Title	Electric learning environments for mastery learning in physical education
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Source	*MERA-ERA Joint Conference, Malacca, Malaysia, 1-3 December 1999*

ELECTRIC LEARNING ENVIRONMENTS FOR MASTERY LEARNING IN PHYSICAL EDUCATION

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Abstract: The purpose of this paper is to explore how the use of information technology in a physical education curriculum can contribute to the development of a mastery learning environment. The physical education curriculum can be viewed as a system and a set of interrelated sub-systems. The most popular are the fitness education and motor skills education sub-systems with possibly a social education sub-system. If the fitness or skills education sub-system is exclusively a physical experience then it would be mainly kinesthetic information that the student would be learning through the instructional programme. In a mastery learning environment, which is seen by many as a motivational learning environment, there needs to be a cognitive and an affective element in the lesson. In short, it is a challenge of the physical education teacher to create an environment conducive to a thinking, feeling moving person. Electronically supported physical education lessons could help to create both the mastery learning physical education environment in class and at the same time help to develop positive attitudes toward physical activity.

Introduction

The purposes of physical education in the school curriculum have been well documented in the literature. From a practical point of view the most comprehensive discussion of curriculum models and curriculum theory building can be found in Jewett, Bain and Ennis (1994). In Singapore, certainly at the secondary level, the modus operandi appears to be either a fitness education or a play education curriculum model (although both models are evident in most schools). The teaching conditions in terms of the time given to weekly physical education, numbers in classes, equipment and facilities etc. make it very difficult for most teachers to achieve the objectives of either the fitness education (children will get fitter) or the play education models (children will get more skilful) (Haslam & Kunalan, 1993). It is unlikely that there will ever be more time available in the local curriculum to give to physical education lessons, which means that one or two things need to happen. On the one hand the instructional outcomes need to be modified or changed to reflect the reality of the teaching conditions for the subject. On the other hand the curriculum can be augmented by information and communication technology (ICT) which can provide for location and time independent learning (Haslam, 1999a). *In short, physical education any time any place.* The purpose of this paper is to discuss the need to leverage technology in physical education lesson so as to create a mastery learning environment and pave the way for advanced learning in physical education. This will require that students prepare themselves for physical education classes by completing electronically based homework assignments, which are an integral part of the unit of instruction (Haslam, 1999a, Haslam & Aplin, 1998). It also assumes that students can adopt an active learning role in lessons and the teacher instructs a student centred learning process.

Curriculum systems in physical education

The whole school curriculum has been defined as "a plan for providing sets of learning opportunities to achieve broad goals and related specific objectives for an identifiable population served by a single school centre" (Saylor and Alexander, 1974 p. 6). It follows then that the

physical education curriculum should also be viewed as a plan for guiding students through sets of learning experiences and that this plan should be localised to accommodate the needs of students in a single school setting. Learning experiences in physical education can be classified into at least three educational sub-systems including fitness education, psycho-motor skills education and social learning education sub-systems. These continuums of educational experiences should be charted across all the school years from primary to secondary and then to junior college. At the end of the process of planning is a 'blueprint' for action which guides students and teachers through a mosaic of information and activity rich learning experiences leading hopefully to a physically 'educated' student. The real challenge is in the design of each of these educational continuums. The needs of the students need to be the starting point. Closely followed by the learning outcomes which need to be both information based as well as activity based. The sport activities which have traditionally been the basis for curriculum planning in physical education now become as much a *means* to an end as an *end* in themselves. In other words some sports and games activities can be used to develop fitness education and others social education while still others are used to develop skills. Then the question of the sequence of materials needs to be addressed. Traditionally again teachers have stopped at 'surface learning' or basic introduction to skills that comprise the activity being taught. The general position among teachers is that you can do no more in the time available and that is probably true. However, by changing the assumptions of the learning process from *instruction* (behaviourism) to *construction* (constructivism) the teacher can foster deeper learning in physical education. Naturally, if assumptions of the learning process change there will be a concomittant change in the role of the teacher and the methods and procedures used in the class. There will also need to be a change in the manner in which teachers control the instructional process through there *assessment* of students development. If the emphasis is on aspects of social learning and social behavior through movement then the assessment of this learning will have to be appropriate to the outcomes. At the end of the day the teachers and the head of the physical education department as well as the students will have multiple measures of learning and development. Undoubtedly this will contribute very positively to quality assurances about the impact of the curriculum in physical education on learners and it will engage students as well as teachers in the creation and implementation of mastery learning lessons.

