agency. They held masters degrees and, in some cases, held or were working toward BCBA (Board Certified Behavior Analyst) credential. The managers and supervisors were responsible for conducting initial assessments of student learning, and implementing verbal behavior curricular objectives from the agency’s standard curriculum, described in more detail below. The behavior interventionists (teachers/teacher trainees) were responsible for the day-to-day instruction of the students, using the scripted programs put in place by the managers and supervisors. The managers and supervisors monitored student learning and behavior interventionist performance by providing weekly supervision. Upon hire, all of the participants received basic classroom training in learn unit delivery (which included powerpoint presentations and role playing with peers) along with the procedures specific to basic instructional programs. In addition, the managers and supervisors completed quizzes that were

The programs used for instruction were part of a standard, agency wide curriculum comprised of programs in verbal behavior. All programs were evidence-based and derived from research on the verbal behavior development theory (Greer & Ross, 2008), or published in peer reviewed scientific journals. Programs were targeted toward inducing verbal functions, or verbal cusps and capabilities (Greer & Speckman, 2009), and ranged from pre-listener to advanced listener and speaker skills. Examples of such programs include the following: mand (requests) instruction, gross motor imitation, following vocal directions, two-dimensional matching instruction, tact and intraverbal instruction, point-to instruction (for various stimuli, depending on verbal level of functioning), auditory word match-to-sample instruction, prepositions, telling time, identifying and counting money, answering WH (who, what, when, where) questions about pictures or in books, multiple exemplar instruction to induce Naming, learning new operants from listening (to induce Naming), and observational learning instruction. While the content and specific scripted procedures differ across the abovementioned programs, an intact learn unit remains constant regardless of the individual program in question (i.e., all learn units include a teacher antecedent, student response, and teacher consequence). A written description of the procedures for each program was always available to the teacher, in each student’s program binder.
Chapter II
EXPERIMENT I

Method

Participants

The primary participants in the current study included two females in their early thirties, each employed as teacher trainers (e.g., supervisors) by an organization that provided ABA (Applied Behavior Analysis)/special education services (See Table 1). All of the primary participants were selected based on their position as teacher trainers (e.g., supervisors) within the abovementioned organization.

The secondary participants included the teacher trainees and students assigned to each of the teacher trainer participants. All of the students selected to participate in the current study were under the direct instruction of the participating teachers. In other words, during the course of the study, the students did not receive instruction from anyone other than the teacher trainee(s) assigned to him/her, and outlined in Table 2.
Table 1
*Participant Characteristics.*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Level of education</th>
<th>Level of experience</th>
</tr>
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</table>
| Teacher Trainer 1 | 29 years| Degree(s): Bachelor’s in Special Education
Certification(s): Special Education Teacher (California)
In Progress: Currently working toward both a Master’s Degree in ABA (Applied Behavior Analysis), and BCBA (Board Certified Behavior Analyst) Certification | One year in current position
Spent five years as the head teacher in a special education classroom |
| Teacher Trainer 2 | 27 years| Degree(s): Bachelor’s in Human Development with a minor in Psychology.                                                                                | Current: One year in current position
Previous: No prior experience in ABA |
Table 2

Teacher Trainees and Students assigned to each of the participating Teacher Trainers.
Setting

The researcher conducted all dependent variable probe sessions during one-to-one ABA instruction, either in the student’s classroom or in the home. The teacher trainers conducted training via TPRA observations with their respective trainees during one to one ABA instruction, either in the student’s classroom or in the home. The researcher conducted the independent variable calibration training sessions in an office setting.

Dependent Variables

**Dependent variable 1: Accuracy of teacher trainer learn unit instruction.** During each of the baseline conditions, the researcher measured the teacher trainer’s instructional accuracy across each component of the learn unit, including overall learn unit presentation, antecedent delivery, and consequence delivery. The researcher recorded data on instructional accuracy via Teacher Performance Rate and Accuracy (TPRA) observations (Selinske, Greer, & Lodhi, 1991; Ingham & Greer, 1992; Ross, Singer-Dudek & Greer, 2005) without feedback (See Tables 4 and 5).

**Dependent variable 2: Accuracy of teacher trainee learn unit instruction.** During each of the baseline conditions, the researcher measured the trainee’s instructional accuracy across each component of the learn unit, including overall learn unit presentation, antecedent delivery, and consequence delivery. The researcher recorded data on instructional accuracy via TPRA observations without feedback (See Tables 4 and 5).

**Dependent variable 3: Numbers of instructional objectives achieved by students.** During each of the baseline conditions, the researcher measured student learning, quantified by the numbers of mastery criteria achieved within blocks of 1,000 learn units, by each of the target students.

**Definition of Behaviors and Data Collection on the Dependent Variables**

**Instructional accuracy (teacher trainers and trainees).** During the dependent variable measures (baseline conditions), the researcher conducted TPRA observations without feedback in order to determine the accuracy with which the teacher trainers and trainees delivered learn unit instruction. The
researcher measured instructional accuracy across four separate instructional sessions per teacher trainer and trainee, by recording data on each the following components, using a TPRA form:

**Learn units (overall):** correct responses were defined as learn units (i.e., interlocking three-term contingencies between the teacher trainer and student; Greer, 2002) presented without errors, while incorrect responses were defined as learn units presented with one or more instructor errors, on one or more of the learn unit components.

**Antecedent delivery:** correct responses were defined as antecedents delivered without errors, while incorrect responses were defined as those delivered with one or more errors. Antecedent errors include but are not limited to: failure to establish student attention prior to delivering the antecedent, or delivering an ambiguous antecedent.

**Consequence delivery:** correct responses were defined as consequences delivered without errors, that were contingent on the accuracy of the student’s response, while incorrect responses were defined as consequences delivered with one or more errors, omission of consequences, or consequences that were not contingent on the accuracy of student’s response (See Tables 4 and 5 for the specific measurement criteria and standardized TPRA coding).

The researcher determined teacher accuracy across each learn unit component (overall learn units, antecedents, and consequences), for a given teacher trainer or trainee, based on scores derived from the TPRA observations without feedback. Following the completion of each TPRA observation without feedback, the researcher calculated percentage correct for each particular learn unit component. In order to calculate accuracy based on all four of the TPRA observations within a particular baseline condition, the researcher collapsed data for each learn unit component across all TPRA observations within the corresponding condition. In addition, and when possible, the researcher compared her own data on student response accuracy to that which the target teacher trainer or trainee collected during the instructional session (See Tables 4 and 5 for definitions of correct and incorrect student responses to instruction).

**Numbers of instructional objectives achieved by students.** During each baseline condition, the
researcher calculated the numbers of mastery criteria achieved (within blocks of 1000 learn units) by each target student. The researcher measured student learning across basic verbal behavior instructional programs, in the following areas: 1) academic equivalence, including match-to-sample instruction, textually responding to sight words, number skills (e.g., intraverbal counting, textually responding to Arabic numbers), and; 2) communication, including listener (e.g., following vocal directions, gross motor imitation, match-to-sample instruction, point-to instruction), and speaker (e.g., tact instruction, social intraverbal instruction) programs (Greer & McCorkle, 2009).

**Independent Variables**

The independent variable involved a package comprised of two separate, successive treatments

**Treatment intervention 1.**

**Teacher trainer TPRA calibration training (observing others).** The first independent variable involved training the teacher trainers to measure the accuracy of another individual’s learn unit instruction, by conducting TPRA observations to a calibrated standard of mastery, using a set of pre-determined videos (See Tables 4 and 5). During the teacher trainer TPRA calibration training, the teacher trainer conducted TPRAs while observing pre-recorded videos of various individuals delivering learn unit instruction. Following the completion of each video, the researcher scored the teacher trainer’s accuracy in coding each learn unit, by comparing the teacher trainer’s TPRA to a master (one that had been previously scored by two separate observers, with 100% agreement), then provided reinforcement for correctly coded learn unit components, and corrections for incorrectly coded components.

During the initial portion of the teacher trainer TPRA calibration training, the researcher provided immediate consequences to the teacher trainer’s coding responses, by pausing the video following the completion of each learn unit presentation. During subsequent portions of the training, the teacher trainer was required to observe and code entire instructional sessions (i.e., approximately 20 learn units per video) prior to receiving feedback/consequences. The researcher continued to present new videos that showed different teachers, students, and instructional programs, until the teacher trainer achieved the mastery criteria for the TPRA calibration training, which was set at 90% accuracy across two consecutive
Teacher trainer TPRA observations with feedback (on respective trainees). Following mastery of the TPRA calibration training, the teacher trainer was required to conduct TPRA observations with feedback, until each of her respective trainees delivered learn unit instruction without errors. During the TPRA observations, the teacher trainer measured the trainee’s instructional accuracy across each learn unit component, then provided specific feedback in the form of reinforcement and corrections (all corrections were delivered immediately after an error was made) (See Tables 4 and 5). The teacher trainer continued to conduct TPRA observations with feedback until each trainee demonstrated the mastery criteria for learn unit instruction, which was set at 100% accuracy across two different instructional programs.

