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Effect of Physical Education and Activity Levels

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ABSTRACT

This study was conducted to determine the effect of physical education class enrollment and physical activity on academic achievement in middle school children. Methods: Participants were 214 sixth-grade students randomly assigned to physical education during either first or second semesters. Moderate and vigorous physical activity (MVPA) (number of 30-min time blocks) outside of school was assessed using the 3-d physical activity recall (3DPAR). Students who either performed some or met Healthy People 2010 guidelines for vigorous activity had significantly higher levels (P G 0.05) than students who performed no vigorous activity in both semesters. Moderate physical activity did not affect scores. Standardized test scores were not significantly linked to physical education class enrollment or physical bodily function levels.

Key Words:PEDIATRICS, EXERCISE, SCHOOL, ACADEMIC PERFORMANCE

Numerous surveys have demonstrated positive relationships between academic achievement and both physical activity (3,8,10 –12,16–18,20) and sports participation (7), whereas a few have demonstrated no correlation (6) or an inverse relationship (21). The mechanisms by which students, may improve academic achievement as a result of increased physical activity through physical education include increased arousal and reduced boredom, which may contribute to increased attention span and concentration. Increased activity levels might as well be linked to increased self-esteem, which could be

required to improve classroom behavior as well as academic performance (16). Most previous studies are cross-sectional. Longitudinal evaluation of physical education classes, physical activity participation, and academic achievement may offer more complete information about their true relationships. This investigation was conducted to see the outcome of physical education class registration and overall physical activity with academic achievement in middle school children over the course of an academic year.

METHODS

The participants in the study. Participants were 214 sixth-grade students from a single public school in West Michigan. The mean income for this school district is higher when compared with the median income of the state of Michigan. The racial breakdown of students in the district is 62.7% white, 17.5% Hispanic, 8.6% Asian, 5.8% multiracial, 3% black, 0.2% Native American, 0.1% Pacific Islander, and 2.1% other. There were 7875 scholars enrolled in these schools (K–12) for the 2002–2003 academic yr. Apiece of the 622 sixth-degree students in the school had the opportunity to be called for in the work. A bundle containing the consent and assent forms was mailed home with each student on the inaugural day of school (August 2002).

In accord with school policy, all sixth-level students were arbitrarily allotted to one of four teams by administrators. Each team consisted of one teacher from each of the core classes (mathematics, scientific discipline, English, and world studies). Each pupil on a given team had the same teachers for the kernel classes, simply they were randomly assigned the order in which they had each class. There were just two physical education instructors and one teacher for each exploratory class, which is why the students were randomly assigned these classes for only one semester. Scholars were not allowed to switch teams or to request a team to be with friends. The appointment process was serendipitous, rather than the outcome of a preplanned study. For the design of this work, students were put into one of two groups. One group was enrolled in physical education during the first semester (August to mid-January), and the other group was enrolled in physical education the second semester (mid-January to

June). During the semester that the students did not receive physical education, they were enrolled in an alternative exploratory class (i.e., arts and computer classes). All classes met every day of the week for 55 min.

The pupils took part in the survey on a voluntary base. All pupils in sixth grade received a package containing an informational letter about the subject as well as the assent and consent forms on the inaugural day of school. The pupils who turned back the signed assent and consent forms were included in the survey. The participation rate was 36.8% (229 of 622). Complete data collection was obtained in 93.4% (214 of 229) of the students who took part. Each participant was evaluated three times: at the beginning (August–September), middle (January), and end (May– June) of the school year. The study was approved by the university_s committee on research involving human studies at Michigan State University. Written informed child assent and parental consent were obtained before each participant went into the theater.

Anthropometry. Height was measured to the nearest millimeter with a field anthropometer (GPM, Martin type; Pfister Import-Export, Inc., Carlstadt, NJ) by one trained technician. Weight was measured to the nearest 0.1 kg using a calibrated digital scale (Precision Health Scale UC-300, Milpitas, CA). The body mass index (BMI; kgImj2) was then calculated.

Physical activity recall. Habitual physical activity was estimated using the 3-d physical activity recall (3DPAR), a variation of the previous day physical activity recall developed by Weston et al. (23). The 3DPAR asks each child about his or her previous day's actions for three sequential days. Specifically, the youngster was asked to come back on Wednesday activities that had been performed on the previous Sunday, Monday, and Tuesday. These 3 d was divided into 30-min blocks, and participants were instructed to choose a single activity code for each 30-min block. If the child performed more than one activity, the bodily function performed for most of that 30-min period was listed. For each 30-min block, the child also provided an intensity level for the activity performed.

