The Report Committee for Daniel Joseph Fox
Certifies that this is the approved version of the following report:

The Influence of Pedagogical Experience on Assessing Student Comprehension from Nonverbal Communication

APPROVED BY
SUPERVISING COMMITTEE:

Supervisor:

Richard H. Crawford

Brock E. Barry

The Influence of Pedagogical Experience on Assessing Student Comprehension from Nonverbal Communication

by

Daniel Joseph Fox, B.S.; M.S.

Report

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science in Engineering

The University of Texas at Austin

May 2014

Acknowledgements

I want to extend a sincere thank you to my graduate advisors, Dr. Richard Crawford and Dr. Brock Barry, for the consistent support and the persistent guidance they provided to me in developing this report. When starting my graduate education at the University of Texas at Austin, I never envisioned researching engineering education. Thank you for exciting my mind to a worthy and applicable area of study, and guiding my research and communication to make it academically creditable. I would like to thank Dr. Marilla Svinicki and Dr. Rene Dailey for their candid discussions and professional guidance which focused my literature review and developed my research instruments. A heartfelt thank you is extended to the University of Texas professors who endured my pilot research and provided me with valuable guidance and discussion: Dr. Cesar Delgado, Dr. Anthony Petrosino, Dr. Jill Marshall, Dr. Carolyn Seepersad, Dr. Llewellyn Rabenberg, and Dr. Yuebing Zheng. Lastly, I would like to thank my wife and daughters for supporting my pursuit of a graduate education. Thank you for giving me the time to complete this research, for always listening, and for keeping me grounded and balanced.

Abstract

The Influence of Pedagogical Experience on Assessing Student Comprehension from Nonverbal Communication

Daniel Joseph Fox, M.S.E

The University of Texas at Austin, 2014

Supervisor: Richard Crawford

This report details the development and execution of a pilot study investigating the influence of pedagogical experience on assessing student comprehension from nonverbal communication. The literary review identifies gaps in the current body of knowledge pertaining to teacher decoding of student nonverbal communication. The literary review also identifies instruments and procedures used in current nonverbal behavior research which will benefit the pilot study. After describing the instruments and procedure, the report presents the pilot study's results from interviewing six subjects. Using the results and recommendations from the study's subjects, the report recommends an instrument and procedure to conduct a full experiment.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

THE COMMUNICATION PROCESS

In the classroom environment communication between teacher and student is foundational to the learning process. Montagu (1967) states the main purpose of education is to teach the art of communication since the child learns to become human through communication (Smith, 1979). Teachers utilize all available means to present lessons in ways so students readily understand lesson objectives. The methods selected by a teacher to convey the lesson are wide and often varied based on: class size, student age, subject matter, physical classroom layout, availability of instructional material, student understanding of the material, and learning objectives, to name a few. The teaching methods used by a teacher can each be analyzed as methods of communication. Within the context of pedagogy, communication can be understood under the following model and definitions as taken from Simonds (2011).

Communication involves interaction between people. Interactions may occur between a teacher and large groups of students, small groups of students, or a single student. Each participant within the interaction brings a number of variables to the communication event. The synthesis of these variables creates the frame of reference with which a participant interprets and understands the communication. Simmonds lists these variables as: "personal experiences, goals, values, attitudes, knowledge, gender, culture, and beliefs" (2011, pp. 8). Due to frame-of-reference differences between teachers and students, classroom communication can be misinterpreted or even completely missed.

Communication involves both verbal and nonverbal messages. Verbal messages consist of the words spoken by a sender. Nonverbal messages consist of both how these

words are said and the sender's accompanying body language. The verbal message is understood as the vehicle which conveys ideas. The nonverbal message is understood as the vehicle which conveys feelings and emotion possessed by the sender (Gregersen, 2005). While verbal messages are not always present during communication, nonverbal messages are.

Communication occurs over a channel. A channel is the medium used to convey communication and can include face-to-face, written letters or reports, electronic messaging (emails or text messages), phone calls, etc. The channel selected for communication plays an important role in how a message is interpreted (Simonds, 2011). Media which solely utilize text or audio remove much of the sender's nonverbal signals; therefore, emotion and emphasis may potentially be lost.

Interference is described as anything which impedes the communication process. Interference can be physical or psychological. Physical interference includes noise in the classroom's interior or exterior, lighting within a class, seating arrangements which block a student's view of the lesson area, room temperature, and extraneous movement from classmates or outside a window which distract student attention. Psychological interference includes daydreaming, personal problems, sickness, and personal attitude.

During the communication process, feedback occurs when a receiver conveys reception of a message. Feedback is a very important response during communication. Feedback is often referred to as backchanneling and is an integral part of active listening. According to Bjorge (2010, pp. 193), "the term backchannel refers to verbal and nonverbal listener feedback in spoken interaction that does not involve a speaker shift, but functions as a turn-continuer." Verbal feedback can be a simple 'yes', 'right', or 'uhuh' of agreement, or a question for clarification. Nonverbal feedback includes facial expressions, head nods, eye glances, forward or backward body positions, laughter to

signal understanding, or facial frowns to signal confusion or disagreement. In addition to serving as a method for signaling message receipt, feedback serves to meter the speed of the communication and to signal turn-taking between communicators. Rapid head nods accompanied by a "yes, yes, yes" signal that a student understands the teacher's message and is ready to move forward with the lesson. Prolonged eye contact from a student whose body is poised as if he/she is about to leap out of the seat may indicate the student desires an opportunity to speak or ask a question (Bjorge, 2010; Simonds, 2011).

In addition to the frame of reference described earlier, communication occurs and is interpreted within a context. Context may include the time of day a class is taught and the social, economic, and political (local, state, or national) atmosphere. Context affects students' concentration by influencing the students' desire to engage with a lesson or apply the lesson outside the classroom.

Communication analysis is done with an understanding that communication is a transactional process. Signals are continually and simultaneously being sent, received, and processed by each individual involved with the communication. As an individual processes through each received message, verbal and nonverbal responses continually change.

NONVERBAL COMMUNICATION

This report focuses on the nonverbal portion of communication occurring within a classroom, specifically the nonverbal portion sent by students and received by the teacher. When student verbal feedback during a lesson is minimal, due to either lesson presentation method or student personal communication preference, the teacher must rely on nonverbal cues to determine the effect of their communication (Jecker, 1964). From

Barry et al. (2011, pp. 2-3), nonverbal communication generally falls within one of ten categories:

1. "Chronemics" – The timing of verbalizations and pauses
2. Haptics – Contact and deliberate touch between individuals
3. Kinesics – All forms of body language and body movement, including facial expressions, eye movement, gestures, and posture
4. Oculesics – The intentional and unintentional eye contact in the act of communication
5. Olfactics – The influence of odor
6. Physical Appearance – The characteristics of the body, clothing, and hairstyle
7. Proxemics – The arrangement of physical items and physical space
8. Silence – The absence of verbal and nonverbal communication
9. Symbolism – The meaning associated with symbols
10. Vocalics – The vocal impacts on the act of speaking, to include tone of voice, timbre, volume, and rate of"

Within the categories of nonverbal communication, this report focuses primarily on kinesics – the students' body language and body movement, including facial expressions, eye movement, gestures, and posture. The focus on kinesics is influenced by Jecker's observation that "during the ordinary classroom presentation of a lesson…the teacher must rely predominately on nonverbal feedback – facial expressions and various bodily movements." (Jecker, 1965, pp. 243) Often, teaching methods which promote passive learning limit the range of channels available to students. This narrow range of channels is generally reduced to static displays, such as gaze direction, concentration expressions, and posture (Neill, 1991). Kinesics itself is divided into unique categories.

The number of categories of kinesics varies within professional literature, but is generally broken down into the following seven:

Gaze – gaze refers to the duration which a person's eyes are fixed on another person, object, or location. Sustained gaze can indicate interest. The interest can be either positive or negative based on the presence of other nonverbal behavior. A student who maintains eye contact with a teacher during a lesson and displays relaxed facial and body positions may indicate positive interest in the lesson. A student who glares at a teacher and shows a frown or scowl likely indicates negative feelings for either the lesson or the teacher. Gaze is linked to creating emotional closeness; people bring things closer by looking at them. Likewise, people create distance by looking away. Children who are reprimanded often look down or away to avoid eye contact as a way of distancing themselves from the individual delivering the reprimand. Gaze within most classroom situations results in intermittent eye contact between the students and the teacher (Neill & Caswell, 1993).

Facial Expression – facial expressions are described as movement and position of facial features (brow, eyebrows, and mouth). Facial expression can be categorized with head position as the two are often signaled together. Of the two, facial expression is given more prominence as a display of emotional affect. Head position can be used to indicate dominance. A raised chin[1] is likened to standing over a person and is a sign of dominance. A lowered chin is non-threatening, and a sign of submission. The 'head cock', displayed by tilting the head to one side, can be a sign of sympathetic interest. Smiling and frowning are the most easily recognized facial expressions displayed in a classroom. Smiling is generally believed to be an innate expression for comfort and

[1] Also described in literature as a 'Plus Face'.

agreement. In contrast, frowning can imply multiple emotions, which is why it is difficult to distinguish a concentration frown from an anger frown. It is believed that a frown is used when an individual wants to see something more clearly; the slight squint of the eyes narrows vision and allows for concentration. The frown, by itself, does not distinguish whether the sender's concentration is due to interest or annoyance. Additional facial expressions include puzzled and surprised looks. The puzzled look can be used during feedback to signal a lack of understanding. Both puzzled and surprised looks can be used by a teacher to emphasize verbal points by concurrently signaling that the idea within the verbal message is confusing or surprising (Neill & Caswell, 1993).

Body Position – is described as the lean or tilt of a person's torso and position of arms and legs. Posture signals a person's intentions. It can be thought of as the intention of a person's motion if they were to engage in motion. For example, leaning towards a person signals an increase in intensity and attention. The person wants to become closer to the other whom they are communicating with, and if they followed through with their movement would move closer. A forward lean signals interest and desire. When a rearward lean is displayed it signals distance. If the back-leaning individual were to begin motion they would move away from the other person engaged in communication. Standing over someone is a display of dominance. Height is likened with power. In a physical battle, a taller individual or a force holding higher ground has an advantage. When an individual is leaning over someone, if they were to begin motion and attack they would hold an advantage over the lower individual. Alternately, sitting or maintaining a lower position is non-threatening. Positioning the body in a lower position can indicate either comfort (the individual does not feel threatened by the surroundings) or submission (the speaker's turn is ended and the speaking floor is yielded back to the lecturer/audience) (Neill & Caswell, 1993).

Eye Movement – eye movement is the direction and speed of a moving eye, and its movement frequency. Blinking can be included within this category as can gaze. Blinking is the closing and opening of the eyelid over the eye. Gregersen (2005) conducted a study of the anxiety experienced by foreign language students during oral exams. The study found that non-anxious students glance and maintain eye contact with their instructor with greater frequency than their anxious counterparts. Non-anxious students were found to maintain slightly less than normal blinking frequency (the average person's spontaneous blink occurs at a rate of 14-17 blinks/minute) while anxious students blinked at a rate 1.5 times the average (Gregersen, 2005, pp. 391).

Gesture – involves hand and body movements which serve to emphasize a verbal statement (a geography teacher pointing to a map to indicate the location of a city), give form to an idea (a history teacher moving hands in the shape of a pyramid when describing a medieval social structure), or provide control and structure within a classroom (a student raising their hand to ask a question, a teacher identifying a student to speak by pointing at the student). In his literary review of nonverbal research in education, Smith (1979) reported that gestures play a critical role in the classroom. In their discussion on learning within the cognitive domain, Philippot et al. (1992) suggest that information encoded using multiple channels (verbal idea accompanied by a nonverbal gesture) strengthens the receiver's ability to remember and recall the information.

