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Modifying Teacher Behaviors to Promote Critical Thinking in K-12 Physical Education

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This study examined four physical educators' teaching behaviors before and after an intervention. The study was conducted over the span of three 15-week academic semesters. Phase 1 of the study involved videotaping the participants' instruction prior to intervention. In Phase 2, participants were involved in two workshops planned to convey teaching strategies related to promoting critical thinking in physical education. In addition, participants and co-investigators team-taught three sample lessons focused on incorporating teaching behaviors attempting to foster critical thinking. Data collection was completed during Phase 3 by videotaping each teacher during one unit of instruction. A chi-square analysis of post-intervention data revealed that all four teachers' observed instructional behaviors differed significantly from that expected. Results suggest that the intervention employed during Phase 2 was successful in helping teachers modify their instruction to promote critical thinking in physical education.

Developing students' ability to use skillful and reasonable thinking is not a recent trend. Early in the century, Dewey (1910) cited critical thinking as a key ingredient in education. Today, scholars suggest critical thinking contributes to the development of rational deliberation relevant to a democratic education (Weinstein, 1991). Garside (1996) suggests at least four defining aspects of thinking make it critical: (a) thinking that is clear, precise, accurate, relevant, logical, and consistent; (b) thinking that reflects a controlled sense of skepticism or disbelief of any assertion, claim, or conclusion until sufficient evidence and reasoning is provided to conclusively support it; (c) thinking that takes stock of existing information and identifies holes and weakness, thereby certifying what we know and don't know; and (d) thinking that is free from bias, prejudice, and one-sidedness of thought (p. 215).

Reflecting on Paul's (1990) criticism of instruction in schools as "out-moded didactic, lecture, and drill-based instruction" (p. 40), Garside (1996) highlights that students exposed to this type of instruction "fail to learn how to gather, analyze, synthesize, or assess information. They do not learn how to analyze the logic of questions and problems they face, and as a result cannot adjust their thinking to them" (p. 212). Instead, students need to become active learners rather than passive recipients of information, taking responsibility for their own thinking and

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learning (Kruse, 1988; Maryland State Department of Education, 1990). When students are challenged to engage in critical thinking, they use broad and adventurous thinking that involves looking beyond the obvious, inventing novel ways to express ideas, or looking at things from different points of view (Tishman & Perkins, 1995). Helping students to employ critical thinking is a distinct and significant aim among many educators today.

Several studies have been conducted to examine how teachers can develop students' critical thinking skills. Garside (1996) compared lecture and group discussion teaching strategies in developing university students' critical thinking skills. Group discussion strategies produced significantly more learning with regard to higher-level thinking items (e.g., analysis, synthesis, or evaluation of material). In a comparison of critical thinking-related teaching practices of seventh and eighth grade science and mathematics teachers, Lawrenz and Orton (1989) found science teachers more open to relevancy, diversity, and encouragement. Science teachers also involved students in cooperative learning activities more than mathematics teachers. Eggen and Kauchak (1988) suggest cooperative learning groups promote effective learning, since students are "actively involved in organizing and finding relationships rather than being passive recipients of teacher-delivered bodies of knowledge" (p. 1).

Critical thinking in physical education (CT-PE) is defined as "reflective thinking that is used to make reasonable and defensible decisions about movement tasks" (McBride, 1992, p. 115). Critical thinking in physical education was addressed by those who adopted the movement education approach to physical education (Locks, 1966; Ludwig, 1968). At the core of this curricular approach was the goal of engaging children cognitively. Kirchner, Cunningham, and Warrell (1970) explain that a movement educator should provide suitable tasks, with the onus being on the children to solve the problem(s) (p. 10). Within this type of learning environment, children are stimulated to think as they are challenged to explore, select, repeat, and refine movement sequences. Eloquently stated, "Physical education, to share meaningfully in the education of the learner, must provide experiences that improve his ability to move, that engage his thought processes" (Logsdon et al., 1977, p. 16).

Recognition of the need to develop students' higher-order thinking and critical thinking skills in physical education has been revitalized. During the past 10 years, scholars have made progress in defining, justifying, and discussing the relevance and benefits of fostering critical thinking in physical education (Buschner, 1990; McBride, 1988, 1992, 1995; Schwager & Labate, 1993). The findings of this research have prompted physical educators to infuse critical thinking into teaching (see Blitzer, 1995; Cleland & Pearse, 1995; Woods & Book, 1995). Wall and Murray (1994) highlight the necessity of addressing the cognitive domain of learning in physical education:

Children are complex beings whose thoughts, feelings and actions are constantly in flux. Because of the dynamic nature of children . . . change in one element often affects the others. Thus, it is the "whole child" whom we must educate, not merely the physical or bodily aspect of the child. (p. 9)

