The use of technology in movement and dance education: recent practices and future perspectives

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Abstract

The study of the effectiveness of the use of technology in the teaching of motor skills has recently attracted the researchers’ interest to a great extent. The aim of this study is the analytical and critical presentation of the researches focusing on the application of technology on movement education with emphasis on physical and dance education. The predominant research finding is that although contemporary technological media are substantially advanced and innovative, they have not been incorporated in the classroom everyday learning practice yet. A prerequisite for the achievement of this goal is the researchers’ interest to be focused: a) on the cognitive aspects of a technologically supported instruction and b) on the design of multimedia products according to the principles of the modern theories of multimedia learning.

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1. Introduction

The study of the effectiveness of the use of technology in the teaching of motor skills has recently attracted the researchers’ interest to a great extent. An increased number of scientific journals are publishing whole units or even issues on this topic (Sorrentino, 2000). Furthermore, many researchers are experimenting on the development and application of visual teaching tools, digital multimedia and virtual learning environments for the teaching of motor skills (Ignico, 1997; Antoniou, Derri, Kioumourtzoglou, & Mouroutsos, 2003; Vernadakis, Zetou, Antoniou & Kioumourtzoglou, 2002; Amaradidis, Antoniou & Giossos 2006; Goulimaris, Koutsouba, & Giosos, 2008; Kavakli, Bakogianni, Damianakis, Lamou, & Tsatsos, 2004; Rose, 1994; Smith-Autard, 2003; Popat, 2002; Parrish, 2000; Calvert, 2005). It is argued that the proposed multimedia learning environments combining electronically supported image, sound, text and graphics with live performances, provide opportunities for personalized instruction, cooperation, feedback and creative interaction between the medium and the user. Their text may be in a written form (i.e. text on a computer screen) or in an audio form (i.e. narration), while their images may be static (i.e. photographs, graphs, symbols or maps) or dynamic (i.e. video, interactive depictions, animation) (Mayer and Moreno, 2003).

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Interactive multimedia in particular is one of the most important applications of technology in computer assisted instruction. It is one of the most accessible technological innovations, which does not require expert knowledge in computer programming. Interactive multimedia involve all the aforementioned elements (i.e. text, image, sound, graphics, etc.) all included in a learning environment where creative action and inquiry have the primary role, so that the student can affect his/her own learning stages and determine those that fit to his/her learning style.

However, in those cases where the researchers include in the teaching practice their innovations, it turns out that their impact on the students’ motor skills and performance is either nonexistent or moderate compared with the traditional teaching methods. The teaching practice proves that technology can offer opportunities for personalized instruction, cooperation, communication and feedback (Kwok-Wing Lai, 2008; Leijen, Admiraal, Wildschut, & Simons, 2008) as far as it is used with a focus on the improvement of instruction and the promotion of human movement and not its replacement.

With this axiom in mind, the aim of the present research is the analytical and critical presentation of the researches focusing on the application of technology on movement education with emphasis on physical and dance education. The literature review method is used, which includes: a) the detection of the relevant with the subject primary and secondary resources and b) the analysis, assessment and integration of related published literature, in order to bring forward the most important research findings of the current time (Thomas, & Nelson, 2003).

Starting from physical education, researches of the last ten years that have incorporated technological applications in the teaching of motor skills are reviewed and their impact on motor performance is comparatively discussed. The review continues with relevant researches from dance education, putting forward subjects like dance choreography, dance multimedia and distance education in the teaching of dance. Through the comparative study and critical evaluation of this literature, the designing and constituting principles that should govern the teaching of motor skills with multimedia are revealed, so that these applications could be used for the promotion of each curriculum’s learning goals.

2. The use of interactive multimedia technology in the teaching of motor skills

2.1. Physical education

The structure of a physical education lesson is undoubtedly multidimensional. On the part of the teacher, it combines the demonstration of motor skills together with the verbal description of the rules and principles that govern them. On the part of the student, it demands experimentation on these demonstrations through the practice of movement type activities and cognitive tests, according which relevant motor schemata can be embedded. In order to serve both the teachers’ and the students’ needs, many researchers suggest the combinational use of text, images, symbols, animation, sound and video in the same multimedia application, which in the majority of cases is a computer learning environment (i.e. digital multimedia or hypermedia).

The suggested software tutorials either as separate learning media or in the context of computer learning environments, are used widely nowadays by physical education teachers. According to Sorentino (2000) these software applications are used in physical education for:

1. The evaluation of physical fitness (body fat, heart rate, V02 max, etc.).
2. The collection of data relevant with the students’ or athletes’ performance (time, distance, rates, etc.).
3. The teaching of sport skills, tactics and rules as well as topics like health and fitness.

