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## PHYSICAL EDUCATION CURRICULUM SYSTEMS AND THE USE OF TECHNOLOGY IN SINGAPORE SCHOOLS

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Abstract: A review of computer applications in physical education in schools around the world reveals an adhoc collection of software and CD-ROM being used in various ways and with different outcomes in mind. Most of it not produced for school age students and the majority of it not readily available in Singapore. What compounds the problem is the actual or perceived pressure on teachers to integrate IT in all subjects in the school. Hence it is done possibly for the sake of doing it rather than have it contribute to previously determined curriculum goals or instructional outcomes. The 'higher ground' would suggest that PE departments should revisit the purposes of physical education in schools with a view to understanding if any aspects of the curriculum can be enhanced through the use of IT. Theoretically, the result would mean a paradigm shift in our approach to the curriculum and what it could achieve with the help of an IT integrated facility. The Physical Education Information System (PEIS) is a comprehensive PE department management information system that among other things facilitates teacher decision making and should enhance mainstream physical education curriculum services. Central to the curriculum aspect of Singapore's PEIS are a series of web based instructional materials used to compliment the PE lessons in school. The lessons could be undertaken as homework using both instructional theories of learning as well as constructivist learning assumptions. The hypermedia materials are then developed in class in small and large group settings.

### **Introduction**

This paper has become more than a discussion of 'islands' of technology or curriculum sub-systems in physical education a la Singapore style. It does still though reflect a developing philosophy of physical education curriculum and instruction that relies on the use of information and communication technology. A more substantive explanation of the use of information technology in physical education is provided which represents a quest for what might be called an '*authentic physical education curriculum*'. Authenticity in the curriculum is based on the search for a personally meaningful and relevant physical activity experience in school for all children. It relies on accessibility to successful and meaningful physical activity experiences in and out of school as well as a body of knowledge about physical activity that motivates the practice. The curriculum is 'global' in nature just as the world economy is global in nature. The curriculum is information rich just as society is information rich through the use of multimedia technology. It should be visually appealing and socially rewarding so that it not only 'educates students in the physical' but it also adds to the quality of their daily lives. In fact the curriculum in physical education should not really be seen as a subject that you endure two or three times a week but in fact it should be a lifestyle pursuit that is organic and has meaning for the person on a daily basis. It is only when we can achieve this goal will physical education have truly achieved its purpose in the school curriculum and only then will society benefit from the concomitant effects of a physically fit, robust and optimistic nation.

I would argue that if physical educators are to be motivated to search for ways in which technology can be used effectively in their work lives then the present purposes of physical education in local schools will need to change. Not only should the purposes of physical education change but so too

will the instructional process and by deduction the methods and procedures that teachers use to teach the curriculum should change. Perhaps the largest adjustment beyond the necessary IT skills is the concept of quality assurances (through measurement and evaluation) in physical education. Determining educational outcomes for students, which are related to educational benchmarks required of the school by its national curriculum, is a start. Then to configure an instructional process including units of physical activity that teachers and students undertake so that pre determined educational outcomes can be achieved. Clearly, this requires assessment in the curriculum. Due to the lack of class time in most schools it also requires homework. If the homework experiences are to be relevant to the students it must be used in the classroom and the teacher will have to adopt a different structure to the lesson as well as become more of a facilitator and navigator of experiences than was traditionally the case. I will spend the rest of the paper discussing why and how a technologically integrated physical education might be conceived. It starts with the question of what is the curriculum in physical education and requires that physical education curriculum domains of learning (or physical education curriculum sub-systems) be used as a planning device. For more information about curriculum domains of learning and curriculum sub-systems generally see Saylor and Alexander (1974). As students move through the curriculum sub-systems in physical education they need to be challenged by more advanced learning. This has always been a problem in physical education (teachers argue that we don't have enough time to perfect skills so we have to keep repeating them each year of the curriculum). Cognitive flexibility theory (Spiro et al, 1992.) argue that active learning and group work could lead to advanced learning in 'ill-structured' domains of knowledge. They go on to suggest that a hypermedia learning environment can help achieve advanced learning.

