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FITNESS

Implementation of a Personal Fitness Unit Using the Personalized System of Instruction Model

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Abstract

Levels of physical activity and health-related fitness (HRF) are decreasing among adolescents in the United States. Several interventions have been implemented to reverse this downtrend. Traditionally, physical educators incorporate a direct instruction (DI) strategy, with teaching potentially leading students to disengage during class. An instructional strategy that has been shown to be effective in increasing content knowledge and skill competency in physical education is the personalized system of instruction (PSI). Students (N = 24) from a private, urban high school in a major city within the Mountain West region of the United States participated in the 6-week study. Video and audiotaping, along with interviews and journals, were used to determine if criteria standards associated with PSI were met. Three of the 4 components of PSI were met as well as 10 of 12 design features, indicating that implementing the personal fitness unit using PSI was suc-

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cessful. The results indicate PSI was successfully implemented. With its characteristics of self-pacing and mastery learning, PSI has the potential to be an effective teaching model within physical education.

Regular engagement in physical activity is important in the growth and maturation of adolescents. A growing concern is the significant decrease in activity levels of adolescents. The Centers for Disease Control and Prevention (2011) recommends adolescents participate in at least 60 min of aerobic activity a day, 7 days a week, and at least 3 days of muscle strength activities a week. According to Song, Carroll, and Fulton (2013), only 16.3% of adolescents in the United States achieve these recommended goals and almost half (47.8%) meet neither goal. Others have reported significant decreases in physical education (PE) participation between eighth (91%) and 12th (34%) grades (CDC, 2011). It is well known that potential consequences of being physically inactive include increased risk for obesity (Trost, Kerr, Ward, & Pate, 2001) and decreases in cardiovascular health, physical fitness (Grunbaum et al., 2004), and psychological well-being (Goldfield et al., 2011). If a national goal is helping teenagers lead healthy lives by increasing physical activity, the reasons why teenagers stop being as active during the adolescence needs to be examined.

For the majority of adolescents, PE classes provide the best environment for increasing activity levels and thereby personal fitness levels (Moreno Murcia, Coll, & Ruiz Pérez, 2009; Pate, Ward, O'Neill, & Dowda, 2007; Sallis et al., 2012). Others have also reported decreases in motivation and perceived relevance toward PE (Olafson, 2002; Osborne, Bauer, & Sutliff, 2002; Parish & Treasure, 2003; Saffici, 2011; Webster, Mindrila, & Weaver, 2011; Whitehead & Biddle, 2008). Trudeau and Shepard (2005) suggested that decreases in participation in PE may be due to the formatting or structuring of the class. When students do not perceive that what or how something is taught is important to their lives, there is potential for decreased involvement and decreased activity within the classroom (Webster et al., 2011). Cothran and Ennis (1999) also reported that when students perceive the curriculum as enjoyable and meaningful, the desire on the behalf of the students to participate increases. They go on to say that to meet this desire for relevance, physical educators

need to evaluate what is being taught and how it is being taught. Models-based instruction provides a multitude of benefits including (a) provides an overall plan for teaching, (b) has research support, (c) allows for valid assessments, and (d) promotes specific standards and learning outcomes (Metzler, 2005).

Traditionally, secondary PE teachers use a direct instruction model (DI) to teach traditional team sports, such as flag football, basketball, and soccer (Bauman et al., 2009). DI can be effective, but consistent decreases in student motivation, participation, and health-related fitness (HRF) highlight a need to examine other potential instructional strategies. Curtner-Smith, Todorovich, McCaughtry, and Lacon (2001) suggested PE teachers need to move from the direct, teacher-centered methods of teaching and incorporate more indirect, pupil-centered instructional strategies to help increase motivation and participation within PE. Indirect instruction generally allows students to learn at their own pace by providing more opportunities for learning and practice. Increased practice time leads to higher levels of perceived competence, which can lead to higher levels of activity. Student-centered practices can encourage a task or mastery-involved environment in which students are allowed to perform based on predetermined criteria, rather than an ego-involved environment in which the concentration is more on the ranking of students based upon performance. The personalized system of instruction (PSI) is an instructional model in PE that has the potential to increase physical activity and skill and knowledge simultaneously.

The PSI model was originally designed by Dr. Fred Keller in the early 1960s (Keller, 1968) to replace traditional lecturing and incorporate an independent, self-paced approach to learning. Because of larger class sizes, Dr. Keller had doubts the traditional DI model would work. Through prior work, he realized individuals generally learn at their own pace rather than a predetermined rate and they can learn independently when provided with proper support materials, including written handouts and feedback through an individual who has already mastered the material. This personalization is one of the driving forces for PSI.

