Bug-In-Ear Technology to Enhance Preservice Teacher Training: Peer Versus Instructor Feedback

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Abstract. Earbud technology has been used in teacher education to strategically increase learning outcomes and appropriate decision-making of pre-service teachers (PST) for over 60 years (Ottley & Hanline, 2014). Research on the integration of wireless communication in physical education teacher education (PETE) programs is limited, however needed to prepare PST for effective teaching. The purpose of this study was to examine the influence of instructor and peer cues via Bug-In-Ear (BIE) technology on PST delivery of feedback and movement. Participants (n=16) in an introductory methods course taught 12 lessons to K-2nd grade children during a practical course experience while receiving a condition: instructor verbal cueing, peer verbal cueing, or control with no verbal cueing. Data collection included videotaping and coding lessons for performance feedback (PFB) and sector changes (SC) and individual interviews. Based on the occurrence of cues per minute, results found significance with PFB offered more frequently with instructor cues (F 2, 33 = 8.5, p= 0.001). Sector changes increased in the instructor and peer cueing conditions, but differences were not significant. Interview data revealed four major themes: (1) PST focused more on teaching when using BIE technology; (2) using BIE was sometimes distracting; (3) suggestions for improved implementation; and (4) differences in peer and instructor verbal cueing. Results support the beneficial integration of BIE technology into teaching methods within a PETE program.

Keywords: teacher training; earbud technology; wireless communication; teacher effectiveness

Introduction

Earbud technology has been used to help individuals gain the applied skills needed to be successful in the workforce for over 60 years (Ottley & Hanline, 2014). This kind of technology is referred to as a Bug-In-Ear (BIE) device or a Whisper-In-My-Ear (WIME) device (Farrell & Chandler, 2008), in which trainees insert the device into their ear, and the trainer or observer can speak to the trainee through the microphone on the transmitter. With BIE the trainee is not able to speak back to the trainer at the transmitter and the trainer does not have

to be visible, thus encouraging more flexibility and independency due to more indirect supervision. When using BIE to deliver immediate feedback, the individual is able to alter behavior and techniques instantaneously.

Combining BIE with a virtual network can enable immediate feedback from remote locations (Gibson & Musti-Rao, 2016). Webcam and Skype are examples of technological advancements that make supervision of PST more convenient and realistic. Individuals can set up a webcam to face the classroom or gym, while the teachers or professors supervising can be in another classroom or school. Videoconferencing has been used in rural and international locations providing accessibility to those who are limited with resources and are isolated (Alger & Kopcha, 2009; Bullock, Gable, & Mohr, 2008; Scheeler, McKinnon, & Stout, 2012). More recently eCoaching or electronic coaching has been used for simultaneous supervision through the internet to the PST to provide immediate feedback during teaching (Coogle, Rahn, & Ottley, 2015; Regan, Weiss, & Evmenova, 2017; Rock et al., 2014; Scheeler et al., 2010).

BIE technology can also be an effective tool to implement in the education setting when preparing pre-service teachers (PST) (Farrell & Chandler, 2008; Scheeler & Lee, 2002). BIE technology can be useful in providing a more independent approach for PST to learn, however attitudes toward the technology vary. For cooperating teachers, being able to use the BIE allowed them to "feel closer and more connected with their k-5 class without actually teaching…one of my major concerns is losing contact with my class, or watching them get out of control when not under my supervision…I now had control over my class and a better connection with the student teacher" (Farrell & Chandler, 2008, p. 3). Cooperating teachers also gained a stronger relationship with their PST personally and professionally by working as a team (Farrell & Chandler, 2008).

Aim and purpose

The purpose of this study was to examine the influence of instructor and peer prompts via BIE communication on PST feedback and movement. Specifically, researchers examined the frequency of performance feedback statements and sector changes during a series of teaching episodes. PST were also asked to reflect on the use of BIE technology and its influence on their teaching in interviews.

Background

In this section, we aim to review the literature in classroom and physical education settings that have incorporated BIE technology into research designs. Justifications for the use of performance feedback and sector changes as the outcomes measured will conclude this part of the article.

