

# Nonverbal Communication and Teaching Performance

Roghayeh Barmaki

Department of Electrical Engineering and Computer Science  
University of Central Florida  
barmaki@knights.ucf.edu

## ABSTRACT

Nonverbal communication plays a vital role in determining the success or failure of people in their ordinary life and professional careers. In a classroom, successful teacher-student communication has a critical effect on teaching proficiency and student learning. The majority of interpersonal communication is nonverbal including kinesics, proxemics, and paralanguage. This research examines the applications of nonverbal techniques such as hand gestures, body postures and proximity as powerful communication skills exhibited during teaching in a virtual classroom called TeachLivE™. A reflection tool, *TeachLivE After Action Review System* (TeachAARS), is used for data collection from two perspectives: 1) evaluate the effectiveness level of teachers with ratings based on observational data, and 2) annotate the constructive and unconstructive body movements of these teachers in the virtual classroom environment. Teaching effectiveness ratings combined with collected kinesics tags from five participant teachers were analyzed. The analysis indicates that nonverbal cues, especially open hand gestures and proximity, may play an important role in the preparation of an individual for teaching. In future, the data set will be analyzed with machine learning techniques such as regression to design a predictive model of classroom preparation based on nonverbal communication skills. The goal is to use objective metrics as part of teacher preparation, helping prospective and in-service teachers to reflect on and improve their classroom performance.

## Keywords

nonverbal communication, virtual reality, after action review, teacher preparation

## 1. INTRODUCTION

Establishing a good communication between students and the teacher introduces successful steps for both learning and teaching process. Communication is more than words, and it is important for teachers to understand the nonverbal messages they are sending and receiving in the classroom [2, 8]. Nonverbal messages include facial expressions, eye contact or lack of eye contact, proximity and closeness, hand gestures, and body language [8]. Much of the research about nonverbal communication indicates that as little as 7 percent of communication is spoken words and the majority is nonverbal and paralinguistic cues [1]. Hence it is critical for teachers to learn to apply nonverbal communication signals in the classroom.

Apart from the theoretical courses and references that help novice teachers to passively learn about teaching proficiency basics such as communication and management skills, simulation-based training systems provide a safe and comfortable environment for them to interactively practice teaching skills in a realistic classroom. TeachLivE™ is an immersive, mixed-reality virtual environment, designed at University of Central Florida, for

teachers to rehearse and hone their classroom skills. In this virtual classroom, teachers interact with student avatars that are controlled in real time by a human-in-the-loop system. Having good communication skills, specifically nonverbal, is critical for teachers in a real classroom and, as such, in the virtual classroom.

This study is intended to discover and understand the correlation of classroom teaching preparedness to nonverbal signals exhibited by teachers while interacting in the virtual classroom-TeachLivE™. The study mainly emphasizes body language and proximity. These types of nonverbal behaviors are reviewed and annotated manually by experts with an after action review tool (TeachAARS) that keeps a record of each teaching session. Additionally, teaching effectiveness is also assessed based on Danielson's [3] teacher evaluation criteria. This approach involves four observers who tag the behavior of five teacher participants from the above two different perspectives. The analysis of results at this point of the study indicates that nonverbal signals are effective indicators of teaching proficiency/preparedness.

## 2. SIMULATION AND TRAINING

Simulation-based training systems provide learners a low-cost and hazardous-free environment in which they may practice and improve their skills. As a consequence, simulation and modeling are broadly used in a variety of fields and across different applications. As an example of simulation research that is more closely related to the focus of this study, Luciew and colleagues [6] present the details of developing interview procedure for Immersive Learning Simulations (ILS). Concurrent research of body language, facial expression and proxemics relative to the interview process are discussed in the research. Their work is focused on nonverbal expressions of human and avatar subjects that indicate the impact of nonverbal expression studies in simulation. There are many other applications of the use of modeling and simulation in education, that TeachLivE is one of the pioneers.

