

# The Effects of a Curricular Fitness Integration on the Heart Rates and Skill Improvement of Elementary Physical Education Students

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## Abstract

*Researchers have demonstrated that American youth are not as fit as necessary for a healthy lifestyle. Furthermore, physical education students are not typically engaged during lessons at appropriate intensities for any fitness-related effects. The majority of physical education programs are sport-related; therefore, teachers focus on sport-related skills. When students are engaged in sport-skill instruction, often they complete a sport or motor skill trial and then wait for the next opportunity to respond. The purpose of this study was to determine the effects of a curricular intervention on students' heart rates and skill improvement in a mini-basketball unit. An experimental group (n = 48) of fourth and fifth graders was taught via the Fit-Sport Model while a control group (n = 44) were taught via the traditional sport skill instructional process. Significant heart rate differences were found for a sub-sample of both groups, but no differences were evident in skill improvement for the larger sample described above.*

Evidence exists which demonstrates that over 11 million American youth are obese and that obesity is linked to a number of health problems (Strand, Scantling, & Johnson, 1997). Since obesity has been linked to cardiovascular disease, hypertension, diabetes, cancer, joint stress and other health problems, it is evident that changes need to be made in the lifestyles of youth to increase their levels of physical activity. Not only does

physical activity reduce obesity levels, but it also provides other benefits which help lead to healthier lifestyles.

Regular physical activity also helps reduce the risks of developing most of the leading causes of death in the United States as well as enhance longevity of life (Bar-Or, 1987; Blair & Connelly, 1996; Lee & Paffenberger, 1996; NIH, 1995; Slattery, 1996). Children and youth in the United States still do not typically participate in the recommended amounts of physical activity suggested to lower health risks (Corbin & Pangrazi, 1996; Strand, Scantling, & Johnson, 1997). Experts suggest that in order to achieve a healthy life-style, one must participate in moderate-to-vigorous physical activity at least three days per week for a combined 30-minutes duration each day (ACSM, 1995; Corbin & Pangrazi, 1996; Sallis & Patrick, 1994). Although, the optimum opportunities for many children and youth to engage in physical activity is in school physical education (McKenzie & Sallis, 1997; Sallis, 1987; Strand, Scantling, & Johnson, 1997; Simons-Morton, et al., 1987; Verabioff 1988), it is distressing to find that many physical education teachers pay fitness development only lip-service (Matanin & Tannehill, 1994; Veal, 1988, 1990). Often, the obligatory "warm-up" exercises are the only fitness activities specifically planned by teachers. In many instances, when physical education classes are observed, relatively little physical activity is seen

(McKenzie, & Sallis, 1997; McKenzie, Alcaez, & Sallis, 1994). Others provide support that school physical education is not contributing to enhance and/or maintain fitness levels of students (Lee, et al., 1987; Simons-Morton, et al., 1987) by providing optimum amounts of physical activity in which students engage (Sallis, 1987). In a study of the heart rates of elementary children during physical education, Burton (1996) found that children spent less than 41% of class time within a predetermined target range with the percentage decreasing with the grade level. At the secondary level, Li and Dunham (1993) found that physical education students spent no more than eight percent of physical education lessons at or above target heart rate zones. Ignico (1994) concluded that, "As it stands now, with the way many physical education classes are taught today, it is difficult to achieve any training effects."

Research is limited in determining the relationship of various activities within physical education class to heart rates of children. Stratton (1996a,) found that the gender, age, and the type of activity affected the level of heart rates in physical education class. Results indicated that 14 year olds were less active than all other age groups studied, while invasion games appeared to produce higher levels of intensity in physical education students than more individually oriented activities such as gymnastics, track and field, and dance. Invasion games are those described in the "games for understanding" literature as requiring a team to invade territory of another team (football, soccer, hockey, basketball, etc.).

Stratton (1996b) concluded that children failed to achieve recommended amounts of moderate to vigorous physical activity for at least 50 percent of lesson time in a majority of observed lessons. Stratton (1996b) also suggested that invasion games (soccer, hockey, basketball, etc. . . .) were those which more consistently stimulated the highest means of

heart rates, especially when compared to net/wall-type activities like badminton and volleyball. This provides evidence that the type of games in which students are engaged in physical education influences the cardiovascular effects gained in lessons.