### **The Physical Education Curriculum**

There are a number of published models of the physical education curriculum in the literature. Each one represents a different view of the structure and function of the school physical education curriculum at different levels of schooling. Probably the most comprehensive collection of models resides in Jewett, Bain and Ennis (1994) where they attempt to compare and contrast on the basis of the theory behind the model, its goals and objectives as well as its content. At the elementary or primary school level the developmental physical education and movement education models appear to be quite popular. The latter includes a belief in the notion of thinking movers and organizes its content around Laban's (1948) four motion factors of body awareness, space awareness, effort quality and relationship awareness. Typically teachers are encouraged to use problem-solving approaches to teaching the content and in so doing challenge children intellectually in the gym as well as physically. The developmental physical education model has a similar orientation. At the secondary level the play education model is most used (certainly in Singapore) which tends to emphasize an education in adult forms of play, which include of course culturally predominant sports and fitness activities. The kinesiological studies model integrates the sport sub-disciplines of human movement with the practice of physical education in schools. This approach is used to service exam driven curriculum at the O level and A level in various programs around the world. All these models of curriculum do have one thing in common and that is that they serve as a guide for actually planning the curriculum for children in schools. Personally, I like Saylor and Alexander's (1974) definition of the curriculum although I have modified it to the subject area. *The physical education curriculum is a plan for providing sets of learning experiences (domains or sub-systems of learning) for a single school population (each individual school has to make its own decisions) according to pre determined goals and objectives.*

### **Physical Education Curriculum as a System**

A system is a set of interrelated components and a curriculum is a cluster of interrelated domains of education. As such the curriculum can be viewed as a system providing sets of learning opportunities for a single school centre. Past efforts to plan the curriculum have lost sight of the integral relationship between goals and purposes and learning opportunities offered during sport units. With a systems approach the objectives are central to the decision making process about what sports to teach and in what way they are to be taught. Similarly in the past attempts to plan the curriculum have been fragmentary and piecemeal. With a systems approach the planners are concerned with all relevant factors as they work out steps to achieve their goals. The underlying philosophy behind the plan involves acceptance of the fact that physical educators are obliged to provide children with the most complete development educationally feasible of the self-directing continuing learner. Secondly that when learners are actively involved in the planning and implementation of instructional materials in a transparent process it eliminates the 'hidden curriculum'. Figure One illustrates the elements that support the physical education curriculum as a system.

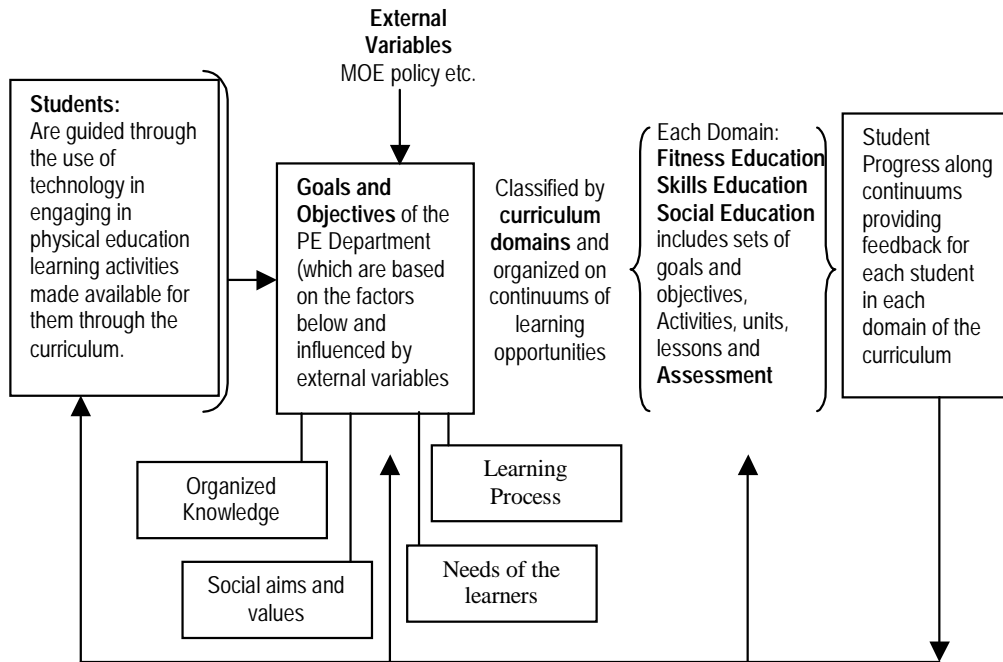
### **Physical Education Curriculum Domains**