One of the main capabilities of training systems based on simulation is the provision of assessment and feedback. As a result, the majority of simulation-based training systems are paired with an after action review (AAR) tool that makes it possible for supervisors and reviewers to oversee the trainee's simulation sessions and provide feedback.

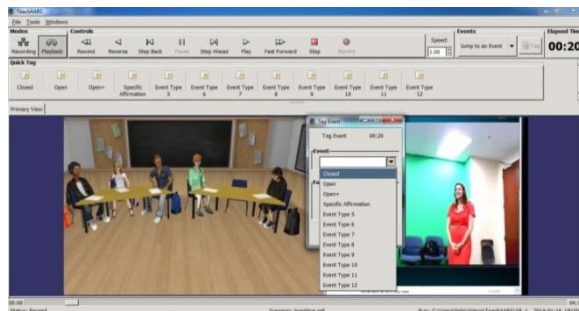
The TLE-TeachLivE™ (TLE represents for Teaching Learning Environment) was designed at the University of Central Florida explicitly to help in-service and practicing teachers hone their teaching skills, including those associated with classroom management, pedagogy and content delivery.

In the TeachLivE™ environment, there is typically one student who is in focus and the others who are out of focus. The student in focus is the one currently being addressed by the teacher [4]. That student is inhabited by a human-in-the-loop, called an inter-actor, who controls behaviors and interactions. Students who are out of focus are controlled by agent-based software that can be influenced by the inter-actor who can choose a behavior genre. In

general, that selection is influenced by the classroom management skills of the teacher. Teachers walk into a room with a big TV screen, one camera, one wireless microphone and one Kinect sensor that is connected to the client machine. Teachers can see the virtual classroom and five student avatars in the TV and approach to students by entering to their virtual zones. For vocal interactions, there is a Skype connection between client (teacher) and server (the inter-actor station).

Every teacher can provide a lesson plan for her intended teaching session, and also determine the level of behavior escalation (0-5) in order to hone her effective teaching behaviors. Behavior escalation levels are defined for treatments of student avatars that vary from no misbehavior to intense misbehavior in the virtual classroom. These settings help teachers with professional development in areas of targeted need.

In order to facilitate the process of teacher assessment, TeachAARS, or *TeachLivE After Action Review System*, was designed and integrated into the TeachLivE system. TeachAARS does direct video/audio capturing that contains both the virtual classroom and the participant video in a paired window. In addition to directly recording sessions, TeachAARS has the capability to support behavior tagging. Each tag is associated with a sequence of frames, and thus allows selective viewing during reflection or debriefing procedure. Figure 1 displays the TeachAARS environment for teacher assessment. TeachAARS is integral to this study, as it is used to tag the nonverbal messages and body signatures that teachers use in the classroom.



**Figure 1. TeachAARS as a review tool. In the primary view, left window shows the virtual classroom, right window shows the teacher participant while interacting with the classroom. An observer annotates tags associated with observed behaviors, e.g., the closed tag if the teacher exhibits a closed posture.**

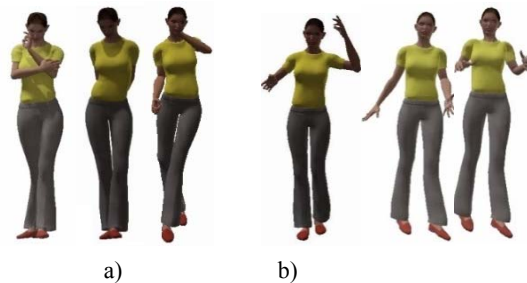
### 3. STUDY PROCEDURE

Nonverbal communication refers to all of the elements of communication excluding the actual words used [7]. Nonverbal communication strategies are consistently noted in approaches to teacher training. The effects of strategies like eye contact, prolonged gaze, and proximity can have positive or negative effects on student behavior and classroom management, depending on the situation and context [9]. In this research, nonverbal communication skills are indicated as a major factor of teaching preparedness [3]. Two types of nonverbal expressions are investigated in this study: a) proximity b) open vs. closed body posture.

