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Effects of a Curriculum and Inservice Program on the Quantity and Quality of Elementary Physical Education Classes

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The primary responsibility for engaging children in opportunities to be physically active and learn physical skills rests with school physical education. This study evaluated the effects of a combined health-related curriculum and inservice program on the quantity and quality of elementary school physical education lessons. Seven schools (N = 28 fourth-grade classes) in one district were randomly assigned to one of three conditions: 10 classes were taught in their usual manner by classroom teachers (Control [CO]); 10 classes were taught by trained classroom teachers (TT) who received inservice training and follow-up consultations; and 8 classes were taught by physical education specialists (PES) hired by the research project. Student activity level, curriculum context, and teacher behavior were directly observed and coded during a sample of 112 lessons over an 8-month period. Results indicated significant differences in both the frequency and mean length of classes (PES, 26.7 min; TT, 23.4 min; CO, 18.9 min). Additionally, the curriculum and inservice program equipped trained classroom teachers to provide significantly better classes than were provided by controls in terms of student activity engagement, lesson context, and active instructional behavior, though their classes did not match the quality of those taught by the physical education specialists. This study is unique in its use of direct observation of lessons to assess a curriculum and inservice intervention.

Key words: elementary physical education, teacher preparation, physical activity, systematic observation

A basic function of physical education is to engage learners in moderate to vigorous physical activity (MVPA), a requirement for experiencing both health and motor skill development benefits. By providing opportunities for physical activity, quality physical education can make important contributions to public health (Sallis & McKenzie, 1991). The key role of physical education in children's health was recognized in the *The Year 2000 Health Objectives* (McGinnis, Kanner, & DeGraw, 1991; U.S. Public Health Service, 1991). One objective calls for increasing the proportion of children who participate regularly in daily physical education. Another calls for the amount of time that students are active during physical education lessons to be increased to at least 50%, preferably in lifetime physical activities. Large amounts of activity time during physical education are associated with curricula that emphasize cardiovascular fitness development (McKenzie, Sallis, & Nader, 1991). The amount of physical activity in physical education lessons is related to the type of sport (Metzler, 1980), with gymnastics and softball typically having low activity engagement. Additionally, specific instructional behaviors have been identified that promote and motivate higher levels of participation and activity (Taggart, 1985). Active teaching behaviors such as modeling, prompting, and reinforcing have received general support in the physical education literature for their success in promoting participation and learning (Siedentop, 1991).

While nearly all children in the United States are enrolled in physical education in elementary schools (Ross, Dotson, Gilbert, & Katz, 1985; Ross, Pate, Corbin, Delpy, & Gold, 1987), not all receive instruction of sufficient quantity and quality to produce fitness and motor skill development (Sallis & McKenzie, 1991; Simons-Morton, O'Hara, Parcel, & Baranowski, 1990). Numerous studies indicate that students in classes of physical education specialists spend large amounts of class time being inactive (Metzler, 1989; Silverman, 1991). That inactivity is related to the curricular choices that teachers make and to their instructional behaviors (Faucette, McKenzie, & Patterson, 1990).

Many physical education curricula are available, and they vary widely in philosophy, theoretical basis, and instructional methods. For most of the 20th century, the dominant physical education curricula have emphasized skill-related (athletic) fitness or movement education,

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though developmental, humanistic, and personal meaning curricula also have been promoted (Steinhardt, 1992). In the past 10 to 15 years, the emphasis has begun to shift to the effects of physical education on the health of children, as the important health effects of physical activity have become documented (Blair, Clark, Cureton, & Powell, 1989; Sallis & McKenzie, 1991). Health-related physical education programs have sought to promote fitness components of cardiovascular endurance, muscle strength and endurance, and flexibility (Simons-Morton, O'Hara, Simons-Morton, & Parcel, 1987), as well as establish a pattern of physical activity that may carry over to adulthood and reduce the risk of chronic diseases (Sallis & McKenzie, 1991). Several studies have demonstrated that health-related physical education curricula in elementary schools can increase physical activity during class (Simons-Morton, Parcel, & O'Hara, 1988), improve cardiovascular fitness (Duncan, Boyce, Itami, & Paffenbager, 1983), and improve cardiovascular disease risk factors (Dwyer, Coonan, Leitch, Hetzel, & Baghurst, 1983). However, the curricula in these studies were not comprehensive approaches to physical education. The curriculum developed as part of the present study was designed to be comprehensive, with an emphasis on health outcomes. Thus, it was developed to meet several criteria. First, it should promote high levels of physical activity for all children, regardless of skill level. Second, it should promote health-related fitness through aerobic activities and allow for sport skill development to enhance success and enjoyment of activities. Third, it should be practical and able to be implemented by classroom teachers. The present study evaluates the extent to which the curriculum leads to high activity levels as taught by both physical education specialists and trained classroom teachers.

