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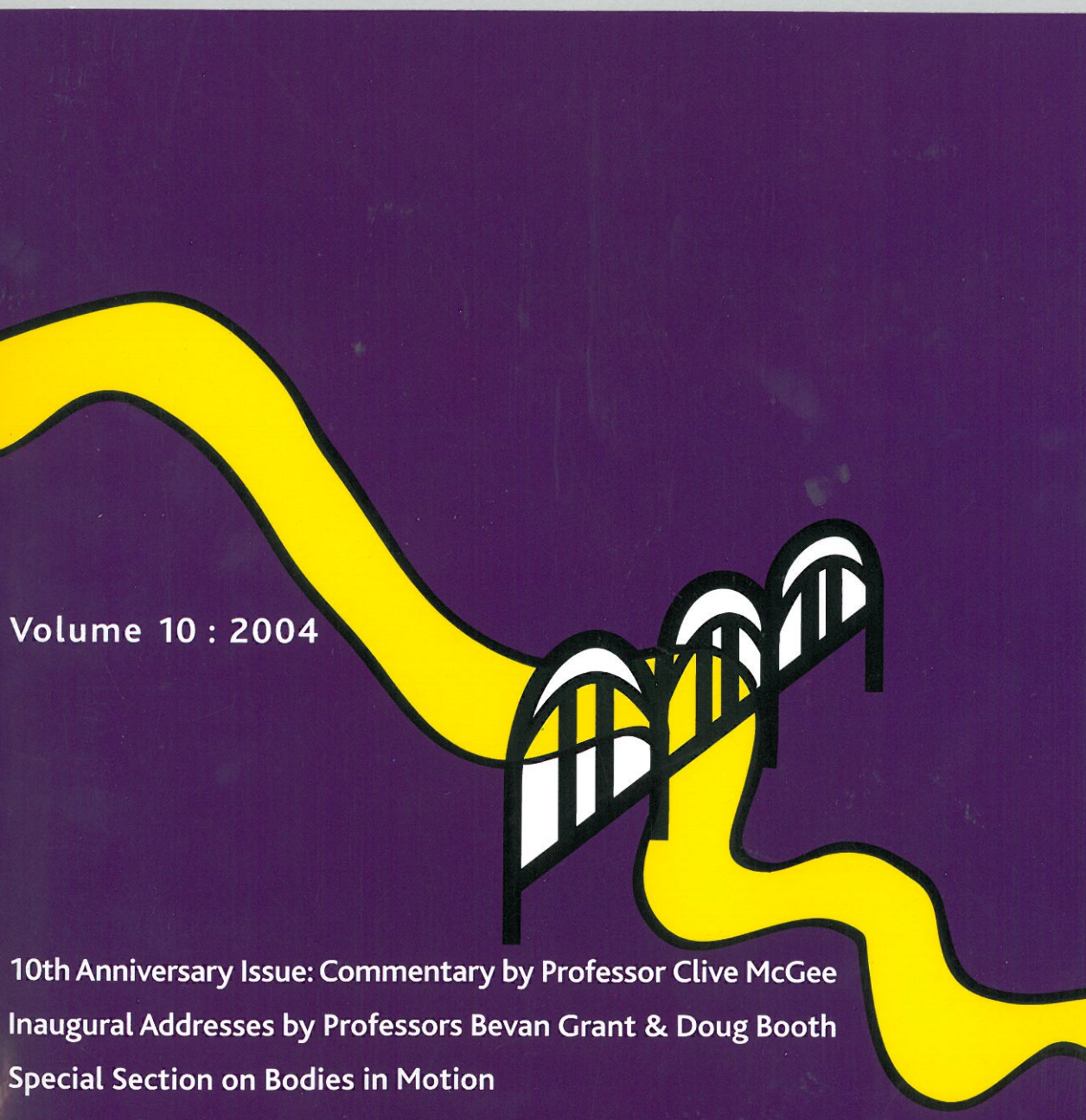

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THE ECOLOGY OF COOPERATIVE LEARNING IN A HIGH SCHOOL PHYSICAL EDUCATION PROGRAMME

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ABSTRACT *The purpose of this study was to describe and interpret the ecology of cooperative learning as an instructional model in two high school physical education classes. One eighth grade (year 9) and one eleventh grade (year 12) class and their teacher were observed during a ten-lesson team handball unit. The following research questions framed the study (a) What were the curricular and organizational characteristics of the handball units? (b) How was the content organized and presented through the instructional tasks? and (c) What were the students' motor responses during the physical education content? A modified version of the task structure observational instrument was used to systematically observe 20 physical education classes (Siedentop, 1994). The ecological analysis demonstrated that both classes had low management time, high engagement time, and a large number of refinements tasks. Students in both classes performed a high number of opportunities to respond in both practice and game situations. Much of the accountability for student performance in managerial and instructional tasks was embedded within the cooperative learning tasks. In addition, the student social system contributed to work in the managerial and instructional task system. Cognitive tasks, which appeared in every lesson, contributed to the students' understanding of the content and contributed to their selection and implementation of appropriate skills and strategies in the games. Cooperative Learning appears to be a viable instructional model for teaching quality high school physical education.*

INTRODUCTION

The ecological approach to teaching was proposed by Doyle (1977) to describe and explain life within the classroom. Doyle suggested viewing classrooms as interrelated systems in which change in one system would influence change in another system. In biological terms "ecology" refers to the study of the habitat of living objects, the relationship between organisms and their environment. The ecological model focuses on the work students do in their classrooms. Students exert strong influences on their teachers and this model highlights that teaching is not unidirectional from teacher to student. The ecological approach provides a better understanding about the dual-directional interactions between students and teachers in a learning environment: how is content organized and presented and what is the student's response to that content? Fundamental to the study of the class ecology is the notion of tasks or task systems. Doyle (1986) discussed instruction as made up of a series of tasks; that is, academic work can be seen as a series of "academic tasks" and management can be seen as a series of "management tasks". The task designates the structure that organizes and directs student cognitive work (Doyle & Carter, 1984).