Proximity can be used to encourage student participation and strategically redirect them. Proximity also helps teachers to have better management in the classroom because the students'

disruptive behaviors are controlled by approaching them [5]. On the other hand, proximity means attention, affirmation and closeness of the teacher to the speaking student [2]. In TeachLivE™, the simulation has been designed to enable the teacher to move close to the student avatar within the virtual environment. While moving, the visual perspective moves with the teacher, even allowing eye-to-eye communication. Proximity behaviors of teachers are tagged in TeachAARS by observers, to understand how frequently teachers use proximity in their teaching sessions.

Another effective measure for nonverbal cues is open vs. closed posture [10]. Open posture is often used as a measure of closeness, receptivity, and interest. Open postures illustrate positive feelings to others and show that the person is open and positive to the listener, whereas closed postures are often cited to indicate defensiveness, aggression, and avoidance [10]. In general, closed body poses demonstrate negative feelings to the other person. When somebody folds and crosses her arms, she seems to protect herself from the other person and her listener feels that she is not open and comfortable in the communication. Figure 2 represents some frequent standing open and closed body posture models [2] that reviewers use as a reference during the coding of nonverbal expressions in this study.



**Figure 2. Some standing postures for a) closed and b) open body language [6].**

More explicitly, reviewers measure the frequency and the timing for teachers withholding open or closed poses.

In this research, it is hypothesized that there is a correlation between positive teaching performance and having good nonverbal signals. The first step in data collection is to review the teaching sessions of teacher participants in the virtual classroom environment, TeachLivE™. As mentioned before, TeachLivE's assessment tool, TeachAARS is used to annotate the nonverbal behaviors (proximity and body posture). As the next step, it is required to evaluate the teaching skills of the participant teachers. Two experts who were blind to nonverbal assessment results, were asked to rate the teaching performance of subjects based on Danielson's [8] teacher evaluation reference. In summary, Danielson defines a framework for a teaching evaluation instrument. Different domains of teaching evaluation are discussed in this framework. Some important domains for teaching evaluation based on Danielson's criteria are: classroom management, communicating with students, student engagement, application of pedagogy and content delivery. The inter-rater reliability for body language coding was 0.72 and 0.78 for teaching performance rating (for each category, two different reviewers observed the videos; four in total).

The collected data from coding nonverbal signals and teaching performance ratings of teachers will be used for designing a computational model for teaching practice in TeachLivE™.

## 4. EXPERIMENTAL RESULTS

This study is related to a national research project funded by the Bill & Melinda Gates Foundation. The research focuses on practicing biology high school teachers. They are asked to interact with the virtual classroom to teach a sample scenario (Technology applications in biology) in a nine-minute session once a month for nine consecutive months. All of the sessions of participants are recorded with TeachAARS for later evaluation. In this paper, ten video sessions of five biology teachers are evaluated from nonverbal and teaching performance aspects. Table 1 represents a summary of collected data for these five participants.

**Table 1. Mean, Standard Deviation and Range for nonverbal variables and teaching performance ratings**

Variable	Mean	(SD)	Range
# open posture	15.6	9.17	2 - 29
# closed posture	10.2	3.56	7 - 14
# proximity	15	6.48	5 - 20
total # tags	40.8	15.25	14 - 50
% time open posture	43 %	35%	2% -78 %
% max time non-interrupted open posture	14.7%	14.9%	0.54%-33%
% max time non-interrupted closed posture	29 %	28.8%	9.5% -75.9%
teaching performance rating	7	1.41	5 - 9

Table 2 shows the correlations between nonverbal indicators and teaching performance rating in a correlation matrix. The last row of the table highlights the strong positive correlation of proximity and open body posture; and negative correlation of closed body posture with teaching performance. Apart from the maximum of non-interrupted open time in percentage (% max-n open) that has a small negative correlation with teaching rate, all other nonverbal variables have the expected correlation. The strong negative correlation between the maximum of non-interrupted time in closed body posture and teaching performance is considerable.