The "Keller Plan," as PSI is sometimes referred to, has five distinct characteristics: (a) self-pacing, (b) mastery learning, (c) teacher as motivator, (d) emphasis on the written word, and (e) the use of proc-

tors (Keller, 1968). Self-pacing allows students to work at their own speed, or as Metzler (2000) stated, as fast as they want or as slow as they need. Self-pacing is determined by the experience of the student and the external demands of life. Mastery learning means students may only progress to the next unit or modular when they have demonstrated mastery of the current subject. This usually takes the form of a written assessment, but can be another form that is approved by the instructor that allows for students to showcase what they have learned, whether skills or knowledge. The third characteristic is that the teacher acts as a motivator as opposed to the sole source of information. Traditionally in education, emphasis is placed upon the teacher's knowledge and the passing on of skills and knowledge to the students. Within PSI, the teachers' knowledge is incorporated into the lessons and modules, making the emphasis on the written word for materials and learning, usually a workbook. The fifth characteristic is the use of proctors to aid in assessments. There are mixed feelings regarding this characteristic within the PSI literature. Several authors have commented on the importance of proctors to the successful use of PSI in the classroom (Calhoun, 1977; Carlson & Minke, 1976; Farmer, Lachter, Blaustein, & Cole, 1972). The use of proctors provides several benefits including allowing students quick or immediate feedback on assessments and providing the opportunity to repeat assessments if needed. Others have commented on the negative aspects of proctors. Depending on the environment of the class, particularly in secondary education, the use of proctors may cause more problems than solutions (Caldwell, 1985). Others have reported similar instances of student learning outcomes not being met because of the subjective assessments that were used (Caldwell et al., 1978). Robin and Cook (1978) commented about the effort needed to train proctors properly, therefore making the use of proctors potentially counterproductive.

In the 1970s, researchers of PSI suggested it would replace or at least be comparable to traditional lecture in higher education (Taveggia, 1976). During the 1980s, the use of PSI declined, but implementation began to increase during the 1990s. With the trend of online and Web-based learning in the 21st century, PSI has again shown its viability as a legitimate instructional model within education (Grant & Spencer, 2003) through the posting of online materi-

als (compared with traditional written workbook). Testing is offered on several online teaching platforms, which provides students with immediate feedback on some assessments. Online sources, such as YouTube, can be used to demonstrate proper activities compared to still pictures and diagrams previously used. Finally, with readily available access to the Internet through tablets and phones, instructors have a wealth of resources to aid in their teaching.

Researchers have highlighted the effectiveness of PSI as a legitimate mode of teaching in many fields ranging from psychology (Calhoun, 1977; Johnson & Croft, 1975; Springer & Pear, 2008), nurse education (Fell, 1989), distance education (Grant & Spencer, 2003), mathematics (Hambleton, Foster, & Richardson, 1998), and biochemistry (Ocorr & Osgood, 2003). Research on PSI within PE is limited (Pritchard, Penix, Colquitt, & McCollum, 2012). The use of PSI in PE to teach skills has been documented in volleyball, golf, racquetball, and tennis (Metzler & Sebolt, 1994). Others have demonstrated the use of PSI to teach more health-related content knowledge. Hannon, Holt, and Hatten (2008) successfully implemented an HRF unit using PSI to teach postrehabilitation fitness in a high school setting. Their 3-week study demonstrates the effectiveness of PSI to teach content knowledge successfully as opposed to the traditionally researched skill acquisition. Pritchard et al. (2012) reported increases in content knowledge as well as fitness levels (cardiovascular endurance, muscle strength and endurance, flexibility) in a collegiate weight training class.

The majority of research on PSI has been for skill development and acquisition primarily at the collegiate level. Metzler and Sebolt (1994) stated that units in which PSI is used could easily be adapted to middle and high school levels. According to the Society of Health and Physical Educators (2014), the outcome of an effective PE program is to "develop physically literate individuals who have the knowledge, skills, and confidence to enjoy a lifetime of healthful physical activity" (para. 1). To accomplish this, research needs to be done in which different instructional strategies are examined, beyond the traditional lecture-based approach.