Studies that compare physical education taught by specialist and nonspecialist teachers generally support the superiority of the physical education specialist both in process and outcome measures (Faucette et al., 1990). However, a substantial amount of elementary school physical education is taught by nonspecialists who may have limited training in physical education. For example, classroom teachers in California are responsible for up to 97% of the elementary physical education classes, and until recently California universities awarding elementary teaching credentials were not even required to offer a single course in physical education instruction (Petray, Hennessey, & Coulter, 1984). To supplement limited preparation, teachers are frequently offered a variety of inservice training or staff development programs. The diversity of inservice training in physical education has been described in the literature (Locke, Graber, & Dodds, 1984; Martinek & Schempp, 1988), with formats ranging from a 1-hour session conducted on site after school to week-long summer sessions at university campuses.

A concern relevant to each of these formats is the effectiveness of such staff development for classroom teachers who may be required to teach physical education. Although most inservice programs are evaluated immediately, mainly through participants' subjective ratings, few studies have been conducted to examine their long-term effects. Taylor (1977) recommended assessing the impact of inservice training in general education by measuring teacher and student behaviors in the natural setting. This notion is also supported in physical education (Locke et al., 1984); however, rarely have the effects of an inservice training in physical education been documented by data generated through direct observation of participants' lessons (Faucette, 1987).

The purpose of this study was to evaluate the efficacy of a combined health-related curriculum and inservice program on the quantity and quality of elementary school physical education lessons. The physical education lessons of elementary school classroom teachers who participated in an extensive inservice training program were compared to lessons of teachers who did not receive the training and to those taught by physical education specialists.

Minutes of physical activity is the common measure of exposure to physical activity in epidemological studies with children (McKenzie, 1991; Simons-Morton et al., 1990). Additionally, time variables have been promoted as measures for discriminating between more and less effective teachers in general education (Smyth, 1985), and time is a widely studied variable in teacher effectiveness in physical education (Metzler, 1989; Silverman, 1991). Units of time, including minutes and percentage of class time, obtained through direct observations of the frequency and length of lessons as well as the student activity levels, lesson context, and teacher behavior, served as primary measures in the present study.

Method

Setting and Subjects

After being matched for size and ethnic make-up (percent white), 7 of 12 elementary schools in a single district in Southern California whose administrators volunteered to participate were randomly assigned to one of three conditions: control (CO), trained classroom teacher (TT), and trained physical education specialists (PES). The schools were situated in a middle-class suburb of a large city, and all followed a traditional 10-month schedule. Equivalent space was available at each site, and similar amounts and types of equipment were provided to implement the curriculum at each school, including controls. Teachers provided signed consent for partici-

pating and could withdraw from the study at any time. All 4th grade classes ($N = 28$) in the 7 schools participated in the project.

CO classes ($n = 10$) were taught in their usual manner by credentialed classroom teachers. No attempt was made to alter either their curriculum or instructional behaviors. TT classes ($n = 10$) were taught by credentialed classroom teachers who received 23 hours of inservice training in physical education as well as weekly follow-up consultations. PES classes ($n = 8$) were taught by two credentialed physical education specialists who were hired specifically for the study and trained to implement the curriculum. One, a female just beginning her professional career, taught five classes. The other, a male with 12 years of teaching experience, taught three classes and consulted with TT classroom teachers four afternoons per week. Teachers of the TT and PES classes used a specially designed curriculum that combined fitness and sports skill units.

Physical Education Curriculum

The curriculum used in PES and TT classes was designed specifically to promote high levels of student physical activity and skill practice. Each teacher received a project guide and a three-ring binder containing the curriculum, which included a yearly plan divided into units of instruction for both fitness and sports skill development. Activity progressions were provided for each unit, and both skill and managerial cues were provided for each activity. PES and TT classes were taught the same instructional units.

Lessons were scheduled to be 30 min in length and offered three times per week throughout the entire year. A detailed lesson plan was provided for each class, which was to include a 15-min fitness and a 15-min sports skill segment. Lesson plans, designed to attach to clipboards for use at instructional stations, identified the number and pieces of equipment needed, class formations and transitions, and instructional cues for skills being taught that day.