If the trainee did not demonstrate increased accuracy on the dependent variable measures, as recorded (by the researcher) during the post-intervention TPRA observations without feedback, the researcher implemented the second treatment intervention.

Treatment intervention 2.

Teacher trainer TPRA calibration training (self-observation). During the second treatment intervention, the teacher trainers were required to conduct TPRAs on the accuracy of their own learn unit instruction, to a calibrated standard of mastery, while watching pre-recorded videos of their own instructional sessions (See Tables 4 and 5 for a detailed outline of the learn unit components, definitions of correct and incorrect responses during instruction, and standardized coding for TPRA observations). The researcher presented pre-recorded videos that showed the corresponding teacher trainer deliver learn unit instruction, while the teacher trainer conducted TPRAs on her own instructional accuracy (all videos were recorded during the baseline condition). Following the completion of each video, the researcher scored the teacher trainer’s accuracy in coding each learn unit, by comparing the teacher trainer’s TPRA to a master (one that had been previously scored by two separate observers, with 100% agreement), then provided reinforcement for correctly coded learn unit components, and corrections for incorrectly coded components. The researcher continued to present novel videos of the teacher trainer delivering learn unit
instruction, until the teacher trainer achieved the mastery criteria for the self-observation TPRA calibration training, which was set at 100% accuracy across two consecutive TPRA observations.

**Teacher trainer TPRA observations (on respective trainees).** Following mastery of the TPRA self-observation calibration training, the teacher trainers were required to conduct TPRA observations, with feedback, until their respective trainees delivered learn unit instruction without errors. During these TPRA observations, the teacher trainer measured the teacher’s instructional accuracy across each learn unit component, and provided specific feedback in the form of reinforcement and corrections (See Tables 4 and 5 for a detailed outline of the learn unit components, definitions of correct and incorrect responses during instruction, and standardized coding for TPRA observations). The teacher trainer continued conducting additional TPRA observations with feedback until each of the trainees demonstrated the mastery criteria for learn unit instruction, which was set at 100% accuracy on two different instructional programs (i.e., two different objectives, each from a different curricular area).

**Data Collection on the Independent Variables**

During all independent variable treatment sessions, the researcher determined the teacher trainer’s accuracy in conducting and coding each TPRA observation by calculating the percentage of correct coding responses emitted while observing the learn unit instruction. In order to determine the accuracy of each particular coding response (i.e., each learn unit component, across all learn units within the instructional session) the researcher compared the teacher trainer’s notations (per component) to the master TPRA (one that had been previously scored by two separate observers, with 100% agreement), and highlighted any coding errors made by the teacher trainer. The researcher determined the teacher trainer’s overall accuracy for the corresponding TPRA observation by dividing the number of correctly coded learn units (i.e., learn units coded without errors), by the total number of learn units within that particular instructional session. In other words, while the teacher trainer was required to code three components (antecedent, response, consequence) per learn unit, the researcher calculated overall accuracy by learn unit, not learn unit component, for a given TPRA observation. As such, correct responses were those that contained zero coding errors across all components within a given learn unit, while incorrect
responses were those that contained coding errors on one or more components. For example, an
instructional session that was comprised of 20 learn units resulted in 60 coding opportunities (three per
learn unit). However, for the purpose of determining the teacher trainer’s overall coding accuracy for a
given TPRA observation, correct responses were defined as those for which the teacher trainer coded all
components correctly.

During the correction procedure for inaccurate TPRA recording responses, the researcher did the
following: (1) indicated the trial number along with the relevant learn unit component(s) (i.e., antecedent,
response, consequence); (2) said, “let’s watch,” and presented the video segment that showed the
corresponding learn unit presentation; (3) provided a vocal description of the teacher and/or student
behavior and the correct coding, as relevant to the corresponding learn unit component in question (along
with further clarification or explanation, if necessary), then; (4) said, “let’s watch again. Please record
data on each learn unit component,” and re-presented the corresponding video segment until the teacher
trainer coded all of the learn unit components accurately and independently.

Design

The current study included a delayed multiple probe design across participants (See Table 6, and
Figures 1-3), with two treatment phases.
Table 3

Sequence of the experimental conditions in Experiment 1, including baseline, Teacher Trainer TPRA calibration sessions (teacher trainer observes others), and Teacher Trainer TPRA calibration sessions with self-observation (teacher trainer observes self), along with point of onset and subsequent progression for Teacher Trainers 1 and 2, and their respective Trainees and Students.

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Intervention</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV 1: Measure accuracy of LU instruction, TT1</td>
<td>TPRA Calibration (observe others) with TT1</td>
<td>DV 1: Measure accuracy of LU instruction, TT1</td>
<td>TPRA Calibration (observe self) with TT1</td>
<td>DV 1: Measure accuracy of LU instruction, TT1</td>
</tr>
<tr>
<td>DV 2: Measure accuracy of LU instruction, Trainees A, B</td>
<td>Teacher Trainer 1 conducts TPRA observations with feedback, on Trainees A, B during LU instruction</td>
<td>DV 2: Measure accuracy of LU instruction, Trainees A, B</td>
<td>Teacher Trainer 1 conducts TPRA observations with feedback on Trainees A, B during LU instruction</td>
<td>DV 2: Measure accuracy of LU instruction, Trainees A, B</td>
</tr>
<tr>
<td>DV3: Calculate student learning, Students 1, 2, 3, 4</td>
<td></td>
<td>DV3: Calculate student learning, Students 1, 2, 3, 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>Intervention</td>
<td>Baseline</td>
<td>Intervention</td>
<td>Baseline</td>
</tr>
<tr>
<td>----------</td>
<td>--------------</td>
<td>----------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>DV 1: Measure accuracy of LU instruction, TT2</td>
<td>TPRA Calibration (observe others) with TT2</td>
<td>DV 1: Measure accuracy of LU instruction, TT2</td>
<td>TPRA Calibration (observe self) with TT2</td>
<td>DV 1: Measure accuracy of LU instruction, TT2</td>
</tr>
<tr>
<td>DV 2: Measure accuracy of LU instruction, Trainees C, D</td>
<td>Teacher Trainer 2 conducts TPRA observations with feedback on Trainees C, D during LU instruction</td>
<td>DV 2: Measure accuracy of LU instruction, Trainees C, D</td>
<td>Teacher Trainer 2 conducts TPRA observations with feedback on Trainees C, D during LU instruction</td>
<td>DV 2: Measure accuracy of LU instruction, Trainees C, D</td>
</tr>
<tr>
<td>DV 3: Calculate student learning, Students 5, 6</td>
<td></td>
<td>DV 3: Calculate student learning, Students 5, 6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

32
The accuracy of the instructor's consequence is always dictated by the student's response. In addition, consider the following:

**ACCURACY OF THE INSTRUCTOR'S ANTECEDENT**

1) Is the student attending?
   - Are the student’s hands down, and free of any objects/toys/reinforcers?
   - Is the student looking at the instructor, quietly?

2) Does the instructor deliver the vocal (or non-vocal) antecedent correctly and unambiguously?
   - Does the instructor present the antecedent as outlined in the particular program, including each of the essential components?
   - Does the instructor present the antecedent only one time (without repeating it)?

3) Does the instructor rotate Learn Units correctly?
   - Does the instructor present an equal number of Learn Units per each target stimulus?
   - Given five target stimuli and a single response type, does the instructor rotate Learn Units across the target stimuli, such that the student cannot learn a pattern of responding?
   - If the target objective includes multiple response types, does the instructor rotate Learn Units across both target stimuli and response types, such that no stimulus or response type is presented across consecutive Learn Units?

**ACCURACY OF THE STUDENT'S RESPONSE**

- Correct responses are defined as the student’s emission of a response that is consistent with the response definition outlined in the particular instructional program and within the specified intra-response time (3-5 s for mastery instruction; one or fewer seconds for fluency instruction)
- Incorrect responses are defined as one or more of the following: 1) the student’s emission of a response that is not consistent with the response definition in the particular instructional program; 2) the student’s emission of a response after the specified intra-response time is over; 3) lack of a student response, or; 4) the student’s emission of a correct response directly following an incorrect response (i.e., self-correction)

In addition to the specific response definitions outlined within a given instructional program, consider the following in order to determine the accuracy of the student’s response:

1) Does the student repeat the instructor’s antecedent as part of his response? If so, does this constitute an acceptable response? Does the student emit a single response, as opposed to a chain of responses (as in “self-corrections”?)

