

The effect of using digital mind mapping on cognitive achievement and performance level of some basic skills in handball

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Abstract. This study aims to identify the effect of using digital mind maps to on the cognitive achievement and the performance level of some basic skills in handball. Research population includes the first-year students at the Faculty of Physical Education in Port Said consisting of 200 students. Research Sample both researchers randomly selected the sample of first year students. The total sample size reaches 180 students with a 90.00%, after excluding failed students, re-registered students, the students of other levels of curriculum, practitioners to previous experiences and irregular students. The total number was 20 students with a percentage of (10.00%). They were divided into: Basic Sample: includes 80 students with a 44.44%. They were divided into two equal groups of 40 students. First Exploratory Sample: includes 60 students from the same research population and from outside the basic sample in order to find Tests Validity of the tests with a 33.33%. Second Exploratory Sample: includes 40 students from the same research population and from outside the basic sample in order to find Tests Reliability of the tests and identify the extent of pilot program appropriateness for the sample under discussion with a 22.22%. The first-year students were selected, according to the study plan, which contains a handball curriculum for the students of this educational level. Statistical Treatments: Both researchers conducted data statistically processes, using a statistical package for Social Sciences, SPSS ver. 20.0, in order to identify: arithmetic mean, standard deviation, median, skewness coefficient, correlation coefficient, discriminant validity coefficient, "t" test per one group, "t" test per two groups. The use of mind maps has a positive effect better than (explanation and model) method on the cognitive achievement and the performance level of some basic skills in handball. Active learning techniques, such as the method of digital mind maps in teaching handball curriculum for the students of Faculty of Physical Education should be used.

Keywords. Basic skills, cognitive achievement, digital mind mapping, handball, performance.

Introduction

Visual learning is a proven teaching method in which diagrams such as concept maps, mind maps, tree diagrams, organization charts and spider diagrams are used to help students of all ages

think and learn more effectively. They are all used for storing, processing, organizing and presenting information graphically. These techniques are used across the curriculum and at all Key Stages. The most popular is Mind Mapping (Nada et al., 2009). One of the most important problems in education is to realization a greater degree of utilization of mental abilities. One approach to this problem is the use of so – called mind maps, whose founder is Tony Buzan (Stankovic et al., 2011; Ying et al., 2014).

According to Michael Michalko in his best-selling book *Cracking Creativity*, a Mind Map: activates your whole brain, clears your mind of mental clutter, allows you to focus on the subject, helps demonstrate connections between isolated pieces of information, gives a clear picture of both the details and the big picture, allows you to group and regroup concepts, encouraging comparisons between them, requires you to concentrate on your subject, which helps get the information about it, transferred from your short-term memory to your long-term memory. Mind Maps help you to learn, organize, and store as much information as you want, and to classify it in natural ways that give you easy and instant access (perfect memory) to whatever you want. and has a whole range of advantages that help make your life easier and more successful it's one of the most powerful strategies you can use to optimize your learning capabilities, become enormously creative, understand complex systems with ease, and maximize your performance level in any area of your life (Buzan, 2009).

Mind mapping is an amazing tool that you will benefit from in any area of life. Learn these techniques and increase your level of productivity, bring out your inner creativity, and unleash the limitless power of your mind (Ingemann, 2015). Buzan mind mapping is a visual tool used to organize and related themes or objectives. Buzan asserts that mind maps that incorporate pictures and different colors bring ideas to life (Tee et al., 2015). Mind mapping means the technique for visualizing these relationships among different concepts. By using such

pictorial and graphical design flourishes, mind mapping can make learning and teaching more vivid and thus can promote memory retention as well as enhance the motivation of the learners. When it comes to free form and unconstrained structure of mind mapping (Ying et al., 2014).

A mind map allows the user to record a great deal of information on one page, and to show relationships among various concepts and ideas. Visual presentation of ideas helps one to think about a subject in a global, holistic sense and increases mental flexibility. On a mind map structures of the subject can be seen in a way that is not possible with linear outlines (Mento et al., 1999). A Mind Map is the easiest way to put information into your brain and to take information out of your brain – it is a creative and effective means of note taking that literally ‘maps out’ your thoughts. And it is so simple and to help plan and organize your life for maximum success, to come up with amazing, creative new ideas, and to absorb new facts and information effortlessly (Buzan, 2005). Mind mapping is a learning technique, which uses a non-linear approach to learning that forces the learner to think and explore concepts using visuospatial relationships flowing from a central theme to peripheral branches, which can be inter-related (Zipp, 2015).