BIE in general and special education

BIE technology has been used in research extensively in general and special education classrooms. Numerous studies have found BIE technology to work

effectively in providing feedback to change teaching behaviors of PST working in general classrooms and with special education students (McAfee, Ruhl, & Lee, 2006; Scheeler & Lee, 2002; Scheeler, McAfee, Ruhl, & Lee, 2006). Immediate performance feedback, as stated by Scheeler, McAfee, Ruhl, and Lee (2006), instantly stops teachers from practicing less effective teaching methods, permitting students to receive more effective instruction. However, immediate feedback can have a negative impact on the instruction the PST is giving by distracting the teacher. The authors also found that if the feedback is delayed or once the session is complete, the PST may continue the negative behavior throughout their field based experiences and in service applied settings (Scheeler et al. 2006). In a study by Goodman, Brady, Duffy, Scott, and Pollard (2008), BIE technology was utilized to provide immediate feedback to special education teachers in a K-8 classroom. Results showed rate and accuracy of effective teaching behaviors improved with the novice teachers that used BIE technology; during baseline period (without BIE) average accuracy was 58.3%, and during intervention (with BIE) average accuracy was 95.3%. Coogle, Rahn, and Ottley (2015) used BIE eCoaching through Skype to support effective communication strategies of early childhood special education teachers. Results indicated that immediate feedback through the use of BIE eCoaching improved the PST communication strategies with children with special needs in small-group activities. This outcome supports the use of BIE technology to give feedback from a distance to enhance the student teaching methods (Rock et al., 2009; 2012; Scheeler et al., 2010).

BIE in physical education

Research using BIE technology in physical education is limited to qualitative designs focusing on satisfaction of using the device while teaching (Fry & Hin, 2006; Kahan, 2002). Kahan (2002) studied communication characteristics, participant satisfaction, and attitudes toward BIE technology from the standpoint of a PST and a cooperating teacher (CT). Data collection included communication analysis, eight questionnaires (one after each lesson), and one exit interview for one PST and her CT over the course of one semester. Results found that communication in each lesson was of short duration (M = 15.8 s) and low rate (M = 0.25 communications/min) with the majority of communications being managerial and initiated by the CT. Interview data generated three themes to explain the characteristics of analyzed communication: CT and PST interpersonal and professional compatibility; role clarity; and commitment to perceived role function. Interpersonal and professional compatibility represented the balanced and compatible relationship between the CT and PST. Both participants exhibited an emphasized managerial teaching philosophy and similar attitudes on curriculum ideas. Role clarity explained the participants' sense of roles and responsibilities toward each other. The CT provided the advice, mentorship, and supervising that the PST needed in order to develop as a quality teacher. Perceived role function were different for both participants due to their status, and this reflected in their initiated communications. The CT perceived her role to critically observe and provide instructional feedback to the PST, whereas the PST perceived her role to be focused on her teaching and to develop her confidence and self-efficacy as a teacher. Thus, the number of PST

initiated communication was lower than the CT. The PST developed her skills as a teacher through the initiation of communication.

> "Over time, the student teacher's teaching behaviors indicated that she had assumed ownership of the class in every facet and had adopted the cooperating teacher's ideas such as beginning-of-lesson fitness games, time saving equipment-distribution routines, and organization of students for class that prevented or reduced off-task behavior and increased activity time" (Kahan, 2002, p.95).

Kahan (2002) found the PST showed higher satisfaction when receiving instant feedback during the lesson. It was also stated the PST took ownership of the classes and was more comfortable after receiving peer coaching via wireless earbuds. PST reported that the discretion, immediacy, and feedback were cooperative, supportive, and offered great value to her teaching (Kahan, 2002).

Furthermore, Fry and Hin (2006) used interactive wireless technology to allow PST (n= 21) to communicate with each other throughout their lessons, while measuring satisfaction in the role of a teacher and coach. The PST were enrolled in a Physical Education Teacher Education (PETE) program and were required to teach daily lessons over a four-week period. Data from a questionnaire reported PST had higher levels of satisfaction at the end of the four-week teaching block in the amount of communication (3.25 to 3.76), the content of communication (3.85 to 4.00), and satisfaction with the role as a student teacher (3.70 to 4.00). Results support PST being generally satisfied using the technology during their teaching experiences.