Self-Touch – takes many forms and may indicate multiple nonverbal messages. Self-touch includes touching the hand to the face or body. The touch may scratch; massage; adjust clothing, hair, or an accessory; or provide support as when the chin rests on a hand. Self-touch may also include the appearance of hanging onto oneself (when an arm is brought across the body to grip an opposite side of the body) or giving oneself a

hug (tightly folding the arms in front of one-self). The self-touch signals multiple messages. A person may scratch their face because they have a physical need to itch, they may adjust clothing to lessen a constriction, and they may adjust their glasses to gain clearer vision. Propping one's head upon a hand may signal physical fatigue or an experience of focused thought. Hanging an arm across the body or crossing both arms across the chest can fulfill a psychological need for security due to discomfort or anxiety. Like a defensive barrier, the arms can deflect an attack and prevent injury. Folded arms create a barrier for any incoming communication. A person with folded arms may be signaling disinterest or skepticism with the communication they are receiving (Pease, 2004)

Article Manipulation – is similar to self-touch adjustments. Manipulated articles often include small, handheld objects carried by a person or within a person's reach. Frequently manipulated objects include pens, pencils, papers, coins, and clothing accessories. Article manipulation is displayed by individuals who are anxious, non-attentive, or bored so it must be assessed in the context of other nonverbal signals. Looking out over a classroom, one frequently finds students who are flipping pencils between fingers or clicking pens (Hartley, 2007).

As mentioned above, the frame of reference held by each person during communication has a direct impact on the verbal and nonverbal signals they send as well as their interpretation of the verbal and nonverbal signals they receive. Much literature investigates and reports on the impact of gender and culture on communication. It is generally accepted that women are more nonverbally expressive and receptive than men. Debate continues on whether certain nonverbal behaviors such as surprise, fear or happiness are innate to all people, (Banziger, 2011; Neill, 1991; Neill, 1993; Pease, 2004; Wiggers, 1982) but culture strongly influences the types of nonverbal signals displayed

when an individual is angry, sad, interested, or disgusted. Culture also influences social behavior when an individual is in the presence of elders or superiors. It is beyond the scope of this report to investigate the influence of these areas on a teacher's ability to assess student comprehension from nonverbal communication, but the author acknowledges their presence and influence. The pilot study described below incorporates both genders into its primary instrument. The full experiment intends to incorporate and assess the influence of gender and culture by including both men and women and multiple cultures into both the video clip instrument and the subject population.

NONVERBAL INDICATIONS OF COMPREHENSION

The nonverbal signals indicating student comprehension or confusion generally involve a simultaneous display of chronemics, kinesics, oculesics, and silence. When describing emotional affect and their corresponding nonverbal signals, the majority of literature focuses on either the signals of affection between genders or the main seven emotions (surprise, fear, happiness, anger, sadness, interest, disgust). Several authors describe the nonverbal signals of confidence displayed by students in the classroom (Jecker, 1965; Allen & Atkinson, 1981; Knapp, 2006; Neill & Caswell, 1993).

Jecker (1965, pp. 240) provides specific details related to comprehension cues. These cues include "maneuvering the body and face to orient them toward the source of information, the frequency and speed of movement to and away from the source of information, raising and furrowing of the brow, chin rubbing, and the like." While Jecker did not describe whether the frequency of these cues or simply their presence indicates comprehension, their descriptions provide the basis for the instrument used in this report's pilot study. Additionally, Jecker provides a coding form used in his experiment listing fourteen nonverbal cues related to student comprehension. Once again, details are

not given as to the specific cues or cue frequency which indicate student comprehension. The identification of these cues, used in context with recent literature, further our understanding of the nonverbal behavior of comprehension in the classroom. The cues identified by Jecker as being present when a student either understands or is confused by a lesson are (Jecker, 1965, pp. 241):

1. Amount of time looked at source (Gaze)
2. Number of times looked away from source (Eye Movement)
3. Speed of eye movements away from and returning to the source (Eye Movement)
4. Amount of blinking (Eye Movement)
5. Grouping of blinking (Eye Movement)
6. Duration of lowering eyebrows (Facial Expression)
7. Strength of lowering eyebrows (Facial Expression)
8. Duration of raising eyebrows (Facial Expression)
9. Strength of raising eyebrows (Facial Expression)
10. Movement of hands on face (Self-Touch)
11. Frequency of general body movement (Body Position)
12. Extent of general body movement (Body Position)
13. Amount of mouth movement (Facial Expression)
14. Chewing gum or candy (Article Manipulation)

According to Neill (1991), children's nonverbal behavior becomes habitual. Research conducted by Allen & Atkinson (1978) found that children tended to signal a characteristic level of understanding regardless of their actual level of understanding. Video recordings of high-achieving students experiencing a lesson much above their grade level were perceived by groups of teachers to comprehend the lesson. Likewise, video recordings of low-achieving students experiencing a lesson below their grade level

were perceived to appear confused by the same group of teachers. Neill cites Lawes (1987) when describing the nonverbal cues teachers may observe from confused students. These cues include "irrelevant behavior such as playing with objects, hand to mouth, and looking around" (Neill, 1991, pp. 20). During experimentation, Lawes found that combinations of these cues presented a strong indication of confusion. Absence of these cues indicated student comprehension. Lawes' experiment also identified several cues which teachers misidentified. These cues included student understanding signaled by a fast response and student confusion signaled by a frowning brow. (Neill, 1991)

As described earlier, backchanneling is an important process during the feedback process of communication. Backchanneling is central to active listening and is associated with a number of functions as described by Bjorge (2010, pp. 193):

> On the positive side it is said to signal support, attention, empathy, enthusiasm, agreement, evaluation, and acknowledgement of what the current speaker says; to express – but not to guarantee – understanding; it is used to request clarification; to respond to new information and also to encourage the speaker to continue his/her turn…On the negative side, it has been pointed out that backchanneling may indicate lack of interest, and even be used to signal indignation, indifference and impatience.

Similar backchannel signals are present in the classroom for the teacher to observe. Students nod or smile in agreement or frown and shake their heads in dissent. When asked a question, students may summarize the teacher's prior statements in an effort to demonstrate active listening. Students also ask clarifying questions to ensure they understand the lesson.

HOW TEACHERS PROCESS STUDENT NONVERBAL INFORMATION

To provide a pedagogical benefit, after teachers learn to identify the nonverbal cues of student comprehension, they must be able to mentally process the information

and make cogitative decisions to modify their lecture or otherwise engage with confused students. Successful teaching relies heavily on successful two-way communication between the teacher and students. While communicating a lesson, the teacher must continually assess the effectiveness of their communication. In one-on-one settings, feedback is often immediate and continuous. When a teacher addresses a small group, occasional verbal feedback is possible, but is largely limited. Student responses and questions are a useful source of immediate information, but these are often limited to a few students within a group. When addressing a sizeable class, the teacher must use other means to assess the comprehension of students not actively responding or asking questions (Jecker, 1964).

It is difficult, if not impossible, for a teacher to construct and present a lesson which is completely understood by every student. A multitude of classroom assessment techniques are available to teachers as means to check student understanding. Classroom assessment techniques may take the form of in-class or small group discussions or debate; probing questions from the teacher in line with Bloom's taxonomy; short writing assignments; class projects; or quizzes and tests (Fisher, 2007). The difficulty in using these assessment techniques is the time delay in receiving feedback of student comprehension. Projects, tests, quizzes, and written assignments must all be graded to assess comprehension. In-class or group discussion provides an expedited method for receiving feedback if the teacher is able to observe that each student is participating and correctly applying the lesson material. Questions by the teacher directed to individual students may provide opportunities for confused students to ask questions or afford the teacher an opportunity to clarify lesson points, but first the teacher must identify a student who looks confused. Rapid feedback assessment is gained when a teacher accurately assesses a student's comprehension during critical points during the lesson. It was

Jecker's belief that nonverbal feedback provides useful cues in making such assessments (Jecker, 1965).

To make use of nonverbal feedback, a teacher must first accurately observe the classroom. In addition to accurate observance, a teacher must understand the desired lesson outcomes and be able to differentiate the performance of each student regarding these outcomes. Teacher perception of student activity and actual student activity can be vastly different. Radford (1990) explained that teachers like to feel comfortable in their environment. They have an expectation of what behavior should and should not be observed during a lesson. As a result, teachers may examine events which appear familiar and expected but, in fact, are misinterpreted. A scenario is described where some students within a class are adept at appearing to be on task (head down, moving their pencil) when in fact they do not understand the lesson or are avoiding the class assignment. Quick scans of a class do not give the teacher the opportunity to catch this discrepancy. To combat this tendency, Radford (1990) suggests teachers employ a 'scanning and focusing' method to observe their class. Rather than quickly scanning the room to detect disturbances, teachers should focus their attention on individual students for a longer period of time. This longer look provides the opportunity to gather a sequence of each student's verbal and nonverbal behavior. Radford (1990) further discusses the challenge novice teachers have in processing the mass of stimuli presented to them throughout the duration of a class. Novice teachers may feel overwhelmed by the stimuli and misidentify critical student behavior or may misinterpret the behavior they do identify. Experienced teachers are said to have developed a feel for the classroom such that they are able to glance around the room and make sense of the same mass of stimuli (Radford, 1990).

The situation described by Radford where novice teachers tend to be overwhelmed by the mass of stimuli presented by a classroom environment while

experienced teachers are capable of observing the same stimuli and making sense of it is explained by Bransford (2000). In his text, Bransford states that experts process information differently than novices. First, experts are able to make more efficient use of their short-term memory. The amount of short term memory available to every person is relatively equal. Experts are able to take newly observed information and place it into 'chunks.' An expert's ability to chunk information stems from an increased understanding of a hierarchical structure within their area of expertise. With training and practice, experts have accumulated examples and outcomes within their long-term memory. New information can be compared with examples in long-term memory and easily sorted into chunks of valuable information. Novices do not possess memory of examples and outcomes, and therefore, lack a hierarchical structure and are unable to use a chunking strategy. The hierarchical structure possessed by experts also allows them to develop and use schemas to analyze problems. By recognizing patterns within a new problem, experts are able to identify critical information for use in decision making. In contrast, novices lack a hierarchical structure and may not necessarily identify critical information needed to solve a problem. In studies conducted by Sabers et al.(1991), when shown a video recording of a busy classroom, expert teachers and novice teachers recalled different details and had very different understandings of the classroom behavior they observed. Experts organize their knowledge differently than novices. Experts organize their knowledge around 'big ideas' rather than around facts and figures. When asked what steps one would use to solve a problem, experts start by describing an overarching theory or idea which encompasses the problem and then describe how the principles within the theory apply to solving the problem. Novices tend to solve problems by searching for an equation or example which they have used to solve similar problems. Experts are able to free up their working memory by fluently retrieving information from

long-term memory. An expert's knowledge is conditioned to problems where it is applicable, rather than searching through one's memory to find relevant knowledge as done by a novice. Experts easily recognize patterns and only recall relevant knowledge.

Fortunately, for novice and expert teachers alike, research shows that training in student nonverbal behavior significantly increases a teacher's ability to correctly assess student comprehension from nonverbal behavior. During his 1965 experiment, Jecker successfully determined that teachers who received 6-8 hours of training on student nonverbal cues showed a 7% increase in assessment accuracy of student comprehension when compared to their pre-training test. The training conducted by Jecker included review and discussion of the 14 cues his team identified to be present during student confusion or comprehension along with observing video clips of students displaying these cues (Jecker, 1965). Neill provides additional advice on training teacher nonverbal skills by adding that:

> Lessons must contain at least two of the following four elements: presentation of theory, training in discriminating nonverbal signals, modeling of the skills involved, and practice of the new skills with feedback – preferably in this order. Courses with two or fewer practice sessions were found to be less effective…the effects are greatest in the skills directly related to those trained, and persist when course participants are reassessed up to three months later (Neill, 1991, p157).

To date, no studies are known to have explored the long-term retention of nonverbal assessment skills gleaned from any such training.

PROPOSED RESEARCH

The focus of this report is on the development and execution of a pilot study to answer the question of whether pedagogical experience influences assessment of student comprehension from nonverbal communication. Integral to the teaching process is the teacher's ability to assess a student's level of understanding of the subject taught. A

multitude of classroom assessment techniques exist, providing teachers with methods to gauge students' level of understanding and comprehension. While each technique has its advantage, a common shared disadvantage is the time lag between technique application and receipt of assessment results. From observation and interpretation of students' body language and facial expressions, the perceptive teacher is equipped with an accurate assessment method with near instantaneous feedback results. Understanding factors which improve teacher's ability to interpret student body language helps future generations of teachers more effectively assess their classroom and engage students.