Curriculum domains in physical education are clusters of learning experiences planned to achieve a single major set of closely related physical education goals and specific objectives. The most obvious domains of learning in physical education are fitness and psychomotor skills although social education (vicariously to do with character training, leadership, fair play and communication skills) has also seen to be a priority of physical educators. Typically, activities in the curriculum address these areas but across the full spectrum of school life rarely if ever does one see a systematic attempt to integrate and then control and direct students fitness, skills and social education system. Each domain at each year of the curriculum should be explicitly identified with goals, objectives and then experiences that include not only the practical side of for example, fitness but also a concomitant growth of knowledge and understanding about fitness. The same should be done with the motor skills and social education systems.

### **Caveat**

Many colleagues would I am sure at this point reflect of the writers position in the 'ivory tower' and suggest that he 'get real' with regard to the reality of physical education in local schools. In short it all sounds so grand but the reality is physical education teachers do not have the time or the resources to do more than they are all ready doing. Neither do they have the priority in the power structure of school subjects to make a claim for more of anything. This is all true and its precisely the reason that colleagues must step back and look at what they are able to do and what they have been doing. Ask themselves if they are satisfied and if they are then things can be left alone. If they are not then what can be done to improve the situation? What changes need to be made what resources are needed and what in-service training if any will be required. The balance of this paper is concerned with the instructional theory of constructivism and the use of a hypertext physical education learning environment.

**Figure 1: The elements of the physical education system (Adapted from Saylor and Alexander, 1974)**



### Constructivism and Advanced Learning in Physical Education

Perhaps the most appealing feature of constructivist learning theories is the foundational premise that children actively construct their knowledge. Rather than the traditional demonstration, explanation practice model that plays such a large role in sport settings even today children are asked to construct their own interpretations of the material. The notion of children taking an increasingly active role in the physical education lesson has been around for a number of years but has not been terribly well conceived outside of the British primary school. The movement approach to physical education lends itself to constructivist practices. The developmental physical education curriculum model would also include these features and certainly constructivism could be used and is used in the context of a kinesiological studies model of physical education. It is not systematically used nor is it electronically supported by hypertext in most cases. Assimilation of new experiences into existing experiences seems to be the assumption on which constructivist learning unfolds. If this concept sounds familiar to some it should as its main proponents include Piaget, (1973), Vygotsky, (1978), Bruner (1966) Resnick, (1989), and Spiros, (1992) among others not least of which is Seymour Papert. The process of assimilation of new ideas seems to be the main focus of much of the past research. From these data arise the notion that play and experimentation are valuable forms of learning. Play involves the novel combination of ideas and expected outcomes. It might be seen as a form of mental exploration where children create, reflect and reconsider their existing understanding. 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 cognitive flexibility theory discussed by Spiros et al (1992). In physical activity terms the adaptation of a fundamental motor pattern requires an ability to extract the particular specifications required to execute a situationally specific skill from a motor concept (developed through hours of

play and practice under many different conditions). Then to practice motor patterns using these particular combinations of mental specifications during game play. Adaptations to motor patterns thus need practice, exploration and experimentation under a variety of situations and perhaps ever changing performance conditions so as to enrich the development of the motor concept.

A further feature of constructivism is the need for children to work together in small and large groups in pursuit of deeper understanding (Rysavy & Sales, 1991). 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).

Applied to skill development lessons in physical education a number of considerations are necessary. The first is that it is not just physical performance skills that are the focus of the lesson. Research that argues that constructivist (rather like movement education) learning environments do not develop physical skills (Toole and Arink, 1982) or fitness (Bischoff & Lewis, 1987) in students is misguided. Misguided because it is not the only purpose of the movement approach to develop basic skills and fitness levels in students specifically but rather to develop knowledge and understanding, which could lead to advanced learning of motor skills and fitness concepts. Proponents of the constructivist approach are interested in a conceptual understanding of the theory and the practice of human movement. In short, they are interested in advanced learning and the 'education of the physical'.