The ecological model that was initiated in classroom research was adapted to physical education by Tousignant and Siedentop (1983). Since then a number of research studies have been conducted utilizing the task structure system in

physical education (Dyson, 1994; Tousignant & Siedentop,1983; Hastie, 2000; Jones, 1992; Lund, 1992; Romar, 1995; Siedentop, Doutis, Tsangaridou, Ward, & Rauschenbach,1994). This research has suggested that teaching and learning in physical education can be viewed as an ecology represented by three interrelated systems: the managerial task system, the instructional task system, and the student-social task system (Hastie & Siedentop, 1999). A managerial task relates to the organizational and behavioral aspects of physical education, that is, all the subject requirements for students and teachers to work together. The instructional task system relates to the subject-matter activity of physical education, the learning students are supposed to acquire by participating in the instructional activities. The student-social task system relates to the intentions for social interaction that students seek in physical education. Allen (1986) introduced the concept of a student social system, suggesting that students have two major goals in the classes: to socialize and to pass the course. The social system has not received as much attention in research as the managerial and instructional task systems. However, in classes utilizing Sport Education Carlson and Hastie (1997), and Hastie (2000) found that students enjoyed peer interaction, skill development, and team strategies. Both studies also reported that the leadership and responsibility that were embedded in the social system enhanced the managerial and instructional tasks. These results are similar to the findings of Dyson and Strachan (2000) who found that cooperative learning helped students: develop motor skills, develop game strategies, actively participate, respect one's peers, accept responsibility, and improve communication skills.

Jones (1992) examined two elementary physical education classes using the task structure system. Her data supported the existence of managerial and instructional task systems along with an informal social task system. She found that the managerial system was the priority at the beginning of the year. The teachers in this study generally presented informing tasks, added extensions, and then applied skills to modified game situations. Jones (1992) discovered that the teachers rarely asked their students to perform refining tasks; only three refining tasks were observed in 34 lessons. This is a common finding in many physical education classes (Romar, 1995; Rickard, 1992), despite the literature emphasizing the importance of refining tasks in skill acquisition (Rickard, 1992). Jones (1992) found that at the elementary level a less formal accountability system was evident as the children were not involved in the formal grade exchange of performance.

In a study of 11 high school teachers, Siedentop, Doutis, Tsangaridou, Ward, and Rauschenbach (1994) found that both teachers and students regarded physical education as "no sweat." They reported that only two teachers had students engaged in activity for 60% or more of lesson time. In these classes there were few refinement tasks, few opportunities for students to respond, and the teachers merely gained and maintained the cooperation of the students. Romar (1995) discovered in his study of four secondary school teachers that an average of only 51.4% of the class time was spent in engagement in units consisting of a varied mix of aerobics, dance, gymnastics and basketball. The same study reported opportunities to respond (OTRs) ranging from 1.6 per minute in gymnastics to 3.3 per minute in a high school basketball unit. Appropriate responses ranged from 59.7% in a gymnastic skills unit to 83.1% in a basketball skills unit.

As Hastie (2000) pointed out, most of the research in physical education using the ecological model has studied teachers and students in situations where the teacher is directing the content. However, he has described adventure education (Hastie, 1995) and Sport Education (Hastie, 2000) as two other curricula

that have less direct instruction where the teacher is more of a facilitator than a supervisor. In this article we analyze cooperative learning through the ecological approach to teaching physical education.

Recently, at the American Education Research Association conference, leading scholars suggested that we look to a models-based approach to teaching physical education as described by Metzler (2000) (Kirk, personal communication). This models-based approach focuses teachers and teacher educators on developing strong instruction in physical education in contrast to the "multi-activity program" that dominates physical education programs in North America (Metzler, 2000). One instructional model that has been highlighted in general education is cooperative learning. Cooperative Learning (CL) is an instructional model that organizes students to work together in small, structured, heterogeneous groups to complete instructional tasks. The students are not only responsible for learning the material, but also for helping their group-mates learn (Antil, Jenkins, Wayne, & Vadasy, 1998; Putnam, 1998).

There is extensive research based in general education, that is, classroom research on CL. Studies have emphasized the positive effects on academic achievement, self esteem, active learning, social development, and inclusion of all students in the learning process (Cohen, 1994; Johnson & Johnson, 1989; Kagan, 1992; Slavin, 1996). One of the most appealing attributes of CL is its dual focus on social and academic outcomes (Antil et al., 1998; Cohen, 1994; Putnam, 1998). Students have the greatest learning gains when teachers are successful in delegating responsibility so that more students can talk and work together at multiple learning centers (Cohen, 1994). Even though there are benefits to this instructional model, implementing CL requires a conceptual shift in the ways teachers organize and manage their classrooms or gymnasiums (Dyson, in press).

There are five essential elements to cooperative learning: positive interdependence, individual accountability, promotive face-to-face interaction, interpersonal and small group skills, and group processing (Antil et al., 1998; Putnam, 1998). These elements and CL approaches are described in previous papers (Dyson, 2001; 2002; Dyson & Strachan, 2000).

CL in this study is closely aligned to the cognitive theory of social constructivism. Students are perceived as active, social, and creative learners (Perkins, 1999). The constructivist perspective has been promoted in the physical education literature (Ennis, 2000; Rovegno & Bandhauer, 1997; Rovegno & Kirk, 1995).

Several physical educators have encouraged the use of CL as an instructional model for change in physical education classes (Dyson, 2001; 2002; Grineski, 1996; Kirk & McPhail, 2002; Metzler, 2000; Rovegno & Kirk, 1995). Despite the rhetoric there is limited research on CL in physical education. Nonetheless, the studies that have been conducted indicate promising results. Grineski (1989) found that CL can enhance physical fitness and social interactions for elementary, kindergarten, and pre-school children. Pre-school children involved in cooperative games had higher rates of positive physical contact than free play, especially for children with disabilities. In addition, cooperative games enabled players to demonstrate high rates of goal-related cooperative behaviors and lower rates of negative physical contact and negative verbal interactions. The CL structures facilitated successful student participation and positively affected player performance. Smith, Markley, and Goc Karp (1997) used CL with third grade students in physical education classes. They found that student social reasoning skills, interaction, and social participation improved after a six-week CL

unit. With grade five and six students using CL, Dyson (2001) reported that both the teacher and the students emphasized: improving motor skills, developing social skills, working together as a team, helping others improve their skills, and taking responsibility for their own learning. In the same school district at the high school level, Dyson & Strachan (2000) found that a physical education teacher believed CL helped her meet the following goals: developing motor skills, developing game strategies, actively participating, respecting one's peers, accepting responsibility, and improving communication skills. Grade eight and eleven students stated that CL encouraged participation, was fun, and allowed them to develop motor skills, strategies, and interpersonal skills.