2) Does the student emit a single response without any additional/extraneous components (such as autoclitics that are not included in the response definition)? An example of this would include: the instructor holds up a picture of a pretzel during tact instruction, to which the student responds, “I want pretzel” (which is the wrong autoclitic for tacts and, therefore, constitutes an incorrect response)

3) Does the student emit the entire response? (i.e., if the instructor directs the student to, “stand up,” does the student stand all the way up as opposed to simply putting his feet on the floor and leaning forward?)

4) Does the student emit an approximation of the target vocal response? If so, does this constitute an acceptable response according to the specific response definition?

**ACCURACY OF THE INSTRUCTOR’S CONSEQUENCE**

Accurate reinforcement procedures entail the instructor’s presentation of a known reinforcing stimulus, immediately following the student’s emission of a correct response.

Accurate correction procedures will vary based on the student or the particular instructional program but, in general, should include each of the following components: The instructor re-establishes the student’s attention, and presents the antecedent along with a model of the correct response, to which the student should respond by emitting the correct response. Next, the teacher re-presents the antecedent, followed by an opportunity for the student to emit the correct response independently (without a teacher model). The teacher does not praise the student’s independent response during the correction.

The accuracy of the instructor’s consequence is always dictated by the student’s response. In addition, consider the following:

1) Did the instructor provide reinforcement contingent on the student's correct response?
   - Did the instructor praise the student immediately following a correct response?
   - Does the student have tokens as part of his instructional programming?
   - Is there a specific schedule of reinforcement for the particular student and/or program (this must be clearly noted)?
   - Did the instructor deliver prosthetic reinforcers at the appropriate time?
   - Did the instructor have a variety of reinforcers available, and did she respond appropriately to signs of reinforcer satiation (i.e., an observable decline in motivation and correct responding)?

2) Did the instructor deliver a correction following an incorrect response?
   - Did the student attend to all components of the antecedent (including any visual target stimuli) during the correction?
   - Did the student emit the correct response following the instructor’s model?
   - Did the instructor re-present the antecedent a second time and require the student to respond independently (without a teacher model), before moving on to the subsequent Learn Unit?

3) Common errors:
   - Did the teacher praise the student before he was finished emitting the target response? (over time, this will function to shape the student’s emission of partial responses (which are incorrect)
   - Did the instructor provide reinforcement following a correction?
   - Any statements made by the instructor following the correction (i.e., “ok,” etc.) should be emitted in a neutral tone, that clearly differs from the tone that he/she uses when providing reinforcement
Table 5

Standard coding used for TPRA observations, in order to measure the accuracy of instructor and student responses during Learn Unit instruction (Greer, 2002; Ross, Singer-Dudek, & Greer, 2005).

<table>
<thead>
<tr>
<th>Learn Unit Component</th>
<th>Code</th>
<th>Definition/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor Antecedent</td>
<td>✔</td>
<td>The instructor delivered a correct antecedent</td>
</tr>
<tr>
<td></td>
<td>✔️</td>
<td>The instructor delivered an incorrect antecedent, or delivered an antecedent while the student was not attending</td>
</tr>
<tr>
<td>Student Response</td>
<td>+</td>
<td>The student emitted a correct response</td>
</tr>
<tr>
<td></td>
<td>−</td>
<td>The student emitted an incorrect response, or did not respond</td>
</tr>
<tr>
<td>Instructor Consequence</td>
<td>R</td>
<td>The instructor provided appropriate reinforcement following the student's emission of a correct response</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>The instructor, 1) did not provide reinforcement following the student's emission of a correct response or, 2) provided reinforcement incorrectly following the student's emission of a correct response</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>The instructor delivered an appropriate correction following the student's emission of an incorrect response</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>The instructor made one or more of the following errors after the student's emission of an incorrect response, 1) did not deliver a correction; 2) delivered an incorrect correction; or, 3) delivered a correction followed by reinforcement</td>
</tr>
<tr>
<td>Other</td>
<td>✔️</td>
<td>A circle around the entire Learn Unit (either alone or in addition to other circled components) indicates that the whole Learn Unit is incorrect, for one or more of the following reasons,</td>
</tr>
<tr>
<td></td>
<td>✔️</td>
<td>1) The instructor did not present an equal number of Learn Units across each of the target stimuli</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>2) The instructor did not rotate the target stimuli across Learn Units (i.e., presented target stimuli in a pattern)</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>3) In the case of MEI (multiple response topographies rotated within a single instructional session): the instructor did not rotate Learn Units across both the target stimuli and the response topographies (i.e., presented either the same target stimulus or the same response type across consecutive Learn Units)</td>
</tr>
</tbody>
</table>
Table 6

*Example of a completed TPRA form. A breakdown of teacher accuracy can be found in the section labeled comments.*

<table>
<thead>
<tr>
<th>Observer: Elizabeth</th>
<th>Date: 12/9/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor/Student: Jack / Jill</td>
<td>Program: Tact Animals</td>
</tr>
<tr>
<td>Target: Dog, Cat, Bird, Elephant, Frog</td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
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</tbody>
</table>

**Comments**

- Accuracy
  - Overall LV: 5/20
  - Antecedents: 17/20
  - Consequences: 17/20
- Not looking at teacher
- R+ on correction
- V-C did not change order of stimuli presented

**Instructor Performance**

- Instructor trials (+): 5
- Instructor trials (-): 15
- Elapsed Time (minutes): 5:03
  - *Convert elapsed time into decimal form by calculating total number of seconds, then dividing by 60*
- Converted Time (decimal): 5.05

**Instructor CPM:** 9.99 (# correct/converted time)

**Instructor IPM:** 2.97 (# incorrect/converted time)

**Student Performance**

- Student trials (+): 7
- Student trials (-): 13
- Elapsed Time (minutes): 5:03
  - *Convert elapsed time into decimal form by calculating total number of seconds, then dividing by 60*
- Converted Time (decimal): 5.05

**Student CPM:** 1.4 (# correct/converted time)

**Student IPM:** 2.57 (# incorrect/converted time)
**Interobserver Agreement**

The researcher and an independent observer collected data during measures of the dependent variable, in order to obtain interobserver agreement (IOA). IOA data were calculated by dividing the number of agreements by the total number of point-to-point agreements and disagreements and multiplying by 100% (Cooper, Heron, & Heward, 2007). With regard to the teacher trainees, IOA data were available for 75 of the 96 total sessions, with a mean of 97% agreement (range: 77%-100%). With regard to the teacher trainers, IOA data were available for 25 of the 36 total sessions, with a mean of 90% agreement (range: 90%-100%). Using permanent products, the two observers calculated the dependent variable data on student learning, with an interscorer agreement of 100%.

**Results**

The results are shown in Tables 7-9, Figures 1-11, and are as follow:

During the initial baseline condition, Teacher Trainer 1 delivered learn units with a mean accuracy of 73%, overall. Specifically, Teacher Trainer 1 delivered instructional antecedents with a mean accuracy of 98%, and consequences with a mean accuracy of 74%. Following Intervention 1 (calibration training, observing others), Teacher Trainer 1 delivered learn units with a mean accuracy of 95%, comprised of 100% accuracy in presenting instructional antecedents and 95% accuracy in delivering consequences. Following Intervention 2 (calibration training with self-observation), Teacher Trainer 1 delivered learn units with a mean accuracy of 100% across all learn unit components.

The trainees assigned to Teacher Trainer 1 (Teacher Trainees A and B) also demonstrated improved Learn Unit accuracy. During the initial baseline condition, Teacher Trainees A and B delivered learn units with a combined mean accuracy of 42% (Trainee A: 53%, Trainee B: 32%) overall, including 92% accuracy on antecedent delivery (Trainee A: 97%, Trainee B: 86%) and 46% accuracy on consequence delivery (Trainee A: 57%, Trainee B: 37%). Following intervention 1, Teacher Trainees A and B delivered learn units with a combined mean accuracy of 82% (Trainee A: 77%, Trainee B: 86%), overall, including 94% accuracy on antecedent delivery (Trainee A: 90%, Trainee B: 97%) and 87%
accuracy on consequence delivery (Trainee A: 86%, Trainee B: 87%). Following intervention 2, Teacher Trainees A and B delivered learn units with a combined mean accuracy of 97% (Trainee A: 100%, Trainee B: 94%), overall, including a 99% accuracy on antecedent delivery (Trainee A: 100%, Trainee B: 98%) and 97% accuracy on consequence delivery (Trainee A: 100%, Trainee B: 94%).