An issue that arises with implementing theoretical strategies into daily practices is the concept of fidelity. O'Donnell (2008) stated that fidelity of implementation determines how well the intervention

compares to the original design. Without an examination of fidelity, gaps arise that can significantly alter intended outcomes within the study (Hulleman & Cordray, 2009). As with other research, the usage of a different convention of teaching must be examined to make sure what is being taught and how it is being taught matches the theory. With a myriad of instructional strategies, using one particular instrument to determine fidelity can be difficult. As previously mentioned, PSI has been incorporated and determined successful in a variety of educational areas, including PE. However, only a handful of researchers have examined the fidelity of implementation of PSI (Cregger & Metzler, 1992; Hannon et al., 2008), whereas others have used benchmarks to maintain fidelity (Colquitt, Pritchard, & McCollum, 2011; Pritchard et al., 2012). With the potential for PSI to be a highly effective instructional strategy for secondary PE, the purpose of this study was to examine the fidelity of implementing a personal fitness unit using the PSI model at the high school level. In a similar study, Hannon et al. (2008) examined the implementation of PSI and generally looked at the four main characteristics of PSI—self-mastery, self-pacing, teacher as motivator, and emphasis on written material for teaching—as well as the 12 design features:

- Independent Student Progression
- Low Management Time
- High Rate of Cues and Guidance
- High Rate of Task-Related Feedback
- Performance of Tasks to Criterion
- Student Rating of PSI for Learning
- High Rate of Practice Time
- High Rate of Attendance
- Learning Tasks in Written Form
- Study Materials in Written Form
- Class Information in Written Form
- Low Lecture/Demonstration Time

Using the 12 design features reported by Cregger and Metzler (1992), we hypothesized at least nine (75%) of the features would meet the predetermined criteria.

Method

Participants

One PE class of 25 students (n = 21 males; M_{age} = 15.4 ± 1.23 years old) from a local high school in the urban area of a large city in the Mountain West region of the United States was recruited for this study. This school and teacher were approached based on prior relationships and willingness to examine different instructional strategies within PE. Approval from the school and university institutional review board was obtained and parental permission and child assent were granted prior to the beginning of the study. An introductory section of personal fitness was selected based upon the need for proper training of high school students in resistance training, health-related fitness, and the application of this information.

The class met for 6 weeks, on 4 days of the week, for 40 min of weight room activities. Available resources included a moderately sized fitness facility consisting of free weights, dumbbells, weight machines, and cardiovascular equipment. The classroom teacher had a degree in pedagogy with 16 years of teaching experience with knowledge of the format of PSI. The principal investigator (PI) trained the teacher in PSI philosophy and implementation as well as worked closely to maintain fidelity of the instructional strategy and curriculum.

Curriculum and Materials

The curriculum used for this study was adapted from Colquitt et al.'s (2011) personal fitness unit originally developed for secondary and collegiate students. Topics covered included cardiovascular fitness, muscle strength and endurance, flexibility, body composition, and nutrition. Students were required to demonstrate competencies and content knowledge through written assignments, task performance and completion, and creation of exercise workouts based on fitness improvement areas.

The workbook was designed to introduce students to personal fitness through the PSI model with an explanation of how the curriculum (modules) works as well as learning objectives, classroom policies, readings, and access to learning videos demonstrating specific exercise techniques. Students had the opportunity to complete

16 modules during the 6-week study. This program was designed for students to use at the beginning of the PE course as an introduction to health and fitness, with the outcome being the ability to self-evaluate their current fitness levels and, based on these results, to create an individual workout that will assist them in reaching their fitness goals. In the curriculum, an overview of fitness, proper lifting techniques, how to lift safely, and content designed to encourage a healthy lifestyle were provided. The curriculum modules consisted of the following:

- Fitness Assessment
- Cardiovascular Training
- Resistance Training
- Flexibility Training
- Fitness Principles
- Program Design
- Nutrition
- Fluid Balance
- Abdominals and Lower Back
- Hip/Thigh Multi-Joint
- Hip/Thigh Single-Joint
- Chest
- Upper Back
- Shoulders
- Biceps
- Triceps

Instrumentation

Using Cregger and Metzler's (1992) original design, we collected 12 data sources for analysis. These sources were categorized into four parts: (a) course management, (b) instructor and student in-class processes, (c) progress of students, and (d) student ratings of PSI features. The criteria were established based on similar work in PSI and what a "true" PSI model should look like (Table 1). These criteria have been established as the gold standard of measuring PSI fidelity and have been used in other fidelity studies (Hannon et al., 2008; Leach, 2011).