There are two kinds of mind maps: hand-made mind maps and software mind maps. Thanks to the progress of technology, nowadays there is a chance to design mind maps by computers. Among the increasingly number of mind map software programs, we can mention some of them like, Free mind map, Buzan I mind map, personal brain, mind manager, x mind. It is a fact that there are some benefits of computer mind mapping over manual mind mapping (Hariri, 2013). The use of information and computer technology has enabled information mapping to be achieved with far greater ease. A plethora of software tools has been developed to meet various information mapping needs (Davies, 2011).

Traditionally, mind maps were drawn with colored pens and paper. With presently available technology, it is possible to create mind map by using computer, which makes it easy to make, review, revise, and save mind maps. Moreover, such computer technology is very useful in creating presentations that are more beautiful (Tungprapa, 2015). In the digital word and the age of ICT, writing anything out long hand is unfavorable, and therefore, paper mind maps creation seems to be time consuming and a huge step backward. However, it is valuable to benefit from computer to create mind maps, namely, digital mind maps (Jbeili, 2013). In the past 5–10 years, a variety of software packages have been developed that enable the visual display of information, concepts and relations between ideas, More recently, the use of information and computer technology has enabled information mapping to be achieved with far greater ease. A plethora of software tools has been developed to meet various information mapping needs. A clear

understanding of the nature and distinctiveness of these tools may offer educators as yet unrealized and potentially complementary functions to aid and enhance student learning (Davies, 2011).

Handball is one of the main subjects in the curriculum of the faculties of physical education and sports, where skills are taught and mastered through several semesters, where the students must reach the highest physical and skill levels that enable her to perform well after graduating and applying that to work field (Badr, 2013). The handball game is not only influenced by physical fitness. As any physical activity it is performed and generated by thinking (Czerwinski & Taborsky, 1997).

Through the first researcher experience in supervising the curriculum of practical education and field training for 3rd and 4th levels students and the experience of the second researcher in teaching handball curriculum for the students of the first level, they noticed the weakness of cognitive achievement level and the basic skills performance among college students. In addition, they did not have the ability to teach handball skills during practical education classes and field training at 3rd and 4th levels, and the inability to provide and give a true model of basic skills in handball. As well as the weakness of the cognitive achievement level and the performance of basic skills in handball for the first level students in faculty. This can be attributed to the use of the usual teaching method, such as demonstration and presentation.

The curriculum of handball game is taught to the first year students of Faculty of Physical Education in Port Said. In the light of the philosophy of progressive education quality prevailing in the college, it emphasizes the attention to all mental, physical and skill and tactics aspects of the learner's personality to achieve the targeted educational outputs and stimulate learners to a good level to gain information and knowledge, and perform basic skills in handball, as well as the use of constructivist teaching methods or active learning methods, which are several and varied.

Both researchers believe that there is an appropriate method for each learning attitudes or adequate with all educational activities. However, there is teaching method suitable or appropriate for specific educational position and specific educational activities. This determines the conduct of research and scientific studies.

Due to the multiplicity of constructivist learning methods and activity, including the digital mind maps, it became the researchers' duty to practically contribute to conduct this research to resolve the matter and identify the effect of using digital mind maps on the cognitive achievement level and performance of some basic skills in handball.

The research aims to identify the effect of using digital mind maps to on the cognitive achievement and the performance level of some basic skills in handball.

Hypotheses: There are significant differences between both pre and post test of the control group (demonstration and presentation method) in the cognitive achievement and the performance level of some basic skills in handball for favor of posttest. There are significant differences between both pre and post test of the experimental group (digital mind maps) in the cognitive achievement and the performance level of some basic skills in handball for favor of posttest. There are significant differences between both control and experimental groups in the cognitive achievement and the performance level of some basic skills in handball for favor of the experimental group.

Material and methods

Both researchers used the experimental approach by designing two groups, control and experimental, using pre and posttest due to its appropriateness to the type and nature of this research.