This pilot study proposes to achieve its goal by advancing a study conducted by Webb, et al. (1997). The hypothesis is based on cognitive development theory, specifically meta-cognitive development. Two hypotheses are proposed.

a. Instructors with more teaching experience possess a developed schema and deeper problem solving techniques, and therefore, will respond with greater accuracy than instructors with less teaching experience, when evaluating student comprehension from nonverbal communication.

b. By removing all verbal and nonverbal communication except kinesics, teachers are prevented from using these channels to gather mutually confirming feedback. Due to a perceived lack of information, instructors with more teaching experience will have less confidence in their answers than less experienced instructors. Less experienced instructors may not be aware of the critical feedback they are missing and will be more confident in their answers.

A review of the literature was conducted and is provided in Chapter 2. Chapter 3 describes the procedure, material, and participants involved in the pilot study. Chapter 4 presents the results of the pilot study as well as recommendations from the pilot study participants for full experiment improvements. Chapter 5 concludes with

recommendations for the design, participants, material, procedure, and subsequent analysis of a full experiment aimed to answer the same question.

Chapter 2: Literature Review

The literature review conducted for this report focused on publications from 2011 to the present. The extensive literature review conducted by Barry et al. in 2011 found the majority of publications focused on general topics, Nonverbal (NV) Communication (NVC) research guides, and descriptions on the NVC differences observed within cultures and between genders. Literature pertaining to NVC in the classroom tended to focus on NV behaviors encoded by the teacher and their perceived effect on the students. The literature review conducted by Barry et al. found "surprisingly little content specific to decoding student generated cues." (Barry, 2011, pp. 9). A journal publication by Webb et al. (1997) was identified by Barry as one of the few recent publications to test "the ability instructors have to accurately interpret student nonverbal communication." (Barry, 2011, pp. 9). A search of The University of Texas at Austin Library's physical and digital repository yielded fourteen texts and journals containing discussions on the topic of NVC published from 2011 to the present. Searches within professional publications of the *American Educational Research Association (AERA), American Society of Engineering Education (ASEE), International Journal on E-Learning(IJEL), Journal of Computers in Mathematics and Science Teaching(JCMST), Journal of Interactive Learning Research(JILR), Journal of Educational Multimedia and Hypermedia(JEMH), AACE Journal(AACEJ), Contemporary Issues in Technology and Teacher Education(CITE), Information Technology in Childhood Education Annual(ITCE), and the Society for Information Technology & Teacher Education* produced a wide variety of articles. While very few publications discuss how teachers can identify and interpret student nonverbal cues, several interesting trends exist within recent publications. These include articles discussing research methods and results of action research as applied to the use of video

and software technology to aid teachers with interpreting NV behavior of students, and instructor use of NV behaviors to create proximity within distance learning environments.

Several studies (Flake, 2002; Cooper, 2013; Brown, 2004) used cameras and video recognition software to conduct real-time analysis within a classroom. The availability of high-resolution video cameras, high speed processors, and high memory computers allows researchers to use software capable of detecting verbal and nonverbal behavior of recorded individuals. Experiments using this technique have analyzed the behaviors of both teachers and students. In 2002, Flake et al. successfully created an online database of videos showing children in grades K-5 working through grade-appropriate mathematical concepts and problems pertaining to: patterning and algebraic thinking, space and geometry, measurement, early number concepts, number and operations, rational numbers, and probability and statistics. The videos were labeled (and therefore searchable within the online database) based on each child's grade, child's pseudo name, and mathematical topic discussed. Flake's undergraduate teaching students were given a weblink which allowed them to view the videos from any computer. Each video's webpage provided space for the students to comment on the child's behavior and perceived thought process. Flake's goal was to provide pre-service teachers with an alternate method of experiencing how children construct meaning with mathematical concepts within a classroom; in hopes of exposing the pre-service teachers to the great variety of methods by which children think and learn (Flake, 2002)

In 2004, Brown used videos and computer software to simultaneously analyze the behavior of a teacher and corresponding behavior of her students. It was designed to serve as a tool to help school administrators clinically supervise and provide specific guidance to pre-service teachers. Specific student nonverbal behavior gathered by the software included time on task, student positive or negative response, and room location

where questions or discussion arose. While the software required input from a researcher trained in identifying non-verbal behavior, its output provided feedback to the teacher on areas of improvement to increase the overall educational experience for the class (Brown, 2004).

Cooper (2013) discussed the use of a virtual interviewing system (VIS) with real-time video monitoring in English as a foreign language (EFL) classes in Japan. Due to the difficult nature of learning EFL and the high student to teacher ratio (60:1), Cooper explored VIS as a detection tool to identify areas in real time where students struggled. Armed with a real-time assessment, VIS allowed teachers to intervene and provide clarification. The class occurred in a computer lab where each student used an individual workstation. Mounted at each workstation was a 'Kinect' style motion sensitive camera. Each lesson was presented as a series of pre-recorded video clips. After viewing each video clip the software prompted the student to repeat words and phrases or answer questions using English. Whenever the student responded, the motion sensitive camera began recording. While recording, the VIS software analyzed the facial expressions and mouth formation used by the student and compared them to a native English speaker. The software then transmitted a composite analysis of the class to the teacher. Using the analysis, the teacher identified trends of difficulty experienced by the class. The teacher could then choose to intervene with the lesson and provide additional examples, correction, or instruction to reinforce correct English.

Several journal articles (Bai, 2003; Cui, 2013; Kim, 2007; Offir, 2004; Rose, 2009; Schutt, 2010) focus on the influence of nonverbal communication on a student's sense of perceived presence in a distance learning environment. Just as in Barry's literary review, these articles each focused on nonverbal behaviors of the teacher, as well as on the effects those behaviors have on the distance learning class. The articles focused

neither on the nonverbal behavior of the distance learning students, nor on how the instructor should interpret nonverbal behavior to improve student learning.

Despite the absence of recent discussion on decoding student nonverbal communication, several studies performed within the past decade provide useful instruments, procedures, and analysis methods from which a discussion can begin. Dickson and Burton's 2011 investigated 9- and 13-year-olds' ability to encode whether pupils recognize and interpret non-verbal communication accurately. While the overarching focus of this research sought to determine whether teachers consistently conveyed non-verbal messages and whether effective communication assisted with classroom management and behavior, their method for testing student recognition of NVC applies to this report. In Dickson's study, 60 9-year olds and 60 13-year olds were asked to complete two tasks using emotional labelling and emotional recognition. The pupils were shown photographs of an adult's face whom they would recognize (teacher or staff at the pupils school). The face in the photograph displayed one of six emotions. The pupils were asked to give one of six possible emotional response answers: happy, sad, disgust, surprise, fear, or anger. While this study focused on the pupils' ability to decode NVC from an adult, Dickson's method for testing NVC literacy seems applicable to this study. When testing teachers and their ability to decode student comprehension or non-comprehension, the six emotions need to be modified to reflect student displays of comprehension and non-comprehension. This requirement prompted further investigation by the author into identifying an established test (Profile of Nonverbal Sensitivity, or PONS) currently used to assess NVC literacy, and identifying those NVC behaviors which indicate comprehension and non-comprehension. Another assessment instrument, the Multimodal Emotion Recognition Test (MERT) (NCCR Affective Science, 2014), is

found in Jecker (1965), Allen & Atkinson (1981), Knapp (2006), and Neill & Caswell (1993).

A study on the attentional and mental workload demands in NVC by Newlin-Canzone et al. (2011) investigated how changes to the demand on a subject's working memory affected their ability to decode NVC behavior. The analysis method appears applicable to this current report. Newlin-Canzone, studied 36 university undergraduate students in a 2 X 2 factorial experiment on the attention and mental workload demands in nonverbal communication. A mock job interview was used as the instrument scenario. During the interview, the researcher (acting as the interviewer) acted out three types of nonverbal behavior for the subject to observe. Subjects participated in one of four scenarios: conduct a five-minute mock job interview where the student must improvise their response; conduct a five-minute mock job interview where the interview questions are provided beforehand as well as scripted responses for memorization prior to conducting the interview; watch a video-taped mock job interview where the interviewee improvised their response; or watch a video-taped mock job interview where the interviewee memorized the interview questions and a response script. Following each scenario subjects were given two surveys. First, a post-interview query was administered in which they recorded the nonverbal behaviors they observed from the mock interviewer. The nonverbal behaviors were divided into categories of kinesics, body position, gaze, and vocal behavior. Second, a National Aeronautics and Space Administration (NASA) Task Load Index which measures the subjective mental work load. From her results, Newlin-Canzone found subjects expressed higher mental work-loads during active interviews than during passive observation of an interview. Subjects expressed higher mental workloads during improvisational versus a rote memorization situation within each active/passive category. Newlin-Canzone found an inverse

correlation between subjects' correctly identifying nonverbal behavior and the perceived mental workload of the subject. The subjects correctly identified a greater percentage of nonverbal behaviors during passive scenarios and during interviews containing rote memorization. Newlin-Canzone's analysis method using an analysis of variance (ANOVA) seems applicable to this report's recommended full experiment. The nonverbal behavior of the researcher playing the role of the interviewer was controlled – just as the cadet comprehension is controlled in this report's pilot study. In Newlin-Canzone's study, the accuracy of each subject was scored by the number of correct nonverbal behavior categories identified during the post-interview. In addition to subjects correctly assessing student comprehension, this pilot study might conduct further analysis by asking subjects to identify the specific student nonverbal behavior they used to determine comprehension.

The literature review conducted for this report focused on publications from 2011 to the present. The review primarily used The University of Texas at Austin Library's physical and digital repository and yielded fourteen texts and journals containing discussions on the topic of NVC. The review found that most literature pertaining to NVC in the classroom tended to focus on NV behaviors encoded by the teacher and their perceived effect on the students. While very few publications discuss how teachers can identify and interpret student nonverbal cues, several interesting trends exist within recent publications which will be valuable for conducting this report's full experiment. The full experiment will most benefit from the articles discussing research methods and results of action research, as applied to the use of video and software technology, to aid teachers with interpreting NV behavior of students. In Chapter 3 the instruments, population, and experimental procedure used to conduct the pilot study are described in detail.

Chapter 3: The Experimental Method

In Chapter 3, a detailed description is provided for the specific instruments, population, and experimental procedures used to conduct the pilot study. The instruments used to conduct the pilot study include: Cadet Video Clips, a Subject Response Sheet, a Post-clip Interview, and a Post-session survey. The Post-clip Interview and Post-session survey instruments were created specifically for this pilot study so additional information is provided regarding the rationale behind their purpose and form. This research used human subjects; therefore, approval was requested from The University of Texas at Austin Human Subjects and Institutional Review Board (IRB). See Appendix A for this study's IRB research proposal and Appendix B for the subject participation consent form. Analysis methods for data gathered using these instruments are described in Chapter 4.

DESCRIPTION OF THE INSTRUMENTS: CADET VIDEO CLIPS

The primary instrument is a series of 20 short video-only clips showing freshman college students providing written responses to a set of ten mathematics questions. The videos vary in length from 25 to 70 seconds and show each student in a traditional classroom setting, with classroom seating arranged in a 'U' shape. The use of 60 second duration, video-only film clips is consistent with previous studies of teacher interpretation of student nonverbal behavior conducted by Jecker (1964, 1965), Webb et al. (1997), and Allen & Atkinson (1978, 1981). Each video is framed to display the student's facial expression and upper torso body position. The audio in each clip is muted to focus the subject on assessing only kinesic forms of nonverbal communication.

The students shown in the clips are freshmen year cadets at the United States Military Academy at West Point, New York. The researcher, Dr. Brock E. Barry,[2]

[2] Dr. Brock E. Barry, Associate Professor, United States Military Academy, West Point, New York

credited with capturing the videos, selected cadets in a first-year, World History core curriculum course. Prior to the videotaping session, four cadets were preselected by their World History course instructor. The instructor selected these four cadets based on their higher degree of nonverbal expression and animation during previous lessons, and provided their names and seating locations to Dr. Barry. The day of the taping, four cameras were placed throughout the classroom; each camera focusing on a selected cadet. The cameras were positioned to appear as if the entire class was being filmed – it was not obvious or announced that the cameras focused on four cadets. The entire class was told they would be taking a mathematics quiz as part of a research study on cadet confidence. The selected cadets took the same quiz as their classmates and were oblivious that a camera was focused individually on them.