Inservice Training Program

Research on training teachers to implement a new curriculum (staff development) indicates there are at least four important components: creation of teacher awareness of the goals of the new program and differences from the former program; specific-skill training; on-going administrative support; and group support with feedback (Anderson, 1982; Faucette, 1987; Knowles & Hord, 1981). In this study, each of these components was incorporated into the extensive training program for the TT teachers. The inservice program was conducted by university physical education faculty and a trained physical education specialist who simultaneously implemented the curriculum in a PES school. The goals of the inservice program were threefold: to develop teachers' commitment to the physical education curriculum, to help them understand the curricular units and activities, and to develop their class management and instructional skills so they could implement the curriculum effectively.

Substitutes were provided to allow the TT teachers to participate in the group training sessions that were held at alternating school sites during school days. Attendance by TT teachers at the 11 sessions (23 hours), which were spread throughout the school year, was 89%. Teachers evaluated each session by completing anonymous questionnaires. School principals from the intervention schools and the district assistant superintendent were invited to participate in all inservice sessions, and they attended at least the first and the last sessions.

The physical education specialist/consultant visited each of the TT schools two afternoons per week to provide on-site follow-up consultations with both individuals and small groups of teachers. These sessions involved the consultant/specialist assisting teachers by leading grade-level planning meetings, modeling lesson segments, coordinating space and equipment use, and giving verbal and written feedback to teachers after observing their lessons.

SOFIT Observations

A previously validated observation instrument, SOFIT (System for Observing Fitness Instruction; McKenzie et al., 1991), was used to obtain information on both the quality and quantity of instruction provided during physical education lessons of teachers in the CO, TT, and PES conditions. Using the instrument, trained observers were able to assess the curriculum implementation in terms of student activity levels, curricular lesson context, and teacher behavior. Through momentary time sampling, randomly selected students were coded every 20 s during a lesson to determine the intensity of their physical activity. Codes 1 to 4 described the body position of the student (lying down, sitting, standing, walking) and Code 5 (very active) identified when the student was expending more energy than would be expended during ordinary walking. Coding was based on the observed activity of the individual student at the moment the 10-s observation interval ended.

The curricular lesson context was also coded every 20 s. First, observers decided if the class time was allocated for general content (such as management) or for actual subject matter (physical education) content. If physical education content occurred, it was then coded as knowledge content *(general knowledge* or *physical fitness knowledge)* or motor content *(physical activity)*. If motor content was occurring, it was further coded as either *fitness, skill practice,* or *game play* context.

Using partial interval recording, the teacher's behavior was coded into one of six categories every 20 s. The first behavior category, *promotes fitness,* was coded if the teacher prompted students for physical engagement. The second category, *demonstrates fitness,* was coded when the teacher modeled or engaged in fitness activities. The remaining categories, *instructs generally, manages, observes,* and *off-task,* were used to describe teacher behaviors indirectly related to student fitness opportunities.

Precautions were taken to reduce the possibility of reactivity by teachers to the presence of observers. The SOFIT visits were made over an 8-month period, were not preannounced, and were made by measurement personnel, none of whom were part of the intervention team. Observers provided no feedback to the teachers and, except for acknowledgement and normal consideration, did not interact with them.

Observer Training. Training for SOFIT measurement staff included a combination of discussion, role playing, videotape analysis, and actual field observation methods. Videotapes of students and teachers engaged during physical education lessons were used during both observer training and maintenance periods. Before being certified as a SOFIT data collector, observers had to exceed 85% agreement on precoded "gold-standard" videotapes.

Field Reliabilities and Observer Recalibration. Interobserver agreement scores (reliabilities) for SOFIT were obtained through two independent data collectors making simultaneous observations during approximately 15% of observed lessons. Interobserver reliabilities, using stringent interval-by-interval comparisons, indicated agreements of 93.7, 96.1, and 89.0%, respectively, for Student Activity, Lesson Context, and Teacher Behavior. Observer retraining had been planned for instances of reliabilities less than 80%. Low scores did not occur, but to reduce the possibility of observer drift (instrument decay) observers were retrained and recalibrated approximately every 2 months. These sessions included discussions and coding of "gold-standard" videotapes.

Frequency and Duration of Lessons

Because weekly self-reports by teachers on the frequency and duration of physical education lessons proved unreliable, a 2-week study using direct observation procedures was implemented during the spring semester. Trained data collectors spent entire days (typically, 8:00 AM to 3:00 PM) simultaneously observing at each of the seven study sites for 10 consecutive school days. During this time, they recorded the frequency and duration of all physical education lessons by target classes. This procedure allowed for comparisons of the quantity of physical education across conditions while at the same time controlling for time of year, school schedules, and weather conditions. Class time started when 50% of the children arrived at the instructional station and ended when 50% of them departed.