Barrett (2000) investigated the use of two CL structures, Performer and Coach Earn Rewards (PACER) and Jigsaw II in Physical Education (Jigsaw II-PE), in which the two roles of performer and coach were utilized in two grade six physical education classes. These strategies used three elements of CL: cooperative interaction (positive interdependence), individual accountability, and group contingency. PACER and Jigsaw II-PE resulted in increased correct trials for participants and total trials for Jigsaw II-PE in sports skills units. Participants within PACER and Jigsaw II-PE classes also showed improved performances for low-skilled male and female students.

To further understand the process of implementing CL Dyson (2002) reported results from a teacher and her third and fourth grade students over a two-year period. The teacher used Pairs-Check-Perform and Learning Teams as CL structures (Dyson & Grineski, 2001; Grineski, 1996). In this study the teacher and students held similar perceptions of CL. This was represented in the categories that emerged from the data: goals of the lessons, student roles, accountability, communication skills, working together, and practice time.

The current study builds on Hastie's (2000) examination of the Sport Education. It's purpose is to describe and interpret the ecology of cooperative learning as an instructional model in two high school physical education classes. We are not aware of any previous study examining the ecology of CL in physical education. More specifically, the following research questions provided a guideline for the study:

1. What were the curricular and organizational characteristics of the handball units?
2. How was the content organized and presented through the instructional tasks?
3. What were the students' motor responses during the physical education content?

METHOD

Participants and Settings

Two all-female classes, one eighth grade (year 9) and one eleventh grade (year 12), were observed during a ten-lesson team handball unit. Lennox High School was a culturally diverse urban school in North America with a population of 520 students. Anne MacDonald had been teaching physical education at Lennox High School for 23 years. She had also been a cooperating teacher, supervising student teachers for ten years. Anne was one of the most effective physical educators in the local area according to her principal, university faculty, other physical educators, and student teachers.

Anne used a CL instructional format that was most similar to the CL structure "Learning Teams" (Dyson & Grineski, 2001; Grineski, 1996). In her peer-mediated approach, students worked in groups using one another as resources to complete the tasks. Students were assigned various roles and were expected to perform complex tasks or game strategies. Anne had attended two workshops on cooperative learning and tried to incorporate its elements in her program: positive interdependence, individual accountability, promotive face-to-face interaction, interpersonal and small group skills, and group processing. Anne had taught this group of grade eleven students (n= 28) for three years using cooperative learning strategies. For the grade eight class (n =26) this was their first year using CL structures.

Students in both classes were organized into Learning Teams of four students that were designed to operate as a team throughout the unit. The CL lessons were designed for maximum participation by the students. Anne planned tasks to provide students with an opportunity to learn the routines and structure, and to take responsibility for themselves and other teammates. In each class, each group had a folder in which they wrote down handball content, such as how to throw and pass a ball, offensive strategies, defensive positioning, and the rules of the game. The members' signatures, on their folder, denoted their contribution to the subject matter for their group. A typical lesson for grade eight involved Anne helping students get organized and demonstrating new information. This was followed by practice in their small groups while Anne moved around providing feedback to students. Teams were asked to figure out their goal or strategy for the lesson. Grade eleven students came into the gymnasium and immediately organized their equipment (Ex. balls and pinnies), took their group folder to read their task sheet, discussed their goals or team strategy for the day, and started their first task for the day without direction from their teacher.

Data Collection

The teacher and the students in the two classes were systematically observed for ten lessons each during a handball unit. The study involved non-participant observation of all grade eight classes and 10 of the 20 lessons for the grade eleven handball unit. All lessons were videotaped and the teacher wore a wireless microphone which provided teacher verbal data. Both classes were taught the same handball content by the same teacher. Permission to participate in the study was obtained from both the parent and the child through written consent.

A multiple-method case study design was utilized to investigate the ecology of the physical education environment (Yin, 1989). This included the use of both quantitative and qualitative lines of inquiry. The quantitative inquiry was utilized through a modified version of the task structure observation system (Siedentop, 1994). In addition, field notes were written as part of data collection on the task structure observational instrument. The qualitative inquiry included interviews and document analysis, and were reported in a previous paper (Dyson & Strachan, 2000).

A modified version of the task structure observation system was the systematic instrument used to describe the ecology of the physical education classes (Dyson, 1994). The focus of the task structure observation system was the instructional system, managerial system, and social system of the gymnasium. The instrument focuses on how the gymnasium was organized, how tasks were presented, and how students responded to that instruction. The task structure

observation instrument is used to analyze teachers' and students' behaviours during teaching episodes and combined the use of duration and event recording (Siedentop, 1994).

Managerial Task System. Data related to the managerial task system were generated from the videotapes of 10 lessons from each class. Managerial tasks were defined as those tasks relating to non-content, such as, the organization and the direction of student behaviour (Tousignant & Siedentop, 1983). Managerial tasks were recorded by incidence (number per lesson), and the focus (student behavior, class organization, or task-specific management). An example of task-specific management was observed when students entered the gymnasium and immediately moved to the equipment room to organize their equipment for the task.

Instructional Task System. All instructional tasks presented by the teacher were coded using the following criteria: (a) incidence, to measure the relative frequency of the tasks, and (b) task type, to determine the instructional focus. The type of task was classified as either "informing", "refining", "extending", "applying", or "aerobic" using classifications developed by Rink (1993).

For each time a student performed a motor skill or strategy an "opportunity to respond" (OTR) was recorded. Student OTR data were recorded for engagement in the instructional task system according to their rate per minute, total number, and percent success. Also, the quality of an OTR is coded as either appropriate or inappropriate (Siedentop, 1994).