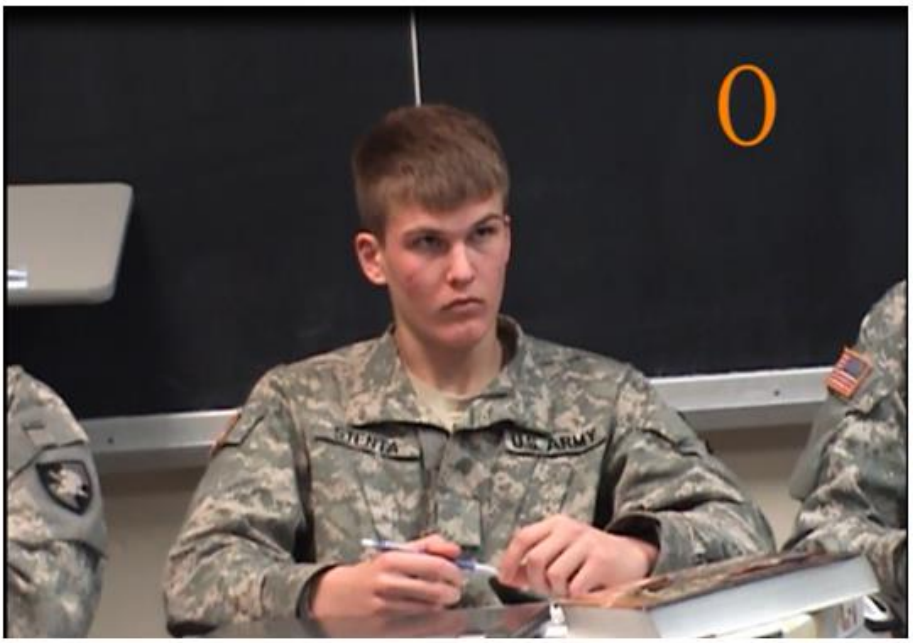
The test given to the cadets consisted of ten short, SAT-style multiple choice mathematics questions. The content in the questions ranged from solving straight-forward linear algebra to confusingly-worded word problems. The questions were displayed one at a time on the room's projector screen. Once displayed, the researcher read each question aloud twice for the class. Cadets were given approximately one minute to answer each question. In addition to recording their answer, cadets were instructed to record their level of confidence in answering each question. Confidence level ratings included: 'Not at all sure', 'Somewhat unsure', 'Somewhat sure', Sure', and 'Very sure', using a five-point Likert scale.

After filming, the video clips were analyzed and matched with the cadet's score sheet. The test scores helped identify videos when the cadet correctly answered a question and possessed a high confidence level, as well as videos when the cadet incorrectly answered a question and possessed a low confidence level. After identifying high-confidence correct and low-confidence incorrect video segments, further scrutiny

was applied to identify five video clips for each cadet (20 clips in total) that displayed the most overt forms of corresponding nonverbal communication. Prior to use in the pilot study, the final videos were shown to three independent experts for validation. The experts included a professor of Nonverbal Communication from the College of Education from The University of Texas at Austin, a 20-year professor in the Cockrell School of Engineering from The University of Texas at Austin, and an Associate Professor researching nonverbal communication at the United States Military Academy at West Point, New York. Each expert provided feedback identifying the cadet's nonverbal behavior as confident or not confident. Each expert also identified the nonverbal signals displayed in every clip which supported their conclusion. The feedback from the three experts met with 81% agreement across the range of 20 video clips. The final 20 clips were then placed in a random order to create the final video instrument. See Figures 1 and 2 for a sample screenshots of the final video. A feature highlighted in Figure 2 is the colored indicator used to differentiate when cadets received verbal problem instruction from their teacher (top) from quiet classroom time (bottom).

Figure 1: Video clip screenshots of each cadet

Burnt Orange 'O' indicating the question is being read to the student



Almost-Army Green 'O' indicating the instructor has completed reading the question

Figure 2: Video clip screenshots highlighting the colored indicator used to differentiate when cadets received verbal problem instruction from their teacher (top) from quiet classroom time (bottom)

PARTICIPANTS: PILOT STUDY

Participants in the pilot study were selected from Professors and Associate Professors currently teaching in the College of Education and the Cockrell School of Engineering at The University of Texas in Austin. The University of Texas at Austin is a research intensive university with numerous faculty members willing to participate in pedagogical research. The primary investigator (PI) contacted faculty who either taught the PI during previous semesters, or who were recommended to the PI by his primary academic advisor. Instructors possessing wide ranges of teaching experience were solicited. Ideally, the experience range of participating volunteers would include 1st year professors through professors with multiple years of teaching experience. The pilot study sought 5-6 volunteers. Instructors within The University of Texas at Austin College of Education and Cockrell School of Engineering were sought for convenience, but all instructors were welcome to participate. No restrictions were imposed to limit participants with respect to gender or ethnicity. The only demographic information collected was the subject's prior teaching experience, and completion of formal or informal nonverbal communication training was collected. The answer sheet, post-clip interview audio recording, and post-interview survey results were each anonymized and linked only by a participant number.

DESCRIPTION OF THE INSTRUMENTS: RESEARCH SUBJECT RESPONSE SHEET

During the experiment, research subjects recorded each of their responses on an answer sheet. The subjects were restricted to two responses, either 'The student appeared confident' or 'The student did not appear confident'. Adjacent to these two responses, the answer sheet provided five blocks for the subject to record their level of confidence in their assessment of the clip. The five blocks used a Likert scale whose response labels

included: ‘Not at all sure’, ‘Somewhat unsure’, ‘Somewhat sure’, Sure’, and ‘Very sure’. See Figure 3 for an example of the subject response sheet.

Participant Number: _____

	Does the student appear:		Rate Your Confidence in Your Assessment				
			1	2	3	4	5
Video Clip	Confident	Not Confident	Not at all sure	Somewhat unsure	Somewhat sure	Sure	Very sure
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Figure 3: Answer sheet used by subjects during the pilot study

DESCRIPTION OF THE INSTRUMENTS: POST-CLIP INTERVIEW

After providing a response and confidence rating for each clip, the primary investigator asked the subject one question, “Please describe the student behaviors which indicated to you comprehension or non-comprehension.” Subject responses were recorded using an audio recorder. The purpose of this instrument is to identify the nonverbal behaviors exhibited by the cadet that the subject believed indicated comprehension or non-comprehension. Similar to the ‘think aloud’ methods conducted by deGroot (1965) during his *Thought and Choice in Chess* experiment, this instrument intended to frame an understanding of the subjects’ student behavior schema, breadth of metacognition, and problem solving methods used to reach a conclusion. Additionally,

transcriptions of the audio recordings allow qualitative examination of the key words used by the subjects. See Figure 4 for an example of Interview sheet.

Post-Video Clip Interview Questions for Influence of Pedagogical Experience on Assessing Student Comprehension from Nonverbal Communication Pilot Research

Clip #1:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #2:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #3:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #4:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #5:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #6:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #7:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #8:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #9:
Please describe the student behavior which indicated comprehension or non-comprehension:

Clip #10 - #20:
Please describe the student behavior which indicated comprehension or non-comprehension:

Figure 4: Sample of post-video interview questionnaire used during the pilot study

Participant Number: ____________________

Post-Session Survey for Influence of Pedagogical Experience on Assessing Student Comprehension from Nonverbal Communication Pilot Research

Nonverbal Communication is defined as: All aspects of message exchange without the use of words. It includes all expressive signs, signals, and cues. Nonverbal communication includes the tone, loudness, speed, and timing of the words used in communication, but it does not include words and their associated meanings. Nonverbal communication is often grouped into various categories such as: Orientation, distance, posture, gesture, diffuse body movements, facial expression, gaze direction, use of artifacts, tone of voice, and rate, amount and fluency of speech. The categories pertinent to this study include: Kinesics - All forms of body language and body movement, including facial expressions, eye movement, gesture, and posture; Oculesics - Intentional and unintentional eye contact in the act of communication; Physical Appearance - Characteristics of the body, clothing, hairstyle, etc.; Use of Artifacts - manipulated objects in contact with the interacting person.

National Origin: ____________________

Please describe your teaching experience:

Level of education and year achieved

	Year Achieved
Undergraduate	____________
Graduate	____________
Doctorate	____________
Post Doctorate	____________

Please describe the teaching positions you currently hold, and those held in the past:

School Name	Location	Type of School (Public, Private)	Starting Year	Ending Year	Level (Primary, Secondary, Undergrad, Grad,)	Subjects Taught	Range of Class Size Taught

Have you received any formal instruction in nonverbal communication?

If so, please describe: ____________________

Have you received any in-formal instruction in nonverbal communication (Conferences, journal reading, continuing education, etc.)?

If so, please describe: ____________________

If you received any formal or in-formal nonverbal communication instruction, when did it last occur?

Figure 5: Post-session survey designed to gather teaching experience and demographics

DESCRIPTION OF THE INSTRUMENTS: POST-SESSION SURVEY

At the conclusion of watching the 20 video clips, subjects were given a multi-question survey. The survey requested demographic information pertaining to highest level of education achieved; the subjects' educational employment (school name where currently/previously employed, location, school type, years of employment, student grade level taught, subject taught, and average class size), an inquiry into any formal or informal training in nonverbal communication, and, if such nonverbal training had been received, the approximate time lapse since its completion. In their conclusion following completion of similar research, Webb et al. (1997) suggested that future studies focus on the effects of training, independent of teacher experience. This post-session survey sought to gather demographic information to aid in understanding the subject's particular teaching experience and nonverbal communication training. The full experiment would benefit from a factorial analysis of the effects of formal and informal nonverbal communication training. See Figure 5 for an example of Post-Session survey.

PARTICIPANTS: FULL EXPERIMENT

Participants in the full experiment should be selected from a larger population of professors, associate professors, assistant professors, and pre-service teachers. The particular university or college is not a point of consideration, although due to the number of participants sought, instructors teaching at universities and schools near the PI may be sought for convenience. Subjects should be sought from a variety of academic disciplines. Of interest to the full experiment is selection of subjects who possess either no previous formal or informal training in nonverbal communication, or some training in nonverbal communication. A factorial analysis will likely be used in the full experiment. To achieve the desired effect size of 0.25 a sample size of 137 participants is needed. The sample size was calculated using (Ary et al., 2006):

$$N = (\frac{1}{\Delta})^2 (z\alpha + z\beta)^2$$

where:

N = the number needed in the sample

Δ = the specified effect size (0.25)

$z\alpha$ = the z score for the level of significance ($\alpha = 0.05$; z score = 1.645)

$z\beta$ = the z score for the desired probability of rejecting the null hypothesis (1 - β) ($\beta = 0.1$; z score = 1.28)

THE EXPERIMENTAL PROCEDURE

The pilot study was conducted as an individual interview between the PI and each volunteering subject. The experiments occurred at a location and time of the subject's choosing. General locations for the experiment included either the subjects personal office or in a nearby conference room. The times for conducting each experiment varied, but generally occurred between 8am-5pm. In general, the sessions were completed in less than 60 minutes. After signing a consent form and receiving an overview of the experiment's procedures, the subject was shown the first video clip. At the conclusion of the clip, the video screen was blanked out and the subject was given 30 seconds to record their assessment of whether the student appeared confident or not confident in answering the math question. Subjects also recorded their level of confidence in their response. While viewing the video clip, and during the subsequent answer period, no additional information was provided to the subject. Subjects often requested additional information pertaining to details of the mathematics questions, the student's academic history or past performance, the student's overall performance on the test, the class size, room layout, and other environmental factors. After recording their answers, the PI began recording audio and asked the subject to describe the specific behaviors (or lack of behaviors)

exhibited by the students which supported their conclusion. Following this brief interview, the audio recording was paused and the next clip played. This process repeated itself for the remaining 19 video clips. After viewing the final video, the subject was asked to complete the post-interview survey (Figure 5). Lastly, pilot study participants were asked for their feedback on ways to improve the full experiment.

This chapter provided a detailed description of the specific instruments, population, and experimental procedures used to conduct the pilot study. Two instruments, the Post-clip Interview and the Post-session survey, were created specifically for this pilot study so additional information was provided regarding the rationale behind their purpose and form. The next chapter presents: the data from these instruments, data analysis methods, and recommendations for data-based modifications to the full experiment.