Data Analysis

SOFIT Observations. A total of 112 entire lessons were observed using the SOFIT instrument: 49 in PES schools, 34 in TT, and 29 in CO schools. Given wide variation in the number of lessons (2–8) observed for each class of students, lessons were aggregated into class means. Two of the 10 classes in the CO condition did not present themselves during observation periods and are thus excluded from the analysis. Each class in the CO and TT conditions was taught by its own teacher; therefore, variation among classes is equivalent to variation among teachers. In the PES condition there were 8 classes taught by two teachers; thus the problems of nonindependence among the PES classes arose. Prior to an analysis of modality effects, a *t*-test was performed on all SOFIT variables to assess differences between the two PES teachers. Significant differences between the two PES teachers were found only in the SOFIT variables classifying Teacher Behavior. Given the absence of differences between PES teachers for Student Activity and Lesson Context variables, it was judged appropriate to treat the eight PES classes as independent. The one-way ANOVA analyses of these variables therefore employ class as the unit of analysis, with $n = 8$ in CO, $n = 10$ in TT , and $n = 8$ in PES conditions. For the Teacher Behavior variables, where significant differences between PES teachers were found, the problem of nonindependence was avoided by collapsing classes within PES by teacher to yield ANOVA data with $n = 8$ in CO, $n = 10$ in TT, and $n = 2$ in PES conditions. Because of current epidemiological interest in moderate to vigorous activity, a sixth Student Activity category, MVPA, was created by summing the Walking and Very Active categories. Student energy expenditure calculations were estimated using the mean heart rate values for each of the five SOFIT activity codes (McKenzie et al., 1991).

Data are presented as mean minutes because time in activity is expected to be related to health outcomes. Data are also presented as proportion of class time (i.e., % of observed intervals) because this is often used as an index of class quality. Due to multiple comparisons, alpha was set at $p < .01$.

Frequency and duration of lessons. Comparisons of the quantity of physical education offered during the three conditions (CO, TT, PES) were made by tabulating the frequency and duration of lessons observed during the 2-week, full-day observations. For illustrative purposes, quantity data for each condition were compared to the district and project standard of 180 min (6 lessons x 30 min each).

Results

SOFIT Observations

SOFIT data collected during the 8-month period were compared across the three conditions (CO, TT, PES) for student activity levels, lesson context, and teacher behavior. Table 1 compares the mean number of minutes spent in each of the SOFIT subcategories. It shows that the mean class length differed significantly by condition with PES lessons being 26.7 min long, compared to 23.4 and 18.9 min for TT and CO lessons, respectively.

With regard to Student Activity levels, Table 1 shows significant differences between conditions for children's engagement in the Very Active category and in energy expenditure. Children were Very Active for 5.4 min in PES lessons, compared to 4.1 and 2.8 min in TT and CO lessons, respectively. Significantly more energy was expended during PES and TT lessons, with PES children expending one and a half times the energy of CO children. A visual presentation of the average lesson length and children's minutes of engagement in Very Active and MVPA categories is presented in Figure 1. With regard to Lesson Context, Table 1 shows that the amount of class time allocated for fitness activities differed significantly among the conditions, with PES lessons having the most fitness time (PES = 12.7 min; TT = 8.5 min; CO = 4.2 min).

Table 2 presents SOFIT data on the proportion of lesson time, which adjusts for lesson length. With respect to Student Activity levels, Table 2 shows that differences among the conditions for Very Active, MVPA, and rate of energy expenditure were not statistically significant. With regard to Lesson Context, Table 2 shows that PES and TT lessons had significantly larger proportions of time allocated for physical fitness than CO lessons (CO = 17.9%,TT = 35.9%, PES = 47.8%). Over half (52.4%) of the time in CO lessons was allocated for game

Table 1. Comparison of the mean number (*SD*) of minutes per lesson for Student Activity, Lesson Context, and Teacher Behavior during Control, Trained Teacher, and PE Specialist Classes