Mastery learning in physical education

Mastery learning environments are seen to be motivating for students and conducive to productive classroom experiences. However, when teachers positively respond to students who demonstrate superior performances over others such as in sports and fitness activities then a *'performance oriented'* classroom atmosphere is created. In this setting students would look for ways to overcome their opponents (the other children in the lesson) and be rewarded by the teacher for so doing. In like manner, this tends promote student anxiety in the lesson as they worry about making and 'losing face'. Alternatively, if a teacher responds and rewards students for improving on their previous best effort then a *'mastery learning oriented'* classroom environment' becomes prevalent. Research in these area reveals that students who adopt a high mastery/low performance orientation to their lessons have reported higher intrinsic motivation scores (Roberts, 1992). Biddle (1994) reports studies that examine the relationship of performance or ego and task mastery goals to perceived and actual success on intrinsic motivation in physical education and sport. These projects concluded that high task and low ego orientations of the low ability groups enabled them to maintain their intrinsic motivation for the task. Goudas, Biddle and Fox, (1994) investigated student motivation toward physical education and concluded that perceived competence either in relation to being superior over others or self improvement is related to intrinsic motivation only in the context of autonomous behavior or self determination (central to the notion of 'active learning'). In other words, when there was too much teacher centered instruction with high teacher expectations the

pressure to learn becomes counter productive to learning taking place. Further work on this assumption was conducted to specifically assess the contextual factors of motivation in a naturalistic setting. The aim was to examine whether direct methods of teaching involving greater structure and less student autonomy would have a more positive effect on intrinsic motivation than indirect methods of teaching. One class of 13 year-old girls was taught track and field athletic activities for eight weeks using both teaching styles. Results showed that higher intrinsic motivation was reported by students who experienced *greater autonomy* and were more highly task-oriented (Goudas, Biddle, Fox & Underwood, 1995).

Haslam and Samian (1997) conducted a study to determine if physical education students in a neighbourhood school in Singapore perceived their lessons to be performance oriented or mastery learning oriented. Data was cross-referenced with selected demographic characteristics namely, gender, age, ECA sport participation, and academic abilities. Two hundred and ninety two (n=292) subjects were randomly selected to complete the 26 item Physical Education Class Climate Scale (PECCS) (Goudas and Biddle, 1994). Comparisons of class climate perceptions were made between subjects on the basis of gender, age, academic ability and Extra Curricular sport Activities (ECA). Findings suggested that there was *no significant difference* between mastery learning and performance learning in physical education lessons. This study does need to be replicated many times in many ways but it is of concern to know that due to the equal emphasis on performance outcomes with mastery outcomes more students could be turned off physical education than turned on to physical education in our schools.

The question of involving students both intellectually as well as physically in Physical Education lessons will require changes to the existing PE curriculum. The direction of these changes are actually in line with the Singapore Ministry of Education's move to include more exposure to games for understanding in the local programme. However, even with this change students should probably prepare themselves for lessons on space and relationships leading to tactical and strategical knowledge before class. Information and Communication Technology (ICT) applications for physical education and active living both for in school purposes and for general interest out of school is on the rise.

Information and Communication technology in physical education

Advances in information technology and sport on the information super highway have been well documented in recent years (Stoddart, 1997). Experts have suggested that technology could be used to enhance movement skills and abilities and so the infusion of technology in sport is viewed as a positive development. Some have suggested that it should be used when it can add value to the sport experience (Haggerty, 1997, Zeigler, 1997; Haslam & Aplin, 1998). There have been attempts to determine if computer mediated communication (CMC) such as electronic mail, real-time chat and computer based learning will improve the learning process as well as student-to-student and student-to-teacher interactions (Berge et al 1995). These developments can provide a paradigmatic shift in the instructional process in physical education. As human movement is a visual learning phenomena multimedia and laserdisc technology applications in physical education and sport offer the most likely solutions to electronically based resource materials (Katz, 1992). Computer assisted instruction (Franks & Wood, 1997) can take the use of computers beyond the purely administrative functions (Walsh, 1989) and permeate all aspects of the physical activity service system. Computer applications can also be found in PE in higher education (Finkenberg, 1997), in physical education teacher education (Haslam, 1999c), in computer aided swimming and diving training (Dai, 1996) as well as computer based instruction in primary physical education (Ross's 1994) and at the secondary level (Skinsley, & Brodie, 1990). The physical education information system (PEIS)

(Haslam, 1999a) is a comprehensive PE department management and curriculum information system delivered through the WWW (Haslam, 1999c, Mills, 1998). Its basic purpose is to augment the daily curriculum in physical education through homework assignments in physical education based on the WWW. Active learning by students in physical education classes as well as group problem solving activities is a feature of constructivist learning.