Chapter 4: Results and Discussion

This chapter presents: the data collected using the instruments described in Chapter 3, data analysis methods, and recommendations for data-based modifications to be used during the full experiment.

RESULTS

Testing results for each of the six subjects were tabulated and compared against the experts' assessment. Interviews and post-test surveys were each transcribed and then analyzed for content. Content analysis consisted of conducting a key word search of the transcripts. Key words included all the kinesics behavioral descriptions described in Chapter 1 (Gaze, Facial Expression, Body Position, Eye Movement, Gesture, Self-touch, and Article Manipulation). Due to their frequent mention in the transcripts, key words for categories of Eye Movement, Mouth Position, Forehead/Brow Position, Eyebrow Position, and Timing were included in the analysis. The author counted the type and frequency of each key word was mentioned by each subject when describing the cadet video clips. The results were organized into the frequency of behavior occurrence for confident and not confident subject assessments and are presented in Table 2. While the sample size of six is too small to conduct any statistical analysis, each subject's response was compared against the sample population and against the expert response to identify whether overall nonverbal message discrepancies exist. The results of the expert and subject responses are provided in Tables 1a and 1b. The percentages calculated in each row reflect the fraction of each population (subject or expert) who selected either confident or not confident as their response.

	Video Clip	1		2		3		4		5		6		7		8		9		10	
	Male or Female Cadet (M/F)	M		F		F		M		F		M		F		M		M		F	
	Confidence Assessment of Subject	Confident (C)	Not-Confident (NC)	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC
Cadet (self)	Male or Female Expert/Subject (M/F)		1	1		1			1	1			1	1		1	1		1	1	
Expert 1	M		1		1	1			1	1			1	1		1			1		1
Expert 2	M		1		1	1			1	1			1	1		1			1		1
Expert 3	F	1			1		1	1		1			1	1		1		1			1
Expert Agreeance Total		**33%**	**67%**	**0%**	**100%**	**67%**	**33%**	**33%**	**67%**	**100%**	**0%**	**0%**	**100%**	**100%**	**0%**	**100%**	**0%**	**33%**	**67%**	**0%**	**100%**
Subject 1	M		5	3			4	3		3			2	3			4	4			1
Subject 2	M		5	5		4			3	4			3	5			4		4	3	
Subject 3	F		1	4		4		1		2		3		3		3			3	2	
Subject 4	F		4		3		2		4		3		3	3		4			3		4
Subject 5	M		5		4	5		4		5		4		5			4		5		2
Subject 6	M	3			4	4			3	2			4	3		5			4		5
Subject Agreeance Total		**17%**	**83%**	**50%**	**50%**	**67%**	**33%**	**50%**	**50%**	**83%**	**17%**	**33%**	**67%**	**100%**	**0%**	**50%**	**50%**	**17%**	**83%**	**33%**	**67%**

Table 1a: Results from assessment of cadet confidence (Questions 1-10)

	Video Clip	11		12		13		14		15		16		17		18		19		20	
	Male or Female Cadet (M/F)	M		F		M		M		F		F		F		M		M		F	
	Confidence Assessment of Subject	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C	NC
Cadet (self)	Male or Female Expert/Subject (M/F)	1		1		1		1		1		1	1	1		1		1		1	
Expert 1	M	1			1	1		1		1			1	1		1			1		1
Expert 2	M	1		1		1		1			1	1		1		1			1		1
Expert 3	F		1		1		1		1		1		1	1		1		1			1
Expert Agreeance Total		**67%**	**33%**	**33%**	**67%**	**67%**	**33%**	**67%**	**33%**	**33%**	**67%**	**33%**	**67%**	**100%**	**0%**	**100%**	**0%**	**33%**	**67%**	**0%**	**100%**
Subject 1	M	2		2			2		4	5			5	3			2		5		4
Subject 2	M		2		2	4			5		4	4		5			4		5	2	
Subject 3	F	3		3			3		4	3			2	3		2			3	2	
Subject 4	F	2			4	3			3	3			3	2		3			3		3
Subject 5	M	4		4		5		5		4			5	5		5			5		3
Subject 6	M	4			3	3		5		2			5	5		4			5		4
Subject Agreeance Total		**83%**	**17%**	**50%**	**50%**	**67%**	**33%**	**33%**	**67%**	**83%**	**17%**	**17%**	**83%**	**100%**	**0%**	**67%**	**33%**	**0%**	**100%**	**33%**	**67%**

Table 1b: Results from assessment of cadet confidence (Questions 11-20)

		Article Manipulation	Timing	Eye Movement	Gaze	Body Position	Self-Touch	Mouth
Confident Subject Assessment	Behavior Occurance Percentage	52%	47%	44%	18%	15%	15%	11%
Not Confident Subject Assessment		53%	47%	48%	12%	24%	41%	31%

		Facial Expression	Brow	Body Movement	Eyebrow	Gesture	Other
Confident Subject Assessment	Behavior Occurance Percentage	8%	8%	8%	3%	3%	0%
Not Confident Subject Assessment		16%	9%	5%	5%	9%	7%

Table 2: Nonverbal behavior occurrence percentages during subject confidence assessment

Within the group of experts, 100% agreement was reached on only 9/20 clips (5/10 confident and 4/10 not confident). Within the group of subjects, agreement of 83% or higher was reached on only 9/20 clips (5/10 confident and 4/10 not confident). Agreement of 80% or more between both the subjects and the experts was achieved on only 9/20 clips (5/10 confident and 4/10 not confident). Transcript analysis of each subject's post-video interview provided useful details of the kinesics identified and used by the subject to form a conclusion. Each nonverbal behavior identified by the subject fell into one of 13 kinesic or chronemics categories (Gaze, Forehead Movement, Brow Movement, Mouth Movement or Position, Body Position, Body Movement, Eye Movement, Gesture, Self-Touch, Article Manipulation, Timing, or Other). During their post session interview, the subjects made the following suggestions. Due to the anticipated scope of the full experiment, not all suggestions listed below were included in

the recommended instruments and procedure for the full experiment; rather, the below listed suggestions are provided to document discussions held during the pilot study.

- Provide clearer instructions on when the subjects should list “Very Sure” and “Not at all sure” on their confidence rating. Many subjects requested an “I don’t know” response category. Rather than add an additional category, subjects should be instructed to provide their best assessment of student confidence, and if unsure, record their confidence as “Not at all sure”.
- Include an “Other” category for when the cadet does not look either confident or not confident, such as when they looked sleepy or apathetic.
- Crop videos so only one cadet can be viewed. Cadets on the peripheral of the screen were distracting to the assessment. Not that the neighboring cadet caused the subject to lose focus, rather the subjects found themselves comparing the behaviors of the cadet in the center of the frame to the cadet in the peripheral.
- Either allow the clips to run the entire duration of question and answer session or show shorter durations of each clip. All clips ended after the cadet marked their final answer. Execution of the pilot study found that cadet behavior just seconds after marking a final answer provided critical information for the subject’s assessment. Several subjects felt the clip ended while the cadet appeared to be in mid-thought. The subjects explained that, even though the cadet marked their final answer, behavior during the time immediately following a student marking an answer can indicate confidence. When asked to elaborate, the subject explained that students who continually shift their eyes between: the answer and the question, the answer and the teacher, the

answer and their peers, or gaze at the question are not confident in their answer.

- Communication is a transient process so it is ever evolving. As cadets worked though each problem, the subjects observed a range of confident and not confident nonverbal. During some clips, cadets would receive the problem and dutifully begin working the problem. As subjects talked though the behaviors they observed, the subject initially assessed the cadet to have understood the problem. Within some clips though, after working through the problem, the cadet's behavior changed. Subject observations found the cadet appeared confused or stumped when the clip ended. Alternately, clips showed cadets who, to the subjects, initially appeared confused. After time though, the cadet worked through the problem and appeared to arrive at an acceptable answer. In both cases, subjects questioned how they were to assess the confidence of the cadet. Should the assessment be a response to their overall confidence or the cadet's confidence in their final answer? To rectify these discrepancies, videos in the full experiment should focus on displaying behaviors only expertly recognized as confident or not confident.
- Provide a confidence scale rather than a binary choice of confident/not confident.
- Reshoot videos and ask the cadet's instructor not to pace behind the cadets. Subjects believed the presence of an instructor standing over the cadets while they answer may influence the cadet's confidence. The presence of an instructor standing over the cadet may elicit nonverbal behaviors such as submission, which may make the cadet appear not confident.

- Reshoot clips and ensure that the cadet's line of sight to the blackboard is not obscured by the instructor.
- Resize grid on the answer sheet and shade every other line to prevent mis-marking responses on the wrong line.
- Save the final video in multiple formats. The author used the default file format of the Correl MovieFactory software - *.mpg. Subjects using the Quicktime movie player were unable to view the *.mpg files. In such cases, the subjects deferred to watching the video clips on the author's laptop.
- The instrument presents a simplified situation. Subjects argue that class instruction is much more social. During a class/group setting the interactions are much more complicated than the setting presented here. The subject suggested filming cadets engaged in group discussion while solving a problem.

DISCUSSION AND RECOMMENDED MODIFICATIONS FOR THE FULL EXPERIMENT

The results from the pilot study provided insight into instrument and procedure modifications required prior to conducting the full experiment. Overall, the pilot's instrument and procedure performed well and provided the research team with the intended data of teacher assessments of student confidence based on student nonverbal behavior. Conducting the full experiment requires the following changes:

- Provide clear instructions for subjects to assess the cadet's ending confidence at the end of each video clip. Also include instructions on when the subjects should list "Very Sure" and "Not at all sure" on their confidence rating.
- Adopt a subject answer sheet similar to Jecker's Mark VII (1965).

- Shorten the duration of each video so only expertly validated confident or not confident nonverbal behavior is present. Do not allow videos to display mixed or conflicting nonverbal behaviors.
- Re-shoot videos to remove classroom 'noise' such as: neighboring cadets, instructors in the background, instructors blocking the cadet's line of sight to the problem projected to the front of the class.
- Save the videos using a file format compatible with both Window and Apple media players.

Expert validation of behaviors displayed in each video must occur prior to inclusion as an instrument in the full experiment. The validation should be a three phase process. First, the self-assessment provided by the cadets should be used to initially categorize videos as either confident or not confident. The cadet self-assessments should be compared to the correctness of their answer. Only videos where either self-assessments are confident and the cadet correctly answered the question or self-assessments are not confident and the cadet incorrectly answered the question should be used. Conduct an analysis of each video to identify clips of 3-10 second duration in which simultaneous or sequential kinesic and chronemic nonverbal behaviors are consistently either confident or not confident. The texts by Hartley (2007), Knapp (2006), Neill (1991), Neill & Caswell (1993), Pease (2004) and journal by Jecker (1965) each provide expertly validated descriptions of confident and not confident nonverbal behavior. Decreasing the duration of each video may increase the external validity of the full experiment by aligning it with realistic teacher behavior. While assessing students in a class, teachers continually scan the room, spending no more than a few seconds observing each student. If a negative behavior is observed, a teacher may focus attention for longer periods (Barry, 2014; Radford, 1990). If the self-assessment, correctness of the

answer, and observed nonverbal cues are each in agreement, then the clip becomes a candidate for inclusion in the final instrument.

Conducting post-video interviews and transcribing subjects' verbal responses proved to be a time consuming and tedious process. To facilitate single session data collection from large groups and post-collection data analysis, the post-video interviews should be removed from the full experiment's procedure. To assist researchers in collecting the nonverbal behavior described by the subjects, a revised answer sheet should be adopted. A revised answer sheet is provided as Figure 6. With the exception of not identifying blinking behavior, the nonverbal behavior categories identified by the subjects match the categories identified by Jecker (1965). While some cues are generally always present with each unique cognitive state (i.e., a lack of confidence indicated by a prolonged gaze at the problem after the instructor finishes reading the problem aloud, or confidence indicated by the cadet returning to an upright position after marking an answer with eyes facing the instructor), other cues may be displayed during both occasions when subjects assessed the cadet as confident and not confident. Cues falling into the latter category include furrowing of the forehead and multiple gaze shifts between the problem and the cadet's answer sheet. These cues are not strongly indicative of either cognitive state, and should not be emphasized if nonverbal training for teachers is performed. Often, the presence of any one cue failed to tip the scales for subjects assessing the cadet as either confident or not confident. The presence of multiple, simultaneous cues provide the evidence needed for subjects to make an assessment. Conversely, as noted by Neill, assessments of confidence often result when nonverbal cues are lacking (Neill, 1991). Without the presence of a strong cue, subjects tended to assess the cadet as confident.