Student Social Task System. Data for the analysis of the student social task system were collected from interviews (Dyson & Strachan, 2000) and field notes from the task structure observation instrument. These data were used to describe the ways students achieved their goals and the goals of the teacher. These included determining what their teacher expected, performing the tasks, having fun, reducing boredom, and behaving in an acceptable manner (Hastie, 2000).

Reliability

Inter-observer reliability for this study was conducted for 20 percent of the videotaped lessons. Inter-observer reliability, which implies an agreement between coders (van der Mars, 1989), was determined by two coders who independently coded 20 percent of the observed lessons. Two lessons from each class were randomly selected for inter-observer coding. The independent observers were trained by a researcher prior to the study on how to use the task structure instrument. Inter-observer reliability was calculated by a frequency count of (a) the number of coded events, and (b) the categories of teaching behaviours. Reliability for this data were calculated using the formula of "agreements/(agreements + disagreements) x 100" (van der Mars, 1989), Observers had an 89 percent agreement on the number of coded events and a 93 percent agreement on the categories of teaching behaviours.

Data Analysis

Findings were grounded in a specific school context; that is, these data were based on observations from the physical education lessons. The quantitative data obtained from the modified task structure observation instrument (Dyson, 1994) was tabulated to provide an indication of the frequency, duration, type of instructional tasks, percent, and student responses. The observed tasks were first

classified as to type, frequency, and duration within the managerial and instructional categories. The instructional tasks were further classified into the specific categories of informing, extending, refining, applying, aerobic, or cognitive tasks. The students' responses to these tasks were recorded based on total number of OTRs, number per minute, and percent successful. An analysis of the relationships between the task systems was conducted through the identification of routines and patterns within the managerial and instructional categories (Jones, 1992).

RESULTS

The data represents the teacher's and students' behaviours during the implementation of CL in handball classes. Results from the managerial and instructional task systems will be followed by the student social task system. In the ten lessons observed both the grade eight and grade eleven classes showed similar findings in terms of curricular and organizational characteristics. These findings are broken down into three levels of analysis: overall task selection, engagement tasks, and opportunities to respond. This is followed by accountability and student social task system.

Task Selection

In the task structure observation system the first level was duration of teaching episodes. The grade eight and eleven classes had similar lesson durations and time spent in management, transition, waiting, and warm-up. In the grade eight class, management time was spent at the beginning of seven of the ten classes (Table 1). This was time spent to take attendance and/or to make announcements. Management, as a percentage of class time, ranged from 0.8% to 2.4%, resulting in an average of 1.1%. For the grade eight class management served as a time for structuring and organizing the class before the lesson began.

Instruction for the grade eight class had an overall average of 15.6%, ranging from 32.5% in the first lesson to 7.0% in the final lesson. In contrast, engaged time averaged 62.3% of lesson time, ranging from 51.7% in the first lesson to 73.8% in the final lesson.

For both classes, the amount of time spent in management tasks was somewhat less than that found in the literature (Hastie, 2000; Jones, 1992; Romar, 1995). In the grade eleven class, there were only two episodes of management during the unit, consisting of 6.1% and 2.0% of the class time (Table 2). This resulted in an overall average of 0.8% of lesson time over ten lessons. Management time for the grade eleven class consisted of announcements related to school activities. In lesson three, high management time (6.1%) was due to an announcement concerning a school-wide event. Normally, the teacher would take attendance for this class when they were involved in activity so that time could be used for productive engaged time. In contrast, the grade eight class, with Anne as their new teacher, was more structured with a regular allotment of time for attendance.

For both classes, the amount of time spent in instruction was substantially less than that identified by Romar (1995), who identified as much as 27% of the class time in instruction. Instruction for the grade eleven class had an average instruction time of 11.1%, ranging from 5.8% to 15.4%, which was lower than the grade eight class. Conversely, the average engaged time was slightly higher than

the grade eight class with an average of 68.2%, ranging from 60.7% to 78.0% of lesson time. In general, instruction time decreased throughout the unit as students spent increasingly more time in practice and game situations. In both the grade eight and grade eleven classes, the amount of time spent in engagement was high compared to other comparable research studies (Hastie, 2000; Jones, 1992; Romar,1995). For example, Romar (1995) cited an average of approximately 50% student engagement time.

Wait time was an average of 10.2% for grade eight and 8.1% for grade eleven. During wait time students were observed watching other teams, cheering for teams, talking to each other, and developing strategies for improving their offense or defense (Field Notes). This highlights one of the major problems that face physical educators, a small gymnasium and large numbers of students. Even though, during game time, there were two games occurring simultaneously in the gymnasium, there were still two teams not playing.

Task Engagement

The second level of analysis in the task structure observation instrument was the task type that the teacher presented and the students' responses to those tasks. The types of tasks: informing, refining, extending, and applying were defined by Rink (1993). In addition, cognitive tasks played an important part in this cooperative learning curriculum.

Cognitive tasks were defined by Dyson (1994) as tasks that required students to ask or answer questions, problem solve, make a decision, strategize, or discuss information related to lesson content during the lesson or in a debrief at the end of the lesson. There was no physical activity during the cognitive tasks. In this study cognitive tasks also happened prior to the activity. This was typically in the form of a students strategizing prior to the activity serving as a means of discussing or clarifying some particular aspect of a skill or task.

Informing tasks, which are the first tasks after the presentation of information, occurred in four lessons for the grade eight class (Table 3). Informing tasks averaged 3.5% of the total engaged time, ranging from 3.0% in lesson five to 13.5% in lesson three. The next type of task, refining tasks, focuses on the quality improvement of the task or strategy. For the grade eight class, refining tasks occurred in six of the ten lessons averaging 16.4% of the total engaged time or 8 refinement tasks in 10 lessons. For the past 20 years Rink (1996) has emphasized the importance of refining tasks and its indication as a form of effective teaching. She stated that physical education lessons should include appropriate refinement tasks.