Research population includes the first-year students at the Faculty of Physical Education in Port Said enrolled for the academic year 2015/2016, consisting of 200 students. Research Sample both researchers randomly selected the sample of first year students. The total sample size reaches 180 students with a percentage of 90.00%, after excluding failed students, re-registered students, the students of other levels of curriculum, practitioners to previous experiences and irregular students. The total number was 20 students with a percentage of 10.00%. They were divided into: Basic Sample: includes 80 students with a percentage of 44.44%. They were divided into two equal groups of 40 students. First Exploratory Sample: includes 60 students from the same research population and from outside the basic sample in order to find Tests Validity of the tests with a percentage of 33.33%. Second Exploratory Sample: includes 40 students from the same research population and from outside the basic sample in order to find Tests Reliability of the tests and identify the extent of pilot program appropriateness for the sample under discussion with a percentage of 22.22%.

The first-year students were selected, according to the study plan, which contains a handball curriculum for the students of this educational level.

Research sample homogeneity

Both researchers ensured the homogeneity of both control and experimental groups students by creating skewness coefficients in growth rates (age, weight, height and intelligence) and cognitive, physical and skill variables related to handball under discussion. Skewness coefficient ranged between - 0.713 and 1.52. All of these values are confined between ± 3 , which indicates the

equal distribution of both students groups in these variables.

Research sample equality

Both researchers ensured the equality of control and experimental students groups by identifying the significant differences between the experimental and control groups in the growth rates (age, weight, height and intelligence), and the cognitive, physical and skill variables related to handball under discussion. The value of "t" ranged from -0.803 to 1.639, and with significance level of 0.105 and 0.860. All of these values are greater than 0.05, which demonstrates the lack of statistically significant differences between the students of experimental and control groups, and the equality of the experimental group and control group students in those variables under discussion.

Applied tests

Both researchers settled on the use of physical characteristics and basic and cognitive skills tests of handball based on the reference survey, which had previously been used (Hemo, 2010). The same tests were used on a similar sample of the students of Faculty of Physical Education, Al-Azhar University, namely: IQ Test: Higher IQ test prepared and designed by El Sayed Mohamed Khairi. Handball Cognitive Test: Cognitive test in handball. Handball Physical Characteristics Tests: Running test for 20 meters of stable beginning (higher beginning): to measure the sprint. Standing broad jump: to measure distinctive speed of both legs. Side steps for 20 seconds: to measure agility. Throwing 800g medical ball: to measure distinctive speed of both arms. Standing trunk flexion to forward: to measure flexibility.

Handball Basic skills Tests: Passing and receiving on the wall for 30 sec: To measure the level of passing and receiving skill. Continued dribbling in zigzag direction (15 m \times 2): To measure the level of dribbling skill. High jump shooting on a target (60 \times 60) cm: To measure the level of shooting skill. Diverse defensive movements for 30 sec: To measure the level of defensive movements (Hemo, 2010).

Scientific coefficients of IQ, cognitive, physical and skill tests

Tests Validity: Both researchers identified the tests' validity, under discussion, using the discriminant validity by applying the tests on the exploratory sample of 60 students from Sunday (09/27/2015) to Monday (09/28/2015). It is from the same research population and outside the basic sample. Then, they identified discriminant validity coefficient by finding the significance of differences between upper quartile and lower quartile. The values of discriminant validity coefficients ranged between upper and lower quartile in IQ test, cognitive test, and physical and skill tests, under

discussion, between 7.802 and 23.504, and with significance level of 0.000 for all these values, which is less than 0.05, indicating the validity of those tests used in the study.

Tests Reliability: Both researchers ensured the reliability tests, under discussion, through applying the test and then re-applying it two weeks after the first application from Tuesday (09/29/2015) to Monday (10/12/2015) on the second exploratory sample, consisting of 40 students from the same research population and outside the basic sample after two weeks of the first application. Then, the correlation coefficient between the first and second application was identified. Correlation coefficients ranged from applying tests and re-applying between 0.665 - 0.837 indicating the reliability of the IQ test, cognitive test, and physical and skill tests under discussion.

Basic Experiment: Pretest: Pre tests were conducted for basic research sample from Tuesday (10/13/2015) to Wednesday (10/14/2015).

Basic Experiment: The basic experiment was conducted on the basic research sample from Thursday (10/15/2015) to Tuesday (12/15/2015).