Clip Number _____ Subject Number _____

Gaze Direction a. The board problem b. The answer sheet c. The instructor d. Other direction _____	Head Position a. Head down b. Head up c. Head upright d. Head to one side
Eye Movement a. Eyes Fixed b. 1-2 Eye Shifts c. Multiple Eye Shifts d. Closed eyes	Mouth Position a. Agape b. Relaxed c. Smile d. Frown e. Pursed f. Sneer
Blinking Frequency a. Higher than normal b. Normal c. Lower than normal	Article Manipulation a. Pen/Pencil b. Answer Sheet c. Eyewear d. Clothing/Jewelry
Forehead a. Brow Furrowed a. Brow Relaxed	Hand Position a. Relaxed b. Folded c. Touching Face d. Fidgeting
Eyebrows b. Elevated c. Lowered d. Relaxed	Timing a. Rapid b. Average Delayed
Body Movement a. A lot b. Some c. Little or none	Breathing a. Increased b. Average c. Decreased d. Held
Body Position a. Forward b. Back c. Upright d. Side	
Other (Please Describe)	

This Student is:	Confident	Not Confident

My confidence in this assessment is:	Very Sure	Sure	Neutral	Unsure	Very Unsure

Figure 6: Answer sheet for use in full experiment

To assist researchers with administering the full experiment and analyzing data, attempts should be made to convert the procedure and instruments into a computer program or smart device application. At present, versions of the PONS and MERT are available online (NCCR Affective Science, 2014). Creation of an application, webpage, or software program will allow the research team to reach a population outside the geographic area of the researcher's academic institution. Administering the full experiment digitally also reduces the overhead required to interview subjects and input data for analysis saving both time and funding.

The population size for the full experiment should be 137 individuals. Using Berliner's (1986, 1988) categories of experience, an equal number of novice, advanced beginner teachers, and expert teachers should be included in the experiment. Academic discipline does not need to be considered when selecting subjects, but it should be recorded for future meta-analysis.

While the potential confounding factor of cultural differences in nonverbal communication exist with the experiment's current setup, a correction can be made by modifying the population size and strata. As mentioned in the introduction section, gender and culture each influence an individual's nonverbal behavior and interpretation of other's nonverbal behavior. To account for this influence, selected populations should include both male and female genders and races from across the spectrum of the population of the United States. To the greatest practical extent within the scope of the experiment, the cultural strata of the sample population should mirror cultural demographic percentages of the United States. According to the 2010 U.S. Census Bureau, the cultural demographics of the United States are: 61% Caucasian, 12% African-American, 11% Hispanic, 4% Asian, and 1% American Native (U.S. Census Bureau, 2010). Additionally, the range of video clips used in the instrument should

increase to show confident and not confident nonverbal behavior from male and female students from each race represented in the sample population.

Chapter 5: Conclusion

This report developed and executed a pilot study to answer the question of whether pedagogical experience influences assessment of student comprehension from nonverbal communication. The pilot study was modeled after a study by Webb et al. (1997) designed to prove two hypotheses:

1. Instructors with more teaching experience possess a developed schema and deeper problem solving techniques, and therefore, will respond with greater accuracy than instructors with less teaching experience when evaluating student comprehension from nonverbal communication.
2. Due to a perceived lack of information, instructors with more teaching experience will have less confidence in their answers than less experienced instructors. By removing all verbal and nonverbal communication except kinesics, teachers are prevented from using these channels to gather mutually confirming feedback. Less experienced instructors may not be aware of the critical feedback they are missing and will be more confident in their answers.

The pilot's primary instrument consisted of 20 short video clips of individual, first-year cadets at the United States Military Academy taking a SAT-style mathematics quiz. Each clip was muted to present only kinesic and chronemic nonverbal behavior and had an average duration of 60 seconds. Secondary instruments were developed for the pilot to collect the subject's assessment of cadet confidence, collect the subject's confidence in their assessment of each cadet, collect specific nonverbal behaviors identified by the subject in determining cadet confidence, and collect the demographic teaching information and nonverbal communication training of each subject. The

procedure for administering the pilot differed from Webb' study in that each subject was interviewed individually, subjects only viewed each video clip once, and no feedback was given to the subject regarding the accuracy of their assessment.

The results of the pilot study lead to five recommended instrument and procedure modifications for the full experiment:

1. Provide clear instructions for subjects to assess the cadet's ending confidence at the end of each video clip. Also include instructions on when the subjects should list "Very Sure" and "Not at all sure" on their confidence rating.
2. Adopt a subject answer sheet which includes subject assessment of cadet confidence and subject confidence of their assessment, and asks the subjects to identify the nonverbal behaviors used to make their decisions. The nonverbal behaviors are provided as a sampling of kinesic and chronemic behaviors. See Figure 6.
3. Shorten the duration of each video so only expertly validated confident or not confident nonverbal behavior is present. Do not allow videos to display mixed or conflicting nonverbal behaviors. Re-shoot, or edit videos to remove classroom 'noise' such as neighboring cadets, instructors in the background, or instructors blocking the cadet's line of sight to the problem projected to the front of the class.
4. Incorporate additional videos showing male and female Caucasian, African-American, Hispanic, Asian, and American Native cadets.
5. Save the videos using a file format compatible with both Window and Apple media players. Investigate incorporating the instruments and procedures into a software program, smart device application, or website.

The sample size of the full experiment should be 137 subjects. The subjects' pedagogical experience should cover the range of categories defined by Berliner (1986, 1988). The cultural strata of the sample population should reflect that of the United States as reported in the 2010 Census with both male and female representation of each ethnicity.

Carrying out this full experiment is the first step in filling the gap found in professional pedagogical journals and text. The experiment's results, recommendations, and subsequent debates will advance the body of knowledge needed to equip current and future teachers with training and skills which supplement their ability to quickly and accurately assess the students in their classrooms. By observing and interpreting students' body language and facial expressions, perceptive teachers are equipped with an accurate, and near instantaneous, assessment method. Rapid, individual assessments, applied throughout a lesson, maximize the teacher's opportunity to impart learning into each and every student.

Appendix A: Pilot Study Research Proposal

Research Proposal

1. Title: Influence of Pedagogical Experience on Assessing Student Comprehension from Nonverbal Communication

2. Principal Investigator: Daniel J. Fox, djf842, Mechanical Engineering

3. Purpose

The purpose of this pilot study is to determine if teaching experience affects a teacher's ability to correctly assess student comprehension from the students' nonverbal communication. Integral to the teaching process is the teacher's ability to assess the student's level of understanding of the taught subject. A multitude of classroom assessment techniques exist, providing teachers with tools and methods to gauge students' level of understanding and comprehension. While each technique has its advantage, a common shared disadvantage is the time lag between technique application and receipt of assessment results.

Teaching involves communication between the instructor and students. Studies find that 93% of the communication process uses nonverbal means. Furthermore, 55% of communication is linked to facial expression nonverbal communication. From observation and interpretation of students' body language and facial expressions, the perceptive teacher is equipped with an accurate assessment method with near instantaneous feedback results.

This pilot study proposes to achieve its goal by advancing a 1997 study conducted by Webb, et al titled 'Influence of Pedagogical Expertise and Feedback on assessing Student Comprehension From Nonverbal Behavior'. The hypothesis is based on cognitive development theory, specifically meta-cognitive development. Two hypotheses are proposed.

   a. Instructors with greater teaching experience possess a more developed schema and deeper problem solving techniques, and therefore, will respond with greater accuracy than instructors with less teaching experience when evaluating student comprehension from nonverbal communication.
   b. Instructors with greater teaching experienced will have less confidence in their answers than less experienced instructors.

4. Procedures

The method selected to explore the hypothesis is correlational research. The groups of subjects to be studied include 8-10 professors, associate-professors, or instructors from The University of Texas at Austin's College of Education and Cockrell School of Engineering. Two attribute independent variables will be studied. The first attribute independent variable is the amount of time (in years) a subject possesses in teaching higher level education. The second attribute independent variable is the amount of nonverbal communication training completed by each subject. Four instruments will be used to evaluate these two independent variables. First, video only (no sound) clips of college freshmen students answering questions will be shown to each volunteer faculty. The video will contain up to 40, 30-second clips. The clips show an individual freshman cadet at the United States Military Academy answering ten SAT-style mathematical questions. The clips show the period of time when the cadet is read the test question by the instructor through when the cadet marks a final answer on their answer sheet. The clips are taken from four individual cadets answering questions. The final video shown during the pilot study is a randomized collection of clips from each of the four cadets displaying high confidence correct test answers and low confidence incorrect test answers.

The second instrument is an answer sheet completed by the volunteer faculty while viewing the

video. Following a viewing of each clip, volunteers will record whether they believe the cadet correctly or incorrectly answered the test question. The volunteer faculty will also rate their personal confidence level in their own response. The third instrument is an interview between the volunteer faculty and the PI following viewing of each clip. The interview will focus on discussing the nonverbal communication identified by the faculty which supported their determination of whether the cadet correctly or incorrectly answered the test question. This third instrument is based on DeGroot's think-aloud method[1] which allowed for analysis of the conditions behind specialized learning. The final instrument is an anonymous survey taken by the faculty following their viewing of all video clips. The survey seeks to gather demographical teaching experience data and the type (if any) and extent of any nonverbal communication training experienced by the faculty.

The procedures for this pilot study include:

- Observe up to 40 short videos of college students answering SAT-style mathematical test questions
- Record an assessment of whether the student correctly or incorrectly answered the test question.
- Record the level of confidence in the assessment of whether the student correctly or incorrectly answered the test question.
- Answer interview questions following each video regarding observations supporting the assessment of the student answering the question correctly or incorrectly.
- Complete a survey about teaching experience and any training in nonverbal communication
- Answer interview questions about how to improve this study.

a. Location

This pilot is to be completed solely at the University of Texas – Austin campus location. Individual interview locations include personal offices and department conference rooms of faculty teaching in the College of Education and Cockrell School of Engineering. All data synthesis will occur at UT-Austin.

b. Resources

This research is not funded. Compensation will not be provided to volunteer participants. All research material and instruments are readily available. No additional research material is planned for purchase.

Study Timeline

This duration of this pilot study is approximately three months. Receipt of IRB approval is expected in late-October. Following receipt of IRB approval, predetermined UT College of Education and Cockrell School of Engineering faculty members will be contacted via recruitment e-mails and personal contact. Predetermination of faculty members consists of those members from whom the PI has taken graduate courses from during previous semesters, or faculty

[1] deGroot, A.D.
1965. *Thought and Choice in Chess*. The Hague, the Netherlands: Mouton.

members recommended to the PI from his primary academic advisor. Following identification of 8-10 volunteer faculty members, the PI will meet with each volunteer privately to conduct the interview in the volunteer's office or a local conference room. The duration of the interview is anticipated to last approximately one hour. The interview consists of: watching a series of short video clips of students answering test questions, following each clip the volunteer responds whether the student correctly answered the test question and provides their level of confidence in their response using a 1-5 Likert scale. Following viewing of all video clips, the volunteer will complete a short survey to gather demographic information regarding their teaching experience. The interview concludes with the volunteer providing a description of nonverbal communication behaviors they believe students use when subject material is comprehended or not comprehended. Results of this research are expected to be available in early January 2014.

5. Measures

   Interview questions and post-interview survey questions were developed by the PI specifically for use in this study. All documents are included as part of the IRB application. The interview process will last approximately one-hour, and participants will only be interviewed once.

