

Personalized System of Instruction Model: Teaching Health-Related Fitness Content in High School Physical Education

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Abstract

This study assessed the use of a personalized system of instruction (PSI) to teach a high school personal post-rehabilitation fitness unit. A course workbook was designed to provide the students with a basic introduction to the unit, class rules and policies, learning objectives, content-based modules, and methods of assessment. Based on criteria used to verify effective use of PSI in a physical education setting, implementation of the PSI unit in this study was successful. Student comments indicated that self-paced mastery learning, one of the major characteristics of PSI, was a new experience for them. As students became more familiar with the model, they enjoyed the structure and material being presented. Teacher comments indicated that after explaining and establishing the PSI system, very little teaching time was spent on classroom management. The majority of teaching time was spent providing individualized feedback to students. PSI offers an alternative approach to teaching and learning in physical education as well as other content areas.

Physical education programs are critical in our nation's efforts to address the pediatric obesity epidemic (Koplan & Dietz, 1999). Quality physical education should provide opportunities for students to learn meaningful content across a variety of topic areas. In addition, it must help motivate all students to be active and provide them with the skills necessary to pursue lifelong physical activity (National Association for Sport and Physical Education [NASPE], 2004). In order to meet these goals, physical educators should use teaching methods that increase individual student contact time, motivate students to learn, and prepare students for learning situations they may face as adults. Rarely, as an adult, will an individual receive direct instruction as it relates to participation in physical activity. Many times adults must be responsible for their own learning with little or no guidance from qualified professionals. One approach with potential for developing lifelong learning habits in the physical education setting is the Personalized System of Instruction (PSI) model.

The Personalized System of Instruction model was designed based on five major characteristics: (a) self-pacing, (b) mastery learning, (c) teacher acting as motivator, (d) emphasis on the written word for study materials, and (e) student proctors (Keller & Sherman, 1974). PSI was originally developed by Keller (1968) for

use in an introductory college psychology class after determining that the traditional lecture approach would not meet the needs of his nearly 300 students. Keller was an experimental behavioral psychologist who believed that the complete environment (e.g. what is taught and how it is taught) impacts human learning with or without a teacher's direct role. Keller's goal in the design of PSI was to allow students to learn independently so that the teacher could interact with students needing the most assistance (Metzler, 2005). The PSI model acknowledges that not all students have the same interests and abilities. It allows students to progress at a rate that coincides with their individual abilities (Tousignant, 1983). Students with higher skills are allowed to progress at faster rates, while other students may take additional time to adequately complete each activity (Metzler).

Acknowledging the importance of reinforcement in the learning process in order to maintain student interest and motivation, Keller and Sherman (1974) indicated that PSI must be based on four distinct features: 1) the ability to view creative and interesting learning materials; 2) regular, tangible progress toward course goals; 3) immediate assessment of learning; and 4) individual attention from the teacher. These features provide reinforcement not often available in other instructional models. With these features and characteristics in mind, the design of a PSI unit requires creative, careful, and detailed planning by the teacher.

Although research has indicated that PSI can be an effective instructional model in many subject areas (Lowry & Thornburg, 1988), descriptions of the use of PSI in physical education are limited. Seidentop (1974) was the first to suggest the use of PSI to teach mostly cognitive content to college-aged physical education students. Later, Cregger and Metzler (1992) evaluated the use of PSI in a beginning level college volleyball course. Results of their study indicated that the PSI model was associated with low management time, low teacher lecture time, high rates of task-related feedback, overall high rates of student progression and performance, and increased student satisfaction. Results led the authors to conclude that PSI was a viable alternative to conventional styles of teaching physical education. Metzler and Sebolt (1994) later developed a complete series of golf, tennis, racquetball, and volleyball PSI units for use with college level activity courses. This series was subsequently expanded to include badminton and soccer (Metzler, 2000). Metzler and Sebolt stated that these units could be easily adapted for use at the middle and high school levels; however, there are few accounts of the use of PSI in secondary physical education programs. Tousignant (1983) described PSI use for teaching a high school tennis course. She acknowledged that the system had its drawbacks due to the need for careful planning by the teacher. Many students who were accustomed to daily direct instruction and accountability demonstrated initial hesitance when using PSI. Despite these drawbacks, the author felt that use of the system was effective. PSI provided more time for teachers to spend with individual students, helping them to improve performance.