Table 1
Definitions of PSI Confirmation Criteria Data

Characteristic	Definition
1. Self-Pacing	
a. Independent Student Progression	Mean percentage of tasks students completed each day
b. Low Management Time	Percentage of class time that provided content-related information and spent in management
c. High Rate of Cues and Guidance	Rate per minute the teacher provided verbal guidance and cues
d. High Rate of Task-Related Feedback	Rate per minute of verbal feedback provided during each class
2. Mastery-Based Learning	
a. Performance of Tasks to Criterion	Percentage of tasks (assignments) all students in the class completed to criterion
b. Student Rating of PSI for Learning	Students' perceived increases in skill and knowledge
3. Teacher as Motivator	
a. High Rate of Practice Time	Percentage of class time students spent in subject-related practice
b. High Rate of Attendance	Daily average of students' attendance in class
4. Emphasis Placed on Written Word	
a. Learning Tasks in Written Form	Tasks provided in written form in a workbook
b. Study Materials in Written Form	Study materials provided in written form in a workbook

Table 1 (cont.)

Characteristic	Definition
c. Class Information in Written Form	Class operating policies and procedures provided in written form in a workbook
d. Low Lecture/ Demonstration Time	Percentage of class time students spent in lecture/demonstration

Procedures

Prior to the beginning of the study, students were instructed on the use of the workbooks and other electronic devices (DVDs, laptop, online videos). Students were reminded this unit was self-paced, but they could work with others to complete their modules. This provided the opportunity for spotting of lifts as well as partners to check off learning tasks. Based on the PSI characteristic of mastery learning, students were instructed they needed to complete the first module, Fitness Assessment, before they could move on to another module. Criteria for completing this module included achieving a minimum score of 80% on the assessment quiz as well as completing all tasks within the module. Upon mastering the module, students were allowed to choose the next type of module (i.e., fitness skills or concepts; see Colquitt et al., 2011) on which they wanted to work. Students were instructed that to move from one module to the next, they needed to complete the tasks assigned in the module and score an 80% or higher on the assessment quiz at the end of the module. Six weeks allowed ample time for completing a majority of the modules. As students completed all of the modules at mastery level, they were "recruited" to assist the teacher in checking off performance tasks. During the 6-week study, students and the classroom teacher were encouraged to make comments regarding the learning and teaching process.

Data Analysis

Data were collected and evaluated based upon the four major components of the PSI instructional strategy (Keller, 1968). A variety of sources were used including video and audio recordings, stu-

dent workbooks, and teacher log. Other resources included a single Likert question as well as two questions asked at the conclusion of the study: (1) "Did you feel that you learned from this type of instruction?" and (2) "What were your thoughts regarding the way this class was taught?" Teacher thoughts and comments were obtained through periodic debriefing between the classroom teacher and the PI. At the conclusion of the study, the teacher completed a series of open-ended questions including the following:

1. Compared to other methods of teaching, what is your opinion of the PSI model?
2. How was it different?
3. What were the strengths of the model?
4. What were the weaknesses?
5. What was your sense of student engagement regarding PSI?
6. How would this work in a non-weight training class?
7. How effective do you think this teaching model was in providing students with content knowledge while still giving them sufficient physical activity?
8. Would you use this model in the future?

Responses were used to probe for deeper investigation of the teacher's thoughts regarding PSI.

To analyze the program, we followed procedures established by Cregger and Metzler (1992) and examined four of the five characteristics of PSI. As mentioned previously, in this study, we did not address the fifth characteristic of PSI, referring to the use of proctors during the class. Because of school scheduling, two out of four classes per week were videotaped with the teacher wearing a cordless microphone for later analysis. The PI and a second trained observer coded and analyzed the video and audio. The criteria data are explained in Table 1. Individual student progress (1a) was determined by calculating the number of tasks the class completed during the study and dividing by number of days within the study. Performance of each task was evaluated similarly by calculating the number of tasks completed by the number of tasks possible. Five of the criteria (1b, 1c, 1d, 3a, and 4d) were evaluated by coding of video and audio recordings. Rates of cues and feedback were analyzed by determining the number of occurrences during the recorded classes and di-

viding by total class time. The remaining three (1d, 3a, and 4d) were determined by recording the time spent in each and then dividing by class time. Task to criterion (2a) was evaluated by dividing the number of tasks completed by the number of tasks possible to create a percentage. Student rating of PSI (2b) was analyzed through a 5-point Likert scale given at the end of the study. Average daily attendance (3b) was determined by subtracting absences from opportunities and dividing by total, then multiplying by 100 to reach a percentage: (Total – Absences)/Total. The remaining criteria (4a–4c) were check offs from the workbook to determine that they were available to the students via written work.