> The concern for quality of student performance can be exhibited by teacher feedback to the class or individual students about how they are performing . . . [and] exhibited very clearly by teachers when they stop student practice and focus students on achieving particular movement qualities . . . Refining tasks can have a powerful impact on student performance when the teacher keeps the focus of improvement narrow and when students are held accountable for actually working within the focus of the refining task. (Rink, 1993, p. 101)

Rickard (1992) suggested that refining tasks, which are the building blocks for improvement in skill, are essential in physical education lessons. She found that

refining tasks resulted in increases in low-skilled students when followed by specific feedback. In high-skilled students, practice success increased by 14% over extending and applying tasks when refining tasks were used (Rickard,1992). Extending tasks, which change the conditions of practice to alter the focus of skill development, occurred in only three lessons for the grade eight classes. Extending tasks averaged 3.4% of the total engaged time, ranging from 1.6% in lesson 5 to 20.7% in lesson one. Applying tasks, which were modified games, occurred in all ten lessons for the grade eight class. The average time spent in applying tasks was 50.7% of lesson time, ranging from 17.1% in lesson one to 72.0% in lesson nine. Aerobic tasks or routine tasks (Rink, 1993) for both classes involved an added high activity focus for students in the form of jump rope. Students developed their aerobic capacity and jump rope coordination as they attempted to jump rope for a pre-selected duration of time. For the grade eight class, aerobic tasks were observed in two of the lessons, averaging 4.9% of the engaged time for the unit. This study similar informing tasks, extending, and applying tasks were observed. However, both grade eight and grade eleven students experienced more refining tasks than students in other studies using the task structure system as a form of analysis (Hastie, 2000; Jones,1992; Romar, 1995).

In the majority of classes students spent a high percentage of lesson time in cognitiveengagement. The grade eight class had cognitive tasks in all ten lessons, averaging 21.2% of the total engaged time. This ranged from 8.7% in lesson six to 38.2% in lesson seven. Since the grade eight class was learning social skills they spent more time than grade 11 in situations where they could practice interpersonal skills. For example, a task from lesson seven required students to create an offensive strategy. Grade eight students took an extended period of time to figure out an offensive strategy before they could choose an appropriate strategy to practice in their small-sided teams. This is demonstrated by the cognitive task time in lesson seven at 38.2% of engaged time.

The grade eleven class was similar to the grade eight class related to task presentation (Table 4). For the grade eleven class the extending tasks averaged 2.6% of the total engaged time and refining tasks accounted for an average of 15.7% of the total engaged time; there were 7 refinement task in 10 lessons. This result compares favorably with to other research. In the handball units there were 15 refinement tasks in 20 lessons compared to 3 refinement tasks in 34 lessons in other reported research (Jones, 1992

The grade eleven class had seven lessons with informing tasks, averaging 6.3% of the total engaged time. Informing tasks ranging from 17% in lesson one to 3.7% in lesson five. There were not informing task for the last three lessons of the unit because the focus was on game play, Applying tasks for the grade eleven class were similar to those of the grade eight class. Applying tasks occurred in all but the first lesson, averaging 46.7%, ranging from 29.2% in lesson six to 91.8% in lesson eight.

For the grade eleven class, in addition to handball, a jump rope was an integrated part of the first six lessons and averaged 12.2% of the engaged time. The time was recorded as an aerobic tasks and ranged from 8.2% to 32.6% of the engaged time. The grade eleven class spent more time in aerobic tasks than the grade eight class.

The grade eleven class spent less time in cognitive tasks than the grade eight class. Although cognitive tasks were a part of every lesson, they averaged only 16.5% of the total engaged time. The amount of time spent in cognitive tasks ranged from 0.8% in lesson four to 47.3% in lesson one. In lesson one the students

spent a good portion of the period planning a jump rope routine that their respective groups would perform at a later date.

Students' Responses to Instruction

The third level of the task structure observation system was students' responses to instruction during the lessons. Opportunities to Respond (OTR) was used as a measure. For example, each time a student threw a ball it was considered an OTR. OTRs included both offensive and defensive positioning, throwing the ball, catching the ball, running for the ball, running with the ball and attempting to block a shot. The students in the grade eight class had an average of 98 OTRs per lesson (Table 5). OTRs were then coded as either appropriate or inappropriate. An appropriate response was one that had an acceptable working form and a high probability of successful engagement (Siedentop, 1994). For example, if a student threw the ball with proper form so that it made it to the intended receiver, then it was coded as an appropriate OTR. For the grade eight class, the average percentage of appropriate OTRs was 88.6%. The OTRs were an average of 4.2 per minute of engaged time. This number ranged from 3.2 in lesson ten to 5.9 in lesson eight. The grade eleven class had an average of 109 Opportunities to Respond per lesson (Table 6). The average percentage of appropriate OTRs was 92.8, somewhat higher than the grade eight class. The OTRs per minute was 4.4, similar to that of the grade eight class.

In this study there was a higher number of OTRs for both the grade eight and eleven classes than those reported in the literature (Hastie, 2000; Jones, 1992; Romar, 1995). The percentage of appropriate OTRs was also very high for both classes when compared with similar studies (Hastie, 2000; Jones, 1992; Rickard, 1992; Romar, 1995). The literature has supported the notion that high success with appropriate tasks is an indicator of achievement in physical education (Silverman, 1991). Although for both classes there were only a small number of inappropriate responses, the grade eleven class exhibited more appropriate responses (92.8%) than the grade eight class (88.6%).

Accountability

Accountability was evident in various ways throughout the unit, including: individual testing, member signatures, peer feedback to each other, and constant monitoring and interactions by Anne. At the end of each lesson Anne asked students questions to determine if their goals had been accomplished. At the end of the unit both classes were administered a written test on basic handball knowledge; the average score in both classes was above 80%. On the test the final question asked, "What was the most important thing that you learned during the handball unit?" For both classes the top two answers dealt with teamwork and communication.

In each class, each group had a folder in which they wrote down such things as how to throw/pass a ball, defensive positioning, and the rules of the game. On the outside of the folder
were the names of the group members. The member signatures denoted each student's contribution to the subject matter for their group. This was a method for holding students accountable to each other during the lessons.