## 5. DISCUSSION

A successful teacher-student communication in the classroom indicates teaching proficiency and student learning. In this study two categories of nonverbal communication (proximity and body postures) are focused to discover and understand the correlation between nonverbal codes and teaching efficiency. According to the study, there is a positive correlation between proximity, open body posture and total open posture time with teaching performance rating. There exists a negative correlation between the maximum of non-interrupted closed posture and closed body posture with performance rating, too. This research is going to move forward in two main directions. The first direction will be building robust prediction models for teaching effectiveness with advanced machine learning techniques. The models can also improve with broader range of subjects, which is the goal for future work. The next direction will be collecting automated tags using the Microsoft Kinect SDK in real-time, and assessing the effectiveness of a teacher's body movement using predictive

models to give them real-time feedback.

## 6. ACKNOWLEDGMENTS

I would like to thank Dr. Carrie Straub, Dr. Lisa Dieker and Dr. Michael Haynes as the project designers of the TeachLivE™ that supported me during the data collection and review processes. I also would like to acknowledge the efforts of Aleshia T. Hayes for her comments, knowledge sharing and proofreading. I wholeheartedly would like to acknowledge the supports of my adviser, Dr. Charles Hughes who is also one of project designers of TeachLivE™. Finally, I wish to acknowledge support to the overall TeachLivE™ project from the Bill & Melinda Gates Foundation and the National Science Foundation (CNS1051067). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the sponsors.

## 7. REFERENCES

- [1] Borg, J. *Body language: 7 Easy lessons to master the silent language*. Pearson Education, 2008.
- [2] Caswell, C. and Neill, S. *Body language for competent teachers*. Routledge, 1993.
- [3] Danielson, C. *The Framework for Teaching: Evaluation Instrument*. Danielson Group. 2011.
- [4] Dieker, L. A., Rodriguez, J. A., Lignugaris, B., Hynes, M. C. and Hughes, C. E. "The Potential of Simulated Environments in Teacher Education: Current and Future Possibilities," *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, vol.37, no.1, pp.21-33, 2014.
- [5] Gunter, P. L. "On the MOVE: Using Teacher/Student Proximity to Improve Students' Behavior," *Teaching Exceptional Children*, vol.28, no.1, pp.12-14, 1995.
- [6] Luciew, D., Mulkern, J. and Punako, R. Finding the Truth: Interview and Interrogation Training Simulations. *In Proceedings of the Interservice/Industry Training, Simulation & Education Conference (IITSEC)*. National Training Systems Association, vol.2011, no.1, 2011.
- [7] Mehrabian, A. "Communication without words," *Psychological Today*, vol.2, pp. 53-55, 1968.
- [8] Miller, P. W. "Body language in the classroom," *Techniques: Connecting Education and Careers*, vol.8, pp.28-30, 2005.
- [9] Smith, C. and Laslett, R. *Effective classroom management: A teacher's guide*. Routledge, 1993.
- [10] Tucker, J. S. and Anders, S. L. "Adult attachment style and nonverbal closeness in dating couples," *Journal of Nonverbal Behavior*, vol.22, no.2, pp.109-124, 1998.

**Table 2. Correlations of variables on collected data**

	open	closed	Proximity	% open	% max n-open	% max n-closed
closed	-0.91581641					
proximity	-0.630252814	0.265399837				
% open	0.979459169	-0.920008359	-0.572835101			
% max n-open	0.930559511	-0.81364051	-0.661074991	0.944425568		
% max n-closed	-0.84059492	0.937655126	0.20533967	-0.809136602	-0.620323964	
teaching performance rating	0.139483102	-0.328765936	0.30072311	0.006129132	-0.148887534	-0.553393224