Results

The primary results from the fidelity study are presented in Table 2. Three of the four design characteristics for effective implementation of PSI were met. The first characteristic, self-pacing, showed partial success (50%). Independent progression exceeded the minimum standard (≥ 2% per day), signifying students completed 7.7%, or 1.5 tasks, per day. The second feature, low management time, was considered a success with less than 2% of the class time used for general management of the class. Cues and task-related feedback did not meet the criteria for confirmation, with only 0.54 cues per minute of individual guidance and 0.68 occurrences of task feedback. The second characteristic of mastery-based learning achieved 100% confirmation. Both design features, achievement of criterion and the student rate of learning through PSI, exceeded the minimum criteria. The third characteristic, teacher as motivator, also had 100% confirmation. For the design feature of high practice time, 97.7% (~37 min) of class time was available for student practice. Attendance was also high, exceeding the minimum of 80%. The last characteristic investigated, emphasis on the written word, was deemed a success as four out of four (100%) design features for this characteristic met the minimum standard. With the majority of information available to the students via their workbooks, the classroom teacher did not need much time to lecture or demonstrate the skill or activity.

Table 2
Verification of PSI Implementation

Characteristic	Study result	Average result per class (38 min)	Confirmation criteria	Criteria met
1. Self-Pacing				
a. Independent Student Progression	7.7% completed	1.5 tasks	≥ 2.0% each day	Yes
b. Low Management Time	1.9% of class time	0.75 min	≤ 5.0% of class time	Yes
c. High Rate of Cues and Guidance	0.54 per minute	NA	1 per minute	No
d. High Rate of Task-Related Feedback	0.68 per minute	NA	1 per minute	No
2. Mastery-Based Learning				
a. Performance of Tasks to Criterion	83.2% completed	399 out of 480	≥ 70% completed	Yes
b. Student Rating of PSI for Learning	4.02 out of 5	NA	3 or higher	Yes
3. Teacher as Motivator				
a. High Rate of Practice Time	97.7% of class time	37.13 min	≥ 75% of class time	Yes
b. High Rate of Attendance	98% Attendance	0.5 absence per day	≥ 80% attendance	Yes
4. Emphasis Placed on Written Word				
a. Learning Tasks in Written Form	Tasks Provided	NA	Provided	Yes
b. Study Materials in Written Form	Provided	NA	Provided	Yes
c. Class Information in Written Form	Policy Provided	NA	Provided	Yes
d. Low Lecture/Demonstration Time	2.3% of class time	1 min	≤ 10% of class time	Yes

Teacher's Observations and Thoughts

In interviews and open-ended questions, the teacher noted the first several classes were difficult because of explanations of how PSI worked: "I had to adapt to it at first. Once I did it was great." When asked to explain how he adapted, the teacher commented he normally uses a lot of demonstrations and spends a great deal of time explaining. With PSI, he had to remind himself to allow the students to learn on their own through the information in the workbook. The concept of students being responsible for their work and him being a facilitator required adjustment: "They are doing the learning and examples themselves. I am only their Sherpa on the climb." As the study progressed, he spent less time managing the students and more time providing verbal feedback. When asked his impression of student engagement with PSI compared with other methods, the teacher stated it worked well with the students: "A couple of the students needed a bit more urging and direction, but it was relatively easy to see who was not getting it."

The teacher reported he feels the implementation of the PSI model will work better in the future now that he is more familiar with it. Comparing the PSI to other instructional styles, he commented that he "liked how the skills and knowledge were incorporated into the same lesson/module. Other instructional approaches separate the two and the students have a difficult time joining them together." Overall, the teacher was satisfied in how PSI worked in the classroom:

> I love the fact that it's a lot of work up front, but then the application is easy. Students are able to have an individualized approach. Each kid is in charge of their own education. Most of all, I am freed up to help students that need it and students that get it are on to the next thing.

The only weakness the teacher reported was the starting of the study: "I was not sure how to start and get things going. Once I started, it was really easy."

Students' Thoughts and Comments

According to the teacher, students were hesitant about the new instructional strategy. One student commented, "I enjoyed learning more about personal fitness, but it seems like we don't get to do anything." This theme of decreased physical activity was common among the students. Some mentioned they just want to lift weights and do not care about gaining the content knowledge. As the study progressed, students were able to incorporate the knowledge and the skills into their activity. One female student said, "I like that I know what and why I am doing when working out. This will definitely help me later." Overall, the majority of students reported they enjoy being able to learn a little more about what they are doing rather than just lifting.