The use of constructivist learning theories in a teacher education module on High school level football (soccer) lessons has actually resulted in a challenging yet interesting approach to the study of the sport. Typically, instruction is organized around game fundamentals like passing, shooting, heading and goalkeeping and then possibly attacking and defensive systems of play. The constructivist version chose to sequence ideas around the purposes and problems associated with basic techniques. For example, a unit on *keeping possession of the ball* for attacking purposes involved individual, partner, small and large group practices (designed by the students with the help of the teacher) and games which emphasized passing and dribbling skills. Typically these skills are critical to keeping possession in a game. Normally these problems were contextualised with a problem statement such as 'develop a practice for three people that involved keeping possession in tight areas in the middle of the field'. Another problem would be to 'design a game that involved a shot on goal from a fast break for five people'. Only recently there have been some good examples of possession play leading to shots on goals in the English Premier Football League. Kanu from Arsenal's last goal against Chelsea at Stamford Bridge on October 23rd 1999 comes to mind. Here the player collects the ball from in a wide position on the left and dribbles the ball at speed for the goal line. The goalkeeper races off his line to challenge for the ball. Kanu then dribbles past the goalkeeper (exquisite play) and gets a shot off from an acute angle that scores! The students are asked to view the 10-second video of the goal and recreate this example of possession. Then to design their own variations of the play. The students then bring these ideas to class and implement the activities with their classmates in small groups. During the lessons the skills, timing, organization is refined upon and improved as the students discuss and experiment with the various ideas.

This is just one example of the use of a constructivist approach to a teacher education module on football. The assessment of such a module is also quite interesting in that it focused on aspects that were not usually deemed to be the main purpose of the lesson. For example, the students themselves evaluated the quality of the group solutions to the problems as well as the teacher. The ability of the group to share ideas and (inkeeping with my philosophy of *coaching* football) the groups ability to design learning experiences where *everyone helped everyone else* to look good when they played.

Then the closeness of the solution to the way the game of football is played at a good level. In short, how authentically relevant were the activities that the students designed. The question of say possession in football has various shades of meaning but needs some logical structure so it was decided to explore possession in different areas of the field. In the defensive third, the mid field third and in the attacking third. Within each of these areas there are almost infinite possibilities that occur everytime a game is played. So there are infinite possibilities for solutions to problems presented in football lessons. Students can determine the kinds of solutions that could fit their playing skills and abilities and proceed to work with their friends on presenting these ideas to the teacher and class. Students actually became possessive about their solutions and their ideas and would comment that that was their original idea when someone else copied or seemed to produce a practice that resembled their idea.

Somehow or other though the students had to have access to the game like answers or possibly what might top level football solutions to difficult problems look like. There are limitations to simply free viewing the entire half of a football game as far as an ill structured concept like 'middle of the field possession' is concerned. It would be better to take a number of edited examples from perhaps a variety of games and link them all together with a slow motion facility and possibly commentary. On the basis of viewing 4 to 6, ten-second examples of possession at home on the web the students then make notes and modifications and create their own possession solutions for use in class. In the course of viewing the video clips there are many examples of possession in the mid field area of the game which means students will need to 'criss-cross' the information landscape many times to determine a workable solution to the problem. Not all would be perfect examples but all would certainly be authentic examples in the spirit of constructivist learning theory. The challenge then for physical education teachers is to help students navigate there way around the sport information landscape in a personally meaningful and relevant manner.

### **Hypermedia Learning Environments in Physical Education**

The aforementioned is but one attempt to use a constructivist (advanced learning) approach to teaching physical education in schools. The central features of the process included active learning on the part of students. Assimilation of new ideas with existing understandings as well as the team skills to refine the ideas and suggestions in class. However, there were some additional features, two in particular, that were quite novel yet essential to the ideas. One was *homework* in physical education and the other was *assessment*. The individual and some of the group activities occurred during free time out of class. Ideas were constructed for refinement in class where they were further developed and shared and then evaluated. I shall not get into my thoughts on the existing control of quality in local physical education departments that's for another time but save to say that part of the quality assurance process needs to be assessment of student development. Having accepted that this is a necessary part of any instructional program in any area of the curriculum the constructivist approach can move forward. The use of video taped materials presented through the World Wide Web and located on the school server could now be a reality. Even without the hypermedia concept there has been a free flow of ideas in the SPE computer applications class on the use of technology to promote constructivist work in physical education.