Freeland (1995) emphasizes that teachers serve as catalysts for creating optimal critical thinking learning environments. To become an effective catalyst requires a shift from the traditional role of teacher as the controller of information to

that of a facilitator of information. In physical education, this means we must not rely solely on the traditional demonstration-replication (direct) mode of instruction. We need to utilize other modes of indirect instruction associated with fostering critical. As McBride (1997) states, "there is no magical formula . . . nor can one follow a cookbook approach" (p. 10). Instead, teachers need to employ strategies that enable them to facilitate critical thinking among their students. These strategies may include, but are not be limited to: (a) the use of teaching styles which promote inquiry; (b) engaging students in activities designed to foster the dispositions supporting the critical thinking process (e.g., willingness to take risks, persistence, willingness to be well informed; Beyer, 1987); (c) asking questions, setting up scenarios for students to analyze, and challenging students to defend their movement solutions or ideas; (d) having students compare and contrast movement ideas or solutions; (e) designing situations in which students can make inferences; (f) encouraging students to create movement responses; and (g) involving students in debriefing sessions which focus on defending movement solutions, discussing similarities and differences, and so on (see Cleland & Pearse, 1995, pp. 35-38). Teaching strategies such as these have the potential to empower students through increased cognitive involvement and social negotiation (Lipman, 1988).

Supporting the need to offer students opportunities for enhancing and reinforcing cognitive skills in physical education, Ennis (1991) examined two physical education programs for the presence of opportunities to use thinking skills. The results of this study indicated that teachers use deductive and inductive strategies associated with teacher- and student-structured experiences to encourage student metacognition. Ennis (1991) suggests that in-service programs would be appropriate to assist physical educators in providing additional experiences that encourage thinking.

Given the resurgence and importance of involving students in their own learning and developing their thinking skills, the isolation of physical educators (Templin, 1988), and the need to augment teachers' educational opportunities (Ennis, 1991), this study was designed to provide teachers with an opportunity to expand and improve their teaching repertoire by learning how to promote critical thinking in physical education. The purpose of this study was to examine the teaching behaviors exemplified by four physical educators before and after intervention.

Method

Participants

Four public school teachers volunteered to participate in this study. Years of teaching experience ranged from 3 to 27. All teachers were employed within the same school district.

Instrumentation

The data analysis instrument was designed to record the kinds and frequencies of teacher behaviors promoting CT-PE (see Figure 1). Teaching behaviors were classified into four categories: (a) Initiates Process (IP)—teacher action that begins the critical thinking process among students; (b) Monitors Process (MP)—

Teacher Behavior	Initiates Process (Column 1)	Monitors Process (Column 2)	Direction (Column 3)	Management (Column 4)	Anecdotal Notes
Row 1					
Row 2					
Row 3					
Row 4, etc.					
<p>Column 1, Initiates Process: Convergent/Divergent Statement, Convergent/Divergent Question, Task Card.</p> <p>Column 2, Monitors Process: Process/Results Feedback, Infer/Compare/Contrast/Defend Question, Clarify/Redefine Domain Specific Knowledge, Cues/Prompts.</p> <p>Column 3, Direction: Class, Group, Individual.</p> <p>Column 4, Management: Equipment, Transition, Behavior.</p> <p>Direct Teaching: Demonstrate Skill, Verbal Explanation, Physically Manipulate</p>					

Figure 1 — Instrument used to analyze the videotaped data and to code teaching behaviors.

teacher behavior that observes or facilitates the critical thinking process; (c) Direction (D)—who the teacher is working with, an individual, small group, or class; and (d) Management (M)—teacher behavior not associated with initiating or monitoring critical thinking but dealing with classroom organization (e.g., equipment rearrangement, transitions, discipline).

Column 1 (IP) describes how the teacher can “frame the task” (i.e., verbally, in written form, or via a physical demonstration) and initiate the critical thinking process. Column 2 (MP) describes ways in which a teacher can help students reflect on their movement responses and to elaborate on original movement solutions. Column 3 (D) describes to whom the teacher is directing his or her instruction: an individual student, group of students, or the entire class. Column 4 (M) describes the managerial tasks that teachers perform. Use of the analysis instrument requires that the appropriate columns be coded as the researcher observes the videotaped lessons.

For example, if the teacher stated, “Compare the three different volleyball serves that were demonstrated earlier in class. After practicing each serve, select the serve you have determined to be the most effective and then explain why.” then Column 1 (IP) would be coded as a convergent statement, since the thinking process proceeds from general (e.g., analysis of several movement factors within three serves) to specific (e.g., selected movement factors within one serve). Column 2 (MP) would not be marked since the teaching behavior was initiating a process. Column 3 (D) would be marked C for class and Column 4 (M) would remain blank. Within the space allotted in the margin, the exact words communicated by the teacher to the students would be written.

Content validity of the data analysis instrument was established by having a group of experts of CT-PE review the analysis form. The experts’ comments were critiqued and used to modify and establish the categories and specific subcategories designated on the data analysis instrument.