An often overlooked area in the research on heart rates in physical education lessons is the area of motor and sport-related skill work (drills, modified games, etc. . . .). In one elementary setting, third graders indicated a greater enjoyment of lessons which included a fitness emphasis simultaneously with motor skill instruction (Dunaway, 1994a, 1994b, 1994c; Everhart, Everhart, Sands, & Dunaway, 1998). The Fit-Sport Model (Ward, Everhart, Dunaway, Fisher, & Coates, 1997) was modified so that students were more actively engaged during the entire drills. This modification was geared to elevate and maintain heart rates although research has yet to show effects on heart rate of such a model. Few studies have investigated such a curricular model on students' heart rates in physical education at the upper elementary, middle school, high school, or university levels.

The purpose of this study was to determine the effects of the Fit-Sport Model on the heart rates of upper elementary (fourth and fifth graders) physical education students. A secondary purpose was to determine the model's effects on sport-related skill improvement.

## Methods

### *Subjects and Setting*

Three classes of fourth graders ( $n = 64$ ) and four classes of fifth graders ( $n = 83$ ) served as subjects during physical education class (two time periods separated by grade level) for the study. The students were divided by class into an experimental ( $n = 48$ ) and control group ( $n = 44$ ). The smaller number of subjects in comparison to the original number of subjects is due to absences of students on the pre test days and/or post-test days. For the heart rate portion of the study, a smaller sample was

available for the experimental ( $n = 26$ ) and control ( $n = 21$ ) groups due to limited number of interfacing heart rate monitors. Written informed parental consent and student assent was obtained from subjects prior to beginning the study.

### *Procedures*

All subjects were pretested on shooting skills prior to a curricular intervention. The basketball shooting test used was the AAHPERD Speed Spot Shooting test (Safrit & Wood, 1995). Tape was marked on the floor of a basketball goal area so that students were required to shoot from eight feet from the basket from five different angles. As long as the students shot at least once from each of the five spots, they could shoot from anywhere else with no more than four lay ups counted. Also, students could not make two consecutive shots from anywhere. There was a 60-second time limit on the test and baskets counted two points each.

The sub-sample of subjects who wore heart rate monitors was smaller in number because of the availability of monitors. Six students during each lesson wore the POLAR Vantage NV heart rate monitors which began to track their heart rates every 15 seconds from the beginning of teacher instruction to the end of the lesson. Some students did not turn in consent forms; therefore, the number of subjects was smaller in the sub-sample (experimental  $n = 26$  and control  $n = 21$ ) and unbalanced. This was interpreted as acceptable since it allowed the researchers to collect data on four different lesson days in which the model was implemented. Some problems existed at the end of lessons with some of the monitors thereby reducing the number of heart rate files collected in the control group to 21 subjects in the sub-sample.

### *Curricular Intervention*

A mini-unit on basketball skills was taught by two student teachers simultaneously. Each