Constructivism and active learning in physical education

Constructivist theory suggests that students make sense of learning activities by incorporating new material into previously learned concepts. Constructivist teachers organize their information around conceptual clusters of problems and questions rather than in isolation. Information should be authentic in the sense that it is meaningful and relevant to the student.

The main proponents of constructivist theories of learning include Piaget, (1973), Vygotsky, (1978), Bruner (1966) and Resnick, (1989) among others not least of which is Seymour Papert. The process of assimilation of new ideas into existing mental schema seems to be the main focus of much of the past research. The schema theory of motor learning and the variability of practice of sport skills first proposed by Schmidt (See Haslam, 1989) is not dissimilar to recent discussions on cognitive flexibility theory by Spiros et al (1992).

A compelling feature of constructivism certainly as far as physical education goes is the need for children to work together in-groups (Rysavy & Sales, 1991). Team games form an integral part of the physical education curriculum and lend themselves well to cooperative learning and group work. When students collaborate they share ideas and make adjustments to their own thinking as a result of the input of others. A shared sense of development, understanding and progress can be observed when groups work together to solve problems (Jonassen, 1996). Thus the combination of active learning intellectually as well as physically and the role of group work in learning for the essential ingredients of the mastery learning physical education lesson. These elements however are easier to understand than they are to implement. Introducing active learning of an intellectual nature will require structural change to unit development and lesson planning. It will also require a reconsideration of the nature of group work in physical education. That is group work will continue to involve game play but will now also include development work leading to team play that is resolved by the students themselves. In short students should come to class prepared to participate fully in the lesson.

In as much as they are 'moving' in the lesson they are 'active' in the lesson but only physically and often times are simply following teacher instructions. Students should also be *intellectually* engaged in the lesson as well as physically (Haslam, 1999b). They should therefore be asked to do homework assignments for class and then to use this material in the lesson itself. This is possible without the use of technology although in physical education pictures especially motion pictures are very helpful in learning skills. Video tapes have been used extensively in coaching situations in the past but what with the time available in class and the equipment necessary as well as the passive nature of viewing videos it has always been considered inappropriate for regular lessons. In the past and even today it was difficult to provide videos to every child for homework purposes for a variety of reasons. Today however, with digital video technology, the WWW and the availability of technology in school as well as at home is tempting to physical educators. They might ask questions such as:

- Is it possible to provide children with visual examples of movement content in video form for use in class?
- Can 'Jane Fonda or Arnold Palmer' type instruction be given to students through the web?

- Can students learn physical skills for use in Games for Understanding lessons in school?
- Can students get fit by following instructions on the WWW and through video examples?
- Can students learn how the body works and grows and responds to exercise at home as well as in PE lessons?
- Can students be taught to use exercise to cope with stress and to understand the importance of fair play and sports personship?
- Can students through a combination of positive group lessons and information rich web driven lesson become a physically 'educated'?

We don't know the answers to these questions but one thing that we do know is that there is now more that can be done to educate children physically through the use of ICT and hypermedia instructional design.

Physical education hypermedia curriculum

An exciting development in hypermedia curriculum innovation in physical education at least conceptually is the notion of daily quality physical education provided to students through the WWW. The initial lesson experiences suggested by the PEIS were basic skill patterns for predominant sport such as football or volleyball. These lessons to be required of students over any 24 hour period any time and anywhere. The computer can log the student's interaction with the lesson and a pre and posttest can verify the authenticity of the work. However, once again this enables only surface learning or basic introductory learning experiences. The ability to develop this throughout the curriculum need to be considered as this will take students from a rather superficial ability in the skills of a sport to the quest for polished application of these skills in match play. Not only that but more advanced understandings of the tactical conditions under which some skills are required. To develop the notion of the daily physical education lessons beyond the basic learning of repetitive skill drills a hypermedia based concept relying on fifteen second video footage of segments of game play from top class football matches with instructional voice over, music and extremely relevant high skilled visuals is in the process of being developed.