Category	(1) Control Teachers	(2) Trained Teachers	(3) PE Specialists	ANOVA $p <$	Significant Contrasts[a]
Student Activity	$n = 8$	$n = 10$	$n = 8$		
Lying down	0.0 (0.1)	0.2 (0.3)	0.5 (0.3)	.004	3>1, 2
Sitting	0.8 (1.1)	2.0 (2.0)	2.1 (1.3)	.200	ns
Standing	9.4 (3.4)	10.5 (1.5)	10.3 (0.7)	.550	ns
Walking	6.0 (2.5)	6.7 (2.5)	8.3 (1.4)	.140	ns
Very active	2.7 (1.0)	4.1 (1.6)	5.4 (0.8)	.001	3>2>1
MVPA[b]	8.7 (3.4)	10.8 (3.6)	13.7 (1.8)	.013	ns
Class energy expenditure ($kcal \cdot kg^{-1}$)[c]	1.48 (0.43)	1.87 (0.45)	2.21 (0.15)	.003	2,3>1
Lesson Context	$n = 8$	$n = 10$	$n = 8$		
Management	3.1 (1.9)	4.0 (1.2)	3.7 (0.4)	.360	ns
General knowledge	1.0 (1.6)	4.2 (1.7)	3.0 (0.6)	.001	2, 3>1
Fitness knowledge	0.1 (0.2)	0.5 (0.8)	0.1 (0.1)	.180	ns
Fitness activity	4.2 (4.3)	8.5 (3.3)	12.7 (2.1)	.001	3>2>1
Skill drills	1.7 (2.5)	4.1 (2.1)	3.1 (1.5)	.064	ns
Game play	8.4 (4.7)	2.1 (2.0)	4.1 (1.8)	.001	1>2, 3
Teacher Behavior	$n = 8$	$n = 10$	$n = 2$		
Promotes fitness	0.2 (0.2)	1.7 (0.9)	3.9 (0.8)	.001	3>2>1
Demonstrates fitness	1.8 (2.3)	0.7 (0.8)	1.2 (1.2)	.370	ns
Instructs generally	6.1 (4.8)	13.1 (3.6)	14.6 (1.1)	.005	2,3>1
Manages	4.2 (2.1)	5.1 (1.7)	4.8 (1.2)	.610	ns
Observes	6.4 (3.3)	2.8 (1.3)	2.1 (0.5)	.010	1>2,3
Off-task	0.2 (0.6)	0.1 (0.1)	0.0 (0.0)	.590	ns
Mean observed minutes	18.9 (5.2)	23.4 (5.0)	26.7 (1.4)	.006	3>2>1
Number of lessons observed	29	34	49		

[a]Tested with Tukey's LSD at $p < .05$.
[b]MVPA = moderate to vigorous physical activity (Walking + Very Active).
[c]Estimations based on heart rate monitoring (McKenzie et al., 1991).

play, significantly more than during TT (8.2%) and PES (15.2%) lessons.

With regard to Teacher Behavior, Table 2 indicates significant differences occurred in the proportion of lesson time that teachers in the three conditions spent promoting fitness (CO = 0.6%, TT = 7.6%, PES = 14.5%). CO teachers spent significantly less time providing general instruction (CO = 29.6%, TT = 55.4%, PES = 55.4%) while spending proportionally more time observing (CO = 38.0%, TT = 11.9%, PES = 8.1%). Teachers in all conditions spent very little time off-task. Figure 2 illustrates the proportions of class time that teachers in the three conditions spent in active instruction, defined as the sum of time spent promoting fitness, demonstrating fitness, and providing general instruction.

Frequency and Duration of Lessons

Table 3, which displays quantity of physical education data obtained during full-day observations on 10 consecutive school days, indicates wide variability in class time for physical education. Classes in CO schools averaged 1.9 lessons during the 10 days, compared to 5.1 and 5.6 for TT and PES schools, respectively. Three CO classes had no physical education at all during that time, while all classes in the TT and PES conditions had at least three lessons.

Full-day observation data for class length were similar to the SOFIT data collected over an 8-month period. CO classes were also shorter in length during this 2-week period, averaging 16.6 min, compared to 25.6 and 28.3 min for TT and PES schools, respectively. Total minutes engaged in physical education lessons for each condition were compared to the program standard (90 min per week = 3 lessons x 30 min in length). CO classes achieved 17.5% of the standard, compared to 72.5 and 88.4% for TT and PES schools, respectively. Classroom teachers at PES schools were also observed conducting 11 physical education lessons (265.1 min)

Table 2. Comparison of the proportion (*SD*) of lesson time for student activity, lesson context, and teacher behavior during control, trained teacher, and PE specialist classes