An analysis of accountability, through the task structure observation system (Siedentop, 1994) showed that Anne used monitoring plus interaction (73%), post-

task feedback (19%), public recognition (8%), and grade exchange (test) as means of holding the students accountable. During engagement she was involved in monitoring and interacting with students (93%). Anne was constantly monitoring and giving students feedback on their social or motor skills.

For the majority of the time students were coded as "on the stated task" and they did not modify or alter the tasks or game situation. This was supported by their high engagement time and high OTR scores (grade eight, 4.2 per minute; grade eleven, 4.4 per minute). Although there were no major problems with the grade eight class, they were occasionally found in off-task behaviour (less than 2% of lesson time). This was evident by more talking and fooling around during instructional and managerial episodes (Field Notes). Off-task behaviour in the grade eleven class was virtually non-existent (Field Notes).

Student Social Task System

A complex social system was fostered by the cooperative learning tasks. When asked about the lessons, students talked about participation, fun, motor skills and strategies, and interpersonal skills when they were asked for comments (Dyson & Strachan, 2000). From the interview data and field notes it appeared that the handball unit was fun for students but they took their roles and tasks seriously. They enjoyed taking responsibility for working with each other (Dyson & Strachan, 2000). Students in both classes enjoyed the social interactions that occurred within their teams and with other teams. Jane, an eleventh grade girl commented on the "healthy rivalry" that developed between the teams. Normally when students talk to their peers in class this detracts from their learning, but in this setting the social interactions contributed to the instructional task system. For example, a task might be to develop an offensive strategy to create space in handball. Students had to work together first, "strategize' to come up with an appropriate strategy, agree on the strategy, and then try to implement the strategy in a game.

In the cooperative gymnasium students, particularly the eleventh grade, had enjoyable learning experiences. Students had fun playing together and trying to help their teammates improve their skills and strategies (Field Notes). This suggested that the students' social agenda was similar to the teacher's goals for the unit. Research on Sport Education has also demonstrated that student social agendas can be congruent with the teacher's social agenda (Carlson & Hastie, 1997; Hastie, 2000). In addition, students enjoyed watching other teams play. Students were able to sit and chat during class while performing their observation tasks, that is, watching another team or strategize for their next game. This supports Allen's (1986) notion that the best type of class for students is one that allows them to socialize while learning stimulating content that also allows them to pass the class.

Students also enjoyed playing the games and calling their own time-outs. Students refereed their own games. This was problematic for the grade eight students but grade eleven had few disputes or disagreements. A healthy competition within a cooperative structure of learning had developed. This was similar to students' experiences using the sport education model (Carlson & Hastie, 1997; Hastie, 2000).

DISCUSSION

The purpose of the study was to describe and interpret the ecology of cooperative learning as an instructional model in two high school physical education classes. The ecological analysis indicated that management time was low, instruction time was low, and engagement time was higher than other comparable studies (Hastie, 2000; Romar, 1995; Siedentop, et al, 1994). Students appeared to buy into their teacher's goals and were on task most of the time and did not negotiate to modify the tasks.

The teacher was an effective manager. Research indicates that effective teachers set rules, routines, and expectations early in the school year (Fink & Siedentop, 1989; O'Sullivan & Dyson, 1994). Anne created routines that students learned and followed. Grade eleven students, who were more familiar with CL, came in to the gymnasium and immediately organized their equipment, took their group's folder to read their task sheet, and discussed their goals or team strategy for the day. Grade eleven had very low management time (0.8%). They knew the routine and had learned the CL structure and therefore management time was diminished which allowed for more engagement time.

The data supported Hastie's (2000) findings that managerial accountability can be embedded in the students' tasks. Students can learn to take responsibility for management and organization of themselves and their teams; students became leaders (captains) and self-managers. "Peer accountability also contributed to the efficiency of the managerial system" (Hastie, 2000, p. 369). This was assisted by captains being put in leadership roles to complete management tasks and provide instruction to other students.

Much of the accountability for student performance in managerial and instructional tasks was embedded within the CL tasks. Captains and teams worked together on their own during practices and during the games. The students did not struggle with getting organized or performing their tasks. Anne's ultimate goal for grade eleven was for the students to hold themselves accountable for managerial and instructional tasks. Learning to work together and positively depend on one another also meant that it was more likely that they would play effective offense and defense in team handball games.

Once the managerial system was established Anne spent less time consumed with organization. More time was then available to help students, provide feedback, and assess student performance. Anne empowered students by giving them more responsibility for problem solving and decision making, which enhances management and instruction, and strengthens the student social system. However, Anne did not stand by and observe passively. She facilitated learning by monitoring and interacting with students depending on student need. Anne often gave the team leaders suggestions for team improvement and guided students to solve their own problems.

Students also enjoyed helping each other learn. Students preferred having other students help them learn and preferred having students as coaches. For both classes instruction time decreased during the unit. The instruction time was low because the students were teaching one another. This peer teaching was an inherent part of CL and similar to findings on Sport Education research (Carlson & Hastie, 1997; Hastie, 2000).

The most common tasks observed were applying and cognitive tasks. Several of the games (applying tasks) had a tactical focus on offense and defense and Anne achieved her goals of developing students' skills and strategies. In

addition, refinement tasks were used more frequently than in other comparable studies (16.4% for grade eight and 15.7% for grade eleven). Research has suggested the need for frequent refinement tasks but few studies have yielded high numbers of refinements (Hastie, 2000; Jones,1992; Romar,1995). Despite the fact that she used more refinement tasks than many other teachers, Anne said that she wanted to continue to improve in this aspect of her teaching.

