

ASSESSMENT

Effects of a Sound Field Amplification System on Teacher Movement in Physical Education Settings

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Abstract

This study determined the effect of a sound field amplification system on teacher movement in physical education (PE) settings. Two middle school PE teachers instructing coeducational PE classes were used as the subjects. This investigation used a multiple-baseline single-case design across subjects. The treatment (independent variable) was the teacher using a portable sound field amplification system. The results indicated consistency in the increase of teacher movement for all classes when amplified feedback was implemented, which suggests that the treatment was effective.

Researchers have consistently investigated techniques to improve and better understand teaching strategies that will increase teacher effectiveness. In the past, the professional literature has suggested that high levels of teacher movement can enrich teacher effectiveness (Pangrazi & Beighle, 2012; Rink, 2012). Several studies have emphasized that teacher mobility, or active supervision, is an integral part of smoothly run classes (Anderson, Evertson, & Brophy, 1979; Fifer, 1986; Wong, 1972). Active supervision comprises several

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behavior dimensions, including physical relocation (i.e., movement), proximity to students, visual scanning, length and distribution of interaction with individual students, and provision of feedback on both conduct and staff performance (Brooks, 1985).

In a study using first grade reading groups, Anderson, Evertson, and Brophy (1979) found that students in classes where teachers positioned themselves in locations that allowed them to monitor all the students had greater achievement scores than students in classes where teachers did not position themselves in this manner. Teachers who could scan the room continuously were able to respond more quickly to potential disruptive situations. Continuous monitoring also sent a message to the students that the teacher was well aware of what was going on in the classroom. Furthermore, teachers are advised not to spend too much time with a single student, to avoid spending unnecessary amounts of time in the center of the activity area (Doyle, 1979). Graham (2016) advocated teachers stay on the periphery of the activity area, calling this strategy teaching with your “back to the wall.” This ensures that most students can be kept in view and will remain focused on their tasks.

In a study by van der Mars, Darst, Vogler, and Cusimano, (1994), supervision patterns of elementary physical educators were examined in relation to work involvement patterns of students in each teacher’s class. The supervision patterns analyzed included teacher location, rate of movement, and provision of verbal feedback. Work involvement by students included on-task, off-task, total motor engagement, and successful motor engagement (ALT-PE). The findings revealed that teachers spent more time along the periphery of the activity area, were positioned more along the sides, and were active movers. Teacher movement is also associated with students’ on-task behaviors. These types of monitoring strategies, when used by physical educators, help to guarantee the best use of practice time (Siedentop & Tannehill, 2001). Siedentop and Tannehill (2001) noted that teachers who moved throughout the teaching area helped students to stay on task. Their mobility also enabled the teachers to distribute prompts and feedback more evenly to all students.

Given the importance of teacher movement, research has provided limited strategies for increasing the levels of teacher movement, which in turn should increase teacher supervision and

teacher effectiveness. Recent research in physical education (PE) settings using sound field amplification systems (Ryan, 2009; Ryan, Ormond, Imwold, & Rotunda, 2002), also known as public address (PA) systems, has shown potential for increasing certain areas of teacher effectiveness.

Berg (1993) suggested that perhaps the most cost-effective, appropriate, and suitable strategy for maximizing the learning environment is the use of sound field amplification systems. Allen and Anderson (1995) described this technology as a “piece of equipment that teachers will fight to keep once they try it in their classrooms” (p. 201). An amplification device may improve the classroom signal-to-noise ratio by approximately 8 to 10 dB or more, and enables all children to listen and the teachers to use a comfortable voice level regardless of where the students or the teacher are positioned (McSporran, Butterworth, & Rowson, 1997). A sound field amplification device or PA system typically consists of a small microphone and an FM transmitter worn by the PE teacher, an amplifier, and a stationary FM receiver with one or more speakers (Ryan, 2010a). Some devices are rechargeable and have a built-in CD player, while other systems fit around the teacher’s waist and keep the hands free (Ryan, 2010a).