Measuring teacher effectiveness in physical education

When incorporating BIE technology into teacher preparation, it is important to identify criteria that determine teacher effectiveness. Since Medley (1979) primarily defined teacher effectiveness as having desirable traits and practicing effective methods in the classroom, researchers have focused on developing systematic methods based on these conceptions for measuring teaching (Rink, 2013). Rink (2013) described the shift from studying indirect teaching characteristics (teacher warmth, praise, flexibility) to studying more direct teaching characteristics (task-oriented, learning experiences, activity time, monitoring, and feedback) as more meaningful research. Providing feedback was a direct teaching characteristic identified as being positively correlated with student achievement (Rink, 2013). Additionally, analyzing sector changes provided a critical component of teacher movements within the classroom (van Der Mars, Darst, Vogler, & Cusimano, 1995). van der Mars, Darst, Vogler, and Cusimano (1995) measured teachers' sector changes and performance feedback with students during lessons. Instead of focusing solely on communication between two people, van der Mars et al. (1995) wanted to establish a detailed database on certain dimensions of elementary physical education teachers' involvement and active supervision behaviors, and also observe the relationship between teachers' supervision and students' activity engagement. Results indicated teachers gave frequent skill feedback (3.2 times per minute), which is greater than typical rates with cognizance both to students' motor skill

performance and to basic class conduct (van der Mars et al., 1995). van der Mars and his colleagues (1995) also measured the amount of sector changes by student teachers through the use of video recording and found that on average, the teachers changed sectors 6.05 times per minute.

Methodology

Sample

Participants included 16 PST (M_{age}=21, M=9, F=7) enrolled in an introductory physical education methods course at a university in the southeastern United States. PST had no teaching experience prior to enrolling in this course. As part of the course, PST were required to teach 12 lessons consisting of fundamental motor skill instruction to children in K-2nd grade, each lesson with a duration of 15 minutes. PST videotaped all lessons and submitted them to the instructor at the end of the semester. Approval was granted by the Institutional Review Board (IRB) to conduct the research study.

Design

Using a quasi-experimental design, PST were systematically assigned to one of three conditions: (1) instructor verbal cueing – prompts from the instructor; (2) peer verbal cueing – prompts from a peer; or (3) control – no prompts. PST wore a BIE and wireless receiver clipped to their belt, while the instructor/peer provided verbal prompts by speaking into a wireless microphone transmitter. The BIE allowed the PST to hear feedback from the instructor/peer in response to their teaching performance. PST were provided with two brief statements concerning movement and feedback at the end of each minute which included one of the following dichotomous statements: "Good movement or move around" and "good performance feedback or give performance feedback". The intervention required feedback to be delivered immediately to the PST by the instructor or a peer. Additionally, individual interviews were conducted with each PST.

Data analysis

A research assistant without association with the methods course was responsible for coding all lessons for movement/sector changes (SC) and performance feedback (PFB). Sector changes were measured by the amount of movement throughout the lesson by the PST. All of the teaching areas were divided into four sectors by paint, tape, etc. PST were not informed of why the teaching area was divided into sections. Performance feedback was recorded when PST gave feedback relating to the students' performance. For example, "Nice job keeping your elbow up." Performance feedback was coded when the PST gave feedback to a group or individual regarding the performance of the activity or game. Performance feedback was not recorded when the PST was explaining instructions. Inter-rater reliability was established by the primary researcher and research assistant on four occasions: SC (97.8%); and PFB (95.4%). Data were converted to rate per minute to normalize lesson lengths. A Multivariate Analysis of Variance (MANOVA) was conducted using SPSS

version 22. Interview data were transcribed and subject to standard qualitative methods in order to generate themes (Patton, 1990).

Results

Overall, PST receiving verbal prompts performed more sector changes (peer 3.55; instructor 3.8) and gave more performance feedback statements per minute (peer .85; instructor 1.14) than PST who received no verbal prompts (control = 2.31; .55) (see Figure 1).
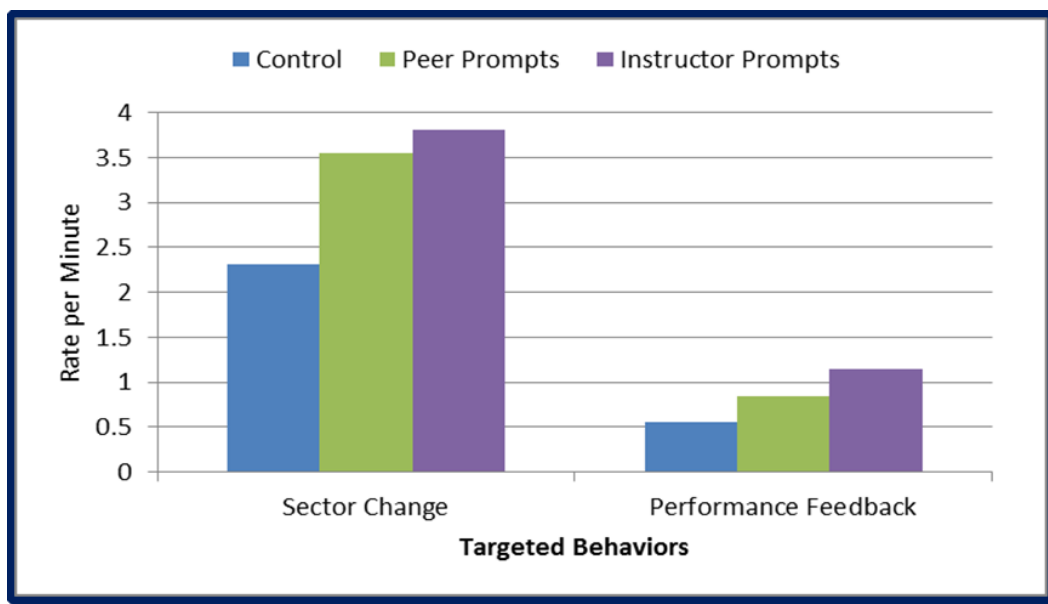