The students assigned to Teacher Trainer 1 and Teacher Trainees A and B (Students 1-4) demonstrated increased rates of learning following the treatment interventions with the teachers. During the initial baseline condition, Students 1-4 achieved a combined total of 8 mastery criteria for instructional objectives (given 1000 learn units per student) (Student 1: 3 mastery criteria, Student 2: 0 mastery criteria, Student 3: 0 mastery criteria, Student 4: 5 mastery criteria). Following intervention 1, Students 1-4 achieved a combined total of 22 mastery criteria (Student 1: 9 mastery criteria, Student 2: 1 mastery criteria, Student 3: 0 mastery criteria, Student 4: 12 mastery criteria). After intervention 2, Students 1-4, collectively, achieved 26 mastery criteria (Student 1: 11 mastery criteria, Student 2: 5 mastery criteria, Student 3: 1 mastery criteria, Student 4: 9 mastery criteria).

During the initial baseline condition, Teacher Trainer 2 delivered learn units with a mean accuracy of 39%, overall. Specifically, Teacher Trainer 2 delivered instructional antecedents with a mean accuracy of 63%, and consequences with a mean accuracy of 54%. Following Intervention 1 (calibration training, observing others), Teacher Trainer 2 delivered learn units with a mean accuracy of 83%, comprised of 88% accuracy in presenting instructional antecedents and 93% accuracy in delivering consequences. Following Intervention 2 (calibration training with self-observation), Teacher Trainer 2 delivered learn units with a mean accuracy of 97% across all learn unit components.

The Teacher Trainees assigned to Teacher Trainer 2 (Teacher Trainees C and D), demonstrated similar gains in Learn Unit accuracy. During the initial baseline condition, Teacher Trainees C and D delivered learn units with a combined mean accuracy of 47% (Trainee C: 45%, Trainee D: 50%) overall, including 82% accuracy on antecedent delivery (Trainee C: 88%, Trainee D: 70%) and 58% accuracy on consequence delivery (Trainee C: 55%, Trainee D: 63%). Following intervention 1, Teacher Trainees C and D delivered learn units with a combined mean accuracy of 16% (Trainee C: 8%, Trainee D: 23%),
overall, including 76% accuracy on antecedent delivery (Trainee C: 73%, Trainee D: 79%) and 40% accuracy on consequence delivery (Trainee C: 8%, Trainee D: 64%). Following intervention 2, Teacher Trainees C and D delivered learn units with a combined mean accuracy of 87% (Trainee C: 77%, Trainee D: 100%), overall, including 95% accuracy on antecedent delivery (Trainee C: 92%, Trainee D: 100%) and 88% accuracy on consequence delivery (Trainee C: 78%, Trainee D: 100%).

The students assigned to Teacher Trainer 2 and Teacher Trainees C and D (Students 5 and 6) demonstrated increased rates of learning following the treatment interventions with the teachers. During the initial baseline condition, Students 5 and 6 achieved a combined total of 1 mastery criteria for instructional objectives (given 1000 learn units per student) (Student 5: 1 mastery criteria, Student 6: 0 mastery criteria). Following intervention 1, Students 5 and 6 achieved a combined total of 0 mastery criteria (Student 5: 0 mastery criteria, Student 6: 0 mastery criteria). After intervention 2, Students 5 and 6, collectively, achieved 9 mastery criteria (Student 5: 4 mastery criteria, Student 6: 5 mastery criteria).
Table 7. Dependent Variable: Teacher Trainer Accuracy in Presenting Learn Unit Instruction

Percentage of correct learn units, antecedents, and consequences, delivered by Teacher Trainers 1 and 2 during each of the baseline conditions conducted prior to and following the treatment interventions. The researcher measured the Teacher Trainer’s accuracy during four separate observation sessions (without feedback), then collapsed data, per learn unit component, across the corresponding condition.

<table>
<thead>
<tr>
<th>Dependent Measure</th>
<th>Initial Baseline</th>
<th>Post 1</th>
<th>Post 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn Units (overall)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(correct/total)</td>
<td>73% (58/80)</td>
<td>95% (62/65)</td>
<td>100% (79/79)</td>
</tr>
<tr>
<td>Antecedents</td>
<td>98% (78/80)</td>
<td>100% (65/65)</td>
<td>100% (79/79)</td>
</tr>
<tr>
<td>(correct/total)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consequences</td>
<td>74% (59/80)</td>
<td>95% (62/65)</td>
<td>100% (79/79)</td>
</tr>
<tr>
<td>(correct/total)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Measure</th>
<th>Initial Baseline</th>
<th>Post 1</th>
<th>Post 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn Units (overall)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(correct/total)</td>
<td>39% (26/67)</td>
<td>83% (60/72)</td>
<td>97% (75/77)</td>
</tr>
<tr>
<td>Antecedents</td>
<td>63% (42/67)</td>
<td>88% (63/72)</td>
<td>97% (77/77)</td>
</tr>
<tr>
<td>(correct/total)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consequences</td>
<td>54% (36/67)</td>
<td>93% (67/72)</td>
<td>97% (75/77)</td>
</tr>
<tr>
<td>(correct/total)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8. Dependent Variable: Teacher Trainee Accuracy in Presenting Learn Unit Instruction (combined per Teacher Trainer)

Summary of the percentage of correct learn units, antecedents, and consequences, delivered by Trainees A and B (combined), and Trainees C and D (combined), during each of the baseline conditions, conducted by the researcher, prior to and following the treatment interventions with Teacher Trainer 1, and Teacher Trainer 2, respectively. The researcher measured the Trainee’s accuracy across four separate observation sessions (without feedback), then collapsed data, per each learn unit component, across the relevant Trainee and within the corresponding condition.

<table>
<thead>
<tr>
<th>Trainees A &amp; B (combined)</th>
<th>Dependent Measure</th>
<th>Initial Baseline</th>
<th>Post 1</th>
<th>Post 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Learn Units (overall)</td>
<td>42% (64/153)</td>
<td>82% (129/157)</td>
<td>97% (157/162)</td>
</tr>
<tr>
<td></td>
<td>Antecedents</td>
<td>92% (140/153)</td>
<td>94% (147/157)</td>
<td>99% (160/162)</td>
</tr>
<tr>
<td></td>
<td>Consequences</td>
<td>46% (71/153)</td>
<td>87% (136/157)</td>
<td>97% (157/162)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trainees C &amp; D (combined)</th>
<th>Dependent Measure</th>
<th>Initial Baseline</th>
<th>Post 1</th>
<th>Post 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Learn Units (overall)</td>
<td>47% (102/217)</td>
<td>16% (20/122)</td>
<td>87% (96/110)</td>
</tr>
<tr>
<td></td>
<td>Antecedents</td>
<td>82% (177/217)</td>
<td>76% (93/122)</td>
<td>95% (105/110)</td>
</tr>
<tr>
<td></td>
<td>Consequences</td>
<td>58% (126/217)</td>
<td>40% (49/122)</td>
<td>88% (97/110)</td>
</tr>
</tbody>
</table>
Table 9. Dependent Variable: Numbers of Instructional Objectives Achieved by Students