Category	(1) Control Teachers	(2) Trained Teachers	(3) PE Specialists	ANOVA $p <$	Significant Contrasts[a]
Student Activity	$n = 8$	$n = 10$	$n = 8$		
Lying down	0.2 (0.5)	0.7 (1.3)	1.9 (1.1)	.009	3>1, 2
Sitting	3.5 (6.8)	8.0 (7.4)	8.1 (4.9)	.230	ns
Standing	49.9 (11.7)	45.4 (7.1)	38.7 (3.8)	.036	ns
Walking	32.4 (8.2)	28.3 (5.8)	31.0 (4.1)	.390	ns
Very active	14.1 (2.8)	17.6 (6.8)	20.3 (3.3)	.056	ns
MVPA[b]	46.4 (9.9)	45.9 (8.1)	51.3 (5.4)	.340	ns
Energy expenditure rate ($kcal \cdot kg^{-1} \cdot min^{-1}$)[c]	.0785 (.006)	.0796 (.007)	.0831 (.004)	.260	ns
Lesson Context	$n = 8$	$n = 10$	$n = 8$		
Management	15.1 (8.2)	17.3 (5.3)	13.6 (1.0)	.380	ns
General knowledge	5.2 (8.5)	17.9 (5.4)	11.2 (2.3)	.001	2>1, 3
Fitness knowledge	0.5 (1.1)	1.8 (3.0)	0.3 (0.5)	.230	ns
Fitness activity	17.9 (17.4)	35.9 (11.4)	47.8 (5.3)	.001	2, 3>1
Skill drills	9.0 (15.5)	18.9 (8.6)	11.7 (5.7)	.147	ns
Game play	52.4 (31.7)	8.2 (7.6)	15.2 (6.8)	.001	1>2, 3
Teacher Behavior	$n = 8$	$n = 10$	$n = 2$		
Promotes fitness	0.6 (0.9)	7.6 (4.1)	14.5 (3.7)	.001	3>2>1
Demonstrates fitness	9.0 (12.4)	2.6 (2.9)	4.4 (3.8)	.290	ns
Instructs generally	29.6 (20.1)	55.4 (8.7)	55.4 (5.7)	.005	2, 3>1
Manages	20.9 (7.8)	22.1 (7.4)	17.6 (4.1)	.730	ns
Observes	38.0 (24.2)	11.9 (5.1)	8.1 (1.2)	.008	1>2, 3
Off-task	1.4 (6.0)	0.3 (0.9)	0.0 (0.0)	.150	ns
Mean observed intervals	56.7 (15.6)	70.3 (15.0)	80.1 (4.3)	.006	3>2>1
Number of lessons observed	29	34	49		

[a]Tested with Tukey's LSD at $p < .05$.
[b]MVPA = moderate to vigorous physical activity (Walking + Very Active).
[c]Estimations based on heart rate monitoring (McKenzie et al., 1991).

during the 10 days, giving children in PES schools a total of 106.8% of the expected allocated time for physical education.

Discussion

This study employed direct observation techniques to assess the effectiveness of a health-related physical education curriculum and inservice training program for classroom teachers. Time-dependent variables served as measures for determining effectiveness, and direct observations were made to determine the frequency and length of physical education lessons, as well as student activity levels, lesson context, and teacher behavior during classes.

A primary goal of the curriculum and the training was to provide students with substantial amounts of physical activity. The results indicate both physical education specialists and trained classroom teachers implementing the innovative curriculum had more active students and effective instructional behaviors than teachers who followed other or no particular curricula. One of the major differences between the controls and the specialists and classroom teachers using the curriculum was in the amount of physical education time. Students in the intervention conditions had substantially more opportunities to be physically active and learn physical skills. During the 2 weeks of full-day observations, PES classes met for 88% of the district time standard and TT classes met for 73%, compared to only 18% for the untrained teachers. These differences have important implications for the overall impact of the physical education on health-related outcomes.

Another primary goal of the curriculum was that it be usable by appropriately trained classroom teachers. There is ample evidence from direct observations that the curriculum and inservice program had significant effects on student activity levels, lesson context, and teacher behavior. Data collected over the 8-month period indicated that students in TT classes were Very Active longer (4.1 vs. 2.1 min) and expended more energy (1.87 vs. 1.48 kcal·kg^{-1}) per lesson than CO children. Although the relative data (proportion of class time) also found the children in TT classes somewhat more active, these differences were not statistically significant. This suggests that the curriculum and inservice program had important effects on the amount of student physical activity, primarily through increasing time spent in physical education lessons rather than increasing the proportion of class time spent in physical activity.

Regarding lesson context, children in TT classes were provided with more time for fitness activities (8.5 vs.