Discussion

The primary aim of this study was to examine the effectiveness of implementing a personal fitness unit using the PSI model. Determining the successful implementation of the PSI model, according to Cregger and Metzler (1992), requires meeting 70% of the 12 design features outlined in Table 1. We hypothesized for this study that at least nine of the 12 (75%) features would be successfully met. Results from the study show the confirmation criteria were met for 10 of the 12 (83%) design features. This indicates the standards of PSI were followed when the curriculum was implemented. In addition, comments from the teacher and students were positive toward the use of PSI in teaching a personal fitness unit for high school students.

An important finding from this study is the use of cues and guidance and task-related feedback. Cregger and Metzler (1992) originally suggested one incident per minute is a criterion for success for each feature. In this study, we reported 0.54 cues per minute and 0.68 occurrences of feedback per minute. One reason for failing to meet the predetermined one occurrence per minute criterion was the lack of proctors. Keller (1968), in his original PSI work, commented on the use of proctors to aid in module assessments. This could alleviate time that could be spent providing feedback and cues. The use of proctors in PSI is mixed. Some have reported decreases in overall learning when proctors are used (Caldwell, 1985), whereas others have stated their use is central to using PSI (Calhoun, 1977; Farmer

et al., 1972). In other studies involving PSI in high school PE, proctors have not been used because of the difficulty in proper training (Hannon et al., 2008). In this study, traditional proctors were not used, but the effects of proctors in high school classes in which PSI is used need to be investigated.

Other key findings from this study include the levels of management time and lecture/demonstration time (1.9% and 2.3% of class time, respectively), thus increasing time spent in practice (97.7% of class time). Increases in practice time may have multiple effects on outcomes of PE. First, increased practice time allows for development of motor skills and competencies that help students to meet national standards (American Alliance for Health, Physical Education, Recreation, and Dance, 2013). These developed skills can manifest in increases in HRF components later in life (Stodden, Langendorfer, & Roberston, 2009). Second, increases in competencies can play a vital role in moving toward more intrinsic motivation toward physical activity (Clark, 2007; Standage & Ryan, 2012; Stodden et al., 2009). A potential drawback of other instructional models is the decrease in time for practice, whereas this study demonstrates the possibility PSI has in increasing practice time, leading to potential higher levels of competency.

A major barrier in implementing a new instructional strategy is the buy-in from the classroom teacher. Most successful teaching models require a lot of planning on the teacher's behalf. This is true of PSI as well. With the creation of the modules, including what skills to teach, how to assess those skills, and other pertinent information, the whole process can be daunting. The classroom teacher in this study acknowledged this, but went on to say that it is worth it because of what PSI does for the student learning experience. Other areas that could appeal to practitioners are the ability of the teacher to engage with more students, provide feedback and cues, and encourage the students in the tasks they are working on.

Although the majority of the results from this study are positive, care must be taken to ensure that generalizations are not made toward other activities in PE. We examined the use of the PSI model in a personal fitness unit. Other content including individual sports and team sports need to be investigated separately for the possible use of PSI.

This study had a few limitations. First, the study took place during the second semester of the school year. Many students were new, but a returning cadre of experienced students may have altered the outcome. Another limitation is the lack of experience in PSI on behalf of the classroom teacher. Although the teacher was familiar with PSI and the PI provided extra training and feedback, the teacher did not have a solid base for this instructional strategy and this may have prevented him from engaging in more feedback and verbal guidance. Gender was not considered during this study, but the majority of participants were males (83.3%), and this may have affected the outcome. Last, the class used in this study was selected for convenience, rather than as a randomized selection.

The traditional approaches of pencil and paper workbook and DVD videos for demonstrating technique were used in this study. With the availability of a plethora of technology, studies need to be conducted using these avenues with PSI. Instead of a pencil and paper workbook, the information could be presented using a tablet or other handheld devices. Quizzes can be taken and corrected using online teaching platforms, and demonstration videos can be shown as well. Implementing these technologies could free up classroom teachers, allowing them to interact more with students as was intended in the original model. More study needs to be conducted to further investigate other variables associated with teaching styles and curriculum including content knowledge, physical activity levels, and psychosocial variables.