### **CDROM**

There is a commercial CD ROM market in sport fitness health and other areas that could be used to *reverse engineer* physical education lessons for use in schools. Teachers can take the ideas and materials from the CDROM and design lessons during for classes from the CDROM> Students can then follow up with homework or other activities between classes in their own space and in their

own time. The CD-ROM'S are information rich and must be used outside of the physical education lessons, which remains a physical activity period for small and large group work. However students could be directed to the software through the school PE web site (which is an essential component for the delivery of future physical education services) and specifically instructed to review and study certain sections which will be covered in class. These could be skill based key teaching points, examples of how these skills are used in game play, rules surrounding the skills or even actual skill practices themselves which can be brought to class.

### **URL's**

In like manner there could be other URL's world wide that have materials which are almost compatible with what the teacher has in mind for his/her unit to which the students are directed. Physical education units in other countries include both the theory and the practice of human movement as part of an examination syllabus. Students in exam based classes do physical education research projects and use the web freely to generate information. There are also activity-based sites with lesson plans for teachers and students to use in their own classes.

### **Physical Education Information System (PEIS)**

However, the most interesting hypertext environment would be a customized on-line Physical Education Information System (PEIS) for use in schools (Haslam & Aplin, 1998). Students will be able to access their own physical activity file daily and throughout the school year through hypermedia lessons on the WWW. These lessons are their virtual lessons and will compliment the units of instruction in the classes at school. If rugby is the unit for the class sessions then rugby skills, fitness and knowledge will be available daily through the web until the end of that unit then another unit will be scheduled for PE lessons as well as for virtual lessons at home. Every virtual lesson will be personally relevant, information rich, visually appealing and will include a video clip on demand of the activity for the day. The lesson will basically involve a single activity and will take anywhere between 10 and 20 minutes to complete. At the secondary one level the skills will be mostly individual and partner activities and can be undertaken at any time during the day and wherever it is convenient for the child to do it. The child will also have the option of an electronic data interface where they are encouraged to record their thoughts of the physical activity and generally chat about their work. Each lesson accessed by the child each day can then be printed and collected to form a Sportfolio of daily physical activity that is used as part of the assessment for the unit. This is at the discretion of the teacher who might designate only one or two modules to be submitted for assessment purposes. The system will be structured such that a child cannot go back a day to collect a missed lesson. Daily physical activity is just that and if the day goes by without accessing the lesson then it is lost for ever to the child. This will enable the teacher and the child to monitor the frequency of physical activity lessons undertaken by the child. There are, of course, no guarantees that the children will actually do the exercises as recommended and perhaps this is a good thing as it is based on the honour and integrity of the child. This in itself is a good thing to be able to teach children - that no one is forcing them to do this but that it is important to their general health and well being and they are trusted to complete the assignment by their teachers. The only check would be the difference between the pre and posttest scores for the virtual unit, which in itself could be a powerful indicator of its use. The first class in school will be a pre test and then a month or so later during class time the students will undertake a posttest. If the student's frequency rating is 100% access to their physical activity file and their is no change in their pre and post test scores it would suggest that they have been opening their physical activity file and not doing the work. Either that or the recommended activities are not adequate in changing the child's physical activity profiles. When the virtual unit has been post tested and the teacher has data for every child



in class he could compute class profiles as well as individual profiles for assessment and quality assurance purposes. Over the course of the year these data can be collapsed with data from other virtual units to reveal a skill profile for the student, the class and the school year cohort. These data could then be used for deciding on the curriculum for year two.

### Conclusions

Technology should be used to support the physical education curriculum only if it can make the curriculum more effective in achieving its goals and more efficient in its instructional processes. The curriculum in physical education has at least three and there could be more sub-systems of information and activity rich experiences including the fitness education sub-system, the motor skill education sub-system and the social education sub-system. The challenges of time, weather, class sizes, equipment, facilities and subject status etc. make it difficult for teachers of physical education if not impossible for them to achieve the existing goals of the curriculum. These therefore need modification and realignment in favour of an authentic physical education curriculum based on the 'education of the physical'. Constructivism is a model of learning that would justify both the quest for an 'authentic' physical education curriculum and the proliferation of information and communication technology throughout the curriculum. Examples of hypermedia learning environments were touched on in this paper but more work needs to be undertaken to study the effects of the constructivist approach to teaching and learning in physical education.

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