Summary of the numbers of mastery criteria achieved by Students 1, 2, 3, and 4 (combined), and Students 5 and 6 (combined), within 1000 learn units (per student), during each of the baseline conditions conducted by the researcher, prior to and following the treatment interventions with Teacher Trainers 1 and 2, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Students 1, 2, 3, &amp; 4 (combined)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Measure</td>
<td>Initial Baseline</td>
<td>Post 1</td>
<td>Post 2</td>
</tr>
<tr>
<td>Numbers of Mastery Criteria Achieved</td>
<td>8</td>
<td>22</td>
<td>26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Students 5 &amp; 6 (combined)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Measure</td>
<td>Initial Baseline</td>
<td>Post 1</td>
<td>Post 2</td>
</tr>
<tr>
<td>Numbers of Mastery Criteria Achieved</td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>
Figure 1. Dependent Variable: Teacher Trainer Accuracy in Presenting Learn Unit Instruction
Percentage of correct overall learn units, antecedents, and consequences delivered by Teacher Trainers 1 and 2, during each of the baseline conditions conducted prior to and following the treatment interventions. During each phase above, the researcher measured the Teacher Trainer’s accuracy across four separate observations (without feedback), then collapsed data for each learn unit component within the corresponding condition. The current figure represents the percentage correct, per learn unit component, per condition.
Figure 2. Dependent Variable: Teacher Trainee Accuracy (combined) in Presenting Learn Unit Instruction Summary of the percentage of correct learn units, antecedents, and consequences, delivered by Trainees A and B (combined), and Trainees C and D (combined), during each of the baseline conditions conducted prior to and following the treatment interventions with Teacher Trainer 1 and Teacher Trainer 2, respectively. During each phase above, the researcher measured the Trainee’s accuracy across four separate observation sessions (without feedback), then collapsed data, per each LU component, across the relevant Teacher and within the corresponding condition.
Figure 3. Dependent Variable
Summary of the numbers of mastery criteria achieved by Students 1, 2, 3, and 4 (combined), and Students 5 and 6 (combined), within 1,000 learn units (per student), during each of the baseline conditions conducted by the researcher, prior to and following the treatment interventions with Teacher Trainer 1 and Teacher Trainer 2, respectively.
Figure 4. Dependent Variable: Teacher Accuracy in Presenting Learn Unit Instruction
Percentage of correct learn units, antecedents, and consequences delivered by Trainee A and Trainee B, during each of the baseline conditions conducted prior to and following the treatment interventions with Teacher Trainer 1. During each phase above, the researcher measured the Trainee’s accuracy across four separate observation sessions (without feedback), then collapsed data for each learn unit component within the corresponding condition. The current figure represents the percentage correct, per learn unit component, per condition.
Figure 5. Dependent Variable: Teacher Trainee Accuracy in Presenting Learn Unit Instruction
Percentage of correct learn units, antecedents, and consequences delivered by Trainee C and Trainee D, during each of the baseline conditions conducted prior to and following the treatment interventions with Teacher Trainer 2. During each phase above, the researcher measured the Trainee’s accuracy across four separate observation sessions (without feedback), then collapsed data for each learn unit component within the corresponding condition. The current figure represents the percentage correct, per learn unit component, per condition.
Figure 6. Dependent Variable
Numbers of mastery criteria achieved within blocks of 1000 learn units, by Students 1, 2, 3, and 4, during each of the baseline conditions prior to and following the treatment interventions with Teacher Trainer 1.
Figure 7. Dependent Variable
Numbers of mastery criteria achieved within blocks of 1000 learn units, by Students 5 and 6, during each of the baseline conditions prior to and following the treatment interventions with Teacher Trainer 2.
Figure 8. Dependent Variable: Teacher Trainer Accuracy in Presenting Learn Unit Instruction
Percentage of correct learn units (overall) delivered by Teacher Trainer 1 and Teacher Trainer 2, during the successive observations (without feedback) conducted by the researcher within each baseline condition.
Figure 9. Dependent Variable: Teacher Trainee Accuracy in Presenting Learn Unit Instruction
Percentage of correct learn units (overall) delivered by Trainee A and Trainee B, during the successive observations (without feedback) conducted by the researcher within each baseline condition, prior to and following the treatment interventions with Teacher Trainer 1.
Figure 10. Dependent Variable: Teacher Trainee Accuracy in Presenting Learn Unit Instruction
Percentage of correct learn units (overall) delivered by Trainee C and Trainee D, during the successive observations (without feedback) conducted by the researcher within each baseline condition, prior to and following the treatment interventions with Teacher Trainer 2.
Figure 11. Independent Variable
Percentage of correct responses emitted by Teacher Trainer 1 and Teacher Trainer 2, during each of the TPRA observations completed during the calibration trainings. During the first training session, the researcher taught the Teacher Trainer to conduct TPRA observations on the accuracy of another instructor’s learn unit delivery. During the second training session, the researcher taught the Teacher Trainer to conduct TPRA observations on the accuracy of her own learn unit delivery via self-video monitoring (by watching pre-recorded videos of herself present instruction).
**Discussion**

Data indicate that both teacher trainers and trainees demonstrated increased accuracy in Learn Unit presentations as a function of the treatment package (Teacher Trainer TPRA calibration trainings, conducting TPRAs on others and on self). The rates of student learning also increased following the interventions. The results suggest that intact learn units are necessary to achieve optimal student learning outcomes, and that the teacher trainers must demonstrate accurate learn unit instruction in order to affect the accuracy of their trainees and, consequently, their students. It is important to note the design flaws in the current study, which consisted of possible sequence effects in the introduction of both independent variables in the same order with both teacher trainers. Like the Bishop, Snyder, and Crowe (2015) study, the current study consisted of a combination of variables within a single condition, and the results raise the question of whether the teacher trainers learned by self-observation of their own instruction (increased self-as-own audience), by watching others present instruction, or simply as a result of conducting more TPRA’s during training. Other limitations include the fact that the TPRA observations were missing rate measures, which represent a critical component.

Future experiments should include analyses of each of the trainings separately (watching others and watching self), in order to avoid sequence effects and to demonstrate clear distinctions between different types of teacher training. Additionally, future investigations should include a single layer of participants (Teacher Trainees only) rather than attempting to determine the role that one set of participants (Teacher Trainers) has on a second and third set of participants (Trainees and Students). Including a single layer of participants will enable researchers to clearly establish the most effective type of teacher training intervention while avoiding the confounds that can arise with multiple layers of participants.

During Experiments 2, 3, and 4, which follow, I aimed to isolate the accuracy of the Teacher’s learn unit delivery in order to determine the most effective method for teacher training. The purpose of the following three studies was to directly isolate and analyze different methods for training teachers.
Chapter III
EXPERIMENT II

Method

Participants

The participants in the current study included three teachers employed as behavior interventionists by an organization that provided ABA (applied behavior analysis)/special education services) (See Table 10). All of the participants were selected based on their position as teachers within the abovementioned organization. Prior to the study, each of the teachers received basic, introductory training on delivering learn unit instruction.

Setting

The setting was the same as that outlined in Experiment 1.
Table 10. *Participant Characteristics*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Level of education</th>
<th>Level of experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher E</td>
<td>24 years</td>
<td>Degree(s): Bachelor’s in Psychology</td>
<td>Current position: 4 months No prior experience in ABA</td>
</tr>
<tr>
<td>Teacher F</td>
<td>22 years</td>
<td>Degree(s): Bachelor’s in Liberal Studies</td>
<td>Current position: 9 months No prior experience in ABA</td>
</tr>
<tr>
<td>Teacher G</td>
<td>30 years</td>
<td>Degree(s): Bachelor’s in Social Work</td>
<td>Current position: 1 month Previous experience working with children with autism; no prior experience in ABA</td>
</tr>
</tbody>
</table>
Dependent Variable

Dependent Variable: Teacher Accuracy. The researcher measured teacher accuracy in delivering learn units across the first four TPRA’s without feedback during the baseline and post-independent variable conditions. Note: The participants did not receive an intervention between the baseline and post-intervention periods, they simply had a month of experience in delivering learn units without any in-situ training.

Data Collection on the Dependent Variable

In order to measure the dependent variable, the researcher conducted TPRA observations without feedback while the teacher delivered learn units. The researcher conducted four TPRA’s without feedback during the baseline condition at the outset of the study, and four TPRA’s without feedback during the repeated baseline condition. This enabled the researcher to determine whether the teacher had improved in his or her learn unit delivery as a function of experience and practice alone.

Independent Variable

In-situ TPRA’s with Feedback. The researcher conducted in-situ TPRA observations with feedback, until each Teacher delivered learn unit instruction without errors. During the TPRA observations with feedback, the researcher recorded data on each the following instructional components, using a TPRA form: learn units (overall), antecedent delivery, and consequence delivery, and provided specific feedback in the form of reinforcement and corrections (all corrections were delivered immediately after an error was made) (See Tables 4 and 5). The researcher determined teacher accuracy based on scores derived from the TPRA observations with feedback. Following the completion of each TPRA observation with feedback, the researcher calculated percentage correct for the overall instructional session (i.e., numbers of correct and incorrect learn units delivered, overall). The researcher continued to conduct TPRA observations with feedback until each Teacher demonstrated the mastery criteria for learn unit instruction, which was set at 90% accuracy or better across two consecutive sessions, or 100% accuracy within a single session. The researcher counted the total numbers of TPRA’s required for a Teacher to achieve mastery criteria for delivering learn units.
Design

The current study included a delayed multiple probe design across participants.
### Table 11

**Sequence of the experimental conditions in Experiment 2, including the baseline and independent variable conditions, along with point of onset and subsequent progression for Teachers E, F, and G**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Baseline (DV):</th>
<th>Repeated/ Prolonged Baseline (DV):</th>
<th>In-situ TPRA’s with feedback (IV):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher E</td>
<td>Researcher conducts TPRA’s without feedback to determine participant learn unit accuracy</td>
<td>Researcher conducts TPRA’s without feedback to determine participant learn unit accuracy</td>
<td>Researcher conducts in-situ TPRA’s with feedback until the Teacher demonstrates mastery criteria for delivering learn units</td>
</tr>
<tr>
<td>Teacher F</td>
<td>Baseline (DV):</td>
<td>Repeated/ Prolonged Baseline (DV):</td>
<td>In-situ TPRA’s with feedback (IV):</td>
</tr>
<tr>
<td>Teacher G</td>
<td>Baseline (DV):</td>
<td>Repeated/ Prolonged Baseline (DV):</td>
<td>In-situ TPRA’s with feedback (IV):</td>
</tr>
</tbody>
</table>
Table 12