Reliability on the use of the data analysis instrument was established by having all three university researchers independently analyze pilot videotapes. Af-

ter coding pilot videotapes, researchers met to discuss their findings. Researchers continued to code pilot videotapes using the data analysis instrument until they achieved 85% inter-observer agreement. The percentage of agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100 (see van der Mars, 1989, p. 56).

Procedures

Design. The study was divided into three phases over a span of three 15-week academic semesters.

Phase One: Preintervention. Phase 1 was conducted during the spring semester of the study. During this phase, teachers were videotaped three times within a unit of instruction. The lessons were analyzed using the data analysis instrument (see Figure 1). This instrument was used to identify the teaching behaviors identified as promoting CT-PE.

Phase Two. During Phase 2, teachers were provided with: (a) the theoretical framework, (b) training sessions designed to introduce teachers to the pedagogical skills necessary to implement critical thinking teaching methodology, and (c) opportunities to team-teach with the co-investigators for the purpose of observing and practicing critical thinking teacher behaviors. Early in Phase 2, the teacher-participants participated in a 4-hour lecture-discussion workshop by the university researchers and one additional expert in the field of CT-PE. Based on McBride's (1992) schema of critical thinking in physical education (see Figure 2), several teaching strategies were presented. The focus of these strategies was to promote an atmosphere of inquiry. These strategies included: (a) the use of specific teaching styles identified with higher-order thinking skills (see Mosston & Ashworth, 1994); (b) engaging students in activities designed to foster the dispositions supporting

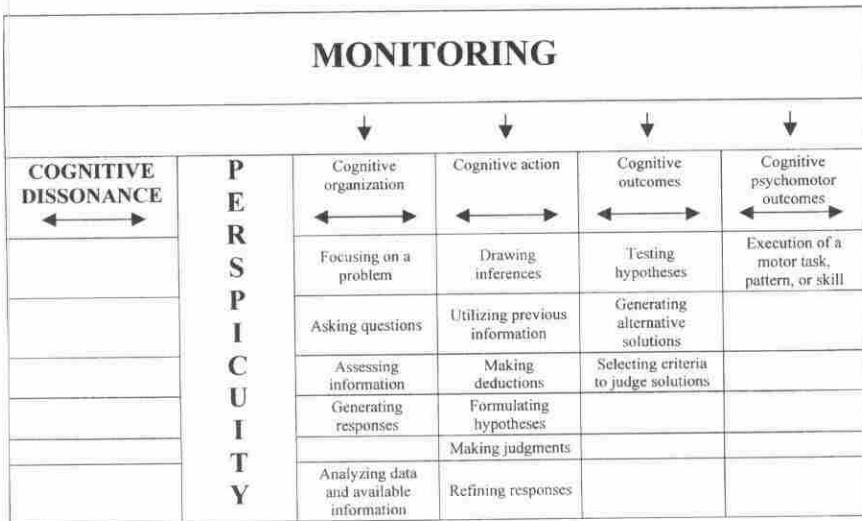


Figure 2 — McBride's (1992) schema of the critical thinking process as it applies to physical education.

the critical thinking process (e.g., willingness to take risks, persistence, willingness to be well informed; Beyer, 1987); (c) asking convergent or divergent questions; (d) setting up scenarios for students to analyze and use problem-solving skills; (e) having students compare and contrast movement ideas; (f) designing situations in which students can make inferences (i.e., if we do this, then that might happen); (g) encouraging students to create movement responses (i.e., use divergent thinking); and (h) involving students in debriefing sessions that focus on defending movement solutions, and discussing similarities and differences (see Cleland & Pearse, 1995, pp. 35-38). The teachers were also provided with the text, *Teaching Physical Education* (Mosston & Ashworth, 1994). Three teaching styles were presented and discussed (Style F—Guided Discovery, Style G—Convergent Discovery, and Style H—Divergent Production).

Later during Phase 2, teachers were assigned to one of the three co-investigators. Each pair held meetings to collaboratively design lesson plans aimed at promoting critical thinking. Three sample lessons were subsequently team taught by each pair. These team-taught lessons were the focus of a 1-day workshop held during the latter part of Phase 2. During this 1-day workshop, four main questions were used to facilitate discussion and analysis of the team-taught lessons: (a) Did teachers' actions promote critical thinking according to McBride's (1992) schema? (b) What modifications could the teacher make to increase the incidence of critical thinking? (c) Was the mode of task presentation conducive to facilitating CT-PE? and (d) were teachers able to develop subsequent critical thinking episodes by elaborating upon initial critical thinking responses by students?

Phase 3: Data Collection. During Phase 3, teachers chose one physical education unit in which to infuse CT-PE. Instructional behaviors were collected by videotaping lessons. The number of lessons videotaped by the university researcher varied among the four teachers. This phase was completed over a 3-month period. During Phase 3, researcher and teacher pairs continued to share in the preparatory phase of the teaching process. The main responsibility for initiating this process, however, was placed on the teacher-practitioner. There was no investigator intervention during the impact phase of the physical education lesson.

