Collaborative Learning in Physical Education through the Use of IT

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Introduction

One of the major aims of Physical Education (PE) is to improve human performance in physical activities through the acquisition of motor skills. At the National Institute of Education (NIE), Singapore, PE teachers undergo a 2-year training programme to develop both pedagogical and content knowledge of a wide variety of motor skills. PE teachers' understanding of the science underpinning movements will influence the extent to which they can help students successfully perform a motor skill. Although PE is defined as the process of educating through the medium of physical activities (Siedentop, 1990), physical activities are not the exclusive learning medium. To this end, we advocate the use of information technology (IT) as a means of facilitating the teaching of PE. This may be relatively new but not far-fetched.

The use of IT in PE may not only enhance the learning of motor skills but may also revolutionize the process of learning, moving from the traditional concept of learning where teachers impart skills to passive learners, to one where learners are required to be more active and collaborative. This article introduces two approaches to incorporating IT in PE teacher education, specifically in the learning of gymnastics. The first approach involves the use of video and computer technology in daily, face-to-face practical lessons; the second incorporates this technology into a form of “blended” e-learning.

PE teachers are required to identify flaws in technique and use appropriate corrective actions or structure progressions in skill learning that should be based on sound mechanical principles rather than guesswork (Hay, 1993).
Typically, verbal feedback is the predominant means of intervention in the teaching of motor skills (Magill, 1993). This would require teachers to encode a physical performance into words and the students to decode the verbal feedback into physical performance. But this mode of communication can result in disappointing outcomes, such as a misunderstanding of the feedback given.

Motor learning researchers (McCullagh and Caird, 1990; Wood, Gallagher, Martino and Ross, 1992) have shown that demonstrations, pictures or other visual models that provide information about a movement are more effective than the use of only verbal input in teaching a new pattern of coordination. With the coming of the IT age, teachers are able to communicate vividly, conveniently, as well as accurately the quality of a physical performance via video and computer technology. In fact, video is such an excellent visualization tool that teachers can use it to facilitate the learning process by showing video clips as often as necessary thus enabling learners to encode and memorize relevant movements more easily. It is of no surprise that Knudson and Morrison (2002) asserted that video is an effective way of increasing observational ability. Fenrich (1997) also noted that video can illustrate realistic representations of procedures and processes in order to gain and focus learners' attention. Basically, learners are more motivated to view their own performances for a variety of reasons. But from the skill learning perspective, viewing one's own performance is the most realistic form of feedback. In physical activities, performers would never have a chance to view their own performances unless they were recorded. Video not only provides good recordings of performances, it is also allows learners to focus on key movements as recorded motions can be replayed at a slower pace or be "paused" for clearer viewing.

In designing the e-learning module, cognitive information processing (Driscoll, 2000) and constructivist (Jonassen, 1994) pedagogical perspectives were used. Using information processing theory, emphasis was placed on focusing learners' attention on important information and providing learning activities that engaged them in rehearsal or elaboration of information. Reinforcement through practice and feedback were provided by means of a pop-up quiz. Through constructivism, learners actively engaged and constructed meaning not only from content provided on the Web but also from collaborative dialogue with others.
In order to take advantage of IT, the following questions arise: How can this technology be used effectively in the teaching and learning of motor skills? How effective is this approach in physical education classes? The following section describes an approach that incorporates the use of video and computer technology in the teaching of gymnastic skills to trainee PE teachers.

**Approach 1: Video and Computer Technology**

A program called “Silicon-Coach” was used to capture and manipulate the gymnastic performances. This software allows two video clips to be replayed simultaneously in order to facilitate the comparison of different performances (usually expert’s versus learner’s). It also provides a means of quantifying physical performances with measured angles and distances by mere “clicks” of the mouse. The use of this technology in teaching and learning movement skills was explored in a gymnastics module for PE trainee teachers where the video computer technology was incorporated as a teaching and learning aid. In each class, after the instructor had introduced a new gymnastic skill and some progressions to attaining the skill, the trainee teachers were required to work collaboratively. Specifically, they were divided into small groups in which each member was tasked with a variety of jobs like recording, performing motor skills, capturing images, manipulating the computer software and most of all, providing information or opinions when analysing and suggesting ways to improve performances.

Each group was equipped with a Panasonic digital video camera recorder (Model AGEZ30), set on a tripod to record individual physical performances for a variety of gymnastic skills. The video camera recorder was connected to an IBM thinkpad computer (Model 2656) by a firewire cable through an IEEE 1394 PC card. This setup enabled the direct recording of video clips onto the computer’s hard-disk. Figure 1 illustrates a typical setup of the video camera to the computer.