Conclusion

The results from this study show that a personal fitness unit in which the PSI teaching model is used can be successfully implemented. It adds to the minimal literature available in which the use of PSI in high school PE is investigated. More research must be done to examine the effects of this instructional strategy in the context of general PE classes.

References

American Alliance of Health, Physical Education, Recreation, and Dance. (2013). Position statement for physical education. Retrieved from http://www.aahperd.org/naspe/standards/nationalStandards /PEstandards.cfm

Bauman, A., Bull, F., Chey, T., Craig, C. L., Ainsworth, B. E., Sallis, J.F., . . . The IPS Group. (2009). The international prevalence study on physical activity: Results from 20 countries. *International Journal of Behavioral Nutrition and Physical Activity, 6*(21), 1–11.

Caldwell, E. C. (1985). Dangers of PSI. *Teaching of Psychology, 1*(12), 9–12.

Caldwell, E. C., Bissonnettee, K., Klishis, M. J., Ripley, M., Farudi, P. P., . . . Radiker, J. E. (1978). Mastery: The essential essential in PSI. *Teaching of Psychology, 5,* 59–65.

Calhoun, J. F. (1977). The combination of elements in the personalized system of instruction. *Teaching of Psychology, 3*(2), 73–76.

Carlson, J. G., & Minke, K. (1976). The effect of student tutors on learning by unit mastery instructional methods. *Psychology Record, 76,* 533–543.

Centers for Disease Control and Prevention. (2011). Physical activity levels of high school students. *Morbidity and Mortality Weekly Report, 60*, 773–777.

Clark, J. E. (2007). On the problem of motor skill development. *Journal of Physical Education, Recreation, & Dance, 78*(5), 39–44.

Colquitt, G., Pritchard, T., & McCollum, S. (2011). The personalized system of instruction in fitness education. *Journal of Physical Education, Recreation, & Dance, 82*(5), 46–54.

Cothran, D. J., & Ennis, C. D. (1999). Alone in a crowd: Meeting students' needs for relevance and connection in urban high school physical education. *Journal of Teaching in Physical Education, 18,* 234–237.

Cregger, R., & Metzler, M. (1992). PSI for a college physical education basic instructional program. *Educational Technology, 32*(8), 51–56.

Curtner-Smith, M. D., Todorovich, J. R., McCaughtry, N. A., & Lacon, S. A. (2001). Urban teachers' use of productive and reproductive teaching styles within the confines of the National Curriculum for Physical Education. *European Physical Education Review, 7*, 177–190.

Farmer, J., Lachter, A. D., Blaustein, J. J., & Cole, B. K. (1972). The role of proctoring personalized instruction. *Journal of Applied Behavior Analysis, 5,* 401–404.

Fell, J. P. (1989). The Keller plan in nurse education. *The Vocational Aspect of Education, 41*(109), 65–68.

Goldfield, G. S., Henderson, K., Bucholz, A., Obeid, N., Nguyen, H., & Flament, M. F. (2011). Physical activity and psychological adjustment in adolescents. *Journal of Physical Activity and Health, 8,* 157–163.

Grant, L. K., & Spencer, R. E. (2003). The personalized system of instruction: Review and applications to distance education. *International Review of Research in Open and Distance Learning, 4*(2), 1–17.

Grunbaum, J. A., Kann, L., Kinchen, S., Ross, J., Hawkins, J., Lowry, R., . . . Collins, J. (2004). Youth risk behavior surveillance – United States, 2003 (abridged). *Journal of School Health, 74*(8), 307–324.

Hambleton, I. R., Foster, W. H., & Richardson, J. T. E. (1998). Improving student learning using the personalized system of instruction. *Higher Education, 35,* 187–203.

Hannon, J. C., Holt, B. J., & Hatten, J. D. (2008). Personalized systems of instruction model: Teaching health-related fitness content in high school physical education. *Journal of Curriculum and Instruction, 2*(2), 20–33.

Hulleman, C. S., & Cordray, D. S. (2009). Moving from the lab to the field: The role of fidelity and achieved relative intervention strength. *Journal of Research on Educational Effectiveness, 2,* 88–110.

Johnson, W. G., & Croft, R. G. F. (1975). Locus of control and participation in a personalized system of instruction course. *Journal of Educational Psychology, 67*, 416–421.

Keller, F. S. (1968). "Good-bye, teacher…". *Journal of Applied Behavior Analysis, 1*(1), 79–89.

Leach, J. R. (2011). *Effects of pacing contingencies in a PSI-taught college-level golf course* (Doctoral dissertation). Retrieved from ProQuest. (3477249)

Metzler, M. (2000). *Instructional models for physical education.* Boston, MA: Allyn and Bacon.