In order to further assess the effectiveness of implementing PSI at the secondary level, data-supported accounts of its use are needed. Therefore, the purpose of this study was to assess the usefulness of implementing a health-related fitness unit at the

high school level using the PSI model. Similar to Cregger and Meltzer's (1992) study, effectiveness was based on assessing the unit in relation to four of Keller and Sherman's (1974) five design characteristics: self-pacing, mastery learning, teacher acting as motivator, and emphasis on written word for study materials. The fifth PSI design characteristic, use of student proctors, was not included in this study because they were not available and their use is not applicable to most high school physical education settings.

Methods

Participants and Setting

Participants included 26 students (13 boys, 13 girls) enrolled in a physical education weight training class at a suburban southeastern United States high school, where students had previous experience using fitness equipment and developing personal fitness plans. Classes met for 50 minutes daily over the course of the semester. The PSI unit of study spanned three weeks. Available facilities included a classroom with audio/visual equipment, a cardiovascular training room, and a fully equipped free-weight and machine weight room. The teacher had a graduate degree in physical education, three years teaching experience, and working knowledge of the PSI model, but had never implemented a unit using PSI.

Materials

Post-rehabilitation (post-rehab) fitness was chosen as the unit topic for this study because it was believed to meet Keller and Sherman's (1974) first distinct feature of being creative and interesting. Post-rehab fitness involves the development and implementation of fitness programs for individuals recovering from injury (e.g., cervical strain patients, knee replacement patients) who have recently been discharged from physical therapy. Certified post-rehab specialists typically work in physical therapy clinics and private fitness clubs. The authors of this study also believed that this focus was unique and applicable to real life, offered exposure to a potential career choice, and had the potential to motivate and challenge high school-aged students. The teacher possessed professional certification and had practical experience in the post-rehab fitness field. The course workbook was developed by the researcher based on experience and information contained in a post-rehab fitness training manual (Jones, 1996). The workbook was designed to provide the students with a basic introduction to the PSI unit (Figure 1), class rules and policies, learning objectives, and assessment. The bulk of the workbook contained learning modules with readings and learning activities in the following areas:

1. Module 1: What is Post-Rehab Fitness?
2. Module 2: Rotator Cuff Tear/Impingement (Figure 2)
3. Module 3: Fibromyalgia, Osteoarthritis, and Rheumatoid Arthritis
4. Module 4: Anterior Cruciate Ligament Rupture and Knee Meniscus Tear
5. Module 5: Patella-Femoral Syndrome, Total Knee Replacement, Total Hip Replacement, and Achilles Tendon Rupture

6. Module 6: Lumbar Disc Herniation and Cervical Strain

In addition to the workbooks, videotapes were created by the researchers to provide visual depictions of the various exercise and screening techniques students would be required to apply throughout the unit.

Figure 1. Introduction to post-rehab PSI unit

Learning Module #1

Hello, class. Welcome to essentials of post-rehab fitness. This workbook contains almost all the information you will need to start learning about the skills and knowledge required to become a post-rehab conditioning specialist. This course in no way trains you to diagnose or treat any medical condition. What this course does is offer an introduction to the practice of post-rehab fitness and the pre-requisite skills needed to attain professional certification. Your instructor for this course will play an important role in regards to providing individual feedback and clarification as you progress through the learning activities enclosed in this workbook.

This course is being taught using what is called the Personalized System for Instruction (PSI) model. The main feature of PSI is that it allows you to learn and progress at your own individual pace throughout the course. This is probably in contrast to courses you have taken in the past where some students learn faster than others. Many students who fall behind become frustrated and are thus less successful and receive less enjoyment from class. Learning by nature is very individualized and PSI allows for this individuality in learning. You will be allowed to progress as fast as you can or as slowly as you need.