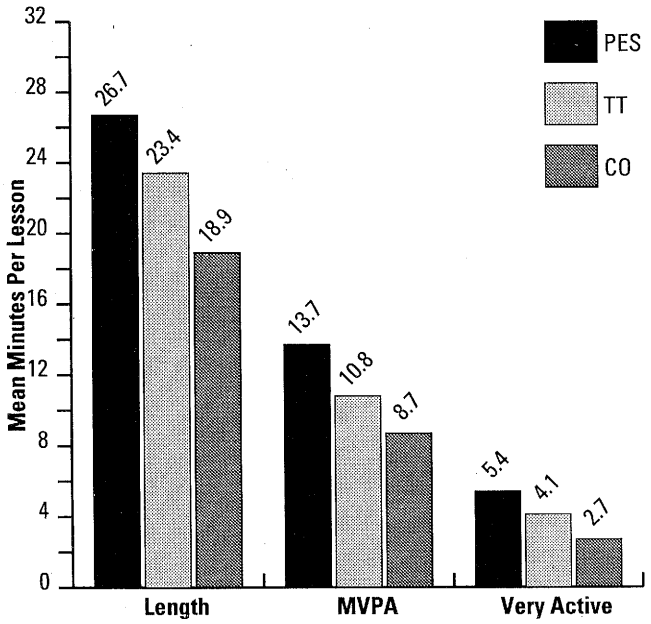

Figure 1. Mean minutes for lesson length and time spent in MVPA and Very Active categories during PES, TT, and CO classes.

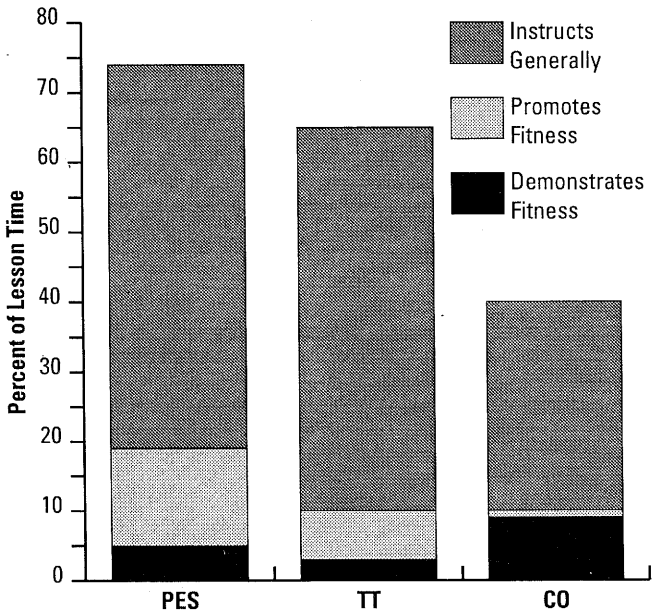

Figure 2. Proportion of lesson time spent in active instruction (instructing generally, promoting fitness, and demonstrating fitness) by PES, TT, and CO teachers.

Table 3. Quantity of physical education for controls, trained teachers, and PE specialists during a 2-week full-day observation period

	Controls	Trained Teachers	PE Specialists
Number of classes in condition	10	10	8
Number of lessons observed	19	51	45
Mean lesson length (min)	16.6	25.6	28.3
Total minutes of PE	315.4	1305.6	1273.5
% of standard (180 min)	17.5	72.5	88.4
% of standard (range)	0–66	43–101	71–100

4.2 min per lesson), skill drills (4.1 vs. 1.7 min per lesson), and general knowledge (4.2 vs. 1.0 min per lesson) than those in CO classes. An analysis of teacher behavior for quality of instruction indicated trained teachers spent much more time instructing actively than their untrained peers. TT teachers spent a larger proportion of class time promoting fitness (7.6 vs. 0.6%) and providing general instruction (55.1 vs. 29.6%), while spending less time observing (38.0 vs. 11.9%). CO lessons were typically unidimensional and often devoted the entire class to a single game or fitness activity that did not demand extensive management or instructional time. On the other hand, TT lessons typically were more well rounded, incorporating both fitness and movement skill activities. However, attempts by the trained classroom teachers to provide more instruction and activity variety during lessons may have hampered their efforts to increase student physical activity engagement. TT and PES teachers spent more of the class promoting fitness and instructing than CO teachers, but these changes did not result in children being active for a significantly higher proportion of the class time.

In summary, comparisons of the TT and CO classes on adherence to recommended class schedule, length of class taught, student activity levels, lesson context, and teacher behavior strongly support the efficacy of the health-related curriculum and inservice training program with classroom teachers. These results, combined with questionnaire and interview data, which are not presented here, indicate that the trained teachers accepted the program and made a commitment to implementing it.