Figure 1. Rate per minute of targeted behaviors based on condition.

Results indicated significant differences for the instructor condition only, Wilk's $\Lambda = 0.656$, $F_{6, 62} = 2.4$, $p < .05$. Specifically, univariate analysis signified PST gave more performance feedback when the instructor provided cues ($F_{2, 33} = 8.5$, $p=0.001$). Post Hoc comparisons using Bonferroni indicated the mean score of performance based feedback for the instructor condition ($M = 1.14$, $SD = .33$) was significantly higher than the peer condition ($M = .81$, $SD = .30$) and the control condition ($M = .61$, $SD = .31$). It is important to note the mean score was higher for the peer condition compared to the control condition, even though there was not statistical significance.

Interview data revealed the following dominant themes: (1) PST focused more on teaching when using BIE technology; (2) using BIE was sometimes distracting; (3) suggestions for improved implementation; and (4) differences in peer and instructor verbal cueing. Pseudonyms were used to maintain anonymity.

Theme 1: All 16 PST said they were more focused on teaching when receiving verbal prompts. One PST stated, "When I went back and watched the videos, I could tell after directions [prompts] were given I would give more feedback and move around more." Another PST explained, "My best lesson was with the earbud in. It's good to have someone keep you on track." Other

representative comments included: "It helped me correct something I was doing right then, rather than later"; "I felt more on task and focused"; and "When I would use them it really helped with continuing to walk around. I wouldn't realize that I was just standing instead of walking as much as I should."

Theme 2: 50% of the PST stated using the BIE device was sometimes distracting. In an interview one PST explained how the verbal prompts interrupted their teaching:

> "I had the ear piece in my ear during this teaching. It was...interesting. It helped to know how much time I had left but it was distracting when I was talking to a child or helping them and Sara would say something. It made me forget what I was saying to the child. I am not sure that I like it."

Another PST added, "When someone was talking in my ear when I was talking it threw me off." Other comments addressed distractions related to the actual BIE device. A PST stated, "The cords to the earpiece always seemed to get in my way." Similarly, a PST noted, "The ear piece would fall out sometimes and I thought that took away from the kid's time," and "The ear bud was annoying when constant static was coming through your ear." Other PST seemed to be less distracted and made alternative comments such as, "It was a little difficult at first to adjust to the ear piece being in your ear as you are teaching but eventually you get used to it and almost do not notice it."

Theme 3: 50% of the PST gave suggestions to improve implementation. Comments focused on three main areas including device capability, timing of verbal prompts, and content of verbal prompts. Concerning device capability, one PST commented, "I wish it was more like a Bluetooth device so you didn't have to worry about the clip and cords." When considering timing of verbal prompts a PST remarked, "I think instead of reminding the teacher every minute…only speak to the teacher if they are not using feedback." Finally, in addressing the required content of verbal prompts, one PST explained, "I think the ear buds are a good idea; however, I think it would be even more helpful if our partner were able to say anything to us, instead of limiting it to good movement/good feedback." Another PST added, "I think it may be a little more helpful to work on different criteria each week."