As far as the third category of instructional software is concerned, during the last ten years a large number of researchers have tested their influence on the improvement of the cognitive and motor performances of students in various educational stages. In particular, Sorrentino (2000) tested, in the context of school physical education, the effectiveness of the use of internet in the teaching of motor and cognitive skills during swimming lesson. Chu and Chen (2000) developed a Multimedia Computer Aided Instruction for the teaching of a badminton skill. The aim of the research of Everhart, Harhsaw, Everhart, Kernodle, and Stubblefield (2002) was to examine the effects of high school physical education students interacting with a multimedia software program designed to provide nutritional and physical activity guidance. In basketball, Antoniou et al. (2003) and Vernadakis, Zetou, Tsitskari, Giannousi &
Kioumourtzoglou (2008) applied specially designed software for the teaching of the rules in the first case and the ball-shooting skill in the second case. Furthermore, similar software were developed and suggested by researchers for the teaching of volleyball skills (Vernadakis, Zetou, Antoniou, & Kioumourtzoglou, 2002; Vernadakis, Zetou, Averinos, Giannousi, & Kioumourtzoglou, 2006). In Karp’s and Woods’ research project (2003), high school students from Idaho of USA attended online fitness and nutrition units on the Idaho virtual campus. In the research of Siskos, Antoniou, Papaoannou, and Laparidis (2005), an interactive multimedia CD-ROM was tested for its influence on the teaching of «Health related fitness» subjects to primary education students. In the study of Amarantidis, Antoniou, and Giossos (2006), distance education was used for training primary school physical education women teachers on football related topics and skills. Antoniou, Moulelis, Siskos, and Tamourtzis (2006) developed interactive software which was used as a means of supportive instruction during the teaching of the basic rules of alpine ski. In the frame of Katona’s research in (2007), an interactive software application, which had the form of an e-book, was used for the purposes of the university course “Sport recreation, Leisure time sports theory and practice I and II” of the Faculty of Pedagogy in the University of West Hungary. Specific sport skills of team invasion games (i.e. rugby, handball, football, etc.) were taught in a research by Hastie, Casey, and Tarter (2010) on a server software online database named “wiki”. Libkuman et al. (2002) and Sommer, & Ronqvist (2009) tested, in separate studies, the effects of training golf athletes with the use of interactive software on their accuracy to shoot on a target.

In the majority of the aforementioned research projects, the methodological design involved comparisons between one or two experimental groups (instruction only with the use of interactive multimedia or mixed design that combined the use of multimedia with live instruction from the teacher) with control groups (direct teaching style with the teacher as a model), the performances and attitudes of whom were assessed at the beginning and at the end of the research. In most cases, the assessment tools were written tests and questionnaires or interviews, while those researches that ended up with quantitative results were few. Furthermore, despite the fact that most of these multimedia productions and/or applications seemed highly promising at the beginning as far as their influence on the teaching and learning of motor skills were concerned, their applications did not give credit to their inventors’ expectations. Except from the studies of Libkuman et al. (2002), Antoniou et al. (2006), Katona (2007) and Sommer, and Ronqvist (2009), most of the researchers did not find statistically significant differences between the experimental and the control groups, despite the fact that the pre and post performances of each group separately proved statistically significant. Factors like the small sample sizes, the deficiencies of the technological devices, the high cost of the suggested applications or the low quality of their graphics, the limited familiarity that physical education teachers had with technology, the different level of their users’ computer skills, as well as the fact that it was impossible to control the time that the students actively engaged with the digital materials, seemed to be the most important weaknesses and limitations of the methodological designs. Furthermore, despite the fact that at the beginning of the projects the students’ attitudes towards the multimedia productions seemed to be more positive in relation with the traditional teaching practices, at the end the mixed teaching methods that combined interactive multimedia with instruction from the teacher seemed to be the most favored.

2.1.1. Dance education

The connection between dance and technology has started by the time dance teachers and researchers used videos to record, interpret, analyze and save dances or dance choreographies (Birringer, 2002). However, the research relative with the influence of technology on dance education (taking dance both as a motor skill and as a social and/or cultural work of art) is still at the beginning (Leijen, Admiraal, Wildschut, & Simons, 2008). According to Calvert, Wilke, Ryman, and Fox (2005), dance is possibly the only branch of education which was late to adopt technology’s applications. The same authors attribute this fact to two reasons: a) the unwillingness of dancers and dance choreographers to let any media stand between them and their live kinesthetic experience and b) the low marketability of this branch, due to which the newly devised technological applications delay to develop and co-opt in the market place.

However, today the dance multimedia applications are many and extremely innovative. Particularly, digital technology is used since 1968 from choreographers and researchers in choreography teaching and composition
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(Merce Cunningham, 1968; Leijen, Lam, Wildschut, Simons, & Admiraal, 2009; Cherry, Fournier, & Stevens, 2003), while lately the experts’ interest turns to the use of internet for the merging of the choreographic design with virtual environments (i.e. the Association of Dance Performance Telematics).

Furthermore, interactive multimedia are one of the most important and multidimensional applications of technology on the teaching of dance skills and styles. CD-ROMs for the teaching of dance form (Smith Autard, 2003) and improvisation (Forsythe, 2003), for the presentation, preservation and access to interactive material relative with the life and productions of important choreographers of the previous century (Strandberg, 1994), for the comparative study of traditional dances (Golshani, Vissicaro, & Park, 2004), for the teaching of dance notation (Marion & Smith, 1999; Wilke, Calvert, Ryman, & Fox, 2005), are some examples of the most representative dance educational/technological multimedia productions.