As you will soon see, improvement will come in ways different from courses you have taken in the past. You will need to assume much more responsibility for your own learning. Remember everything you need will be included in your personal workbook. It is your responsibility to learn the contents of the book, attend class, adhere to class rules and policies, become familiar with the PSI model, and work hard towards completing the requirements for this course. It has been shown that students enjoy taking responsibility for their own learning and appreciate the opportunity provided by PSI to progress at an individual rate. I am sure that you will, too.

Your responsibilities in this course will be to become familiar with and follow your workbook completely. Do not skip anything and complete all learning activities. The workbook is divided into learning modules. The learning modules will contain information in regards to post-rehab fitness programming and specific learning activities to assess your progress. You may work at your own pace, but you should try to complete all modules before the end of the unit. The workbook will provide you with lesson content and class management procedures. Your instructor will be here to help you with specific problems or questions you may have on an individual basis.

Figure 2. Module 2: Rotator cuff tear/impingement

Learning Module #2

All forms are filled out and the musculoskeletal screening is complete. It's time to get started learning about the special conditions you will face as a post-rehab specialist and the guidelines for the conditioning of your clients. You will be working with clients with various musculoskeletal, neurologic, and cardiovascular disorders. Some of these disorders include low back pain, shoulder impingement, rotator cuff tear, hip arthroplasty/ arthritis, cervical strain, ACL rupture/reconstruction, meniscal tear, Achilles tendon rupture, knee arthroplasty/ arthritis, and patello-femoral syndrome. Let's get started by reviewing the rotator cuff/impingement fitness programming guidelines found in this book and Tape 1. After reviewing and feeling comfortable with the guidelines, move on to complete learning activity #3.

Learning Activity

This is a case study. Assume your partner is a baseball player named Sammy. Sammy has suffered a rotator cuff tear. He has received physical therapy, has been released and referred to you. You have been working with him and have reached week 4 in his post-rehab conditioning program. Use one of the post-rehab session training forms included in this workbook to develop a training session for Sammy. What movements should Sammy avoid? After developing your training session, put Sammy through the workout.

Post Rehabilitation Training Session Form

Client's Name: _____
Trainer's Name: _____
Date of Session: _____
Client Condition: _____

Session Goals

1. _____
2. _____
3. _____

Session Training Activities

Exercise	Sets/Reps	Intensity	Limitations

Comments:

Procedures

At the beginning of the unit, the first lesson was dedicated to explaining and establishing the system. Students were assigned a workbook and told to use the same workbook each day. The model was slightly modified to allow for collaboration. For example, students were allowed to work with a partner for certain types of tasks. This collaboration was required in order to perform some of the pre-screening procedures and exercise prescription implementation required during some modules. Students worked at their own pace, but were encouraged to correctly complete as many modules as possible in sequence. After they studied the workbook materials and viewed videotapes to a point of self-determined mastery, they worked on module learning activities. Meeting the requirements of each module was required before progressing to the next. Before doing so, students were required to consult with the teacher to check their work for completeness and accuracy.

Data were gathered during the study in several ways. Each class was videotaped during the three-week unit for later observation and coding. The teacher wore a cordless portable microphone and a concurrent audio signal was recorded. At the conclusion of each lesson, the teacher was asked to record any personal observations or thoughts related to the PSI model. In addition, the teacher was asked to note any comments made by students regarding the material presented and the method of instruction. Upon completion of the unit, each student was asked to self-evaluate his or her learning of the unit content through application of the PSI model using a single Likert item (1-very little to 5-a lot).

