Applying an expert system combined with multimedia to practical physical education teaching

Suwen Lu

Southeast University Nanjing
Nanjing, People's Republic of China

ABSTRACT: Nowadays, sports teaching faces several challenges, one of which is to improve student outcomes through greater engagement during the course of study. Reported in this articles is a study that considered the combination of an expert system with multimedia in practical physical education to improve students' outcomes and the process of teaching. The purpose of this work was to analyse and study the multimedia expert system as a modern teaching method to deal with the problems of practical sports teaching.

INTRODUCTION

Multimedia teaching has been widely applied since its initial development in the 1980s. Multimedia teaching has had a large effect on physical education teaching, promoting the constant updating of teaching material and methods. Some of the earlier teaching models and methods rarely fulfill the learning needs of contemporary students. Thus, pushed by multimedia teaching, there is a tendency to reform teaching models to optimise the whole teaching process. Hence, multimedia teaching is a stimulus to improve teaching effectiveness and the knowledge of students [1].

Knowledge representation is a term used in artificial intelligence to refer to formalisms or methods to represent knowledge and its structure. It enables people to identify and understand knowledge and is also used in computer-based knowledge processing systems. Any knowledge organisation method will be based on knowledge representation. The knowledge in an expert system has specific scope and structure that is represented in the computer system.

The knowledge representation of an expert system is generally divided into three categories. The first category is of concepts from the real world. The second includes events, behaviour and states abstracted from the real world. The third is about process, i.e. it not only includes the description of behaviour, but also the changes of state resulting from the behaviour. Widely used expert systems are rules based on a *rules knowledge representation*. This representation was used in artificial intelligence research by researchers as early as in the 1970s. Other widely used representations include predicate logic and semantic network representations.

MODEL FOR PHYSICAL EDUCATION TEACHING

Although there is no single, agreed understanding of the structure and process of physical education [2], it generally consists of (teaching) guidance, process and method. The relation among the three elements can be understood by a metaphor: the process is the *skeleton* supporting the teaching; method is the *muscle* of the teaching; while the guidance is the *nerve* that co-ordinates and guides the *skeleton* and *muscle*. Teaching guidance reflects the theory; teaching process the activities; and method, how the activities are demonstrated. See Figure 1 for a pictorial representation of this concept.

SPORTS TEACHING USING AN EXPERT SYSTEM COMBINED WITH MULTIMEDIA

An expert system combined with multimedia or multimedia expert system, when used for teaching is an advanced teaching aid that arouses students' interest and creativity. It is an effective way to improve the quality of courses and students. Its rich content and presentation can enliven what might otherwise be boring theory [3].

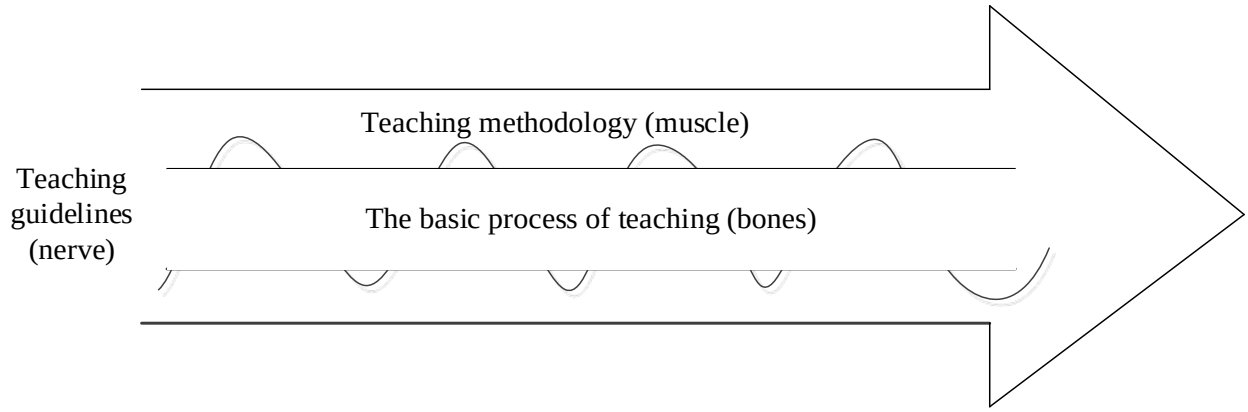

Figure 1: The basic structure of the physical education model.