MET values for each activity in the questionnaire were received from a previous validation study (23) and the compendium of physical activity (1,2). For analytic purposes, the figure of 30-min time blocks of moderate (Q 3.0j5.99 METs) and vigorous (Q 6.0 METs) activity was used to find each child's stage of activity outside of school. In addition to the 30-min blocks for moderate and vigorous action, activity scores were converted to ordinal data. Scores of 1 (no activity), 2 (some activity), or 3 (an activity that meets Healthy People 2010 guidelines) were consecrated to each student, based on bodily function levels, for moderate and vigorous action. This transition was performed because youth are encouraged to see the guidelines for physical activity set by the Healthy People 2010 program. Healthy People 2010 guidelines for moderate activity are 30 minId^{j1} for at least 5 dIwk^{j1} and, for vigorous activity, 20 minId^{j1} for at least 3 dIwk^{j1} (22).

Academic achievement is abysmal. Academic achievement was based on individual grades for each pupil in the core classes (mathematics, scientific discipline, English, and world studies) and a similar test grade. For analytic purposes, individual letter grades were changed to numeric data: A = 5, B = 4, C = 3, D = 2, F = 1. Tiers for the four courses were summed over two marking periods to calculate a grade mark for each semester. First-semester grades were reported in November and January, and second-semester grades were reported in April and June. Numeric grade scores could range from 8 (all fees) to 40 (all As).

Terra Nova standardized test scores were also utilized as a criterion of academic accomplishment. Terra Nova scores are derived from a national standardized test, which consists of multiple assessments of reading or language arts, maths, scientific discipline, and social fields. The exam is administered in April (second semester), and scores (percentiles) can run from 1 to 99.

System for Observing Fitness Instruction Time (SOFIT). The System for Observing Fitness Instruction Time

RESULTS

Age and anthropometric and demographic features of the sample are recorded in Table 1. The only substantial deviation between the groups was in BMI. Because no pretest grade data were available, only midpoint (end of first semester) and posttest (end of second semester) data for combined scores are shown in Tables 2 and 3. Academic achievement (combined scores) was not impressed by the timing of physical education class registration (i.e., first or second semester) (Table 2). The Terra Nova standardized test scores, expressed as percentiles, were also not affected by physical education class enrollment (55.3 T 27.5 (first semester) vs 60.6 T 20.3 (second semester)). Nevertheless, students who performed vigorous physical activity at a level that matched or exceeded the Healthy People 2010 guidelines

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TABLE 3. Distribution of grades, moderate, and vigorous physical activity (mean T SD).

Physical Activity Variables	First Semester Combined Mark	Second Semester Merged Mark
Moderate physical activity (1 = no activity) (N = 55, first semester; N = 33, second semester)	34.3 T 6.1	30.4 T 7.9
Moderate physical activity (2 = some activity) (N = 47, first semester; N = 36 second semester)	33.7 T 6.5	33.5 T 6.8
Moderate physical activity (3 = activity meeting	33.4 T 7.6	33.2 T 7.5

Healthy People 2010 guidelines) (N = 92, first semester; N = 119, second semester)			
Vigorous physical activity (1 = No activity), (N = 145, first semester; N = 131, second semester)	32.9 T 6.8	32.0	T 7.5
Vigorous physical activity (2 = some activity), (N = 12, first semester; N = 11, second semester)	35.5 T 6.9*	31.6	T 11.3
Vigorous physical activity (3 = activity meeting Healthy People 2010 guidelines) (N = 37, first semester, N = 46, second semester)	35.9 T 5.9*	35.1	T 5.7†

* Significantly different from level 1 vigorous physical activity, W^2 = 10.1; def = 2; P G 0.006.

†Significantly different from stage 1 and 2 vigorous physical activity P G 0.05, W2 = 6.05; def = 2; P G 0.049.

Achieved higher academic scores compared with the other students in both first (W^2 = 10.1; def = 2; P G 0.006) and second (W^2 = 6.05; def = 2; P G 0.049) semesters (Table 3). No substantial differences were found in academic achievement and Terra Nova scores as a mapping of action level during either semester (moderate physical activity 56.0 T 25.4 (1) vs 56.5 T 24.6 (2) vs 57.4 T 25.7 (3); vigorous physical activity 57.0 T 25.5 (1) vs 70.8 T 16.3 (2) vs 55.5 T 26.1 (3)).

DISCUSSION

We speculated that students enrolled in physical education would have better academic achievement than those not enrolled in physical education because of increased levels of physical activity gained during class time. We also speculated that students who achieved the Healthy People 2010 guidelines for physical action would cause the highest academic achievement. Physical education class enrollment status did not influence academic achievement in core categories. Using SOFIT, we found that an norm of 19 men of the 55-min class period was spent in moderate to vigorous action. This low level of activity may not provide sufficient stimulation to determine academic achievement.

Shepherd (16) has indicated that increased physical activity during the school day may cause arousal and reduce boredom, which can contribute to increased attention span and concentration. Shepherd also suggested that increased activity levels might be linked to increased self-esteem, which would improve classroom behavior as well as execution. It is potential that a threshold stage of activity may be asked to make these potentially desirable effects. This may explain why increases in academic functioning are linked up with vigorous action and not with moderate physical activity in the present investigation.