There is growing research and information related to the use and effectiveness of sound amplification in classrooms and in PE settings (Crandell, Smaldino, & Flexer, 2005; Ryan, 2009, 2010a, 2010b; Ryan & Mendel, 2010; Ryan et al., 2002). With large amounts of classroom management time devoted to PE classes (Ryan, 2010b), investigating methods for increasing teacher movement may increase teacher effectiveness. Therefore, this research examined the effect of a sound amplification system on teacher movement in PE settings.

Method

Participants and Settings

Two European American female middle school physical education teachers located at two schools in Northwest Florida participated in this study. One school was located in an inner city, and the other was considered rural. Prior to data collection, human subject consent was obtained from both participants. Each teacher taught three classes of sixth, seventh, and eighth grade coeducational

PE students, and the classes contained between 25 and 37 students. Both teachers were observed during a 2-month period in which the activities of volleyball, soccer, and tennis were held outside on the activity areas of both schools. For both schools, the dimension of the volleyball courts was 80 × 80 ft; soccer fields, 300 × 150 ft; and tennis courts, 160 × 120 ft.

Target Behavior and Observation Procedure

Data were collected from live recording sessions of teacher participants. The Teacher Monitoring Analysis System (TMAS; van der Mars, Cusimano, & Ruppert, 1989) measured teacher movement. The location of the teacher was identified via the numbered location chart (see Figure 1), and the number of sector changes the teachers made for each class in a 30-min session was measured via the event recording. Teacher movement data provide an indication of the degree to which teachers move about the activity area to observe or interact with students. The data for each teacher were then converted to mean scores of sector changes for each intervention. For example, the movement rate for Teacher 1 during same sector feedback may be 8, 10, 9, and 13 sector changes for a mean score of 10.

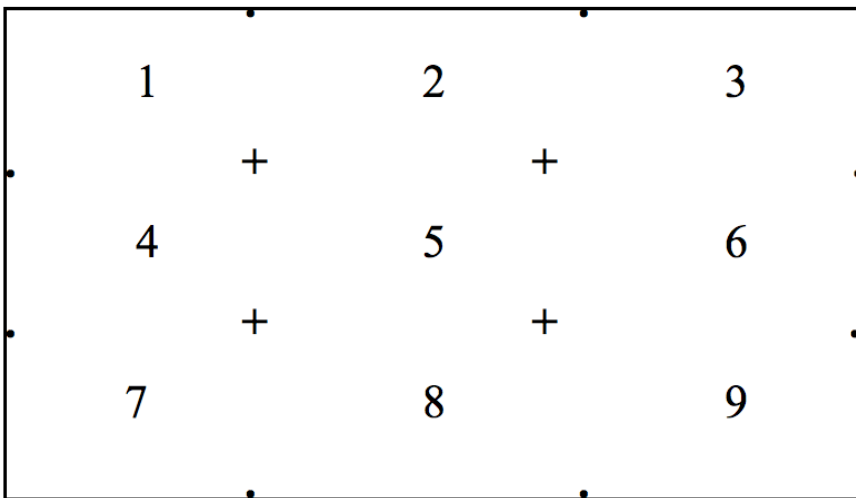


Figure 1. Configuration of sector layout. + = white line. • = cone.

Two graduate students coded the data. Prior to the observation assessment, the guidelines for using the TMAS were presented and learned. Practice observations were conducted during three sessions of a field test. The coders were ready to record once a predetermined criterion of 80% agreement between coders had been reached on identifying levels of teacher movement. Three baseline phase and three intervention phase class periods for each grade were randomly selected as a way of determining interobserver agreement. The variable of identifying teacher movement was compared by observers using the interval-by-interval method and produced percentages ranging from 88% to 97% with a mean of 92%.