Data Analysis: Quantitative Analysis. Using the data analysis instrument, the videotaped data were analyzed over a 6-month period. Pre- and post-intervention teaching behaviors were identified. A total number of coded teaching behaviors was determined for each teacher. The total number of teaching behaviors, coded in Column 1 (IP) as teacher demonstration and (or) explanation were counted as direct teaching behaviors. Indirect teaching behaviors (IP or MP) were also counted. Percentages of direct and indirect teaching were then calculated for each teacher's pre- and post-intervention data. Since each of the four teachers taught differing numbers of pre- and post-intervention lessons, average percentages were calculated by adding the percentages of the total number of lessons and dividing by the number of lessons taught. A one-way chi square was calculated to determine if there was a significant difference between the observed and expected percentages of teaching behaviors, coded as direct and indirect, during the post-intervention phase (Phase 3). The expected percentage of teaching behaviors (85% direct teaching, 15% indirect teaching) is based on findings within the literature regarding the predominant teaching styles employed by physical educators (see Goldberger, 1992, p. 43).

Qualitative Analysis. After coding the specific teaching behaviors demonstrated by each of the four teachers on the videotaped lessons, an inductive method

was employed for analysis of the data. Researchers were responsible for the analysis of their own data. The source of the qualitative data was the verbal narrative corresponding to each teacher behavior identified as promoting critical thinking. These verbal statements were written on the data analysis instrument in the margin designated for anecdotal notes. Subsequently, each researcher examined their teacher's verbal statements and organized them by descriptive units. Lincoln and Guba (1985) describe this type of qualitative analysis as *unitization* or "systematically transforming and aggregating data into units which permit precise description of the relevant content characteristics" (p. 203). A constant comparative method was then employed for the purpose of sorting the "units" into provisional categories on the basis of "look-alike" characteristics. The units created by each of the three university researchers were compared and contrasted, and provisional categories were then determined.

Results

Quantitative Analysis: Direct Versus Indirect Teaching Behaviors

Teacher one was an elementary physical educator who had 20 years of teaching experience. During Phase 1, 17% of teacher one's instructional behaviors fostered critical thinking (indirect teaching), while 83% promoted student recall or reproduction of information (direct teaching). An analysis of teacher one's post-intervention instruction revealed an average of 88% demonstrated teaching behaviors promoting critical thinking and 12% representative of direct instruction (see Figure 3). Based on a one-way chi-square analysis for Phase 1, $\chi^2(1, N = 1) = .10$, $p > .05$. This finding suggests teacher one's observed pre-intervention teaching behaviors were not significantly different from that expected. Based on the one-way chi-square classification for Phase 3, $\chi^2(1, N = 1) = 125.4$, $p < .001$. This finding suggests teacher one's observed post-intervention teaching behaviors coded as indirect (88%) were significantly different from the expected (15%).

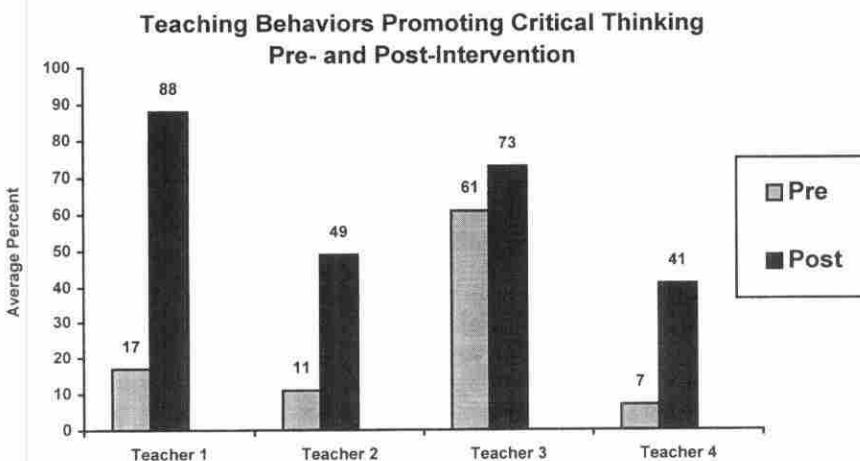


Figure 3 — Graph depicting the percentages of teaching behaviors representing direct and indirect instructions before and after interventions.

The pre-intervention teaching behaviors (i.e., Phase One) displayed by teacher one could be described as those that evoked a low-level of critical thinking. In this type of learning experience only parts of the CT process are facilitated by the teacher, the teacher fails to recognize opportunities for CT, and the depth of CT is limited. The elements of CT that teacher one did evoke in the pre-intervention lessons included, (a) challenging students to utilize previously learned information, (b) asking students questions, and (c) providing some opportunities for divergent thinking.