6. Participants
   a. Target Population

      The target population for this study is college-level instructors. Instructors within the University of Texas at Austin College of Education and Cockrell School of Engineering are sought for convenience. Instructors possessing wide ranges of teaching experience will be solicited. Ideally, participating volunteers will include 1st year professors and professors with multiple years of teaching experience. The age of the professor will not be considered in the selection criteria for participation in this study, though the age range is predicted to be between 30-75 years of age. This pilot study seeks 8-10 volunteers.

   b. Inclusion/Exclusion

      Instructors within the University of Texas at Austin College of Education and Cockrell School of Engineering are sought for convenience, but all instructors are welcome to participate. Instructors are sought possessing wide ranges of teaching experience. No restrictions are imposed to limit participants with respect to gender or ethnicity.

   c. Benefits

      Participants will not receive any direct benefit from participating in this study; however, understanding factors which improve teacher's ability to interpret students' body language helps future generations of teachers more effectively assess their classrooms.

   d. Risks

      The risks associated with participating in this study are minimal and are not anticipated to be greater than those associated with routine interactions in an academic environment. Neither physical nor psychological harm are expected as a result of watching video clips of students involved in routine classroom behavior or answering questions pertaining to such student behavior. In the event of a medical emergency occurring during an interview, the PI plans to call 911. Following any medical emergency, the PI will contact the IRB.

e. Recruitment
The PI will contact faculty within the Cockrell School of Engineering and the College of Education at the University of Texas at Austin. The faculty contacted will be those who taught the PI during previous semesters, or who are recommended to the PI by the PI's primary academic advisor. Faculty will be contacted via their e-mail address or phone number listed on their department's faculty directory, or a personal office visit. Participant contact information will not be collected. While conducting interviews, participant information will not be associated with their response in any way.

f. Obtaining Informed Consent
Informed consent will be sought from all faculty participants. Either an informed consent form will be attached to each recruitment e-mail, or a hard copy consent form will be delivered during a recruitment office call. The PI requires a signed consent form to be on file prior to faculty participation in this research study. If consent is not granted, the faculty will not participate in the study.

7. Privacy and Confidentiality

The privacy and the confidentiality of participant data will be protected by not linking their identity to the data collected. During the study, participant identity information will not be collected. The questions asked during the survey and interview seeks only to collect demographic information. To foster anonymity, the research session may be completed at a location of the participant's choosing.

Confidentiality of the Data or Samples

a. Describe how data or samples will be collected.
Data will be collected from written responses and comments to viewing several short video clips of students answering test questions, to verbal responses provided by volunteering instructors during personal interviews, and from written responses to a post session survey regarding teaching experience demographics and experience and knowledge of nonverbal communication. Audio recordings will be labeled with a participant number, a study number, and date (Example: "Participant 1 Audio Recording. Study 2013-09-0124. Collected November 20th, 2013)

b. Describe how the data or samples will be securely stored and how you will achieve this.
All data will be digitized and stored on the PI's computer. All hardcopy test responses and survey results will be digitized and stored on the PI's computer. Before digitization, all hardcopies will be secured in a folder and kept behind a physically locked door, or carried by the PI on his person. After digitization, all hardcopies will be destroyed. If participants decline audio recording, the PI will take notes of the interview. All data stored on the PI's computer will be encrypted and password protected. A backup set of data will be stored on the PI's jump drive. Data located on the jump drive will be password protected. The PI's computer and jump drive will always be secured behind a physically locked door, or carried on his person.

c. Provide the length of time the data or samples will be kept.

Voice data will be kept for one year. Interview transcripts, participant answer sheets, and post session survey data will be kept for five years. After one year, all voice recordings will be erased.

d. Describe whether data or samples will be kept confidential (i.e., data can potentially be linked to participants) or anonymous (i.e., impossible to link data and participants).
All data will be kept anonymous. No record will be kept of the volunteering instructor's name, address, social security number or any other personally identifiable information. Any e-mail between the PI and the volunteering instructor scheduling an interview time will be deleted immediately following conclusion of the interview.

e. If the data or samples will be destroyed, describe when and how the destruction will occur.
One year after the completion of the pilot study, all voice recordings located on the PI's computer and jump drive will be deleted. The computer's recycling bin will be emptied to ensure complete deletion of the digital files. All hardcopy documents will be destroyed using a crosscut shredder.

8. Compensation
Volunteer instructors will not be given any form of compensation for their participation in this pilot study.

Appendix B: Consent for Participation in Research Form

Consent for Participation in Research

Title: Influence of Pedagogical Experience on Assessing Student Comprehension from Nonverbal Communication

Introduction

The purpose of this form is to provide you information that may affect your decision as to whether or not to participate in this research study. The person performing the research will answer any of your questions. Read the information below and ask any questions you might have before deciding whether or not to take part. If you decide to be involved in this study, this form will be used to record your consent.

Purpose of the Study

You have been asked to participate in a pilot research study about how classroom experience influences a teacher's ability to correctly understand student nonverbal communication pertaining to student understanding or confusion of the subject material. The purpose of this study is to answer two questions: 1) Can experienced teachers assess student comprehension through nonverbal communication more accurately than less experienced teachers? And, 2) Will experienced teachers have more confidence than less experienced teachers in their assessment of nonverbal communication regarding student comprehension.

What will you to be asked to do?

If you agree to participate in this study, you will be asked to:

- Observe up to 40 short videos of college students answering SAT-style mathematical test questions
- Record your assessment of whether the student correctly or incorrectly answered the test question.
- Record the level of confidence you have in your assessment of whether the student correctly or incorrectly answered the test question.
- Answer interview questions following each video regarding observations supporting your assessment of the student answering the question correctly or incorrectly.
- Complete a survey about your teaching experience and any training in nonverbal communication
- Answer interview questions about how to improve this study.

This interview will take approximately one hour and will be completed in one session and will include approximately six study participants. Your participation will be audio recorded. If you do not wish to be audio recorded, the researcher will take notes during your interview.

What are the risks involved in this study?

The risks associated with participating in this study are minimal and are not anticipated to be greater than those associated with routine interactions in an academic environment.

What are the possible benefits of this study?

You will receive no direct benefit from participating in this study; however, understanding factors which improve teacher's ability to interpret students' body language helps future generations of teachers more effectively assess their classroom and decide whether there is a need to check for comprehension, provide more or different kinds of instruction, or assign more practice.

Do you have to participate?

No, your participation is voluntary. You may decide not to participate at all or, if you start the study, you may withdraw at any time. Withdrawal or refusing to participate will not affect your relationship with The University of Texas at Austin in anyway.

If you would like to participate please sign this consent form, scan and e-mail it to Dan Fox at Daniel.j.fox@us.army.mil. You will receive a copy of this form.

Will there be any compensation?

You will not receive any type of payment participating in this study.

How will your privacy and confidentiality be protected if you participate in this research study?

Your privacy and the confidentiality of your data will be protected by not linking your identity to the data collected. During the study, participant identity information will not be collected. The questions asked during the survey and interview seeks only to collect demographic information. To foster anonymity, the research session may be completed at a location of the participant's choosing.

If it becomes necessary for the Institutional Review Board to review the study records, information that can be linked to you will be protected to the extent permitted by law. Your research records will not be released without your consent unless required by law or a court order. The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate it with you, or with your participation in any study.

If you choose to participate in this study, you will be audio recorded. Any audio recordings will be stored securely in a locked filing cabinet in a locked office and only the research team will have access to the recordings. Recordings will be kept for one year and then erased. Audio recording will be labeled only with a participant number, study number, and date (Ex. "Participant 1 Audio Recording. Study 2013-09-0124, Collected Nov. 20th, 2013").

Whom to contact with questions about the study?

Prior, during or after your participation you can contact the researcher Daniel J. Fox at 586-419-2266 or send an email to Daniel.j.fox@us.army.mil for any questions or if you feel that you have been harmed.

This study has been processed by the Office of Research Support and the study number is 2013-09-0124.

Whom to contact with questions concerning your rights as a research participant?

For questions about your rights or any dissatisfaction with any part of this study, you can contact, anonymously if you wish, the Office of Research Support by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu

Participation

If you agree to participate please sign this consent form, scan and e-mail it to Dan Fox at Daniel.j.fox@us.army.mil.

Signature

You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

_____ I agree to be audio recorded.
_____ I do not want to be audio recorded.

_____
Printed Name

_____ _____
Signature Date

As a representative of this study, I have explained the purpose, procedures, benefits, and the risks involved in this research study.

_____
Print Name of Person obtaining consent

_____ _____
Signature of Person obtaining consent Date

References

Allen, V. L., & Atkinson, M. L. (1978). Encoding of nonverbal behavior by high-achieving and low-achieving children. Journal of Educational Psychology, 70(3), 298-305.

Allen, V. L., & Atkinson, M. L. (1981). Identification of spontaneous and deliberate behavior. Journal of Nonverbal Behavior, 5(4), 224-237.

Ambady, N., & Rosenthal, R. (1993). Half a minute: Predicting teacher evaluations from thin slices of nonverbal behavior and physical attractiveness. Journal of Personality and Social Psychology, 64(3), 431.

Angelo, T. C., KP. (1993). Classroom Assessment Techniques. A Handbook for College Teachers (2nd ed.): San Francisco: Jossey-Bass.

Ary, D., Jacobs, L. C., Razavieh, A., & Sorensen, C. (2006). Introduction to research in education (7th ed.): Thomson Wadsworth.

Babad, E., Bernieri, F., & Rosenthal, R. (1987). Nonverbal and Verbal Behavior of Preschool, Remedial, and Elementary School Teachers. American Educational Research Journal, 24(3), 405-415.

Bai, H. (2003). Student Motivation and Social Presence in Online Learning: Implications for Future Research. Paper presented at the Society for Information Technology & Teacher Education International Conference 2003, Albuquerque, New Mexico, USA.

Bänziger, T., Scherer, K. R., Hall, J. A., & Rosenthal, R. (2011). Introducing the MiniPONS: A short multichannel version of the Profile of Nonverbal Sensitivity (PONS). Journal of Nonverbal Behavior, 35(3), 189-204.

Barry, D. B. (2014). Master's Report Guidance Discussion. Interview with D. Fox.

Barry, B. E., Bodenhamer, J., & O'Brien Jr, J. J. (2011). Student Nonverbal Communication in the Classroom. Paper presented at the American Society for Engineering Education.

Berliner, D. C. (1986). In pursuit of the expert pedagogue. Educational researcher, 5-13.

Berliner, D. C. (1988). Implications of studies on expertise in pedagogy for teacher education and evaluation. New directions for teacher assessment, 39-68.

Bjorge, A. K. (2010). Conflict or Cooperation: The use of backchanneling in ELF negotiations English For Specific Purposes, 29, 191-203.

Boice, R., Hanley, C. P., Gansler, D., Shaughnessy, P., & Dudek, B. C. (1984). Generality of observational skill across verbal and nonverbal modes: Literature review and experimental test. Journal of Nonverbal Behavior, 8(3), 172-186.

Bransford, J., & National Research, C. (2000). How People Learn: Brain, Mind, Experience, and School (Expanded ed.). Washington, D.C.: National Academy Press.

Brown, C., & Tenny, J. (2004). Use of Electronic Observation Tools: Improving Classroom Teacher Effectiveness Through Data Driven Supervision. Paper presented at the Society for Information Technology & Teacher Education International Conference.

Burgoon, J. K. G., Laura K.; Floyd, Kory. (2010). Nonverbal communication. Boston: Allyn & Bacon.

Camelia, F. (2010). The Components of Nonverbal Communication: Important Factors in the Teaching Process. Journal of Applied Economic Sciences, 5(4), 370-374.

Chaudhry, N., Noureen Asghar, C., & Manzoor, A. (2012). Teachers' Nonverbal Behavior and Its Impact on Student Achievement. International education studies, 5(4), 56.

Cooper, T., Tsukada, A., Naruse, Y., & Yamaguchi, A. (2013). What about Non-verbal Communication? Teaching Total Communication in EFL Lessons. Paper presented at the Society for Information Technology & Teacher Education International Conference.

Costantino, G., Vazquez, C. I., & Perez, M. (2010). Cross-Cultural School Psychology: An Overview and Examples of Multicultural Treatment and Assessment Modalities Encyclopedia of Cross-Cultural School Psychology (pp. 686-688): Springer.

Cui, G., Lockee, B., & Meng, C. (2013). Building modern online social presence: A review of social presence theory and its instructional design implications for future trends. Education and Information Technologies, 18(4), 661-685.