Specific programs run by Teachers E, F, and G, during each of the dependent variable conditions

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Instructional Programs Run During the Pre-intervention Measure of Dependent Variable</th>
<th>Instructional Programs Run During the Repeated Measure of the Dependent Variable</th>
</tr>
</thead>
</table>
| Teacher E | • Tact Animals  
• Tact Vehicles  
• Following Vocal Directions  
• Tact Food | • Following 2-step Vocal Directions  
• Tact Instruction  
• Mand Instruction  
• Following Vocal Directions |
| Teacher F | • Following 2-step Vocal Directions  
• Multiple Exemplar Instruction for Naming  
• Following 2-step Vocal Directions  
• Auditory Word Match-to-Sample Instruction | • Following Vocal Directions  
• Tact Instruction  
• 3D Matching  
• Auditory Word Match-to-Sample Instruction |
| Teacher G | • Tact Instruction  
• Following Vocal Directions  
• Point-to and Tact Instruction (in rotation)  
• Auditory Word Match-to-Sample Instruction | • Tact Instruction  
• Following Vocal Directions  
• Point-to and Tact Instruction (in rotation)  
• Observational Learning Instruction |
**Interobserver Agreement (IOA)**

The researcher and an independent observer collected data during measures of the dependent variable, in order to obtain interobserver agreement (IOA). IOA data were calculated by dividing the number of agreements by the total number of point-to-point agreements and disagreements and multiplying by 100% (Cooper, Heron, & Heward, 2007). Data for IOA were available for 88% of the dependent variable sessions, with a mean of 95% agreement (range: 75% - 100%).

**Results**

The results are shown in Figures 12-14 and Table 12, and are as follows.

During the initial baseline period, Teachers E, F, and G delivered learn units with a mean accuracy of 37%, 42%, and 30%, respectively. During the post-intervention period (i.e., the follow up after teacher practice alone period), Teachers E, F, and G delivered learn units with a mean accuracy of 28%, 50%, and 36%, respectively. Teachers E, F, and G required 9, 2, and 11 supervisor conducted TPRA’s with feedback, respectively, to achieve mastery criteria of learn unit instruction during the in-situ training.
Figure 12. Mean percentage of correct learn units presented by Teachers E, F, and G, as measured during the baseline condition and the repeated baseline condition (each of which consisted of TPRA’s without feedback), along with the in-situ TPRA’s with feedback condition.
Figure 13. Percentage of correct learn units presented by Teachers E, F, and G, as measured during each session of the baseline condition and the repeated baseline condition (each of which consisted of TPRA’s without feedback), along with the in-situ TPRA’s with feedback condition
Discussion

The results of the study indicated that experience alone, or simply practicing learn units without any supervision, was not sufficient to improve the participants’ skills to mastery levels. All three participants still required direct instruction, in the form of supervisor conducted in-situ TPRA’s with feedback, in order to achieve mastery criteria for delivering learn units. It is interesting to note that, while Teachers F and G demonstrated slight improvements in their learn unit instruction during the second baseline period, Teacher E demonstrated decreased accuracy. Teacher E’s deteriorating performance during baseline might have been a function of practicing errors. In other words, Teacher E was far from accurate during the initial baseline period, and given that there was no intervention between the baseline periods, Teacher E was left to practice errors, repeatedly. Perhaps the one type of error or another became stronger over time and was responsible for Teacher E’s decline in performance during the repeated baseline period.

In Experiment III, which follows, I investigated whether teaching the teachers to identify and measure correct and incorrect learn units by conducting TPRA’s on other individuals, would have an effect on their own subsequent learn unit accuracy.
Chapter IV

EXPERIMENT III

Method

Participants

The participants in the current study included three teachers employed as behavior interventionists by an organization that provided ABA (Applied Behavior Analysis)/special education services (See Table 13). All of the participants were selected based on their position as teachers within the abovementioned organization. Prior to the study, each of the teachers received basic, introductory training on delivering learn unit instruction.

Setting

The setting for the current experiment was the same as that described in the Experiments 1 and 2.
Table 13. *Participant Characteristics*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Level of education</th>
<th>Level of experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher H</td>
<td>24 years</td>
<td>Degree(s): Bachelor’s in History. Certification(s): Currently enrolled in Master’s degree program (Special Education)</td>
<td>Current position: 6 months Previous experience working with children with autism; no prior experience in ABA</td>
</tr>
<tr>
<td>Teacher I</td>
<td>25 years</td>
<td>Degree(s): Bachelor’s in Psychology</td>
<td>Current position: 9 months No prior experience in ABA</td>
</tr>
<tr>
<td>Teacher J</td>
<td>26 years</td>
<td>Degree(s): Bachelor’s in Ecology, Behavior and Evolution</td>
<td>Current position: 2 months No prior experience in ABA</td>
</tr>
</tbody>
</table>
**Dependent Variable**

*Dependent Variable: Teacher Accuracy.* The dependent variable was the same as that outlined in Experiment 2.

**Data Collection on the Dependent Variable**

The data collection for the dependent variable was the same as that outlined in Experiment 2.

**Independent Variables**

*Independent Variable 1: Conducting TPRA’s on others presenting learn units.* The researcher used a set of standardized, research-based training videos (Greer, 2014) to train the teacher to deliver learn units. During the training, the teacher observed pre-recorded videos of various individuals delivering learn unit instruction, and recorded data on whether or not an accurate trial had occurred. Following the completion of each video, the researcher scored the teacher accuracy in coding each learn unit, by comparing his or her data to a master (one that had been previously scored by two separate observers, with 100% agreement), then provided reinforcement for correctly coded learn unit components, and corrections for incorrectly coded components. Each individual video comprised approximately twenty learn units. The researcher continued to present novel videos of the various individuals delivering learn unit instruction, until the participating teacher achieved the mastery criteria for the video learn unit training, which was set at 90% accuracy of coding responses across two consecutive observations, or 100% for one session.

During the initial portion of the training, the researcher provided immediate consequences to the teacher’s coding responses, by pausing the video following the completion of each learn unit presentation. During subsequent portions of the training, the teacher was required to observe and code entire instructional sessions (i.e., approximately 20 learn units per video) prior to receiving feedback/consequences. The researcher continued to present new videos that showed different teachers, students, and instructional programs, until the teacher achieved the mastery criteria for the training, which was set at 90% accuracy across two consecutive TPRA observations, or 100% on a single TPRA observation.
**Independent Variable 2: In-situ TPRA’s with Feedback.**

The procedures for conducting the in-situ TPRA’s with feedback were the same as those outlined in Experiment 2.

**Design**

The current study included a delayed multiple probe design across participants.
Table 14

Sequence of the experimental conditions in Experiment 3, including the baseline condition, classroom intervention (participants learn to conduct TPRA’s on other individuals delivering learn units), post-intervention condition, and the in-situ TPRA’s with feedback condition, along with point of onset and subsequent progression for Teachers H, I, and J

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Baseline (DV): Researcher conducts TPRA’s without feedback to determine participant learn unit accuracy</th>
<th>Intervention (Classroom): Participant learns to conduct TPRA’s on other individuals delivering learn unit instruction, until Participant achieves mastery criterion on doing TPRA’s</th>
<th>Post-intervention (DV): Researcher conducts TPRA’s without feedback to determine participant learn unit accuracy</th>
<th>In-situ TPRA’s with feedback: Researcher conducts in-situ TPRA’s with feedback until the Teacher demonstrates mastery criteria for delivering learn units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher H</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher</td>
<td>Instructional Programs Run During the Pre-intervention Measure of Dependent Variable</td>
<td>Instructional Programs Run During the Post-intervention Measure of the Dependent Variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Teacher H | • Multiple Exemplar Instruction to Induce Naming  
• Count and Give Money  
• Multiple Exemplar Instruction to Induce Naming  
• Count and Give Money | • Count and Give Money  
• Observational Learning Instruction  
• Telling Time  
• Tact Instruction |
| Teacher I | • Telling Time  
• Learning New Operants Through Listener Instruction  
• Following Vocal Direction  
• Tact Instruction | • Tact Instruction  
• Auditory Word Match-to-Sample Instruction  
• Multiple Exemplar Instruction to Induce Naming  
• Count and Give Money |
| Teacher J | • Learning New Operants Through Listener Instruction (to Induce Naming)  
• Following Vocal Directions  
• Learning New Operants Through Listener Instruction  
• Tact Instruction | • Intraverbals  
• Multiple Exemplar Instruction to Induce Naming  
• Tact Instruction  
• Auditory Word Match-to-Sample Instruction |
Interobserver Agreement (IOA)

The researcher and an independent observer collected data during measures of the dependent variable, in order to obtain interobserver agreement (IOA). IOA data were calculated by dividing the number of agreements by the total number of point-to-point agreements and disagreements and multiplying by 100% (Cooper, Heron, & Heward, 2007). Data for IOA were available for 71% of the dependent variable sessions, with a mean of 92% agreement (range: 85% - 100%).