During the last decade another subject matter of interest for dance researchers is the use of teleconference, distance education and the internet for the teaching of dance. Modern societies look for flexible educational methods and practices that could satisfy the need for lifelong learning (Giosos, Mavroidis, & Koutsouba, 2008). Distance education through internet is a contemporary teaching method, a basic advantage of which is the broadening of educational communities through the breaking of the natural, social and political limits of the class. The application of this method on the teaching of dance, even though not so common as in other educational items, seems to be in a constant progress, with a focus on university education. Many educational institutions/researchers develop internet learning management systems for the teaching of dance (Garland, & Naugle, 1997; Popat, 2001; 2002; Mandile, 2004; Kavakli, Bakogianni, Damianakis, Lamou, & Tsatsos, 2004; Leijen, Admiraal, Wildschut, & Simons, 2008; Damianakis, Tsadima, & Tsatsos, 2009). The latter consist of a collection of software teaching tools organized in units (i.e. the teaching of dance skills, dance aesthetics, dance history, etc.), which provide all the necessary media for lesson planning and presentation, for synchronous or asynchronous communication between teachers and students, for performance assessment and lesson administration (Antoniou, Apostolakis, Anastasiades, & Karipidis, 2009).

However, as in physical education, the majority of the published research projects that concentrate on the use of ICT (Internet Computer Technology) in the teaching of dance, focus either on the development of software or on the design of interactive learning platforms (Risner, & Anderson, 2008), without assessing their influence on dance performance in real time. In those few cases that the characteristics of these applications are evaluated, the evaluation is mainly qualitative (questionnaires or interviews) and rarely is accompanied by quantitative data. The teachers and students involved in these projects, although skeptical about the “invasion” of animation figures and digital elements in their kinesthetic interaction and communication, seem to be enthusiastic about the opportunities that ICT offer for personalized instruction. Still, the teacher’s role and impact on lesson planning and instruction is judged by all as determinant for the students’ successful performance and in no way replaceable by technology.

3. Results

The predominant research finding of the present review is that although contemporary technological media are substantially advanced and innovative, they have not been incorporated in the classroom everyday learning practice yet. Factors like the difficulties that educators come up with during their attempts to familiarize with new technologies so that they can integrate them in their lessons, the high cost of buying and installing new software together with its supporting systems, the limited access that a large percentage of the student population has to new technologies, the educational community’s fears about the safety of the use of such media, as well as the anxiety by the part of some teachers that this kind of instruction will discourage students from actively engaging and bodily practicing and experiencing the motor skills they are taught, are certainly inhibitory. Still, more and more students seem to be enthusiastic and motivated by these new teaching methods, choosing to be engaged with them against the more traditional ones (Leijen, Lam, Wildschut, Simons, & Admiraal, 2009; Goulimaris, Koutsouba, & Giosos, 2008). Another finding is that researchers seem to focus on the numbering of the learning results of each intervention, without checking and testing the cognitive processes and demands of the technologically supported instruction. Moreover, the evaluation of the newly suggested methods is confined either to the interpretive assessment of questionnaires and interviews, or to the comparisons between one medium and another. How these
media could be designed so as to promote the teaching and learning of motor skills, regardless of the educational environment they are used, remains still an unsearched field.

4. Concluding remarks

Nowadays, more and more researchers are suggesting a “holistic approach” for the teaching of motor skills; an approach that would equally involve motor and cognitive parameters (Lavender, 1996; Warburton 2004; Smith-Autard, 2003; Koutsouba, & Giosos, 2006; Antoniou, Apostolakis, Anastasiades, & Karipidis, 2009), something that the traditional direct teaching methods does not seem to support.

The media that technology can provide teachers and students with should be treated as tools for the facilitation and improvement of their work and not as substitutes of motor/dance performance. Through the prism of the modern theories of multimedia learning (Clark, & Paivio, 1991; Mayer, & Anderson, 1991; Mayer, 1997), digital multimedia can function as a means of concurrent activation of the visual and verbal system of receiving and processing incoming information. In this way they set up an attractive learning environment suitable for the modulation and embedding of the motor schemata that are necessary for movement performance. The present literature review did not find any recently published research that used the principles of such a theory as guidelines for the development of interactive software.

The use of technology in education should not be encountered as an end in itself, since technology is not a new modernized pedagogy. Any judgment relative with the effectiveness of such applications should come as a result of valid and reliable assessment procedures and not only through the evaluation of their users’ attitudes towards them. Following a student centered scenario, the technologically supported instructional design should work as a tool of knowledge construction (Mayer, & Moreno, 2003) in order to be effective in any educational context regardless of the means that are used for the communication of knowledge.

Basic requirements for the achievement of this goal are: a) the investigation of the way that the human brain works during multimedia instruction, b) the design of multimedia products according to the principles of a theory of multimedia learning and c) the inclusion and application of the technological innovations on the school curricula in a way that they can support the motor learning processes. The authors’ basic conviction is that only such an approach in the teaching of motor skills open the way to really creative innovations.

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