The video images can be presented in a split screen that allows two separate video clips to be viewed simultaneously as shown in Fig. 2. The trainee teachers were able to compare the movement features of one performance visually and repeatedly as required. For example, in Fig. 2, trainee teachers were able to compare the magnitude of the hip extensions of the two neck-spring performances.
Fig. 1. Setup of the video camera connected to the computer.

Fig. 2. Split screen facility that allows the comparison of movement.
The software also allowed the drawing of stick-figure overlays as shown in Fig. 3. This feature permits the analyst to point out key attributes of a recorded movement to the performer or an observer. For instance, in Fig. 3, a stick figure representation of the body shape denoted by a white line is overlaid on the picture to help the observer focus on a key attribute, namely the feet position in relation to the hips in the headspring vault. The software also provides quantitative measurements such as angles and distances of limb segments on the video images. In Fig. 3, the number indicates that the hip flexion angle is 73 degrees. To the observer, it is an indicator that the feet are below the hips, the desired position for the skill in question.

Responses to the Video and Computer Technology

Using a five-point Likert Scale (1—strongly disagree; 5—strongly agree), the trainees were surveyed for their responses on three aspects of the use of video and computer technology in the teaching and learning of gymnastic skills. These aspects were: (a) demonstration and learning of skills; (b) enhancing observational ability; and (c) means of feedback.
We found that our learners were very enthusiastic about using video computer technology. They noted that its use was effective in providing visual demonstrations; an average score of 4.6 was noted from the survey. With an average score of 4.5, they also found that the technology was effective in providing feedback. Finally, they recorded an average score of 4.5 for the enhancement of their observational skills. In short, they found that using this technology not only enhanced their learning of gymnastic skills but also their skill analysis capabilities and competencies in providing effective feedback.

**Commentary on the Video and Computer Technology**

From this exploration we found that the trainees were more motivated to learn gymnastics. In contrast with passive traditional approaches, they were more willing to experiment with different interventions to the performances probably because they were keen to see the results of their actions on screen.

**Approach 2: e-Learning in Gymnastics**

Because gymnastics is a physical activity, the online learning medium may seem alien. However, specific features of this learning medium (such as anytime, anywhere learning, hypermedia access to recently updated information based on related ideas, ease of use, discussion forums and synchronous "chat" facilities that go beyond classroom boundaries; Tan and Hung, 2001), provided the impetus to utilize these features to enhance the students' knowledge base in gymnastics. The following section describes a pioneering attempt to incorporate the use of a "blended" e-learning approach in the teaching of a module in gymnastics.

During face-to-face practical sessions, animations and video footage of gymnastic performances were accessed wirelessly within the gymnasium. The instructor used these graphic presentations to highlight specific phases of movement and their critical attributes. The video and animation, in conjunction with the instructor's verbal instructions, were used to enhance explanations and provide effective guidance to the learning of the task. The timely display of video and animation (or "just in time" instruction) would definitely assist the learners tremendously in attending to specific and relevant information (Fenrich, 1997). A computer screen presentation of a video clip used by learners in the module is shown in Fig. 4.
An asynchronous discussion forum is a feature of e-learning created to facilitate individual and collaborative learning, as well as to promote critical and reflective thought. The discussion forum used provided structured communications (Hannafin, 2001). They were incorporated throughout the hybrid online course and were premised on learner-centred principles (APA, 1997). Online discussions promote opportunities for challenging, debating and refining ideas (Bong and Cunningham, 1998) among the learners, where the learner actively engages and constructs meaning not only from content provided on the Web but also from collaborative dialogue with others.

The online discussion allowed the trainees to post their answers, to review and comment on each other's answers and to post questions. For example, in response to a question on what rectification is required to improve vaulting performance, learners could watch a video clip of the vault and respond accordingly. An example of a thread of discussion that occurred in the module which evolved from agreement, to making conceptual inputs in explaining the movement and making suggestions for improvement, is as illustrated below:

Student A: the impact phase is the most important aspect to look at if the subject's performance was to be improved. This is because
I felt that he did the movement correctly until the impact phase. He had good height from the board take-off phase, giving him good linear and rotational momentum which enabled him to get into a good preflight phase in which he approached the vaulting table at quite a steep angle. However, upon impact, his hands were bent, and remained bent even as his body was at the vertical. It can also be seen that his shoulders have gone past his hands while contact is still being made with the vaulting table, thus constituting rolling.