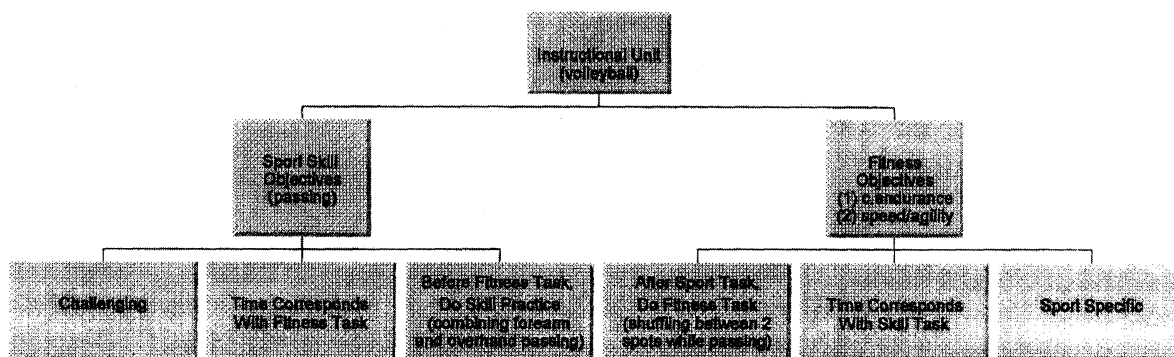
teacher instructed on half of a gymnasium floor to an average of 22 students. The student teachers had been trained prior to the semester to integrate fitness objectives within sport-related skill instruction; therefore, using the student teachers to present the material was appropriate. They also had prior teaching experience for an entire semester with home-schooled children (Everhart & Harper, 1997; Everhart, 1998) and with high school students in a 3-week teaching practicum. This allowed them to use the Fit-Sport Model prior to the student teaching experience. Inservice teachers in the area were not familiar with the model; therefore, it was deemed appropriate to use the student teachers as instructors for the research. The cooperating teachers had half of the physical education class during each period in another classroom or on the playing field for instructional activities unrelated to the research content. This enabled the research to be more controlled and for a more-manageable instructional environment for the teachers to implement the curricular model.

For each lesson, the experimental group always stayed on one half of the court, while the control group stayed on the other. The instructors taught on each half, changing after two lessons per group. This was to reduce the chances of instructor bias or an instructor effect. There were a total of three lessons per class extended over a 6-day period since the classes were divided so that some students were out of the gymnasium with the cooperating teachers. Those students were in the gymnasium on subsequent days engaged in the same lessons as their peers had been on the previous days.

### *Description of Activities*

The Fit-Sport Model (see Figure 1) was designed to engage students in sport-skill-related drills or activities in a way that the cardiovascular endurance was emphasized more than in traditional sport-skill instruction practices in physical education class. This model

# The Fit-Sport Model



**Figure 1.** Diagram of the Fit-Sport Model's interactional process for implementation in sport skill lessons.

has been modified from a similar model used at Samford University in which sport specific fitness activities are used during sport instructional courses so that students are gaining fitness benefits related to the sport they are learning (Dunaway, 1994a, 1994b, 1994c).

The model (Figure 1) depicts an instructional unit in which sport skill objectives and fitness objectives are important. In order for the model to be efficiently used, the sport skill activities must be challenging and the fitness objectives must be related to the sport. The rest of the model description relates to time. The completion of the sport skill task repetition is timed perfectly so that the fitness task can be completed just in time for the next repetition to occur for the sport skill practice. It is set up so that a sport skill drill attempt is performed just before a fitness task repetition is performed. It continues in a cyclical manner (sport skill repetition, fitness task repetition, sport skill repetition, fitness task repetition, etc. . . .).

In a volleyball passing activity (forearm pass and set), for example, a shuffle between spots

on the floor following each pass would occur. A floor hockey shooting lesson might have areas marked off so that students could shoot a ball or puck at a goal and switch with the goal keeper as quickly as possible to an adjoining goal. They would then switch back to the original goal repeat it. This would continue until 10 balls had been shot at goal (Note: The shooter does not have to wait for the goal keeper before she or he can shoot). A third example might be for a basketball passing lesson, a student in a square formation can pass a ball to a partner who passes to a third partner opposite him or her. The third partner would pass to a fourth partner who passes to the first student. After each student passes the ball, he or she runs back to touch a spot five feet away and get back just in time to catch the ball, pass it again, and run back to the spot again. This drill can be done with just pairs as well. The idea is to keep the students moving as much as possible during the drills (see Ward, Everhart, Dunaway, Fisher, & Coates, 1997). Effective pedagogical practices are still encouraged (eliminating/

reducing unnecessary waiting time, etc. . . .), though.

### *Data Analysis*

An independent t-test was used to analyze the differences between groups in relation to average heart rate per minute. A dependent t-test was also used to analyze the scores on the basketball shooting test.