Cognitive tasks were typically in the form of strategizing or group processing prior to or after the tasks. They served as a means of discussing or clarifying some particular aspect of a skill or tactic. Students' cognitive knowledge of handball was confirmed by high scores on the written tests. One difference between the two classes was the task explicitness during cognitive tasks. Tousignant and Siedentop (1983) defined an implicit task as one in which "the task presentation was done with no or very limited information; in such circumstances, students had to know from previous experiences how to play the roles of a participant in such tasks" (p. 53). A partially explicit task was defined as one in which "the task presentation included a general description of the form or the product of an expected response" (Tousignant & Siedentop, 1983, p. 53). A fully explicit task was defined as one in which "the task definition included precise criteria to be used to determine the level of success" (Tousignant & Siedentop, 1983, p. 53). Although motor tasks were generally fully explicit for both classes, the cognitive tasks were presented differently. For the grade eight class, the cognitive tasks were usually fully explicit (Field Notes). For the grade eleven class, the cognitive tasks were usually partially explicit because Anne wanted her students to take more responsibility for their own learning (Field Notes). The teacher attributed this to the fostering of social maturity and previous experience with CL. While the grade eight class needed guidance on what to do, students in the grade eleven class were at a level where the social interaction was more effective without constant teacher assistance (Anne, Interview). Management tasks were embedded in the CL strategies. Once students had learned the routines, tasks did not need to be stated explicitly; grade eleven students knew their roles and took responsibility for their team, not wasting time on management.

In this CL study there were cognitive tasks in every lesson; this is highly unusual in physical education lessons. These cognitive tasks took the form of group processing, which is one of the main elements of CL. Evans (1990) commented that many forms of curriculum innovation emphasize the intellectual and cognitive elements of physical activity. For example, several physical educators have identified the importance of learning through the Tactical Games Model (Bunker & Thorpe, 1982; Mitchell, Oslin, & Griffin, 2003). The Tactical Games approach focuses on the "what to do" within the game context before the question of "how to do." In this manner, the students are involved in more decision making and understand how their learned skills are applied to the game situation. Another example is the sport education model (Carlson & Hastie, 1997; Hastie, 2000, Siedentop, 2002), which is also student-centered and provides tasks that challenge students to use strategies and make decisions. Students act as the coaches of teams, and take on responsibilities that include scheduling games, resolving disputes, coaching, refereeing, scorekeeping, and keeping game statistics. The idea behind these instructional models is for students to understand the strategies and complexities of each sport. This moves us beyond the traditional "multi-activity" approach to high school physical education (Metzler, 2000).

Students in both grade 8 and 11 classes performed a high number of OTRs in both practice and game situations. High numbers of OTRs were enabled by the tasks presented by the teacher – the learning environment that Anne created. This can be attributed to her expertise as a teacher and the CL instructional model that facilitated an energetic, active learning environment. The CL learning environment encouraged high OTR scores with its small groups, active tasks, and plenty of balls to allow for many opportunities to practice the skills. As Siedentop (2002) has reminded us that, "small-sided games are preferred because they increase opportunities to respond" (p. 410).

Holding students accountable is a concern in physical education classes (Lund, 1992). In this study students held each other accountable in addition to the monitoring and feedback by Anne. CL strategies of task sheets, member signatures, peer feedback, and the recording of group performances can assist teachers in holding students accountable.

Compared to other high school situations (Siedentop, et al., 1994) managerial and instructional task systems were efficient and the student social system contributed to students' performance. Students enjoyed the social interactions that were an inherent part of the CL instructional model. Grade eleven students had developed extensive interpersonal skills that helped them plan their offensive and defensive strategies to challenge themselves in the handball games. They were in control of their strategizing with minimal guidance from Anne, which heightened their enjoyment of the game. The grade eleven students' social agenda was similar to their teacher's goals and these findings supported other school-based research (Carlson & Hastie, 1997; Hastie, 2000).

CONCLUSION

Using cooperative learning allowed Anne to overcome many of the challenges that face physical educators in the gymnasium. The ecological analysis demonstrated that both classes had low management, high engagement, a number of refinements tasks, and high appropriate opportunities to respond. Anne appeared to achieve her goals for the unit, which were for her students to: improve motor skills, develop game strategies, actively participate, respect one's peers, accept responsibility, improve communication skills, and have fun.

The student social system contributed to work in the managerial and instructional task system. Cognitive tasks, which appeared in every lesson, contributed to the students' understanding of the content and contributed to their selection and implementation of appropriate skills and strategies in the games. As an instruction model cooperative learning may not suit all teachers, however, in this study it seemed to make an effective teacher even more effective. Cooperative learning appears to be a viable instructional model for teaching quality high school physical education.

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Table 1. Percentage of Lesson Time and Frequency of Tasks for Grade Eight

Lesson #	Lesson Duration	Management	Transition	Wait Time	Instruction	Warm Up	Engaged Time
One	36:17 (40)	-	6.8% (10)	2.0% (4)	32.5%(13)	7.0% (1)	51.7% (12)
Two	38:16 (33)	2.4% (1)	9.0% (6)	10.5% (5)	19.8% (12)	4.6% (1)	53.7% (8)
Three	37:37 (41)	-	5.3% (7)	20.5% (4)	25.3% (15)	6.5% (2)	42.5% (13)
Four	32:30 (19)	0.8% (1)	5.0% (5)	14.2% (3)	13.3% (5)	-	66.8% (5)
Five	40:06 (29)	2.0% (1)	5.1% (7)	3.9% (3)	14.6% (9)	5.0% (1)	69.3% (8)
Six	38:52 (28)	1.5% (1)	6.5% (7)	11.3% (5)	10.5% (4)	6.9% (1)	63.3% (10)
Seven	38:51 (18)	1.8% (1)	5.5% (5)	10.6% (2)	13.3% (3)	-	68.8% (7)
Eight	39:56 (20)	-	8.7% (6)	8.5% (5)	10.0% (2)	5.2% (1)	67.7% (6)
Nine	39:17 (27)	1.3% (1)	6.7% (7)	10.7% (5)	9.6% (6)	6.8% (1)	64.9% (7)
Ten	38:51 (24)	1.4% (1)	8.5% (7)	9.3% (3)	7.0% (7)	-	73.8% (6)
Average	38:03 (28)	1.1% (1)	6.7% (7)	10.2% (4)	15.6% (8)	4.2% (1)	62.3% (8)