The movement tasks presented within the pre-intervention lessons were based on previously learned locomotor skills. Students were prompted to recall these skills, to verbally describe them, and to subsequently execute them with a partner. More specifically, students were challenged to combine a specified number of locomotor skills (as designated by the teacher) while "creating dances." The students, however, could execute these skills "in any way you and your partner want to work it out." Framing a movement task in this manner allowed students to use a divergent thinking process. However, the degree to which students produced alternative responses was limited because the teacher did not encourage students to identify the variables (e.g., pathways, directions, meeting-parting, side-by-side) that would help them to create a varied movement pattern. Opportunities for comparing and contrasting or pinpointing similarities and differences among students' movement sequences were also omitted. Overall, teacher one demonstrated tendencies toward including CT within the preintervention lessons, but the attempts lacked key ingredients cited.

Videotape analysis of teacher one's post-intervention lessons (Phase 3) revealed specific teacher behaviors that could be described as more interactive (e.g., asking questions which prompted students to explain why) and provoking (e.g., encouraging students to think of yet another idea; see Table 1). The focus in these post-intervention lessons was on student-generated solutions. This was accomplished in the way teacher one framed or presented the lesson tasks. Instead of teacher demonstrations or telling students exactly what to do, more open-ended tasks were presented. Students were provided with an overall task composed of several steps to complete. This manner of framing a task prompted students, within small groups, to collectively negotiate, brainstorm, sort through possibilities, and try out movement ideas. It also freed the teacher to actively monitor the learning process. The teacher was observed walking among students, asking "why" questions, and challenging students to defend and explain their progress. In pre-intervention lessons students were not asked "why" nor were they prompted to identify what information could be useful for responding to a movement task. Finally, in the lessons following intervention, teacher one had students assess other students' movement products using specific criteria. This experience enabled students to see how others responded to the same movement task and to discuss differences.

Teacher two was a high school teacher with only 3 years of teaching experience. Teacher two began the study as an elementary school teacher and completed the study as a high school teacher. During the pre-intervention segment, a fifth-grade class was taught. Post-intervention data were based on a ninth-grade coeducational physical education class. Pre-intervention analysis of data revealed 11% of teacher two's teaching behaviors promoted critical thinking, while 89% of the teaching behaviors were classified as direct instruction. An average of 49% of teacher two's post-intervention instructional behaviors promoted critical thinking.

Table 1 Summary of Pre- and Post-Intervention Teaching Behaviors of All Four Teachers

Instruction style	Phase 1	Phase 3	Verbal narrative, Phase 1
Direction instruction			
Teacher 1	83%	12%	<ul style="list-style-type: none"> • Teacher demonstrates slide to music through general space; students observe. Then teacher asks student to “find a personal space. When the music begins, I want you to perform the locomotor pattern of sliding. Ready, begin.” • “Now let’s skip to the music.” (Again, teacher demonstrates and students model.) • Initiates Process and Managerial—“Within your groups, read the task cards I have provided you. Remember to follow the steps I have outlined to create your machine dance.”
Teacher 2	89%	51%	<ul style="list-style-type: none"> • Initiates Process: Teacher Demonstration/Explanation—“Let’s try the grapevine step. Ready, to the right . . . step side-right, cross behind with your left, side-right, and step together.”
Teacher 3	39%	27%	<ul style="list-style-type: none"> • Initiates Process: Teacher Demonstration/Explanation—“We are going to practice three different types of serves. Please practice each serve several times.” (Teacher demonstrates serves as students observe.) • Initiates Process—“Each of you have a packet of information explaining the activity at each station. Please read the directions carefully.”
Teacher 4	93%	59%	<ul style="list-style-type: none"> • Initiates Process: Teacher Demonstration/Explanation—“Let’s try the rocker. Who would like to demonstrate this skill? Sit up, then rock back and forwards.” • Initiates Process: Teacher Explanation: “Stand up and try the Cobra.”
Indirect instruction			Verbal narrative, Phase 3
Teacher 1	17%	88%	<ul style="list-style-type: none"> • Initiates Process—“Decide on a machine to use to create a dance. Using your task card, write down the parts of the machine that move. Then begin to explore how you can create nonlocomotor or locomotor movements to represent the parts of this machine.” • Monitors Process—“How can you make your movements different? Yes! By using the movement framework. Have you used different qualities of movement in your machine dance? What are some of the formations you can use for your dance?”
Teacher 2	11%	49%	<ul style="list-style-type: none"> • “Using the authentic assessment form, analyze another group’s line dance, and evaluate it with the given criteria.” • “Using new steps that you create and any variation of the steps you have learned, choreograph a line dance within your group.”