Experimental Design and Procedure

The experimental design used in this investigation was a multiple baseline design across subjects. At the intervention phases, the treatment variable of the teacher providing feedback using sound field amplification was in effect and changes in teacher movement were noted. To reduce the possibility of the activity influencing the results, the teachers never changed the activities during the introduction of an intervention. Also, at no time prior to or during the study were the teachers informed of the dependent measure of teacher movement. Prior to the intervention, teachers were instructed to wear a headset with a microphone placed 1 in. from the mouth while continuing their typical teaching methods. The microphone amplified their feedback using a portable sound field amplification system that was worn around their waist (LightSpeed, Model PA-3). The headset was connected to the portable sound field system by a wire, and the volume, which was located on the portable waist pack, was adjusted by the teachers to fit the physical settings and the number of students. The teachers were given instructions prior to each daily observation to use the same managerial and instructional methods as they typically used, but with sound field amplification feedback. The teachers were instructed to switch off the microphone if they needed to give personal feedback, instruction, or discipline that may cause embarrassment for the student(s) if it was broadcasted for all students to hear.

Results

Table 1 shows the mean frequency of teacher movement data for all periods. The mean frequency of teacher movement during class clearly shows an increase when the teacher is using sound field amplification feedback with PE students. The occurrence of increased teacher movement by sound field amplification feedback was related by individual class groups and by the total of the classes studied.

Table 1

Mean Frequency of Teacher Sector Change Across Experimental Conditions

Teacher	Grade	Unamplified		Amplified	
		<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)
1	6	9.2	(2.88)	18.5	(2.69)
	7	9.1	(2.23)	17.3	(4.79)
	8	9.3	(2.41)	14.5	(1.75)
2	6	8.8	(1.47)	15.0	(3.28)
	7	9.4	(1.78)	17.0	(4.20)
	8	10.3	(2.21)	21.0	(2.15)

Examining the data by individual class provided a chronological level of teacher movement under the replications of unamplified and amplified feedback given by the teachers (see Figures 2 and 3). The trends that emerged were consistent with the group means and individual class group means. Figures 2 and 3 present information on the variability from session to session of teacher movement but support the overall pattern of increase. The effectiveness of the interventions can be found in the changes in the level between amplified and unamplified interventions.

Figures 2 and 3 also display the point of activity change for each period. Teacher 1 during the sixth grade PE class displayed an average of 9.2 sector changes during unamplified feedback and 18.5 during sound field amplification feedback (see Table 1). Teacher 1 during the seventh grade PE class had an average of 9.1 sector changes during unamplified feedback and 17.3 during sound field

amplification feedback, and during the eighth grade PE class had 9.3 sector changes during unamplified feedback and 14.5 sector changes during sound field amplification feedback. Teacher 2 during the sixth grade PE class displayed an average of 8.8 sector changes during unamplified feedback and 15.0 during sound field amplification feedback (see Table 2). Teacher 2 during the seventh grade PE class had an average of 9.4 sector changes during unamplified feedback and 17.0 during sound field amplification feedback, and during the eighth grade PE class had 10.3 sector changes during unamplified feedback and 21.0 during sound field amplification feedback. Two-tailed *t* tests compared the overall mean frequency of teacher sector change in unamplified and amplified settings. The findings showed that for both teachers and all grades, amplified teacher sector change was significantly ($p < .05$) higher than unamplified teacher sector change.

The results of the sound field amplification feedback interventions for both teachers and all grades clearly show a consistent increase in teacher movement. The change and type of activity appears to have little effect on the results regardless if the activity changed from a noninvasive game (volleyball and tennis) to a possession/invasion game (basketball).

Discussion

This study determined the effect of a sound field amplification system on teacher movement in middle school PE settings. The results indicated consistency in the increase of teacher movement for all classes when amplified feedback was implemented, which suggests that the treatment was effective. The frequency of teacher movement is higher than that in a prior study by Ryan and Yerg (2002), which is likely due to smaller size of activity area and high fitness levels of teachers. The increase in teacher movement in this study is supported by Crandell et al. (2005), who stated that teachers

need to use less energy projecting their voices; they have less vocal abuse and are less tired by the end of the day. Teachers also report that the sound field amplification system increases their efficiency as teachers, requiring fewer repetitions and thus allowing for more actual time teaching. (p. 14)