Table 2. Percentage of Lesson Time and Frequency of Tasks for Grade Eleven

Lesson #	Lesson Duration	Management	Transition	Wait Time	Instruction	Warm Up	Engaged Time
One	38:46 (39)	-	7.7% (11)	2.3% (4)	15.0% (11)	-	75.0% (13)
Two	39:40 (45)	-	11.2% (14)	3.2% (3)	14.6% (15)	-	71.0% (13)
Three	36:52 (29)	6.1% (1)	9.1% (8)	2.5% (3)	15.4% (8)	6.1% (1)	60.8% (8)
Four	40:30 (26)	-	7.4% (5)	5.3% (3)	12.9% (9)	4.2% (1)	70.2% (8)
Five	41:20 (29)	-	8.5% (7)	11.0% (4)	10.9% (9)	5.7% (1)	63.8% (8)
Six	41:50 (38)	-	9.4% (8)	12.3% (5)	13.0% (11)	4.6% (1)	60.7% (13)
Seven	37:45 (27)	2.0% (1)	7.5% (7)	12.8% (4)	9.8% (6)	5.9% (1)	61.9% (8)
Eight	38:06 (16)	-	5.4% (4)	3.8% (2)	5.8% (6)	7.0% (1)	78.0% (3)
Nine	40:38 (23)	-	5.9% (4)	11.9% (4)	6.8% (7)	3.9% (1)	71.6% (7)
Ten	32:48 (23)	-	4.4% (5)	16.1% (5)	6.3% (4)	4.7% (1)	68.6% (8)
Average	38:50 (30)	0.8% (0)	7.7% (7)	8.1% (4)	11.1% (9)	4.2% (1)	68.2% (9)

Table 3. Percentage and Frequency of Engaged Tasks for Grade Eight Handball Unit

Lesson #	Engaged Time	Informing	Refining	Extending	Applying	Aerobic	Cognitive
One	18:45 (12)	8.9% (1)	19.6% (2)	20.7% (2)	17.1% (1)	24.3% (2)	9.5% (4)
Two	20:33 (8)	-	-	-	41.9% (3)	24.2% (2)	33.8% (3)
Three	15:59 (13)	13.5% (1)	26.4% (2)	11.3% (1)	28.9% (3)	-	20.0% (6)
Four	21:42 (5)	9.7% (1)	-	-	57.4% (2)	-	32.9% (2)
Five	27:47 (8)	3.0% (1)	30.6% (1)	1.6% (1)	47.6% (1)	-	17.2% (4)
Six	24:43 (9)	-	34.3% (1)	-	57.0% (4)	-	8.7% (4)
Seven	26:44 (6)	-	-	-	61.8% (4)	-	38.2% (2)
Eight	27:01 (7)	-	23.0% (1)	-	68.1% (3)	-	8.9% (3)
Nine	25:31 (6)	-	-	-	72.0% (3)	-	28.0% (3)
Ten	28:40 (6)	-	30.1% (1)	-	54.8% (2)	-	15.1% (3)
Average	23:45 (8)	3.5% (0)	16.4% (1)	3.4% (0)	50.7% (3)	4.9% (0)	21.2% (3)

Table 4. Percentage and Frequency of Engaged Tasks for Grade Eleven Handball Unit

Lesson #	Engaged Time	Informing	Refining	Extending	Applying	Aerobic	Cognitive
One	29:05 (13)	17.0% (3)	11.3% (1)	9.5% (1)	-	14.9% (4)	47.3% (4)
Two	28:09 (13)	7.7% (1)	10.7% (1)	-	50.5% (5)	22.3% (4)	8.9% (2)
Three	22:25 (8)	11.9% (1)	-	-	48.0% (3)	21.9% (2)	18.3% (2)
Four	28:26 (8)	8.0% (1)	-	3.7% (1)	54.9% (1)	32.6% (4)	0.8% (1)
Five	26:19 (7)	3.7% (1)	29.1% (1)	-	52.7% (2)	8.2% (1)	6.2% (2)
Six	25:18 (12)	5.3% (1)	26.0% (1)	4.0% (1)	29.2% (3)	21.9% (2)	13.6% (4)
Seven	23:35 (7)	9.7% (1)	42.8% (2)	8.5% (1)	33.0% (1)	-	6.0% (2)
Eight	29:43 (3)	-	-	-	91.8% (1)	-	8.2% (2)
Nine	29:05 (7)	-	-	-	56.0% (2)	-	44.0% (5)
Ten	22:13 (7)	-	37.5% (1)	-	50.6% (3)	-	12.0%(3)
Average	26:26 (9)	6.3% (1)	15.7% (1)	2.6% (0)	46.7% (2)	12.2% (2)	16.5% (3)

Table 5. Student's Opportunities to Respond (OTRs) and Appropriate Responses for Grade Eight

Lesson #	Engaged Time	Total OTRs	OTRs A/I #	Appropriate %	OTRs #/Min
One	18:45	85	75/10	88.2	4.5
Two	20:33	69	61/8	88.4	3.4
Three	15:59	82	71/11	86.6	5.1
Four	21:42	61	48/13	78.7	2.8
Five	27:47	122	104/18	85.2	4.4
Six	24:43	73	64/9	87.7	3.5
Seven	26:44	138	129/9	93.5	5.2
Eight	27:01	159	143/16	89.9	5.9
Nine	25:31	97	92/5	94.8	4.1
Ten	28:40	93	86/7	92.5	3.2
Average	23:45	98	87/11	88.6	4.2

Table 6. Student's Opportunities to Respond (OTRs) and Appropriate Responses for Grade Eleven

Lesson #	Engaged Time	Total OTRs	OTRs A/I #	Appropriate %	OTRs #/Min
One	29:05	95	87/8	91.6	3.3
Two	28:09	111	102/9	91.1	3.9
Three	22:25	92	86/6	93.5	4.1
Four	28:26	101	94/7	93.1	3.6
Five	26:19	81	75/6	92.6	3.3
Six	25:18	107	99/8	92.5	4.6
Seven	23:35	114	103/11	90.4	5.8
Eight	29:43	132	125/7	94.7	4.4
Nine	29:05	141	131/10	92.9	4.8
Ten	22:13	116	111/5	95.7	6.0
Average	26:26	109	101/8	92.8	4.4