Theme 4: Differences in preference between peer and instructor verbal cues is included as a theme in part due to an unanticipated absence of comments by PST. Most PST did not appear to notice differences or mention preference as a salient factor in their experience using BIE. The four PST that did mention preference noted partiality to instructor prompts. One PST explained:

> "The "Ear-Bud" device was interesting. I liked it the best when I did it with Dr. Anderson. It helped me keep on my toes about keep moving around and not just standing in one spot of the room. It also helped with giving the kids feedback. When I did it with my partner it wasn't as efficient as doing it with Dr. Anderson."

Another PST concurred by stating, "I liked it the best when I did it with Dr. Anderson." A PST added, "It did make me a little more nervous when the instructor would talk to me but it really made me focus on what I was doing." One PST mentioned receiving verbal prompts but was less partial by noting, "The ear bud was great with either my partner or Dr. Anderson…. I have to admit that I was pretty nervous when I did it with Dr. Anderson, but that was expected."

Discussion

This study confirms prior research on the effectiveness of BIE technology in teacher preparation settings. Teaching behaviors of PST can be altered when immediate feedback on teaching performance is given (Coogle, Rahn, & Ottley, 2015; Gibson & Musti-Rao, 2016; Scheeler & Lee, 2002; Scheeler, McAfee, Ruhl, & Lee, 2006). Specifically, in this study PST were more effective than the control group in increasing feedback and sector changes when provided with verbal cues from their instructor or peer using BIE technology. In interviews PST also identified the importance of immediate feedback on teaching behaviors and explained that it helped them correct performance in the moment rather than considering changes at a later date. Similar findings were noted in numerous teacher preparation studies by Scheeler and colleagues (2006; 2010; 2012), as well as Rock et al. (2014).

BIE technology poses an assistive measure to promoting effective teaching behaviors, however as pointed out in interviews by PST in this study, communicative and technological strategies could be adjusted to ensure that distraction is less of an issue. Scheeler et al. (2006) noted similar findings and explained the teacher's thought process can be interrupted when using BIE, which could have a negative impact on instruction. One potential suggestion is to provide verbal prompts when the teacher is not speaking, and timeliest during a pause immediately following a statement made by the teacher. While this technique may be more useful to provide less distractions, it does compromise the systematic nature in data collection of providing feedback in a precise manner such as the end of each minute. PST also noted the cumbersomeness of the wires of the BIE receiver, the earpiece falling out, and occasional static as distractions. An upgrade to more suitable equipment including a Bluetooth connection is certainly plausible and warranted. Another suggestion for improvement from PST was to allow verbal prompts on behaviors other than the specified criteria. Again, this could compromise the systematic procedures and variables in data collection, however the ability of novice PST to actively observe and provide appropriate and timely verbal prompts would be an interesting prospect to explore.

In addition to mirroring the results of effectiveness and restraints of BIE technology, this study makes a unique contribution to the literature not evident in past research in that it compares the efficacy of prompts given by either a peer or instructor. Although significant differences were only found when comparing instructor cues to the control group for performance feedback, the rate per minute results were similar for peer and instructor prompts for sector changes

(3.55; 3.8) and performance feedback (.85; 1.14) respectively. This finding raises an important implication for using BIE technology in teacher training, particularly in teaching methods courses. Typically, the ability of the instructor to give immediate verbal prompts using BIE technology during a teaching episode is limited due to the pupil/teacher ratio in the course. Determining that peers can give comparable verbal prompts to the instructor on specified teaching criteria is relevant and essential in maximizing effective teacher development. One caveat to note, is three PST in this study did prefer instructor prompts to peer prompts, though this preference did not appear to influence performance.

Conclusion

The results of this study show selected teaching behaviors can be increased when PST receive verbal cues using ear bud devices. However, effectiveness can vary slightly based on whether cues are given by a peer or instructor. An increase in targeted teaching behaviors were evident in all three conditions, but most prevalent with instructor verbal cues. Peer cues also noted an increase in use of targeted teaching behaviors, but not significantly like the instructor prompted cues. Overall, interviews showed PST felt positively about their experience using BIE, but also pointed out how future use could be improved to provide fewer distractions. Looking forward, even with past research utilizing wireless devices and video recording to observe teachers' effectiveness, it is still unsafe to say if teachers are maintaining the effective behaviors they have learned. Future research should explore whether pre-service physical education teachers are retaining and continuing to implement effective teaching behaviors after intervention has occurred. Lengthening the time of intervention, and re-evaluating months after intervention may allow PST to show their true effectiveness in teaching. BIE technology serves as an appropriate communication device for advancing effective teaching methods in teacher preparation programs.

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