Data Analysis

Data were collected and analyzed based on four key PSI design characteristics. Multiple data sources (video tape transcripts, student workbooks, Likert item, and teacher logbook) were used to evaluate success of meeting each design characteristic. The confirmation criteria for each data set were based on standards established for effective implementation of PSI in a physical education setting (Cregger & Metzler, 1992). Two trained graduate students who were unaware of the confirmation criteria independently coded all the frequency and duration data. The data was also coded and confirmed by the researcher. The inter-rater reliability for frequency and duration coding ranged from 93-97% agreement, an acceptable level for observational coding research (van der Mars, 1989).

The data sources for each design characteristic are defined in Table 1. The design characteristic of self-pacing was evaluated through the use of the following: (a) independent student progression, (b) low management time, (c) high rates of instructor

cues and guidance, and (d) high rates of task related feedback. The design characteristic of mastery-based learning was evaluated through the following: (a) performance of each task to criterion, and (b) student rating of PSI for increasing skill and knowledge. The design characteristic of teacher as motivator was evaluated through the following: (a) high rates of skill related practice and (b) high rates of student attendance. The design characteristic of emphasis placed on the written word was evaluated through the following: (a) learning tasks in written form, (b) study materials in written form, (c) class operating information in the written form, and (d) low lecture/demonstration time.

Table 1.
Definitions of PSI Confirmation Criteria Data

1. Self-Pacing	
a. Independent Student Progression	Mean percent of tasks completed by students each day.
b. Low Management Time	Percent of class time that provided content-related information and spent in management.
c. High Rate of Cues & 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 each Task to Criterion	Percent of tasks (assignments) completed to criterion by all students in the class.
b. Student Rating of PSI for Learning	Students' perceived increases in skill and knowledge.
3. Teacher Acting as Motivator	
a. High Rate of Practice	Percent 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 Task 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.
c. Class Operating Information Written	Class operating policies and procedures provided in written form in a workbook.
d. Low Lecture/ Demonstration Time	Percent of class time students spent in lecture/demonstration.

Results

Results for this study and confirmation criteria are presented in Table 2. Three out of four of the design characteristics met the confirmation criteria (Cregger & Metzler, 1992) for effective PSI implementation: self-pacing, mastery-based learning, and emphasis placed on the written word. The design characteristic of the teacher acting as a motivator met the criterion for student attendance but not the high rate of practice criterion. Qualitative data in the form of teacher and students' comments and thoughts, taken from the teacher's log book are summarized in the following sections to provide a deeper analysis of the model's success beyond just that of the quantitative confirmation.

Table 2.
Verification of Effective PSI Implementation

<u>PSI Design Characteristics and Confirmation Data</u>	<u>Study Result</u>	<u>Confirmation Criteria</u>	<u>Criteria Met</u>
1. Self-Pacing			
a. Independent Study Progression	3.2% each day	≥ 2.0% each day	Yes
b. Low Management Time	1.9% of class time	≤ 5.0% of class time	Yes
c. High Rate of Cues & Guidance	1.3 per minute	1 per minute	Yes
d. High Rate of Task Related Feedback	1.6 per minute	1 per minute	Yes
2. Mastery-Based Learning			
a. Performance of each Task to Criterion	93.4% completed	≥ 70% completed	Yes
b. Student Rating of PSI for Learning	4.2 out of 5	3 or higher	Yes
3. Teacher Acting as Motivator			
a. High Rate of Practice	62.4% of class time	≥ 75% of class time	No
b. High Rate of Attendance	96.2% attendance	≥ 80% attendance	Yes
4. Emphasis Placed on Written Word			
a. Learning Task in Written Form	Provided Task	Provided	Yes
b. Study Materials in Written Form	Provided	Provided	Yes
c. Class Operating Information Written	Policy Provided	Policy Provided	Yes
d. Low Lecture/Demonstration Time	4.3% of class time	≤ 10% of class time	Yes

Teacher Observations and Thoughts

The teacher noted the first few days of the unit were devoted to explaining and establishing the PSI system. After that, very little teaching time was spent on classroom management. One particular logbook entry stated, "I was surprised by how the students began entering class each day, picked up their workbooks, and started working without the need for instruction." The teacher also noted that the majority of teaching time was spent providing individualized assistance to students. The teacher commented, "The PSI model has allowed me to spend most of my time engaged in one-on-one teaching with students needing assistance. I love that." The teacher also acknowledged that time was spent checking students' work in order to allow progression to the next module.