(continued)

Table 1 (continued)

Instruction style	Phase 1	Phase 3	Verbal narrative, Phase 1
Indirection instruction			
Teacher 3	61%	73%	<ul style="list-style-type: none"> • Monitors Process—"Which of the three volleyball serves did you think was most effective? Why? What are the similarities/differences among the three volleyball serves?" • Monitors Process—"How does your activity help you to improve anticipation or preparing to set or bump the volleyball?"
Teacher 4	7%	41%	<ul style="list-style-type: none"> • Initiates Process—After students perform rocker . . . teacher states: "Can anyone think of another that fits into that category?" • Monitors Process—"Did you perform three different movements as you traveled across the balance beam? How and why were they different from each other?"

while 51% represented direct instruction. Based on a one-way chi-square analysis for Phase 1, $\chi^2(1, N = 1) = .38, p > .05$. This finding suggests teacher two's observed pre-intervention teaching behaviors were not significantly different from that expected. Based on the one-way chi square classification for Phase 3, $\chi^2(1, N = 1) = 27.2, p < .001$. This finding suggests teacher two's observed post-intervention teaching behaviors coded as indirect (49%) were significantly different from the expected (15%).

During Phase 1 for teacher two, content areas were divided between opposite ends of the spectrum relative to ease of cognitive involvement on the part of the students. Fifth graders first participated in a unit of problem solving activities. During this unit of instruction, teacher two engaged in numerous cognitive if not critical thinking episodes. The tasks were designed to facilitate group involvement and interaction. The learning environment was structured to develop cooperation and communication on the part of the students. The instructor effectively remained an observer during the periods of participation by the students. This lent itself to evidence of the critical thinking dispositions desired by the investigators.

The second content area of Phase 1 involved a unit of basketball skills. Fifth graders were expected to utilize task specific skills and concepts previously covered by the instructor. The teacher began the period of instruction with a demonstration of the task specific requirements and an example of a sequence in which the students could meet the specific requirements of the task to be addressed. The teacher then began student engagement by stating that groups could use the same sequence or create a different sequence to meet the requirements of the task. Many (but not all) of the students were content to simply replicate the sequence and accomplish the task with little or no cognitive involvement on their part. The students who elected to devise their own sequence were positively reinforced by the teacher and chosen to demonstrate their results to the class. It is obvious that with-

out the initial demonstration on the part of the instructor, the students would have been required to engage in the process of communication and cognition to devise their own solutions to the task.

The content area chosen by teacher two and the investigator for the purpose of infusing CT-PE was line dancing. Most of the ninth-grade students did not have previous experience related to this content area. Aerobic and step aerobic classes constituted the “dance experience” for the majority of these students. Consequently, they had little or no domain-specific background or knowledge to bring to their participation in the research study.

Teacher two and the investigator discussed their own approach to the content area, line dancing, and decided that direct instruction at the beginning followed by indirect instruction would best facilitate eventual episodes of cognitive involvement and subsequent critical thinking. With this approach, teacher two proceeded to teach two classes in which there was little opportunity for the students to engage in any higher order thinking skills beyond an awareness of weight transfer and an occasional question concerning the relative position of the feet and the sequence of steps for a specific dance being practiced. After two classes, the ninth graders were asked to devise a simple sequence, or routine, from the steps covered in the previous dances introduced to the class (see Figure 2). In this manner students were utilizing previous domain-specific knowledge relative to the task presented. The new routine required students to reorder steps, make directional and tempo changes, and create transitions from one step to the next. An authentic assessment rubric was utilized for peer, self, and teacher appraisal. The rubric provided students with a way to defend their movement product.

Teacher three was a middle school teacher with 23 years of teaching experience. An average of 61% of teacher three’s instructional behaviors promoted critical thinking in pre-intervention lessons, with 39% of the teaching behaviors coded as direct instruction. An average of 73% of teacher three’s post-intervention instruction was determined to promote critical thinking, while an average of 27% did not promote critical thinking. Based on a one-way chi-square analysis for Phase 1, $\chi^2(1, N = 1) = 39.6, p < .001$. This finding suggests teacher three’s observed pre-intervention teaching behaviors were significantly different from that expected. Based on the one-way chi-square classification for phase 3, $\chi^2(1, N = 1) = 79.2, p < .001$. This finding suggests teacher three’s observed post-intervention teaching behaviors coded as indirect (73%) were significantly different from the expected (see Table 1).

Teacher three intentionally designed aspects of her pre-intervention physical education lessons to evoke CT-PE. She had studied critical thinking and had engaged in professional discussions about critical thinking with her colleagues. During pre-intervention videotaping, teacher three verbally expressed a commitment to cognitively engage her coeducational sixth-grade class. Teacher three had previously taught a physical fitness unit in which she intentionally designed learning opportunities for the purpose of encouraging students to compare and contrast ideas, generate potential solutions, apply principles, and defend their answers and ideas. In the three pre-intervention lessons, teacher three infused CT-PE episodically—in other words, within brief segments of the lessons. The pre-intervention teaching behaviors displayed by teacher three could be described as those that elicit a moderate level of critical thinking in physical education (MLCT-PE). In MLCT-PE, the teacher identifies opportunities for CT during the planning phase; however, actual episodes of CT within the lesson are brief and not well developed.