A multimedia expert system can provide a diverse learning environment and satisfies most teaching principles. Features of such a system are as follows.

Visual Explicitness

Visual explicitness is important for solving the problem of making abstract concepts easily understood. In this process perceptual knowledge leads to conceptual knowledge, i.e. the visual representation leads to abstract knowledge [4]. Students organically combine abstract thinking with visualisation producing clearer, vivid and more interesting learning, which is less reliant on memorisation.

In sports teaching, coherent physical actions in a sport can have complex structures and require rapid movement. Such sports include hurdling, long jump, high jump, shot put, javelin throwing, gymnastics and ball sports. Though teachers may explain and demonstrate these momentary, integrated actions many times, students cannot see the process very clearly to enable them to learn to control the action themselves. What is more, teachers cannot move through the complete action step-by-step, while they are demonstrating, which degrades the effect of their teaching [5].

A multimedia expert system can demonstrate the actions step-by-step without the limitation of the time taken to complete the *real* physical action.

Creating Interest

Curiosity is the best teacher. Teachers should know how to develop a subject to increase the curiosity of students. Many teachers have shown in practice that visual teaching methods and making students learn by simulation play an important role in improving their active learning which, in turn, improves teaching effectiveness in valuable course teaching time.

Multimedia can integrate sound, light, images and captions. Humorous content can provide a relaxed and enjoyable learning atmosphere [6]. The multimedia content can command attention and arouse curiosity.

Multimedia can accurately present objects visually causing students to more rapidly master the material. For example, in hurdling, if the leg is not swung in the appropriate manner, speed will be affected and a barrier easily knocked over.

Students are not familiar with such actions in daily life and, especially beginners, may experience some fear given the difficulty of the action. In this situation, video data, edited using advanced technology, can create an effective teaching environment.

Teachers can explain complex actions of world-level athletes *frozen* or in *slow motion* before the students' eyes. This can motivate students to imitate the actions portrayed and, hence, learn from outstanding athletes. This promotes active as opposed to passive study. Such teaching is easier for teachers and more interesting for students.

Cultural Impact

Images and video convey language and also culture. Multimedia enables foreigners to get to know the Chinese nation and culture. Video can faithfully reflect the history, culture, social customs and habits of a country or a nation. Through watching video, foreign students can understand Chinese culture and how it is different from their own culture. This is a feature that distinguishes multimedia expert systems from other systems used in teaching.

After watching and enjoying world-class sports competition, students can better understand their capabilities relative to what is possible. Meanwhile, teachers can keep abreast of the latest news of world sports and technology, which is good for their professional standing.

SEMANTIC NETWORK REPRESENTATION USED IN MULTIMEDIA EXPERT SYSTEMS

In addition to the earlier discussed rules of productions, as mentioned there are other forms of knowledge representation, such as semantic networks, which is powerful and has wide application.

Concept of a Semantic Network

A semantic network is a network map with nodes connected by arrows. Each node expresses a fact, event, condition or other concept. The arrow shows that a relationship exists between the nodes.

Therefore, a semantic network reflects the primary and secondary nodes in a relationship with a directed graph, as shown in Figure 2.

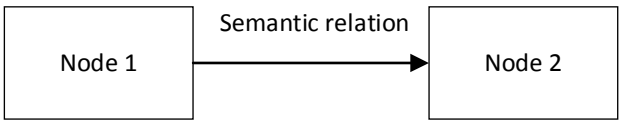

Figure 2: Primary and secondary node relationship in a semantic network.

Semantic Relations

Instance relation or *ISA* reflects the concepts of *abstract* and *concrete*, e.g. Boeing 747 (concrete) *ISA* plane (abstract).