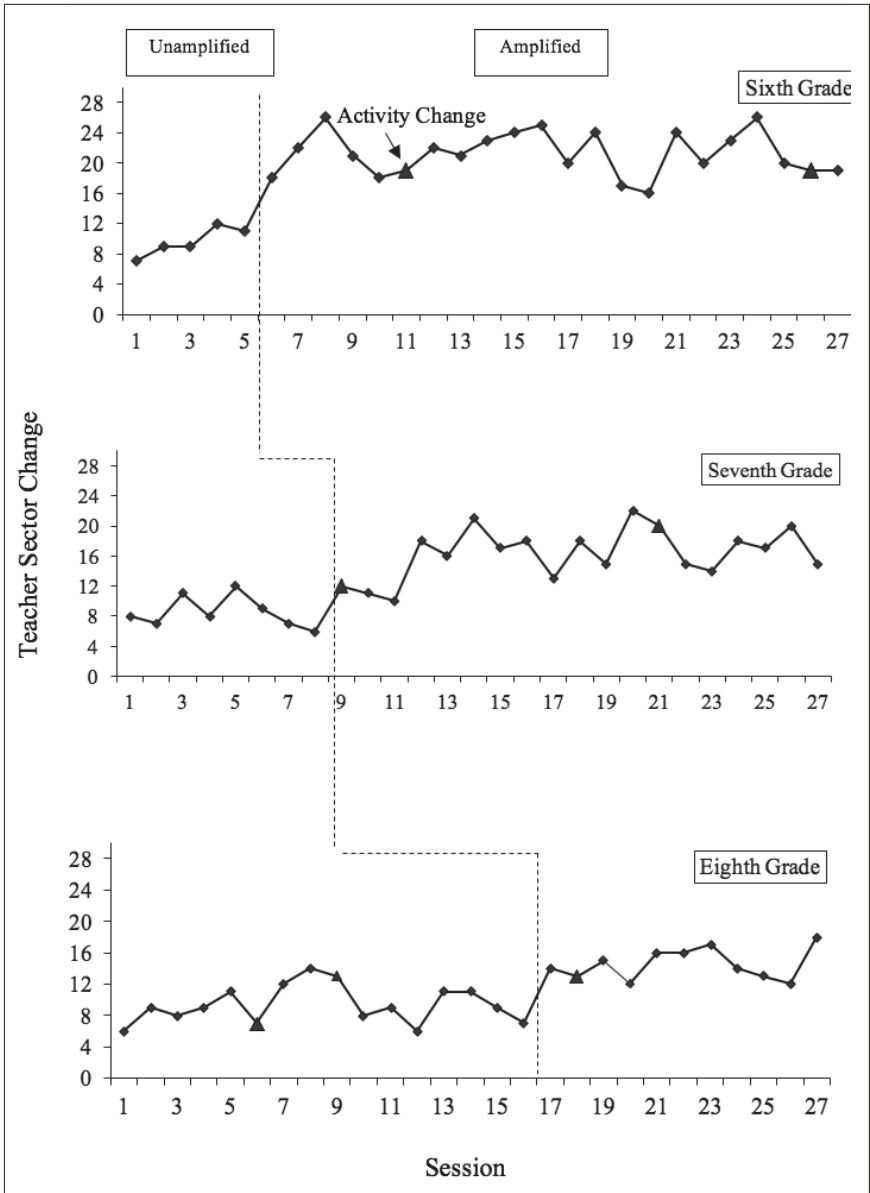


Figure 2. Teacher 1 sector change across experimental conditions.