Posttest: Posttests were conducted for basic research sample from Wednesday (12/16/2015) to Thursday (12/17/2015).

Statistical analyses

Both researchers conducted data statistically processes, using a statistical package for Social Sciences, SPSS version 20.0, in order to identify: arithmetic mean, standard deviation, median, skewness coefficient, correlation coefficient, discriminant validity coefficient,

"t" test per one group, "t" test per two groups. Statistical significant level was accepted as 0.05.

Results

Presentation of first hypothesis results

Table 1 indicates that there are statistically significant differences between pre and posttests of the control group students (demonstration and presentation method) in the level of cognitive achievement and the performance of some basic skills in handball, under discussion, for favor of posttest. Calculated "t" value for all cognitive and skill tests was greater than the tabulated "t" value at the level of 0.05 and with statistical significance level ranged between 0.000 - 0.032.

Table 2 indicates that there are statistically significant differences between pre and posttests of the control group students (digital mind maps) in the level of cognitive achievement and the performance of some basic skills in handball, under discussion, for favor of posttest. Calculated "t" value for all cognitive and skill tests were greater than the tabulated "t" value at the level of 0.05 and with statistical significance level of 0.000.

Table 3 indicates that there are significant statistical differences between posttests of the students of both control group (demonstration and presentation method) and experimental group (digital mind maps) in the level of cognitive achievement and the performance of some basic skills in handball, under discussion, for favor of posttest of the experimental group. Calculated t value for cognitive and skill tests are greater than the tabulated t value at 0.05 level, and with statistical significance of 0.000.

Table 1. The Significance of differences between both pre and post tests of the control group in the level of cognitive achievement and the performance of some basic skills in handball (n=40).

Tests	Pre test		Post test		Difference between both Means	Differences standard error	t	p
	M	SD	Mean	SD				
Cognitive test (degrees)	22.38	1.71	23.43	1.74	1.050	0.815	8.149	0.000
Passing and receiving (number)	15.65	0.83	15.80	0.79	0.150	0.427	2.223	0.032
Continued dribbling in zigzag direction (sec)	12.83	1.13	12.33	1.10	0.500	0.600	5.278	0.000
High jump shooting	2.85	0.53	3.10	0.67	0.250	0.493	3.204	0.003
Varied defensive movements (number)	25.53	0.64	26.20	1.88	0.675	1.886	2.263	0.029

Table 2. The Significance of differences between both pre and post tests of the experimental group in the level of cognitive achievement and the performance of some basic skills in handball (n=40).

Tests	Pre test		Post test		Difference between both Means	Differences standard error	t	p
	M	SD	Mean	SD				
Cognitive test (degrees)	22.23	1.61	24.75	1.15	2.525	1.633	9.780	0.000
Passing and receiving (number)	15.53	0.72	17.40	0.87	1.875	0.911	13.015	0.000
Continued dribbling in zigzag direction (sec)	13.03	1.20	11.15	1.08	1.875	1.159	10.233	0.000
High jump shooting	2.80	0.46	3.90	0.55	1.100	0.744	9.348	0.000
Varied defensive movements (number)	25.48	0.55	27.60	0.87	2.125	0.723	18.594	0.000

Table 3. The Significance of differences between both pre and post tests of the control and experimental groups in the level of cognitive achievement and the performance of some basic skills in handball.

Tests	Control group		Experimental group		Difference between both Means	Differences standard error	t	p
	M	SD	Mean	SD				
Cognitive test (degrees)	23.43	1.74	24.75	1.15	1.33	0.329	4.022	0.000
Passing and receiving (number)	15.80	0.80	17.40	0.87	1.60	0.186	8.600	0.000
Continued dribbling in zigzag direction (sec)	12.33	1.10	11.15	1.08	1.18	0.243	4.842	0.000
High jump shooting	3.10	0.67	3.90	0.55	0.80	0.137	5.847	0.000
Varied defensive movements (number)	26.20	1.88	27.60	0.87	1.04	0.328	4.266	0.000

Discussion

Discussion of First Hypothesis Results: Both researchers attribute the existence of significant statistical differences between pre and posttests of the control group students (demonstration and presentation method) in the level of cognitive achievement and performance of some basic skills in handball, under discussion, for favor of posttest to the use of teaching method applied for this group. It is one of the direct methods (explanation and model presentation) offered using verbal explanation of skill, where verbal explanation of the terms of the technical skill of the subject are provided. This leads to the acquisition and the learner's knowledge of a set of knowledge and information about the way to perform educational skill and then see the practical applied model and its positive impact on having a clear vision of the required skills. Then the learner makes the first experiment, practices and initially performs skill and then receives feedback from the trainer and corrects the erroneous performance. Eventually, learner practices exercises of the required motor action.