Did the curriculum produce enough physical activity to influence students' health outcomes? Unfortunately there is no definitive answer. Descriptive research using other instruments (Godbout, Brunelle, & Tousignant, 1983; Silverman, Dodds, Placek, Shute, & Rife, 1984) suggests that elementary school children typically engage in small amounts of MVPA per class. While the effectiveness of the health-related curriculum and inservice program can be supported through the data, the question of whether the trained teachers were doing "well enough" to promote positive health outcomes was not answered in this study. The relationship between the amount of physical activity required for various health and other outcomes is not known in children, and there is no consensus on the amount of activity children should have in and out of physical education (Sallis & McKenzie, 1991). However, there is at least one recognized criterion for activity in physical education classes. Objective 1.9 of the *Year 2000 Objectives* is to "increase to at least 50% the proportion of school physical education class time that students spend being physically active" (U.S. Public Health Service, 1991). Neither the trained or untrained classroom teachers met this standard, wheras the physical education specialists, at 51.3% MVPA, did. Additional research is needed to validate this criterion, but the present study suggests it may be a realistic goal. However, a more important guideline might address the number of minutes children spend per week being active in physical education classes. Such a guideline might lead to changes in both the quantity and quality of school physical education to meet important public health needs. Total time spent in physical activity, or total energy expended, may be the most important mediator of health outcomes (Blair, Kohl, Gordon, & Paffenbarger, 1992), so national physical education goals are needed for identifying total minutes of physical activity.

Because classroom teachers are responsible for considerable amounts of the physical education in elementary schools across the nation, there is substantial interest in comparing their lessons to those of trained physical education specialists (Patterson & Faucette, 1990). The present study provided a rare opportunity to compare the lessons of trained classroom teachers and specialist physical educators teaching the same health-related curriculum in matched (ethnicity, facilities, and equipment) schools during the same time period. Results of comparisons in this study consistently favored the physical education specialists. They adhered to the recommended schedule better (88.3 vs. 72.6%) and taught longer lessons (26.7 vs. 23.4 min) than the trained classroom teachers. Thus, overall, children in PES classes not only had more opportunities to be physically active but they also received more minutes per lesson of teacher modeling (1.2 vs. 0.7) and instructional cues and prompts for fitness (3.9 vs. 1.7). Data on proportion of lesson time also favored the specialists. Although not statistically significant, children in PES classes tended to engage in more MVPA than those in TT classes (51.3 vs. 45.9% of lesson time), be very active more often (20.3 vs. 17.6% of lesson time), and expend more energy (.0831 vs. .0797 $kcal \cdot kg^{-1} \cdot min^{-1}$). PES teachers allocated a greater proportion of class time to physical fitness activities (47.8 vs. 35.9%) than TT teachers and prompted fitness engagement more often (14.5 vs. 7.6%) while spending less time observing (8.1 vs. 11.9%).

These results were not unexpected. The specialists in this study were handpicked and received biweekly feedback from the curriculum developer and thus served as a stringent reference standard for the trained classroom teachers. Additionally, reviews of studies comparing classroom teachers and physical education specialists (Faucette et al., 1990) have generally supported specialists both in process and product measures. Classroom teachers do not have the pedagogical content, knowledge, and experiences to match those that physical education specialists receive during 4 years of training, and these cannot be gained in a few months. While classroom teachers have responsibilities for physical education, they are typically held more accountable for student progress in other academic pursuits, particularly reading and mathemat-

ics. In addition to having more training in the subject matter and pedagogical skills, physical education specialists have an advantage on a daily basis because they have relatively fewer management problems. Specialists generally do not have to set up an entirely new instructional environment for each lesson, whereas classroom teachers do.

This study is unique in its use of direct observation of student activity engagement, curriculum context, teacher behavior, and frequency/duration of lessons to assess curriculum and inservice innovations. Using systematic observation in schools to study the efficacy of an intervention is both time consuming and expensive. Often lessons did not occur during regular times or even on scheduled days, leading to wasted observer time. The goal was to observe equal numbers of classes from each condition, but limited adherence to schedules, especially by CO, made this impossible. Full-day observations were required to observe sufficient numbers of CO classes and to assess the frequency of lessons.

Many collaborative models exist for bringing about improvements in instructional practice (Martinek & Schempp, 1988), and a note of caution is offered before the results of this intervention are generalized to other inservice programs. This program was a true collaborative effort that included the active participation of an elementary school district, a university, and a federal funding agency. Substantial support for the inservice program and the curriculum implementation was provided by the school district including the assistant superintendent and seven school principals. The classroom teachers were also generally enthusiastic about participating in the project. The inservice program was extensive, involving 23 hours of training in physical education instruction and twice-weekly follow-up visits to each school over an 8-month period. At this time, the effectiveness of the various components of the inservice intervention cannot be ascertained. Further studies are planned to evaluate additional training and to determine whether the results are maintained and generalized when external support is withdrawn.

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