Metzler, M. W. (2005). *Instructional models for physical education* (2nd ed.). Scottsdale, AZ: Holcomb Hathaway.

Metzler, M., & Sebolt, D. (1994). *Instructor's manual for the Personalized Sport Instruction Series.* Dubuque, IA: Kendall Hunt.

Moreno Murcia, J. A., Coll, D. G. C., & Ruiz Pérez, L. M. (2009). Self-determined motivation and physical education importance. *Human Movement, 10*(1), 5–11.

Ocorr, K., & Osgood, M. P. (2003). Self or help? A comparison of a personalized system of instruction biochemistry class to a standard lecture-based biochemistry class. *The International Union of Biochemistry and Molecular Biology, 31*, 308–312.

O'Donnell, C. L. (2008). Defining, conceptualizing, and measuring fidelity of implementation and its relationship to outcomes in K–12 curriculum intervention research. *Review of Educational Research, 78,* 33–84.

Olafson, L. (2002). "I hate phys. ed.": Adolescent girls talk about physical education. *The Physical Educator, 59*, 67–74.

Osborne, K., Bauer, A., & Sutliff, M. (2002). Middle school students' perceptions of coed versus non-coed physical education. *The Physical Educator, 59*, 83–89.

Parish, L. K., & Treasure, D. C. (2003). Physical activity and situational motivation in physical education: Influence of the motivational climate and perceived ability. *Research Quarterly for Exercise and Sport, 74*, 173–183.

Pate, R. R., Ward, D. S., O'Neill, J. R., & Dowda, M. (2007). Enrollment in physical education is associated with overall physical activity in adolescent girls. *Research Quarterly for Exercise and Sport, 78*, 265–270.

Pritchard, T., Penix, K., Colquitt, G., & McCollum, S. (2012). Effects of a weight training personalized system of instruction course on fitness levels and knowledge. *The Physical Educator, 69,* 342–359.

Robin, A. L., & Cook, D. A. (1978). Training proctors for personalized instruction. *Teaching of Psychology, 5*(1), 9–12.

Saffici, C. (2011). The perceived relevance of physical education. *The Physical Educator, 56*, 138–142.

Sallis, J. F., McKenzie, T. L., Beets, M. W., Beighle, A., Erwin, H., & Lee, S. (2012). Physical education's role in public health: Steps forward and backward over 20 years and HOPE for the future. *Research Quarterly for Exercise and Sport, 83*(2), 125–135.

Society of Health and Physical Educators. (2014). National standards for physical education. Retrieved from http://www.shapeamerica.org/standards/index.cfm

Song, M., Carroll, D. D., & Fulton, J. E. (2013). Meeting the 2008 physical activity guidelines for Americans among US youth. *American Journal of Preventive Medicine, 44*(3), 216–222.

Springer, C. R., & Pear, J. J. (2008). Performance measures in courses using computer-aided personalized system of instruction. *Computers and Education, 51,* 829–835.

Standage, M., & Ryan, R. M. (2012). Self-determination theory and exercise motivation: Facilitating self-regulatory processes to support and maintain health and well-being. In G. C. Roberts & D. C. Treasure (Eds.), *Advances in motivation in sport and exercise* (pp. 234–270). Champaign, IL: Human Kinetics.

Stodden, D., Langendorfer, S., & Roberton, M. A. (2009). The association between skill competence and physical fitness in adults. *Research Quarterly for Exercise and Sport, 80,* 229–233.

Taveggia, T. C. (1976). Personalized instruction: A summary of comparative research, 1967–1974. *American Journal of Physics, 44*, 1028–1033.

Trost, S. G., Kerr, L. M., Ward, D. S., & Pate, R. R. (2001). Physical activity and determinants of physical activity in obese and non-obese children. *International Journal of Obesity, 25,* 822–829.

Trudeau, F., & Shepard, R. J. (2005). Contribution of school programmes to physical activity levels and attitudes in children and adults. *Sports Medicine, 35*(2), 89–105.

Webster, C., Mindrila, D., & Weaver, G. (2011). The influence of state motivation, content relevance and affective learning on high school students' intentions to use class content following completion of compulsory physical education. *Journal of Teaching in Physical Education, 30,* 231–247.

Whitehead, S., & Biddle, S. (2008). Adolescent girls' perceptions of physical activity: A focus group study. *European Physical Education Review, 14*(2), 243–262.