Post-intervention lessons within a 5-week, sixth-grade volleyball unit evidenced frequent and well-developed episodes of CT-PE. Teacher three identified several opportunities in each volleyball lesson to develop students' thinking skills as they simultaneously practiced selected volleyball skills. Prior to engaging in complex CT episodes, teacher three had established small groups of students. These small groups (or *teams*) were involved in volleyball problem-solving activities designed to enhance students' communication skills and aid in developing the dispositions that support the critical thinking process.

Other activities involving students in more complex critical thinking included: (a) reading task cards and handouts at separate volleyball stations to determine the specific activity demands at each, (b) comparing and contrasting or looking for similarities and differences in the execution of individual volleyball skills, (c) creating volleyball activities that applied specific offensive principles of play (e.g., moving to the ball, getting under a ball), (d) drawing conclusions after engaging in a teacher-led activity (e.g., asking students, "Why did you practice the overhead set in that manner?"), and (e) providing indirect feedback about the process of executing specific skills.

Teacher three's post-intervention teaching style was predominantly indirect and student-centered. Very little direct teaching was employed during the volleyball unit. If direct teaching was utilized (e.g., for teaching the mechanics of specific volleyball skills), it would be followed by a comparison-contrast, similarities-differences, or analysis learning episode.

Teacher four was an elementary teacher with 27 years of teaching experience. An average of 7% of teacher four's instructional behaviors promoted critical thinking in pre-intervention lessons, with 93% of the teaching behaviors coded as direct instruction. An average of 41% of teacher four's post-intervention instruction was determined to promote critical thinking, while an average of 59% did not promote critical thinking. Based on a one-way chi-square analysis for Phase 1, $\chi^2(1, N = 1) = 1.5, p > .05$. This finding suggests teacher four's observed pre-intervention teaching behaviors were not significantly different than expected. Based on the one-way chi-square classification for Phase 3, $\chi^2(1, N = 1) = 15.9, p < .001$. This finding suggests teacher four's observed post-intervention teaching behaviors coded as indirect (41%) were significantly different from the expected (15%).

Both pre-intervention and intervention units of instruction dealt with fifth-grade gymnastics. During the pre-intervention phase, teacher four worked at a low critical thinking production level. Instruction was mainly limited to direct teaching. Within this style students were introduced to various gymnastics movements and stunts both on the floor and on apparatus. Students used demonstration charts as one information source and attempted to replicate various gymnastic skills from the charts. Students tried to accomplish as many of the exhibited skills as they could successfully master. In addition, teacher four explained and demonstrated skills, and the children attempted to model the skills as shown. Teacher four also spotted students and offered direct feedback to them as they practiced.

Analysis of pre-intervention lessons indicated a predominance of declarative teaching statements. For the most part, students were told what to do and how to do it. Certain mitigating content factors were discussed. An overriding concern of both instructor and investigator was safety and was the rationale for the direct teaching style. The instructor was concerned with the possibility of injury, since the students would at times find themselves above the ground on the various appa-

ratus or in inverted positions. Both instructor and investigator felt this to be a valid concern. A concentrated effort was undertaken to identify parts of the unit that would best lend themselves to a more indirect and open style. Intervention goals dealt with opening the teaching environment to promote more student input and problem solving. Various stunts and movements on the apparatus were identified as tasks that could be "discovered." Presentation wording and format, created by the instructor, framed these skills as open-ended tasks. While the components of the task were described by the instructor, the resolution of the task was left up to the students. Direct teaching styles were continued with stunts and skills that were felt to be more safely covered in this manner. Students were further pushed to think critically by engaging in a culminating activity that required they combine a number of mastered stunts and organize them into a movement sentence. The components of this sentence were decided by the instructor with the help of the investigator. Students were encouraged to help each other and to check each other's sentences to ensure compliance with the task components.

Teacher four utilized indirect teaching to a greater degree after intervention. There were some problems, however. During the initial phases of the intervention, the instructor found it difficult to "stay out of the process." He would successfully define either a convergent or divergent task and subsequently give the children the answers (i.e., verbally or by showing them possible solutions). This teaching behavior prevented students from fully engaging in the thinking process. The problem was discussed, and various solutions were examined. The instructor decided that the best tact to take to solve this problem consisted of increasing his wait time before intervening and using guiding questions when intervening rather than statements or demonstrations that would end the process of critical thinking. By the end of the unit, significant improvement in this area was determined.

Inductive Analysis

Based on an inductive analysis of coded teaching behaviors and accompanying verbal statements, the following categories represent the teaching behaviors utilized by the teachers to promote CT-PE.

Category 1: Replication and Modification. All four teachers provided domain specific knowledge during the initial lessons and subsequently challenged students to use the previous information with minimum modification. For example, teacher one asked students to take 4 claps, 4 hops, 8 slides, and 8 walks to design a dance phrase. The modification the students were asked to make involved the order in which the steps were performed and their relationship to their partners (i.e., side-by-side, face-to-face, and one partner leading the other). Similarly, teacher two asked high school students to design a line dance. The students had to replicate the domain specific knowledge previously provided by teacher two; however, the students could modify the number or repetitions of a particular step and add directional changes. Teacher three provided middle school students with several task cards describing practice activities for a variety of volleyball skills. During the second and third volleyball lessons, students were asked to choose one of the previously practiced volleyball skills and to design a new activity to practice this skill. Teacher four modeled the Replication and Modification category by asking elementary students to replicate specific gymnastic skills while traveling across a balance beam. Students modified the task by putting the skills in any order they chose.