Generalisation relation: *AKO* embodies the concept of *super-class* and *sub-class*, e.g. plane (sub-class) *AKA* machine (super-class).

Membership relation: *A-Member-of* reflects the membership of a class, e.g. Dong *A-Member-of* communist class. See Figure 3 for a summary of these relations.

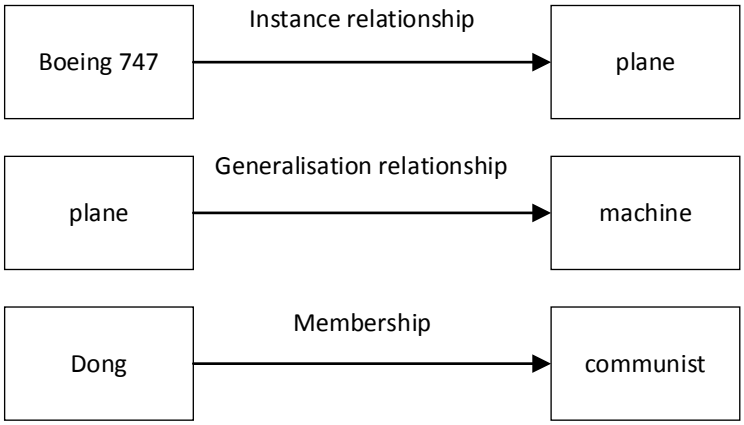

Figure 3: Semantic relations of a semantic network.

Attribute relations refers to the relationship between objects and their properties. Common attribute relations include Have, Can and Age. Specific semantic network diagram for Have and Age are shown in Figure 4.

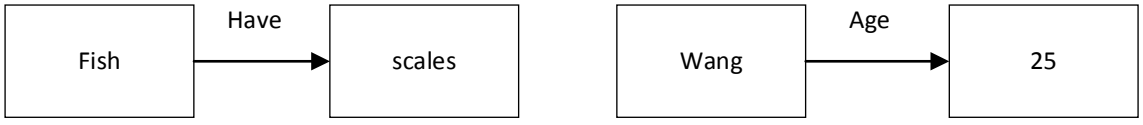

Figure 4: Properties relations.

Inclusion relation is also called the clustering relation and reflects an organisational structure between the elements. Common inclusion relations include *Part-of*, *Before* and *After*, e.g. teacher is *Part-of* education, as shown in Figure 5.

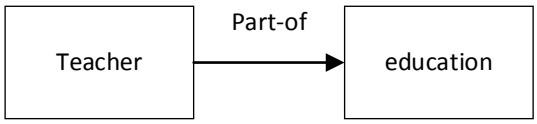

Figure 5: Inclusion relation.

Time relations refer to the time difference between events. Commonly used time relations are *Before* and *After*, e.g. multimedia is used *After* the class, as shown in Figure 6.

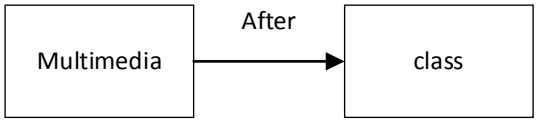

Figure 6: Time relation.

Location relation exists if there is a clear location relationship between nodes. Common location relationship includes *Located-under*, *Located-on*, *Located-at*, *Located-inside*, and *Located-outside*, e.g. computer is *Located-on* the table, as shown in Figure 7.

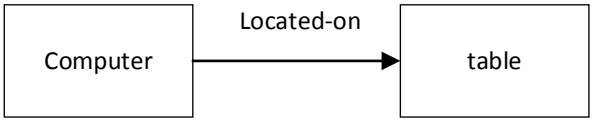

Figure 7: Location relation.

Similarity relation - when different things are similar in some properties, such as content, colour, material. Commonly used similarity relations include *Similar-to* and *Near-to*. For example, monkey is *Similar-to* people, as shown in Figure 8.

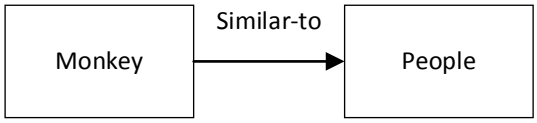

Figure 8: Similarity relation.