Effects of the Trois Rivieres study (Quebec, Canada) indicate that scholars who received an hour of physical education per day in addition to the standard physical training course of study (1 dIwkj1 for 40 min) showed better academic performance compared with control subjects who just received the standard physical education course of study (17). The authors assessed academic achievement using average grades for French, English, math, natural science, and behavior. These cases were similar to the core classes used to assess academic achievement in the present work. The Trois Rivieres findings suggest that if students in physical education receive an adequate measure of physical activity during class sessions, they may perform better academically.

Pupils enrolled in physical training class during the present study did not perform better academically than those who held an extra 55 min of classroom time. Decreased class-room time, nevertheless, did

not translate into a lesser academic performance, either. Previous research where additional time during the school day was allocated to physical education programs showed similar results, demonstrating that de-creased time spent in academic programs did not adversely affect the academic performance of the students (6,14).

Classes were also compared with out-of-school, self-reported physical activity levels. The measure of moderate physical activity performed by the students did not affect academic achievement. A significant association, notwithstanding, is found between vigorous activity and academic accomplishment. During the first semester, when the study participants performed any amount of vigorous activity, they did better academically compared with students who participated in no vigorous activity. During the second semester, but pupils who hit or passed the Healthy People 2010 recommendations for vigorous activity performed better academically compared with pupils who performed only a small amount of, or no, vigorous activity (Table 3). These findings could be construed as indicating that the vigorous activity levels may meet the threshold of physical activity intensity necessary to positively influence academic performance. It is also possible, nevertheless, that these associations represent confounding by socioeconomic position. The relationship between physical activity and academic accomplishment that is noticed in this study may no longer be important when controlling for socioeconomic status. Previous research has shown that socioeconomic status is linked to higher degrees of physical bodily function and more sports participation in youth (12,13). This may explain why children who take part in vigorous physical action, such as plays, perform better in school.

In a comprehensive review, Keays and Allison (8) noted several studies showing the positive effects of daily moderate to vigorous physical action on student performance and academic accomplishment. Academic achievement in individual studies was defined as memory, reflection, problem solving, and decision making. These criteria of academic achievement differ from those in the current survey. However, the results however show an association between increased levels of physical bodily function and improved academic performance.

The only subject that offers a comparable figure to the present investigation is the Trois Rivieres study (17). The study designs were similar, leave out that all pupils received the treatment (physical education) in the present survey. Academic achievement was assessed using grades from core classes in both subjects. In the Trois Rivieres study, physical bodily function over the course of an entire day was assessed using diaries and physical activity recalls. In the present work, physical activity outside of school was evaluated using a 3DPAR. Habitual physical activity outside of school was similar in the experimental and control groups in both studies (15). The outcomes suggest that increased academic achievement in the Trois Rivieres study was determined by the increased time spent in physical education grades. Our work demonstrated that physical activity outside of school influenced academic achievement, not physical activity done during physical training course of study.

Standardized test scores were also examined in the present survey. The Terra Nova test was distributed during the second semester (April). Although the outcomes were not statistically significant (P G 0.12), test scores were approximately 10% higher for students who were concurrently enrolled in physical training class (55.3 T 27.5 (physical education first semester) vs 60.6 T 22.3 (physical education second semester)).

As mentioned, a threshold of activity intensity may be needed to bring about changes in the child that contribute to increased academic achievement. Activity of vigorous intensity may be necessary to reach the threshold. In the present survey, many participants attained activity of vigorous intensity in sports participation. It is possible that sports participation provides an adequate volume level to satisfy the threshold necessary to see desirable effects of physical activity on fitness and academic accomplishment. During the first semester, 48.5% of students played on sports teams, with most playing soccer and football. During the second semester, 37.5% of students played on sports teams, primarily basketball and indoor soccer. At the end of the study, 39.5% of students played sports, with most active in soccer and baseball or softball.

A strong point of the present work is that students were arbitrarily assigned to first- or second-semester physical education class enrollment without bias. In addition, we were able to access semester grades

and standardized examination scores of all student participants. The potential influence of socioeconomic status on the observed association between vigorous physical activity and academic achievement cannot be ruled out (12,13). A limitation of this work was the lack of data on socioeconomic status. This deficiency of data may direct to a mistaking of the data along the observed relationship between physical activity and academic accomplishment. It is possible that physical activity may be merely a marker for more capital degrees of academic achievement and may not be a causal component. It is significant to note that socioeconomic status may be the major grounds of academic functioning (i.e., high socioeconomic status is responsible for higher degrees), with physical activity level acting as a mediator in this relationship. Nevertheless, it is not possible to find the true cause because socioeconomic status information were not compiled as part of the work. This fact should be considered when reading the outcomes.

In summary, improved academic performance was linked up with vigorous activity obtained outside of school in the present work. The findings indicate that a potential role may exist for vigorous activity in physical education grades. Although students did not perform better academically during the semester that they were enrolled in physical education, the results show that they did not exhibit a reduction in academic achievement compared with pupils who got an additional hour of academic instruction per day.

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