Category 2: Questions. All four teachers included questioning strategies within their units of instruction. The most frequent type of question required students to analyze a movement or movements. A second category of questions prompted students to compare and contrast different movements or ideas. The third type of question asked students to think divergently.

Teacher 1 Content Area: Creative Dance

Divergent: "Can your group think of at least three different types of machines?"

Analysis: "How many moving parts of the machine do you have to deal with?"

Teacher 2 Content Area: Line Dance

Analysis: "Where do you want to have your weight . . . which foot?"

Teacher 3 Content Area: Volleyball

Comparison: "If you can't get into position for a set, what should you do?"

Analysis: "Which way do you think you should position your hand for the serve?" (Students were given 3 different hand positions.)

Teacher 4 Content Area: Gymnastics

Analysis: "Can anyone see weight transfer?" (Student demonstrates movement.) "Where's the weight transfer?"

Comparison: "Which movement requires more strength?"

Category Three: Facilitating Movement Products. One teacher prompted students to generate an entire product based on a given idea or theme. The content area was creative dance and students were asked to work in small groups to create a machine. The teacher initiated the process by providing the students with task cards outlining the process of creating a group machine dance. The teacher's role was to question and prompt students to think of all parts of a machine that could move, to help students cooperate and share ideas, and to check if students were using all of the available information and criteria provided on the task cards.

Discussion

Overall, the results of this study substantiate Ennis' (1991) assertion that teachers need in-service training to promote thinking in physical education. The in-service or intervention process employed within this study enabled all four teachers to display qualitative and quantitative changes in their teaching behaviors (see Table 1) or the manner in which they structured the learning environment and framed learning tasks. Both McBride (1992) and Freeland (1995) emphasize that CT-PE depends on both of these variables. Based on the quantitative data, all four teachers succeeded in fostering CT-PE to a significantly greater degree after intervention. The chi-square analysis revealed that only teacher three's observed teaching behaviors were significantly different from those expected prior to the intervention. We can conclude from this finding that teacher three may have been more predisposed and experienced in structuring the learning environment to promote critical thinking in her physical education classes.

The organization of students into groups for creating machine dances (teacher one's elementary students), line dances (teacher two's high school students), volleyball strategies (teacher three's students), and partner gymnastic sequences (teacher four's students) support Eggen and Kauchak's (1988) and Garside's (1996) claims that higher-order thinking processes are used when students are actively (vs. passively) involved in cooperative group work.

The qualitative analysis of data suggests that teaching behaviors can be organized into meaningful categories. The categories created within this study (i.e., Replication-Modification, Questions, Facilitating Student Products) reveal similarities to the components of McBride's (1992) schema of CT-PE (see Figure 2). In addition, the use of questioning techniques, common to all four teachers involved in this study, is similar to the findings of Lawrenz and Orton (1989). Science teachers in their study required students to explain their reasoning and to develop inquiry skills. Lawrenz and Orton (1989) suggest these teaching practices promote critical thinking among students.

Co-investigators also suggest, since all four teachers demonstrated behaviors leading to the creation of Categories 1 (Replication and Modification) and 2 (Questions), the teaching behaviors making up these categories may be easier to implement. In addition, since only one teacher displayed several behaviors related to Category 3 (Facilitating Student Products), this manner of fostering CT-PE may be more difficult to design and implement.

Conclusions and Recommendations

Opportunities for in-service training or "intervention" provide teachers with the skills to modify and enhance their teaching repertoire. In this study videotaped data provided an accurate source of information for determining how teachers structure the learning environment and how they frame tasks designed to foster CT-PE. Future studies may benefit by collecting additional data from interviews and journal writing. These data sources may provide information about teachers' reflections and offer insights relevant to how teachers develop the skills to infuse CT-PE.

Although specific teaching behaviors to promote CT-PE were identified in this study, their effect on students' ability to use critical thinking was not studied. Future investigations focused on measures of student CT are warranted.

As noted in previous research (Cleland & Pearse, 1995), this study supports the value of using McBride's (1992) schema of CT-PE as a foundation for developing teaching practices that expedite critical thinking. The participants in this study were able to employ teaching strategies that targeted specific actions and outcomes designated in McBride's schema.

Future studies may also investigate how different units of instruction lend themselves to the infusion of CT. A comparison of teaching behaviors, measures of student CT, and students' reflections—opinions across different units of instruction, may offer ideas about: (a) Within which units of instruction do teachers feel most comfortable trying to foster CT? (b) Within which units do students develop more CT skills? And (c) do students enjoy an activity more due to their involvement in CT activities?

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