The teacher believed that implementation of the PSI model would have worked better had the students experienced this type of learning system previously. The teacher wrote, "The idea of learning and working at their own pace was unfamiliar to many students. The students often seemed to be waiting to receive some kind of daily instruction since that is what typically occurs in physical education." The teacher noted that some students tended to be procrastinators and initially needed extra encouragement, but as time passed, they adapted to the system and began working at a steadier pace. The teacher wrote, "As the students have become more familiar with the model, they seem to enjoy the structure and type of material being presented. They are working diligently to complete their assigned work." The teacher also noted that the ability to move back and forth as needed between the adjacent classroom and the weight room/cardiovascular room seemed to give students a sense of independence that they rarely experienced. They also seemed to enjoy the individualized teacher attention and feedback on their performance. The teacher commented, "I really feel that the students enjoy the individual time I get to spend with them and appreciate my guidance and feedback." Upon completion of the unit, 78% of the students earned a letter grade of A or B. The teacher was encouraged by this performance considering the uniqueness of the material and the students' initial lack of familiarity with the PSI model.

Students' Thoughts and Comments

It was apparent to the teacher that students were initially reluctant about using the PSI model. One student said, "I do not understand this material and I am totally uninterested in it." Ironically, the teacher noted that this same student became more active and began asking more questions as the unit concluded. Many of the students found the material to be very interesting and asked if they could keep their workbooks. One student said that it was "pretty cool" after he became accustomed to using the workbook. Another student said, "Can we keep our workbooks? This is neat; I would like to show my dad." Another student said, "I am interested in pursuing a career in athletic training and this unit has been a valuable learning experience." Students were very interested in asking questions in the weight room. Many were athletes or attended health clubs after school and welcomed the opportunity to learn what they may have to do someday during rehabilitation if they sustained a major injury. One student said, "I play football and could get injured at any moment. It is good to learn something about

what might occur during my rehab.” Overall, a majority of students indicated that they enjoyed learning new material in a different, self-directed way.

Discussion

The purpose of this study was to assess the effectiveness of implementing a health-related fitness unit at the high school level using the PSI Model. Based on confirmation criteria, originally described by Cregger and Metzler (1992) for use of PSI in a physical education setting, implementation of the PSI unit was successful. Eleven of twelve data sets met the study confirmation criteria. In addition, comments from the teacher and students were supportive in regard to using the PSI model.

An important finding from this study was that the key design characteristic of the teacher acting as a motivator was only partially confirmed because the criterion of a high rate of practice was not met. The confirmation criterion for a high rate of practice was defined as greater than 75% of class time spent on skill practice. However, upon consideration of the unit topic (which is health-fitness related as opposed to skill related), the confirmation criteria may not have been appropriate. As noted by Cregger and Metzler (1992), the confirmation criterion for implementation of a PSI unit in physical education was established based on previous applications of PSI and research on effective teaching in physical education. At that time, most of the available research on teaching in physical education was collected during skill related instruction (Harrison, 1987; Silverman, 1991). Based on that body of knowledge, 75% of class time spent in skill practice was a reasonable expectation. Since that time, more emphasis has been placed on lifetime physical activity and health-fitness related instruction, as opposed to the development of sport skills. Thus, the confirmation criteria set by Cregger and Metzler (1992) may not be applicable to the current study. A more reasonable criterion for health-fitness related instruction may be that students meet the Healthy People 2010 (U.S. Department of Health and Human Services, 2000) recommendation of being active for at least 50% of physical education class time. If the current study were assessed based on the Healthy People 2010 standard, the implementation of the PSI unit would be considered successful because students were active 62.4% of class time.