**Student B:** I agree with Student A that the subject has a good technique during the takeoff phase. He has ensured that the impact is a relatively short one to enable him to produce sufficient force to get to the preflight phase... Personally, I also agree that the takeoff, prelight, impact, postflight and landing are clearly visible in the video. However, it would be more accurate to judge the overall vault had the hurdle step and the run up been shown.

Typically, such discussions demonstrated critical and reflective thought as a result of collaborative effort. These discussions were extended to the face-to-face practical sessions so that hands-on practice could be used to reinforce the understanding of concepts and to enable learners to apply them in authentic situations.

*Response to the e-Learning Approach*

Trainee teachers completed the online cum practical (hybrid) gymnastics module over 9 weeks. For the online module, access was via a password-protected website through a learning management system known as Blackboard®. For the discussion forum, they are assigned into groups of four with each person taking leadership in initiating and ending a specific forum. Four topics are presented for discussion. At the end of each module, they are asked to complete a 10-item attitude survey questionnaire. The survey questions were aimed at obtaining feedback on aspects of the online module using a five-point Likert Scale (1—strongly disagree; 5—strongly agree). These aspects were: adequacy of coverage, perception of knowledge gained and reaction to module design.
In terms of content coverage of the module, the response was highly favourable; an average score of 4.1 was noted in the survey. Participants indicated that the information presented was useful and helped them to understand the activities during the practical sessions. The participants also indicated that the use of pictures and video clips enhanced their understanding of the content. With regard to online discussions, participants generally agreed that the forums enabled them to share ideas, enhanced their understanding of the pedagogical content and encouraged them to apply concepts learnt in the course. For the perception of knowledge gained from the use of this e-learning process, the computed score from the survey was 3.8. The trainee teachers scored an average of 4.1 for the design of the module. However, most were neutral in their opinion with regard to a reasonable level of personal effort spent participating in the discussion forums. This indicated that student interest in terms of online learning is an area that needs more attention and encouragement.

**Commentary on the e-Learning Approach**

In using e-learning, with all its features, learners are encouraged to seek answers to their questions collaboratively. When an answer to a question is given, or the meaning individualized, the confidence of the learner would increase and in turn reduce the dependency on the teacher at the same time. This medium of instruction can be a useful tool in developing individual abilities to becoming lifelong and independent learners. For many of the trainees, online education is a new phenomenon. With time, a paradigm shift may be realized among learners, as they come to accept online instruction as an educational tool to supplement the practical aspects of any sports module, let alone gymnastics.

**Conclusion**

Our approaches received overwhelming endorsement from the students. Their responses indicated that using video and computer technology in teaching and learning motor skills was effective. Moreover, it was effective not only in acquiring the gymnastic skills, but also in enhancing observational abilities and skill analysis capabilities. We suggest that pupils in schools be taught to observe and correct each other’s techniques. PE teachers should venture into incorporating video computer technology in teaching motor skills. They could further capitalize on the potential of video as a
means of feedback and as a tool for analysis. We also recommend that PE practitioners consider using e-learning as a facility to supplement PE programmes. Hung, Tan, Wong and Cheah (2003) commented that the vast potential of IT is waiting to be harnessed.

The use of IT in PE also predisposes the learning process to be one that is more learner-centred. It also facilitates collaborative work and moves away from the traditional passive learning approach. PE teachers who integrate video and computer technology into e-learning will not only improve their instruction but will also enhance the professional image in teaching movement skills.

**Implications**

- Care must be taken when using e-learning to make sure that it is not merely an “information dump” site.
- Discussion forums should be structured to avoid a “free for all” like in chat rooms. Specifically, questions posed should progressively require higher-order thinking skills that promote critical and reflective thought.
- Apply cueing strategies in visuals (by means of annotations or pop-up quizzes) to facilitate information processing.
- The use of modern video and computer technology within PE lessons in school requires capital investment. Therefore, a commitment must be made by PE practitioners to take advantage of the technology and not regard it as a novelty. Teachers must plan to integrate the use of such equipment to meet the affective aspects of the learning outcomes in PE lessons. This can be achieved effectively through collaborative work.
- IT is a tool that has the potential to facilitate the inculcation of independent and lifelong learning skills. However, teachers must make a paradigm shift to use it. Top-management support, as well as technical support, is critical for this endeavour.

**References**