The conceptual framework for the hypermedia experience is to encapsulate the knowledge and skills of the game in the form of problems. There are basically two problems that dictate the outcomes of match play in football and other invasion game sports. These are the problems of 'possession' and 'pressure'. In a nutshell you need *possession* to score (usually) and you need *pressure* to regain possession. It is beyond the scope of this paper to explore these possibilities in all there details and so the problem of possession will be considered. Possession can be seen to occur in different phases of the football field namely the defensive third of the field, the midfield and the attacking third of the field. Possession also requires skill competencies that typically form the basis of introductory learning in football namely passing, trapping, heading and shooting skills. However, at this level it's the use of these skills in creating authentic game like simulations for use in class. Take the average English premier league game on television. Observe the patterns of passing play that occur as a team advances the ball through say the middle of the field. Take a 15 second clip involving the following pattern of possession of a Manchester United attack. Keane collects a short ball from Stam and plays it out to Neville at right back. Neville sends the ball forward to Yorke whose first time pass if collected by Beckham on the right wing. Neville is now making his run into the attacking third of the field past Beckham who slips the ball through for him to cross for goal (Figure 1).

Figure 1: How to maintain possession through the middle of the football field using a passing pattern involving 6 people
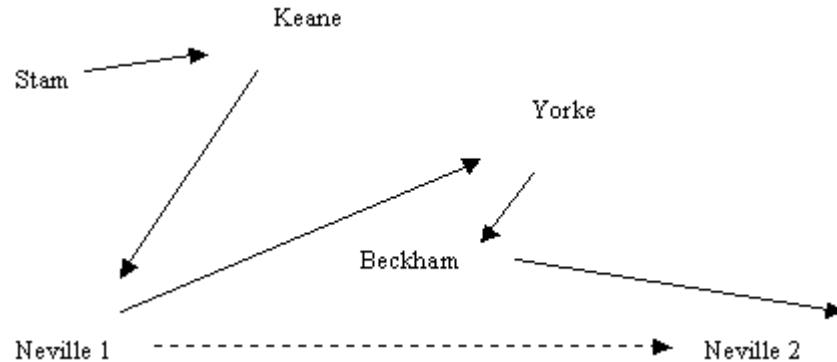
A successful and slick exchange of passing, running and receiving the ball leading to a cross on goal. The students watch 4 to 6 of these examples available to them in digital form on the web. They pick one they like and illustrate it on paper so they can remember the pattern and bring it to class. There is a temporal spatial sequence to the moves that require skillful execution of basic skills as well as movement off the ball. Having criss-crossed an ill-structured domain of information about the game of football and made decisions as to an interesting and appropriate solution to midfield possession they then bring the ideas to class. The teacher organizes groups of students into squads of 6 and puts them in areas of the field marked by cones. The leader of the group for the day then organizes and describes the mid field possession solution that he/she retrieved from the web. The group then work on perfecting their skills and executing a similar pattern of passes. The teacher is not only interested in the copied solution but the way in which the students modify and adapt the solution so that it becomes a meaningful and game relevant vignette of the game. Outstanding examples can be shared with the class. Students can rotate around other groups and be taught by a peer group leader responsible for organizing the solution to the problem for the week. At the end of a twenty-minute problem solving session the students are then asked to integrate these ideas into open play in games of 6 v 6. The following week another hypermedia environment and a different student leader(s) will bring materials to class.

Summary

To create a mastery learning environment in physical education it would help to take a systematic approach to planning the curriculum. It is also necessary to consider how to overcome the limited time and other conditions that restrict the potential of the physical education curriculum. In like manner moving students from basic learning to advance learning in physical education will require students come to class prepared to engage in active learning themselves. They thus need access to information sources from which they can plan and design there participation. In the past this was difficult due to a shortage of video based resources etc. and the assumption that anything more than basic learning was not possible. Information sources in physical education both cognitive resources; visual resources and auditory resources are now available in hypermedia form. The next phase of technological innovation in physical education curricula would be to move from basic instruction of set skills to advanced learning of patterns of play. This requires a conceptual organization of sport movement, which will accommodate a rich variety of movement possibilities in a dynamic and ever changing context.

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