

The Effect of Incorporating Math Skills into Physical Education Classes on Math Achievement of Second Grade Elementary Students

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Abstract: The effect of embedding math skills into physical education lessons on math achievement of second grade students in two classes was investigated. There were no statistical differences between the experimental (PE/Math) group and the control group. However, practical observations indicated more research is needed in this area.

Two important objectives of most quality physical education programs are to promote individual fitness and to develop motor skills through movement activities. Because young children enjoy moving and playing games, most elementary students look forward to participating in physical education classes. Unfortunately and quite often, physical education is thought of as a periphery subject within educational settings. That is, many school administrators, classroom teachers and parents do not consider physical education an essential part of the academic curriculum. This notion is prevalent throughout educational systems for two related reasons. First, many individuals do not appreciate the value of what children are being taught in the gymnasium and as a result, perceive physical education as an extended recess or recreational period. The second reason is that integrated lesson planning between classroom and physical education teachers typically occurs at a minimum, if at all. This, in turn, limits the knowledge of teachers as to what occurs in various instructional settings and across academic areas.

Physical education programs are valuable to the holistic development of children because learning outcomes occur within several domains. In addition to addressing psychomotor objectives by developing fitness and sport skills, many elementary physical education curriculums within the United States contain learning experiences geared at facilitating the cognitive development of children. This is accomplished in part through perceptual motor activities. Perceptual motor activities are movement-based and focus on developing balance, spatial, temporal, directional and body awareness within individuals. These types of activities are believed to augment the cognitive and academic development of younger students (Payne & Isaacs, 1999). Although the cognitive and academic benefits of participating in perceptual motor programs have been debated in the related literature, they do serve as a mechanism through which academic subjects can be taught to children in a motivating manner (Gallahue & Ozmun, 1998; Payne & Isaacs, 1999). To do this, however, integrative lesson planning between classroom and physical education teachers is needed.

Integrative and cooperative lesson planning between teachers is gaining popularity within educational environments because of the professional and emotional benefits teachers derive from this practice. The instructional energy of teachers is often enhanced when teachers are connected with their colleagues professionally as well as emotionally (Graves, 2001). Interactions between teachers create natural social support networks and environments conducive to collaborative planning. In many instances, however, connections between physical education and classroom teachers are difficult to initiate and maintain because of the locations of their planning and instructional settings. Another obstacle to integrative planning between the

classroom and physical education teacher is that the connections between subject areas are not overtly noticeable. This may be due, in part, to differences in learning environments (i.e., open vs. closed). What many teachers do not realize is that teaching methods and instructional strategies are similar across content areas and instructional settings (Graham, Holt-Hale, & Parker, 2001; Pangrazi, 2000). Given that motor performance variables have been shown to be related to the academic abilities of elementary school students (Harris & Jones, 1982), barriers to integrative planning between elementary classroom and physical education teachers must be overcome to promote holistic student learning.

Learning is most enjoyable when it is fun for the students. In some instances, the joy of learning is lost when learners do not find the content meaningful. Creating meaningful and stimulating learning environments remains a challenge to many teachers, especially those in mathematics (Kajander, 1999). Teachers may forget that young children learn most effectively through the kinesthetic modality. Quite often, teachers use very structured organizational formats to maintain appropriate "indoor" student behaviors and choose instructional formats that include sedentary, independent or small group learning formats rather than movement-oriented and play-like arrangements (Corso, 1999).

The best teachers teach largely through playing purposefully with children (Greenberg, 1993). Academic areas such as math, reading and social studies can be taught to children in an enjoyable manner utilizing movements and games (Gallahue & Ozmun, 1998; Payne & Isaacs, 1999). Play and other movement activities that require children to make use of age-appropriate cognitive processes serve to strengthen those processes within the children (Lee, Silverman & Montoya, 2002; Pasnak, 1999). Moreover and specific to this study, experts in teaching mathematics encourage others in the field to employ strategies that make math physical (Moss, 1997). This type of learning strategy and related instructional strategies are readily found in developmentally appropriate physical education curriculums (Graham, Holt-Hale, & Parker, 2001; Pangrazi, 2000).

During physical education classes, students are presented with many activities where math concepts can be applied. For example, students are often asked by their physical education teachers to divide themselves evenly into groups, find the area of a basketball court or compute their gains or losses on fitness tests. Play, fitness and movement activities such as modified sport games enable children to exercise and develop cognitive processes in a way that is exciting (Weininger & Daniel, 1992). As promising as this may sound to most educators, few studies have focused on embedding classroom subject areas into the physical education curriculum. The purpose of this investigation was to determine the effect of incorporating math skills into physical education classes on the math achievement of second grade students.

Methods

Participants

Two cluster second grade classes from a public elementary school were selected to participate in this study. Each class consisted of 28 students heterogeneously grouped by reading level.