Davis, B. G. (2009). Tools for Teaching (2nd ed.): San Francisco: Jossey-Bass.

deGroot, A. D. (1965). Thought and Choice in Chess. Paper presented at the The Hague, the Netherlands.

DePaulo, B. M., Charlton, K., Cooper, H., Lindsay, J. J., & Muhlenbruck, L. (1997). The Accuracy-Confidence Correlation in the Detection of Deception. Personality and Social Psychology Review, 1(4), 346-357.

DePaulo, B. M., & Rosenthal, R. (1979). The structure of nonverbal decoding skills. Journal of Personality, 47(3), 506-517.

Dickson, E., & Burton, N. (2011). 'You looking at me?': investigating 9 and 13 year-olds' ability to encode and decode nonverbal communication and demonstrate 'emotional literacy'. Education 3-13, 39(3), 265-276.

Feldman, R. S. (1992). Applications of nonverbal behavioral theories and research: Psychology Press.

Ferrell, A. C. (2012). Assessing the presence and use of nonverbal communication in primary reading instruction. (M.A. Dissertation/Thesis), Marshall University, Ann Arbor.

Fisher, D., & Frey, N. (2007). Checking for understanding: Formative assessment techniques for your classroom: Alexandria: Association for Supervision and Curriculum Development.

Flake, J. L. (2002). Using Web Videos and Virtual Learning Environments to Help Prospective Teachers Construct Meaning about Children's Mathematical Thinking. Jl. of Computers in Mathematics and Science Teaching, 21(1), 33-51.

Frechette, C., & Moreno, R. (2010). The roles of animated pedagogical agents' presence and nonverbal communication in multimedia learning environments. Journal of Media Psychology: Theories, Methods, and Applications, 22(2), 61-72.

Galloway, C. M. (1977). Nonverbal: authentic or artificial. Theory into practice, 16(3), 129-133.

Georgakopoulos, A., & Guerrero, L. K. (2010). Student Perceptions of Teachers' Nonverbal and Verbal Communication: A Comparison of Best and Worst Professors across Six Cultures. International education studies, 3(2).

Gloria, R., Bogdan Constantin, R., Marinela, R., Gabriel, M., & Mihaela, M. (2012). Verbal and Nonverbal Communication During Hammer Throw Training and Competitions. Ovidius University Annals, Series Physical Education & Sport/Science, Movement & Health, 12(2), 370-376.

Goranka Zoric, K. S., Igor S. Pandzic. (2007). Facial Gestures: Taxonomy and Application of Non-Verbal, Non-Emotional Facial Displays for Embodied Conversational Agents. In T. Nishida (Ed.), Conversational Informatics: An Engineering Approach: John Wiley & Sons, Ltd.

Gregersen, T. S. (2005). Nonverbal cues: Clues to the detection of foreign language anxiety. Foreign Language Annals, 38(3), 388-400.

Gukas, I. D., Leinster, S. J., & Walker, R. (2010). Verbal and nonverbal indices of learning during problem-based learning (PBL) among first year medical students and the threshold for tutor intervention. Medical Teacher, 32(1), 5-11.

Hall, J. A. (2013). Handbook of Communication Science: De Gruyter Mouton.

Harrigan, J. R., Robert; Scherer, Klaus (Ed.). (2005). The New Handbook of Methods in Nonverbal Behavior Research: New York: Oxford University Press.

Hartley, G., & Karinch, M. (2007). I can read you like a book: how to spot the messages and emotions people are really sending with their body language: Career Press.

Helweg-Larsen, M., Cunningham, S. J., Carrico, A., & Pergram, A. M. (2004). To nod or not to nod: An observational study of nonverbal communication and status in female and male college students. Psychology of Women Quarterly, 28(4), 358-361.

Huang, L. B. c. (2011). Nonverbal Communication in College English Classroom Teaching. Journal of Language Teaching & Research, 2(4), 903-908.

Ishikawa, H. H. M. E. (2010). Can nonverbal communication skills be taught? Medical Teacher, 32(10), 860-863.

Jecker, J., Maccoby, N., & Breitrose, H. (1965). Improving accuracy in interpreting non-verbal cues of comprehension. Psychology in the Schools, 2(3), 239-244.

Jecker, J., Maccoby, N., Breitrose, H. S., & Rose, E. D. (1964). Teacher accuracy in assessing cognitive visual feedback from students. Journal of Applied Psychology, 48(6), 393.

Kim, H.-Y. (2007). The Impact of Faculty Training Modules to Enhance Instructional Immediacy in On-line Courses. Paper presented at the Society for Information Technology & Teacher Education International Conference 2007, San Antonio, Texas, USA.

Knapp, M. L., & Hall, J. A. (2006). Nonverbal Communication in Human Interaction (6th ed.): Thomson Wadsworth Learning.

Knapp, M. L., & Hall, J. A. (2013). Nonverbal Communication (7th ed.): Portland: Book News, Inc.

Krohn, F. B. (2004). A generational approach to using emoticons as nonverbal communication. Journal of Technical Writing and Communication, 34(4), 321-328.

Lawes, J. S. (1987). Student Teachers' Awareness of Pupils' Nonverbal Responses. Journal of Education for Teaching, 13(3), 257-266.

Malachowski, C. C., & Martin, M. M. (2011). Instructors' Perceptions of Teaching Behaviors, Communication Apprehension, and Student Nonverbal Responsiveness in the Classroom. Communication Research Reports, 28(2), 141-150.

Manusov, V., & Patterson, M. L. (2006). The SAGE Handbook of Nonverbal Communication: SAGE Publications, Inc.

Marzano, R. J., & Marzano, J. S. (2003). The key to classroom management: Educational Leadership, 61(1), 6-13.

Matsumoto, D., Frank, M. G., & Hwang, H. S. (2012). Nonverbal Communication: Science and Applications: SAGE Publications, Inc.

Maxwell, G. M., Cook, M. W., & Burr, R. (1985). The encoding and decoding of liking from behavioral cues in both auditory and visual channels. Journal of Nonverbal Behavior, 9(4), 239-263.

McKeachie, W., & Svinicki, M. (2014). McKeachie's teaching tips (14th ed.): Belmont: Wadsworth, Cengage Learning.

McVee, M. B., Dunsmore, K., & Gavelek, J. R. (2005). Schema Theory Revisited. Review of Educational Research, 75(4), 531-566.

Miller, P. W. (1981). Silent Messages. Childhood education, 58(1), 20-24.

Miller, P. W. (2005). Body language in the classroom. Techniques: Connecting Education and Careers, 8, 28-30.

Montagu, A. (1967). Communication, evolution, and education. In F.W. Matson & A. Montagu (Eds.). The Human Dialogue: Perspectives on Communication. New York: Free Press.

Moore, N.-J. H., Mark III; Stacks, Don W. (2010). Nonverbal communication: studies and applications (5th ed.). New York: Oxford University Press.

Mumford, S., & Steve, D. (2012). Integrating Nonverbal Communication into Language Classroom Activities. Humanising language teaching, 14(4).

Neill, S. (1991). Classroom Nonverbal Communication (P. Smith Ed.). London: Routledge.

Neill, S., Caswell, C. (1993). Body language for competent teachers: Routledge.

Newlin-Canzone, E. T., Scerbo, M. W., Gliva-McConvey, G., & Wallace, A. (2011). Attentional and Mental Workload Demands in Nonverbal Communication. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 55(1), 1190-1194.

Nishida, T. (2008). Conversational Informatics: An Engineering Approach: Hoboken: Wiley.

Nowicki Jr, S., & Duke, M. P. (1994). Individual differences in the nonverbal communication of affect: The Diagnostic Analysis of Nonverbal Accuracy Scale. Journal of Nonverbal Behavior, 18(1), 9-35.

Offir, B. L., Yossi; Lev, Yael; Barth, Ingrid; Shteinbok, Arkadi. (2004). An Integrated Analysis Of Verbal And Nonverbal Interaction In Conventional And Distance Learning Environments. J. Educational Computing Research, 31(2), 101-118.

Pease, A., & Pease, B. (2004). The Definitive Book of Body Language. New York: Bantam Dell.

Philippot, P., Feldman, R. S., & McGee, G. (1992). Nonverbal behavioral skills in an educational context: Typical and atypical populations Applications of nonverbal behavioral theories and research (pp. 191-213).

Radford, K. W. (1990). Observing the class. Education Canada, 30, 36-39.

Rose, D. (2009). Fostering Immediacy in the Online Classroom. Paper presented at the Society for Information Technology & Teacher Education International Conference 2009, Charleston, SC, USA.

Rosenthal, R., & DePaulo, B. M. (1980). Encoders vs decoders as units of analysis in research in nonverbal communications. Journal of Nonverbal Behavior, 5(2), 92-103.

Rosip, J. C., & Hall, J. A. (2004). Knowledge of nonverbal cues, gender, and nonverbal decoding accuracy. Journal of Nonverbal Behavior, 28(4), 267-286.

Roth, W.-M. (2001). Gestures: Their Role in Teaching and Learning. Review of Educational Research, 71(3), 365-392.

Sabers, D. S., Cushing, K. S., & Berliner, D. C. (1991). Differences Among Teachers in a Task Characterized by Simultaneity, Multidimensional, and Immediacy. American Educational Research Journal, 28(1), 63-88.

Schutt, M. (2010). Instructor Immediacy and Social Presence in Online, Audio Sessions: Implications for Podcasting. Paper presented at the Society for Information Technology & Teacher Education International Conference 2010, San Diego, CA, USA.

Schwebel, D. C., & Schwebel, M. (2002). Teaching nonverbal communication. College Teaching, 50(3), 88-91.

Sciences, N. A. (2014). Web-based Experiments. Retrieved March 17th, 2014, 2014, from http://www.affective-sciences.org/webexperimentation

Simonds, C. (2011). Communication for the classroom teacher (9th ed.). Boston: Allyn & Bacon.

Smith, H. A. (1979). Nonverbal communication in teaching. Review of Educational Research, 49(4), 631-672.

Ugurel, M. (2010). Differences Between Teacher's Nonverbal communication In Different Cultures. (Master of Education), The University of Texas at Austin.

U. S. Census Bureau, (2010). 2010 Census Data. Retrieved March 17th, 2014, 2014, from http://www.census.gov/2010census/data

Webb, J. M., Diana, E. M., Luft, P., Brooks, E. W., & Brennan, E. L. (1997). Influence of pedagogical expertise and feedback on assessing student comprehension from nonverbal behavior. The Journal of Educational Research, 91(2), 89-97.

Weiner, I. B., & Craighead, W. E. (2010). The Corsini Encyclopedia of Psychology (Vol. 4): John Wiley & Sons.

Weisbuch, M., Slepian, M. L., Clarke, A., Ambady, N., & Veenstra-VanderWeele, J. (2010). Behavioral stability across time and situations: Nonverbal versus verbal consistency. Journal of Nonverbal Behavior, 34(1), 43-56.

White, J., & Gardner, J. (2011). The Classroom X-Factor: The Role of Body Language and Non-verbal Communication in Teaching

Wiggers, M. (1982). Judgments of facial expressions of emotion predicted from facial behavior. Journal of Nonverbal Behavior, 7(2), 101-116.

Woolfolk, A. E., & Brooks, D. M. (1983). Chapter 5: Nonverbal Communication in Teaching. Review of Research in Education, 10(1), 103-149.

Zoric, G., Smid, K., & Pandzic, I. S. (2007). Facial Gestures: Taxonomy and Application of Non-Verbal, Non-Emotional Facial Displays for Embodied Conversational Agents. Conversational Informatics: An Engineering Approach (pp. 970-978): John Wiley & Sons.

Vita

Daniel Joseph Fox hails from China, Michigan. After completing high school in May of 2000, he entered the United States Military Academy at West Point, New York to begin cadet basic training. Dan graduated West Point in May of 2004 with a Bachelor of Science degree in Mechanical Engineering and accepted a commission in the United States Army as a second lieutenant in the U.S. Army Corps of Engineers. He has worked for military units in Fort Leonard Wood, Missouri; Fort Lewis, Washington; Fort Richardson, Alaska; Fort Belvoir, Virginia, Iraq, and Afghanistan. Dan currently lives wherever the U.S. Army sends him and proudly calls it 'home'.

Permanent email: Daniel.j.fox.mil@mail.mil

This report was typed by Dan Fox.