### **Results**

The first t-test revealed a significant difference at the .05 alpha level between the experimental and control sub-samples,  $F(1, 1) = 14.479$ ,  $t = .044$ . The mean heart rate per minute for the experimental group was 145.5 beats per minute while the control group mean was 126.7 ( $t = .044$ ).

Results showed no significant differences between groups on the gain scores for the skills tests for basketball shooting ( $t = .373$ ). The experimental group gains mean for the shooting test was (.689) while the control group's was (1.007).

### **Discussion**

The purpose of this study was to determine the effects of a curricular intervention (Fit-Sport Model) on the heart rates and skill improvement of fourth and fifth graders in physical education. While results demonstrated that the curricular intervention generated significantly higher heart rates during the lessons, the model did not affect skill levels significantly. This was not unexpected, though. When students are not constantly moving during skill practice, it is doubtful that any training effects are occurring (Ignico, 1994). However, it is possible that the presentation style of a teacher and pace of the lesson affects how quickly students move through drill progressions. This may influence the occurrence of training effects also. To simplify, depending on the subject matter, if the teacher continues to extend the lesson tasks and students are constantly moving from one task to another, then it is possible that heart rates may con-

tinue to be at or near target zones for all or much of the lessons. That may be an area of study for future research.

The results of this study do not appear to indicate that student learning was increased by such an integrated fitness approach. Would a physical educator want to modify what he or she is doing if fitness objectives would more likely be achieved even though there might not be an improvement in the achievement of other objectives? One option would be to keep things the same and not worry about meeting fitness objectives differently. Another option would be to change the way sport skills are taught so that fitness objectives are met simultaneously (as in the Fit-Sport Model).

The curricular intervention in the form of the Fit-Sport Model generated significantly higher heart rates than the traditional skill practice model. Two relevant issues must be addressed, though. First, the results do not indicate how children's obesity levels, at-risk rates, or other health-related levels changed, which is of primary concern to fitness experts today (Bar-Or, 1987; Blair & Connelly, 1996; Lee & Paffenberger, 1996; NIH, 1995; Slatery, 1996). Second, the heart rates may have been higher due to the curriculum model, but the average heart rate generated still was not at or above target zone for the children. The low average heart rates may be due to the amount and duration of instructions given by the teachers during the lessons and slow transitions. That is, during instructional presentations and student transitions, heart rates may have decreased from where they were during activity times. This may have been corrected if the teachers had kept a rapid lesson pace going.

These are concerns to be addressed in future research on what children do in sport-related skill practice in physical education. A more longitudinal study may be the most appropriate mode of study involving obesity and fitness levels. These could be studied over time in relation to this model. Teachers can still modify what they typically do in order to

generate more positive fitness-related student outcomes. Physical education is a class in which children should be able to reach recommended amounts of physical activity for a more healthy lifestyle. Teachers may need to modify existing strategies and curricular models to assist students to be physically active as recommended for that healthy lifestyle.