Procedure

The math teachers of the two classes participating in this study developed pre and post-instructional math tests specifically for this investigation. These tests consisted of math

concepts, questions, and problems that paralleled the math portion of the standardized achievement test used by the state of Florida, the Florida Comprehensive Assessment Test (FCAT). The pre and post tests each consisted of 20 math problems covering addition, subtraction, charting and symmetry. Students were allowed 45 minutes to complete each test. No significant differences were found between the pre-instructional math test scores of the two second grade classes (PE/Math: $M = 13.81$; Control: $M = 13.62$).

The duration of this investigation was four weeks. Following the pre-instructional math test, each class received math instruction for one hour every day and met for physical education two times each week for 30 minutes. Instruction in math and physical education classes were similar for each class of second graders. Each class participated in comparable physical education activities, which included cooperative games, fitness experiences, sport skill instruction and activities and rhythm movements. The only observable difference in the physical education instruction between the two classes was that math concepts were incorporated into the lessons of the PE/Math class. For example, the physical education teacher would ask the students in the PE/Math class to get into four equal groups. If the groups were not equal, the teacher would ask the students to determine the difference between groups. Unlike the PE/Math class, the physical education teacher would assign students to groups in the Control class. Florida's educational objectives, the Sunshine State Standards, for math and physical education were incorporated into the lessons plans for the PE/Math class. Examples of lesson objectives for the PE/Math class are located within the Appendix.

Following the four week instructional period, the post-instructional math test was administered to the two classes.

Results and Discussion

There were no statistical differences between the two classes (PE/Math: $M = 15.23$; Control = $M = 14.10$). However, some outcomes of practical importance were revealed. First, the two classroom math teachers were not teaching their classes in parallel with the physical education teacher and therefore, the math concepts were not reinforced and practiced in the math class and physical education class simultaneously. In fact, when one math teacher introduced the concept of symmetry to her class, she was surprised that her students already knew what it was because they had been introduced to it previously in their physical education class.

More collaboration in planning across the elementary school curriculum was needed on an ongoing basis. In addition to unit planning, teachers need to discuss learning objectives continually, with emphasis placed on the present progress of students. This practice will provide a better opportunity for teachers across subject areas to reinforce or modify learning objectives to the needs of the students. Furthermore, more research in this area is needed to ascertain the true effects of collaborative planning and embedding academic areas within physical education lessons. This study lasted for a short period of time. Students participated in only 8 physical education lessons in which math concepts were embedded. Perhaps a study maintained over the course of a semester, or a complete school year would have yielded more favorable results.

One natural outcome of this study is that students in both physical education classes had fun. As mentioned previously, learners best understand concepts if they are presented in meaningful and enjoyable contexts. Physical education classes and activities provide a wonderful framework to explore new concepts from areas of the educational curriculum, and teachers across disciplines must work collectively and collaboratively to make sure this occurs.

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Appendix
Lesson Plan Examples (with Florida Sunshine State Standards)

Unit Focus: Free-Throws & Fractions.

Students will:

- Know how to demonstrate functional patterns of shooting a basketball (PE.A.1.2.3)
- Know the proper techniques for shooting a basketball (PE.A.1.2.3.)
- Solve problems involving fractions and percents, using the most appropriate representation of a number for a given circumstance (MA.A.3.2.3)
- Relate percents to fractions and decimals and justify the reasoning (MA.A.1.2.4)

During a basketball shooting lesson, students can focus on both the motor skills as well as their cognitive skills. Have students use the proper technique for shooting free throws. Give each student ten tries and ask them to record how many successful baskets they make. Use ten at the beginning to make it easier for the students to understand. Have the students record their results in a fraction form. For example, if a student made 4 baskets out of ten, he or she would record $\frac{4}{10}$. Have the students simplify the fraction. You can also teach them how to convert it to a percentage. The student made 40% of his/her baskets. You can extend the lesson by having the student figure out what percentage he/she missed.

Unit Focus: Throwing and Measuring.

Students will:

- Know various techniques for throwing different objects (PE.A.1.2.1.)
- Recognize the proper techniques of performing an overhand throw (PE.A.2.2.1.)
- Know the reason that appropriate practice improves performance (PE.A.2.2.3.)
- Verify estimated measures for length (MA.B.4.2.2.)

When working on throwing and catching, you can have the students measure the distance. Give each group of students a measuring tape. As the student throws the ball into an open field, another student will focus on where the ball lands. As a group, they measure the distance of their throw.

Unit Focus: Relay Races and Math Equations.

Students will:

- Define track and field terms and identify the events (PE.A.1.2.4)
- Run while placing the baton in the hand of an already moving receiver (PE.A.2.1.5)
- Exhibit good sportsmanship (PE.C.1.1.1)
- Explain the difference between sprint, relay, and distance races (PE.A.1.2.4 & MA.B.1.1.1)
- Use mental math to find sums (MA.A.3.1.2)

When working on relay races rather than just running and coming back to tag the next person, have the students pick up cards with math equations and cards with the answers. When all the students have picked up a card, they must now get together and match the questions to the answers. The team to complete it first wins the race. This gives a fair opportunity for both students who are physically fast and students who can mentally answer questions fast.