MULTIMEDIA EXPERT SYSTEM TEACHING

Multimedia teaching uses modern teaching concepts and modern technology to improve teaching. Multimedia expert systems present material that integrates sound, images and video to crystallise the understanding of abstract theories and, hence, is a sound concept. Traditional teaching mostly is knowledge inculcation, which can be tedious and frustrate students. Multimedia expert systems present multimedia teaching content to students, which motivates students' enthusiasm for learning and improves their comprehension and memorisation of knowledge.

According to research, if a student just listens to teaching content, i.e. by a teacher talking, then, he/she can remember about 60% of the content after three hours; if a student just watches the teaching content, i.e. by the teacher writing on a blackboard, then, he/she can remember about 70% of the content after three hours; if adopting the *listening plus watching model*, then, he/she can remember about 90% of the content after three hours.

Testing after three days, the remembrance of the three methods, viz. *listening*, *watching*, *listening plus watching*, were 15%, 40% and 75%, respectively. The data are shown in Figures 9 and 10.

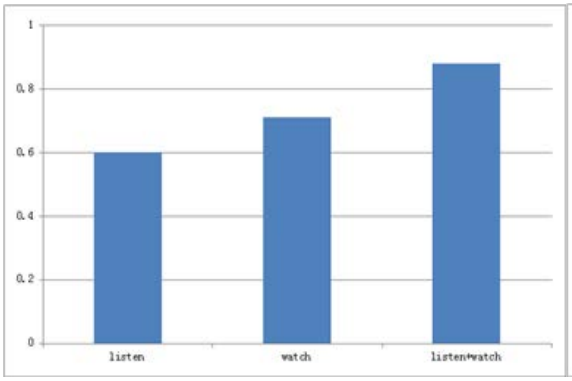

Figure 9: Memory after three hours.

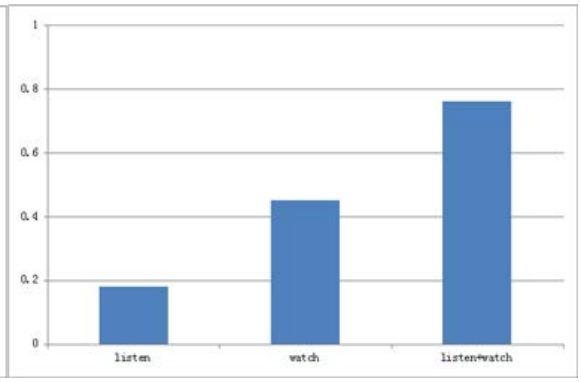

Figure 10: Memory after three days.

These data demonstrate that a multimedia expert system, which involves *listening plus watching*, assists student recall of material.

CONCLUSION

Practical physical education plays a significant role in professional sports colleges and other senior colleges. It is an important aspect in determining a student's development. A multimedia expert system is an advanced teaching system which, when applied to practical sports teaching, can improve teaching effectiveness and quality.

REFERENCES

1. Klein, B. and Crawford, G., Vertical integration, appropriable rents and the competitive education process. *J. of Educ. and Economics*, 297-326 (2008).
2. Dixit, A., The expert system combined with multimedia method used in the teaching of Marxism basic principle. *The Northwest Medical Educ.*, 25-36 (2008).
3. Chen, W.M., Leisure education teaching demonstration, scene creation and feedback. *China Audio-Visual Educ.* (2009).
4. Lindahl, D., Palmer, J., and Edenbrandt, L., Myocardial SPET: artificial neural networks describe extent and severity of perfusion defects. *Clinical Physiology* 19, **6**, 497-503 (1999).
5. Han, Y.J., Worth exploring a new pattern of teaching, the expert system combined with multimedia method. *Water Transport in China* (2007).
6. Lindahl, D., Palmer, J., Ohlsson, M., Peterson, C., Lundin, A. and Edenbrandt, L., Automated interpretation of myocardial SPECT perfusion images using artificial neural networks. *J. of Nuclear Medicine*, 38, **12**, 1870-1874 (1997).