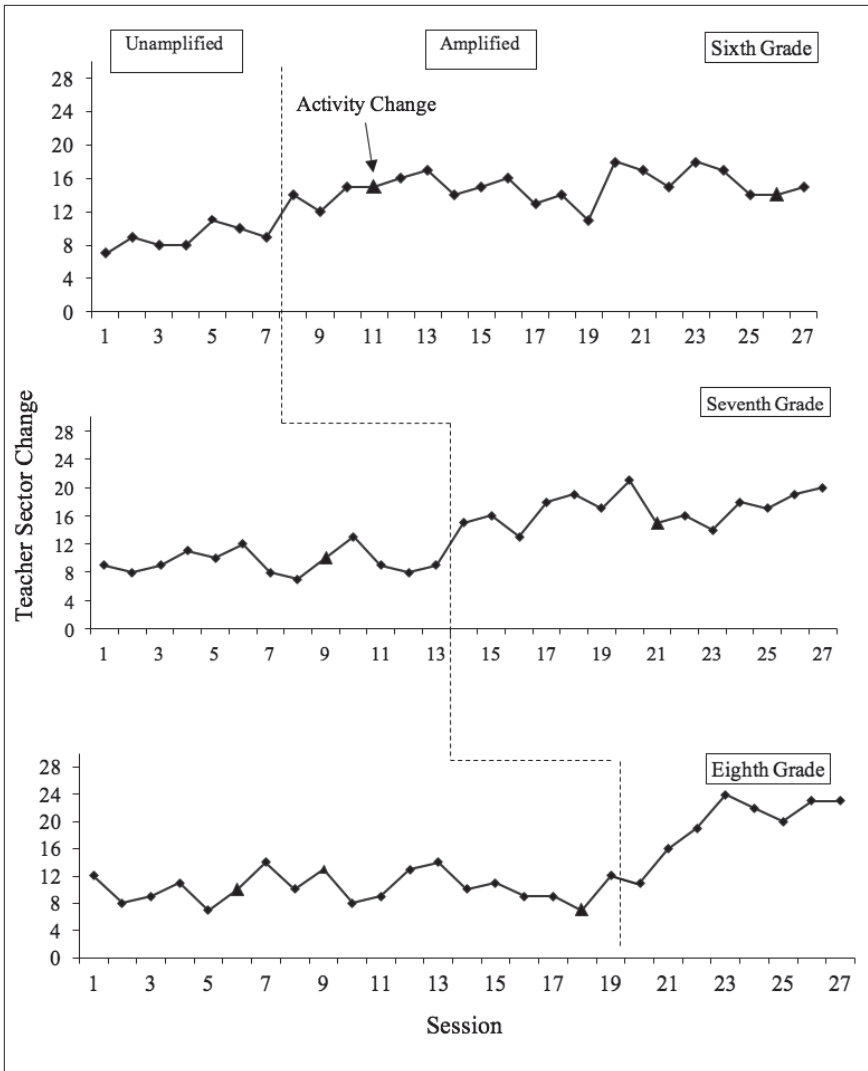


Figure 3. Teacher 2 sector change across experimental conditions.

A study of voice issues related to PE teachers indicated a strong prevalence and impact of voice problems for almost all PE teachers surveyed regardless of grade level taught, age, or gender (Ryan, Rotunda, Song, & Maina, 2012). Teachers with more energy, less voice strain, and less time repeating instruction may be able to spend more teaching time moving around the activity area, which is important to student achievement. In addition, studies have also shown that in amplified conditions, elementary students were more attentive, less distracted (Allen & Patton, 1990), and more on-task (Ryan et al., 2002). Amplified feedback is associated with distal feedback, also known as “crossgroup feedback,” and has been shown to reduce management feedback and student off-task behavior (Ryan & Yerg, 2001). Reduced need for management feedback and reduced student off-task behavior may allow teachers more time for active supervision and teacher movement.

Teachers who actively move about the activity area can attend to more students. Active teacher movement during fitness instruction has resulted in students being less likely to be lying down and inactive during class (van der Mars, Darst, Volger, & Cusimano, 1994). A study of supervision patterns found that active movement around the periphery correlated with students’ total engagement in motor tasks and with successful motor engagement (ALT-PE; Sariscsany, Darst, & van der Mars, 1995).

The research supports the importance of teacher movement and active supervision in PE settings. Teaching strategies that increase levels of teacher movement should in turn increase teacher effectiveness and student learning. The results of this study support the use of sound field amplification systems in PE settings as a technique for increasing teacher movement.

This research further extends the use of behavioral technologies in a school setting outside the classroom and provides an effective tool for increasing teacher movement in a PE setting, which may enrich teacher effectiveness and student learning. Forthcoming efforts to study the effects of sound field amplification feedback in the area of student work involvement and skill development may provide additional insight into effective teaching components. Discovering new and better ways to be more effective will always be an objective of educators, and sound field amplification may be an additional tool that improves teacher effectiveness and enhances student learning.

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