Results

The results are shown in Figures 15-17 and Table 15, and are as follows.

During the baseline period, Teachers H, I, and J delivered learn units with a mean accuracy of 25%, 50%, and 35%, respectively. During the post-intervention period, Teachers H, I, and J delivered learn units with a mean accuracy of 49%, 59%, and 29%, respectively. Teachers H, I, and J required 4, 8, and 14 supervisor conducted TPRA’s with feedback, respectively, to achieve mastery criteria of learn unit instruction during the in-situ training.
Figure 14.
Mean percentage of correct learn units presented by Teachers H, I, and J, during the baseline condition and the post-intervention condition (each of which consisted of TPRA’s without feedback), along with the in-situ TPRA’s with feedback condition.
Figure 15. Percentage of correct learn units presented by Teachers H, I, and J, during each session of the baseline condition and the post-intervention condition (each of which consisted of TPRA’s without feedback), along with the in-situ TPRA’s with feedback condition.
Figure 16. Independent Variable.

Percentage of correct learn units presented by Teacher H, Teacher I, and Teacher J, during the classroom intervention, in which the Teachers learned to conduct TPRA’s on others presenting learn units.
Discussion

The results of the current study indicated that training the teachers to identify and measure correct and incorrect learn units by teaching them to conduct TPRA’s on other individuals, did not have a measureable effect on their own subsequent instructional accuracy or rate of acquisition.

This could be, in part, due to the fact that during the intervention (conducting TPRA’s on other individuals), the participating teachers were not required to emit a correct learn unit. Rather, they were required to make a selection response as a listener and, therefore, only served as an audience for another teacher’s behavior, rather than their own behavior. This is the type of difference outlined by Ryle (1949) and Skinner (1966) in their analyses of verbally mediated (“knowing that”) and contingency-shaped behavior (“knowing how”). Both authors discussed this difference in terms of the type of understanding involved. Specifically, contingency-shaped behavior is constructed from interactions with contingencies, whereas verbally mediated behavior involves rules that are transmitted as instructions to be followed in a given situation (Ribes-Inesta, 2000).

In the next experiment, I tested the effects of self-observation, or audience control for one’s own behavior, on teacher learning. Specifically, I measured teacher learn unit accuracy and rate of acquisition prior to and following an intervention in which the teachers were required to conduct TPRA observations on their own learn unit instruction (via pre-recorded video).
Chapter V

EXPERIMENT IV

Method

Participants

The participants in the current study included three teachers employed as behavior interventionists by an organization that provided ABA (Applied Behavior Analysis)/special education services (See Table 16). All of the participants were selected based on their position as teachers within the abovementioned organization. Prior to the study, each of the teachers received basic, introductory training on delivering learn unit instruction.

Setting

The setting was the same as that outlined in Experiments 2 and 3.
<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Level of education</th>
<th>Level of experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher K</td>
<td>30 years</td>
<td>Degree(s): Bachelor’s in Psychology</td>
<td>Current position: 1 month&lt;br&gt;Previous experience working with children with autism; no prior experience in ABA</td>
</tr>
<tr>
<td>Teacher L</td>
<td>30 years</td>
<td>Degree(s): Master’s degree in Psychology with a concentration in ABA</td>
<td>Current position: 4 months&lt;br&gt;Previous experience: 5 years working in the field of ABA in both home and school settings</td>
</tr>
<tr>
<td>Teacher M</td>
<td>23 years</td>
<td>Degree(s): Bachelor’s in Psychology Certification(s): Registered Behavior Technician (RBT)</td>
<td>Current position: 1 month&lt;br&gt;Previous experience: 2 years working in the field of ABA</td>
</tr>
</tbody>
</table>
Dependent Variable

**Dependent Variable: Teacher Accuracy.** The dependent variable was the same as that outlined in Experiments 2 and 3.

**Data Collection on the Dependent Variable**

The data collection for the dependent variable was the same as that outlined in Experiments 2 and 3.

**Independent Variable**

**Independent Variable: Conducting TPRA’s on oneself presenting learn units.** The participants were required to watch videos of their own instructional sessions and record data on the accuracy of their learn unit presentations. During the training, the participating teacher observed pre-recorded videos of his or herself delivering learn unit instruction, and recorded data on whether or not an accurate trial had occurred. Following the completion of each video, the researcher scored the teacher accuracy in coding each learn unit, by comparing his or her data to a master (one that had been previously scored by two separate observers, with 100% agreement), then provided reinforcement for correctly coded learn unit components, and corrections for incorrectly coded components. Each individual video comprised approximately 20 learn units.

During the initial portion of the teacher trainer TPRA calibration training, the researcher provided immediate consequences to the teacher’s coding responses, by pausing the video following the completion of each learn unit presentation. During subsequent portions of the training, the teacher was required to observe and code entire instructional sessions (i.e., approximately 20 learn units per video) prior to receiving feedback/consequences. The researcher continued to present novel videos of the teacher delivering learn unit instruction, until he or she achieved the mastery criteria for the learn unit self-observation training, which was set at 90% accuracy of coding responses across two consecutive observations, or 100% accuracy for one session.

**Design**

The current study included a delayed multiple probe design across participants.
Table 17.

Sequence of the experimental conditions in Experiment 4, including baseline condition, classroom self-observation intervention (Participants learn to conduct TPRA’s on their own learn unit instruction), and post-intervention, along with point of onset and subsequent progression for Teachers K, L, and M

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Baseline (DV): Researcher conducts TPRA’s without feedback to determine participant learn unit accuracy</th>
<th>Intervention (Classroom): Participant learns to conduct TPRA’s on self delivering learn unit instruction, until Participant achieves mastery criterion on doing TPRA’s</th>
<th>Post-Intervention (DV): Researcher conducts TPRA’s without feedback to determine participant learn unit accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher K</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher M</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 18

Specific programs run by Teachers K, L, and M, during each of the dependent variable conditions

<table>
<thead>
<tr>
<th></th>
<th>Instructional Programs Run During the Pre-intervention Measure of Dependent Variable</th>
<th>Instructional Programs Run During the Post-intervention Measure of the Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher K</strong></td>
<td>• Tact Instruction</td>
<td>• Multiple Exemplar Instruction to Induce Naming</td>
</tr>
<tr>
<td></td>
<td>• Multiple Exemplar Instruction to Induce Naming</td>
<td>• Learning New Operants Through Listener Instruction</td>
</tr>
<tr>
<td></td>
<td>• Following Vocal Directions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tact Instruction</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher L</strong></td>
<td>• Personal Information (Intraverbals)</td>
<td>• Following Vocal Directions</td>
</tr>
<tr>
<td></td>
<td>• WH Questions</td>
<td>• Tact Instruction</td>
</tr>
<tr>
<td></td>
<td>• Tact Instruction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Following Vocal Directions</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher M</strong></td>
<td>• Tact Instruction</td>
<td>• Following Vocal Directions</td>
</tr>
<tr>
<td></td>
<td>• Multiple Exemplar Instruction to Induce Naming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tact Instruction</td>
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<td></td>
<td>• Multiple Exemplar Instruction to Induce Naming</td>
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<tr>
<td></td>
<td>• Tact Instruction</td>
<td></td>
</tr>
</tbody>
</table>

Interobserver Agreement (IOA)

The researcher and an independent observer collected data during measures of the dependent variable, in order to obtain interobserver agreement (IOA). IOA data were calculated by dividing the number of agreements by the total number of point-to-point agreements and disagreements and multiplying by 100% (Cooper, Heron, & Heward, 2007). Data for IOA were available for 82% of the dependent variable sessions, with a mean of 99% agreement (range: 80% - 100%).

Results

The results are shown in Figures 18-20 and Table 18, and are as follows.

During the initial baseline period, Teachers, K, L, and M delivered learn units with a mean accuracy of 46%, 23%, and 55%, respectively. During the post-intervention period, Teachers, K, L, and M delivered learn units with a mean accuracy of 98%, 98%, and 100%, respectively. Teachers K, L, and M did not receive in-situ TPRA’s with feedback since they were at mastery level for delivering learn units following the self-observation intervention.
Figure 17. Dependent Variable.
Mean percentage of correct learn units presented by Teachers K, L, and M, during the baseline and post-intervention conditions. During the intervention, each Teacher conducted TPRA's while watching videos of his or her own learn unit instruction.
Figure 18. Percentage of correct learn units presented by Teachers K, L, and M, during each session of the baseline condition and the post-intervention condition.
Figure 19. Independent Variable.