#### REFERENCES

- ACSM (1995). *ACSM's guidelines for exercise testing and prescription* (5th ed.). Baltimore: Williams & Wilkins.
- Bar-Or, Q. (1987). A commentary to children and fitness: A public health perspective. *Research Quarterly for Exercise and Sport*, 58, 304-307.
- Blair, S., & Connelly, J. (1996). How much physical activity should we do: The case for moderate amounts and intensities of physical activity. *Research Quarterly for Exercise and Sport*, 67, 193-205.
- Burton, (C). The heart rates of elementary children during physical education classes. *Microform Publications*, (International Institute for Sport & Human Performance No. 410958)
- Corbin, C., & Pangrazi, R. (1996). How much physical activity is enough? *Journal of Physical Education, Recreation, and Dance*, 67, 33-37.
- Dunaway, D. (1994a). *Cornerstone pickleball*. Unpublished course outline packet. Samford University, Birmingham, AL.
- Dunaway, D. (1994b). *Cornerstone tennis*. Unpublished course outline packet. Samford University, Birmingham, AL.
- Dunaway, D. (1994c). *Cornerstone volleyball*. Unpublished course outline packet. Samford University, Birmingham, AL.
- Everhart, B. (1998, November/December). Perceptions of home-schooled physical education: Views from parents, students, and preservice teachers. *Journal of Physical Education, Recreation, and Dance*, 69, 51-55.
- Everhart, B., Everhart, L., Sands, C., & Dunaway, D. (1998, fall). The effects of combining a fitness emphasis during motor skill practice on third graders' enjoyment of physical education lessons. *The Physical Educator*, 114-120.
- Ignico, A. (1994). A longitudinal study of children's fitness levels during and following daily physical education. *Journal of the International Council for Health, Physical Education, and Recreation*, 30, 31-35.
- Lee, A., Carter, J., & Greenockle, K. (1987). Children and fitness: A pedagogical perspective. *Research Quarterly for Exercise and Sport*, 58, 321-325.
- Lee, I., & Paffenberger, Jr., R. (1996). How much physical activity is optimal for health: Methodological considerations. *Research Quarterly for Exercise and Sport*, 67, 206-208.
- Li, X.J., & Dunham, P. (1993). Fitness load and exercise time in secondary physical education classes. *Journal of Teaching in Physical Education*, 12, 180-187.
- Matanin, M., & Tannehill, D. (1994). Assessment and grading in physical education. *Journal of Teaching in Physical Education*, 13, 395-405.
- McKenzie, T., Alvarez, & Sallis, J. (1994). Assessing children's liking for activity units in an elementary school physical education curriculum. *Journal of Teaching in Physical Education*, 13, 206-215.
- McKenzie, T., & Sallis, J. (1997). Physical activity, fitness, and health-related fitness. In S. Silverman and C. Ennis (editors; 223-246) *Student learning in physi-*

- cal education: Applying research to enhance instruction.* Champaign, IL: Human Kinetics.
- National Institute of Health (1995, December). *National Institutes of Health Consensus Statement: Physical Activity and Cardiovascular Health*, 13 (3).
- Safrit, M., & Wood, T. (1995). *Introduction to measurement in physical education and exercise science* (3rd ed.). St. Louis: Mosby.
- Sallis, J. (1987). A commentary on children and fitness: A public health perspective. *Research Quarterly for Exercise and Sport*, 58, 326-330.
- Sallis, J., & Patrick, K. (1994). Physical activity guidelines for adolescents: Consensus statement. *Pediatric Exercise Science*, 6, 302-314.
- Simons-Morton, B., O'Hara, N., Simons-Morton, D., & Parcel, G. (1987). *Research Quarterly for Exercise and Sport*, 58, 295-302.
- Slattery, M. (1996). How much physical activity do we need to maintain health and prevent disease: Different diseases—different doses. *Research Quarterly for Exercise and Sport*, 67, 209-212.
- Strand, B., & Reeder, S. (1993). Using heart rate monitors in research on fitness levels of children in physical education. *Journal of Teaching in Physical Education*, 12, (2), 215-220.
- Strand, B., Scantling, & Johnson (1997). *Fitness Education. Teaching Concepts-Based Fitness in the Schools.* Allyn and Bacon: Boston.
- Stratton, G. (1996a). Children's heart rates during British physical education lessons. *Journal of Teaching in Physical Education*, 16, 357-367.
- Stratton, G. (1996b). Children's heart rates during physical education lessons: A Review. *Pediatric Exercise Science*, 8, 215-233.
- Veal, M.L. (1988). Pupil assessment issues: A teacher educator's perspective. *Quest*, 40, 151-161.
- Veal, M.L. (1990). Measurement and evaluation curricula in professional physical education preparation programs: A view from the practitioner. *Journal of Physical Education, Recreation, and Dance*, 61, 36-38.
- Verabioff, L. (1988). Fitness behavior during physical education class. *Canadian Association for Health, Physical Education, Recreation, and Dance*, 54, 31-36.
- Ward, B.M., Everhart, B., Dunaway, D., Fisher, S., & Coates, T. (1998). Emphasizing fitness objectives in secondary physical education. *Journal of Physical Education, Recreation, and Dance*, 69, 33-35.

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