Overall, the findings from this study were favorable and similar to those described by Cregger and Metzler (1992) for the use of PSI in a college volleyball class and consistent with the literature on effective teaching in physical education (Silverman, 1991). Specifically, low management time, high rates of teacher cues and guidance, and high rates of task-related feedback have been shown to differentiate between more and less effective teaching and learning in physical education (Rink, 2006). This is of particular importance considering that post-rehab fitness is a health-fitness unit and volleyball is a sport-skill unit. Therefore, based on the data, it appears that PSI can be implemented and assessed effectively regardless of whether the physical education content is health-fitness or sport-skill related (e.g., volleyball, golf, tennis). This is an important finding relative to the use of PSI in high school physical education settings. Contemporary physical education at the high school level has shifted from a focus on skill acquisition and sport performance to providing content and learning experiences

related to developing skills for lifetime physical activity. In fact, nine states currently require that high school students complete a concepts-based lifetime fitness course in order to graduate and 41 other states offer similar classes at the high school level (NASPE & American Heart Association [AHA], 2006). These classes are typically structured so that a period of time is devoted to learning concepts in a classroom and another period of time is devoted to applying the concepts in a movement-based setting (Dale, Corbin, & Cuddihy, 1998). Managing time spent in the classroom is often difficult for the traditional physical education teacher because those teachers have not been trained to deliver conceptual-based material. Using an alternative to the classroom lecture format, such as PSI, may be desirable for many physical educators as it would allow them to focus their teaching on something that they are more accustomed to, providing individual guidance and feedback to students.

Although the overall study results were positive, generalizations of the results of this study should not be made to all types of physical education activities or to all student populations. The data were only collected across one unit with one class and one teacher. The use of PSI with another group of students and other teachers may yield different results. In addition, other health-related fitness topics, individual sports, and team sports may produce different results. Additional studies using PSI in a variety of physical education settings should be conducted. Another limitation of this study was the lack of a comparison control group. It would be helpful to compare PSI to other models typically used in physical education, such as direct instruction. A research design comparing the same teacher using two different instructional models to present the same unit to similar groups of students would represent an improvement to the research design used in this study.

Researchers should consider taking advantage of current technology in future studies. Course workbooks and video clips could be digitized so that students could access and complete the activities on school or home computers. The program could also be designed so that cognitive tests or quizzes are instantaneously graded by the computer, providing students with immediate feedback on test performance. If physical activity was a primary outcome, the students could be trained to upload heart rate monitor data or accelerometer count data directly to a computer into a graphics chart in their PSI workbook. As technology advances, the development and refinement of implementing PSI units in physical education is almost limitless.

At the college level other subject areas have implemented computer-aided personalized system of instruction. For example, researchers have evaluated the use of computer-aided PSI to teach a behavior modification course (Martin, Pear, & Martin, 2002) and psychology courses (Pear & Crone-Todd, 1999). Although PSI for instruction in physical education is not a new idea, the use of PSI has received limited research attention and development especially at the high school level and with health-fitness related material. The continued study of this alternative form of teaching and learning is strongly recommended as it lends itself to the teaching of conceptually based physical education content.

Conclusions

In summary, PSI offers an alternative approach to physical education teaching and learning at the high school level. In addition, PSI has potential applications to other subject areas outside of physical education, such as math and science. Not all students learn at the same pace and PSI offers students the chance to work at a pace that is more conducive to their individual needs. In fact, Ironsmith and Eppler (2007) reported that low-aptitude students enrolled in a PSI-based course scored higher on their final examinations than low-aptitude students enrolled in a traditional lecture-based course. Despite the reported benefits of PSI, it is important to remember that PSI may not be appropriate for all students and classes. The format may need to be adapted according to specific activities and characteristics of different groups of students. It is up to an individual teacher to determine when PSI is a viable alternative to traditional teaching styles. Teachers wishing to experiment with PSI should choose activities with which they are most confident. Effective use of the PSI model requires teacher's careful planning. Although it is time consuming to develop a course workbook and organize a unit, when effectively used, PSI offers both teachers and students a valuable, interesting, and unique experience.

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