Percentage of correct learn units presented by Teacher K, Teacher L, and Teacher M, during the classroom intervention, in which the Teachers learned to conduct TPRA's on themselves presenting learn units (by watching pre-recorded videos).
Discussion

The results of the study indicated that self-observation, or learning to conduct TPRA’s on one’s own learn unit instruction, had measurable effects in terms of the teachers’ subsequent learn unit accuracy. All three participants demonstrated mastery of learn unit instruction during post-intervention measures, and did not require any supervisor conducted in-situ TPRA’s with feedback.

It is possible that watching themselves and measuring their own learn unit delivery, resulted in the teachers’ development of self-as-own-audience. According to Skinner (1957), the self-as-own-audience repertoire is present when an individual’s own behavior has become aversive or reinforcing to the individual himself.
Chapter VI

GENERAL DISCUSSION

Summary of Findings

The experiments outlined above are important because, while it has been clearly demonstrated that teacher accuracy is an essential variable for student learning (Albers & Greer, 1991; Bahadourian, Tam, Greer, & Rousseau, 2006; Greer, 2002; Ingham & Greer, 1992; Keohane & Greer, 2005; Ross, Singer-Dudek & Greer, 2005; Selinske, Greer, & Lodhi, 1991), identifying effective and efficient means for training large numbers of teachers in applied settings remains a critical need. Also, establishing the controlling variable for how teacher accuracy is achieved is necessary to reduce the amount of intervention and training time needed.

Experiment I showed that observing other people deliver learn units and measuring their accuracy did not result in any significant improvements in terms of the Teacher Trainers’ own learn unit instruction accuracy. Additionally, the results suggested that the Teacher Trainers, having not achieved mastery of learn unit instruction themselves, were not effective trainers of other teachers. In an applied sense, simply having teacher trainers (or supervisors) do TPRA’s on teacher trainees is not likely to be effective until the teacher trainers are able to deliver flawless instructions themselves. While both teacher trainers in Experiment I did achieve mastery of learn unit instruction following the self-observation intervention (measuring their own instruction), there may have been sequence effects due to the multiple independent variables. Therefore, in order to determine how to efficiently and effectively train individuals to deliver accurate learn units, it was necessary to separate the independent variables in the subsequent experiments.

Experiment II showed that the Teachers did not achieve mastery of learn unit instruction by simply practicing learn unit delivery during the repeated baseline. All three Teachers required direct feedback via the in-situ TPRA’s with feedback.

The results of Experiment III showed that observing other people deliver learn units and measuring their accuracy did not result in any significant improvements in terms of the accuracy of Teachers own subsequent learn unit instruction. Again, none of the Teachers demonstrated accurate,
mastery level-learn unit instruction until they were required to emit their own responses and receive feedback, via the in-situ TPRA’s. These results are significant, given the way individuals are often trained to do new things, in general. Commonly, trainees are given a demonstration, or shown instructional videos of others emitting behavior, with the expectation that they, themselves, will then be able to emit the behavior with the same level of accuracy. The results of Experiment III showed that this is not the case. This raises the question of how much time should be spent requiring a trainee to watch an instructional video or watch others perform tasks that they, themselves, are expected to acquire/master.

The results of Experiment IV showed a functional relationship between the Teachers observing themselves and measuring their own learn unit instruction, and subsequent demonstration of mastery criteria for delivering learn units. In other words, the Teachers in Experiment IV did not require any further training in the form of in-situ TPRA’s with feedback. This could be due to the participants’ development of audience control for their own behavior via the self-observation. It is possible that serving as an audience for one’s own behavior functioned to reinforce correct responses while punishing incorrect responses. While other studies have shown that repeated feedback from a supervisor (TPRA) or other training packages (Bishop, Snyder, & Crowe, 2015) were effective methods for training teachers, the fourth experiment herein, showed that teachers can achieve mastery criteria for delivering learn units in a more independent manner and given significantly less intervention from supervisors.

Overall, observing and measuring one’s own instructional accuracy was an efficient method of training teachers and, according to the results, required fewer supervisor conducted TPRA’s than other methods. Additionally, the results of experiments one and three, taken together, suggested that observing others was not an effective means for training teachers, and the participants still required in-situ TPRA’s with feedback in order to achieve mastery criteria levels. This is similar to the verbal behavior research which indicates that emitting a listener response, or simply observing, isn’t as effective as emitting a speaker response (Greer & Ross, 2008; Greer & Speckman, 2009), and emitting a speaker response results in quicker acquisition rates than emitting a listener response alone.
**Verbally Mediated and Contingency Shaped Behavior**

Ryle (1949) and Skinner (1966) discussed the difference between verbally mediated ("knowing that") and contingency-shaped behavior ("knowing how") in terms of the type of understanding involved. Specifically, contingency-shaped behavior is constructed from interactions with contingencies, whereas verbally mediated behavior involves rules that are transmitted as instructions to be followed in a given situation (Ribes-Inesta, 2000).

Perhaps this difference represented one of the variables that controlled the different outcomes of Experiments III and IV. During the intervention for Experiment III (measuring the accuracy of individuals’ learn unit instruction), the Teachers were not required to emit a correct learn unit. Rather, they were required to make a selection response as a listener and, therefore, only served as an audience for another teacher’s behavior, rather than their own behavior. Therefore, the observation of others did not lead to the Teachers “knowing how.” However, the self-observation intervention for Experiment IV (measuring one’s own learn unit instruction), did result in the Teachers “knowing how.” Maybe the difference between “knowing that” and “knowing how” is somehow rooted in self-observation or self-audience repertoires.

**Self-Audience**

The topic self-audience (Skinner, 1957), or developing audience control for one’s own behavior, deserves additional discussion. Skinner (1957) defined audience control, in general, as a repertoire that develops as the product of one’s instructional history, which includes the influence of an individual or a group of individuals over a speaker, and results in the establishment of the audience character. Audience control is a discriminative stimulus for either a) an approving audience, which reinforces behavior, or b) a critical audience, which punishes or negatively reinforces behavior. Perhaps generalization of behavior that is acquired in the presence of particular audience, to environments lacking that audience, may be a result of the individual becoming an observer (punisher and reinforcer) of his/her own behavior. Observing oneself may provide a means for increasing desirable or correct behavior and reducing undesirable or incorrect behavior, or for simply increasing the correspondence between seeing and doing.
This is suggested by studies on the acquisition of generalized imitation via mirror instruction (Du & Greer, 2014), as well as what is done in the applied setting for learning to dance. Individuals watch themselves dance in the mirror to increase the correspondence between one’s own movements and the instructors’ movements, through self-observation.

Experiment IV raises the question of whether it is most effective to watch oneself while measuring or taking data on one’s own behavior. Many teacher-training programs include self-observation components, in which the teacher trainee must watch a video of him or herself teaching a lesson. Is this type of training most effective when the individual is also required to take data on his or her performance via some pre-determined measurement criteria?

Limitations

In addition to the possible sequence effects in Experiment I, due to multiple and successive independent variables, other limitations for the current experiments include the possibility that the participants could have acquired skills through sources outside of the experiment, such as interacting with other professionals and supervisors, reading program descriptions, and training experiences that were not known to the researcher. Additionally, more participants could have been used across all experiments. There is also a need to further test the relation between the accuracy with which an individual delivers learn units and his/her accuracy in training others to do so. Perhaps this is an area for future research. While I did investigate this relation in Experiment I, the sequence effects weaken the results.

Topics for Future Research

A potential topic for future research would be to directly compare, via larger groups of matched pairs, whether it is more efficient, and timely to conduct in-situ TPRA’s with feedback or to have individuals observe and measure their own instruction via video. Though, in an applied sense, both strategies have been shown to be effective methods of training, and either could be utilized depending on the circumstances.

Additionally, a topic for future research could include further analysis of whether an individual who learns to present flawless learn units via self-observation is able to provide effective supervision to
teachers. This was one of the questions involved in Experiment I but was not addressed in the subsequent experiments.

Another topic for future research would be to directly test whether measuring one’s own instructional accuracy (via self-observation) for one specific set of instructional programs (i.e., following vocal directions and gross motor imitation) would result in the individual demonstrating accuracy in his/her learn unit instruction for a different set of specified programs (i.e., multiple exemplar for Naming). While the programs in the current study did vary from baseline to self-observation instruction, the researcher did not directly control for this variable. Future research might also include a measure of student learning along with teacher accuracy.
References


governed behavior: Cognition, contingencies, and instructional control (pp. 191-220). New York: Plenum.