These results are consistent with those concluded by (Al-Haliq et al., 2014; Al-khiat & Bilbas, 2010). The results of both studies confirmed that there were significant differences between the both pre and post test of the control group, which used the traditional or followed method in favor of post test of the variables under their discussion.

Discussion of Second Hypothesis Results: Both researchers attribute the existence of statistically significant differences between pre and post tests of the experimental group students in the of cognitive achievement and the performance of some basic skills in handball, under discussion, for favor of post test to the use of digital mind maps in teaching the students of this group. Digital mind maps provide some features, helping the students to form a general vision of handball curriculum, have a clear vision on the subject of the lesson, enable them planning goals, gain as much information to display in an easy way, and enable them to read, review and remember the skill that has been studied.

This result is in line with what indicated by (Buzan, 2009) that mind maps provide an overview of the topic or a large field and enable to manage to planning goals or identify options. They also lead to compile as much information in one place, encourage solving problems

that offer a vision of new creative ways, and they can be seen, read, and remembered.

Both researchers also attribute these results to the features that digital mind maps have, including the ease of moving between lesson content and the strengthening of this content with text, video and images associated with it.

When students actively employed the features of digital mind maps such as hyperlinks, hide and show, navigation, attachments, video, audio, animations, and file saving, they could achieve the best educational outcomes (Jbeili, 2013).

Learning proceeds more economically and effectively when the learner participates actively in the process. Participating actively in the lesson requires students to find out main ideas , select significant detail, listen to interpret correctly, listen to evaluate critically and listen to summarize. These activities could only be achieved through the use of mind map in note taking (Madu & Metu, 2012).

Discussion of Third Hypothesis Results: The results of the current study indicated that there are statistically significant differences between post tests of the students of both control group (demonstration and presentation method) and experimental group (digital mind maps) in the level of cognitive achievement and the performance of some basic skills in handball, under discussion, for favor of post test of the experimental group (digital mind maps). These results are due to the following reasons:

- Digital mind maps had a much more consistent appearance, and had the potential to appear much cleaner
- Hide and show features helped students to concentrate on a specific idea and to avoid visual clutter.
- Students saved digital mind maps as files, shared files with colleagues, and easily retrieved them.
- Multimedia (videos, sounds, and animations) reinforced students to use different senses, and therefore to learn with understanding (Lih-Juan, 1997).
- Hyperlinks, email links, file attachments, and pictures are essential features that enabled students to achieve higher. Riley & Ahlberg, 2004) indicate that "ICT capacity enables storage and revisiting of mapping

and automatic functions, and creating concepts and vectors enable immediate linking and labeling that increase the ease and speed of mapping".

- Colored pictures and videos may assist students' learning motivation and attention (Lamberski, 1980) and accordingly influence their performance (van Schaik & Ling, 2001).
- The use of keyboard and mouse as input devices, enabled students to navigate through the digital mind maps easily and faster than the paper mind maps.
- Digital mind maps offered a dynamic, distributed learning environment, which expanded the physical learning space and afforded students a means of developing, organizing and structuring their ideas using higher-order thinking skills and thereby enhanced their understanding (Novak & Cañas, 2006). It can be concluded that the utilization of digital mind maps enhanced students' science achievement (Jbeili, 2013).
- Mind mapping is probably the best way to organize, create, visualize and analyze complex information:
- Its visual nature, using icons, images, relationships and direct links between topics, attachments, multimedia, hyperlinks to web sites, spreadsheets and charts (Shepard, 1967) Visual information is processed by the human brain significantly faster than information delivered by linear text.
- The relationships between the parts are visible and clear.
- The collapse/expand feature of the branches of mind maps
- The capability of simultaneous whole-view and detail view.
- All the information appears on a single page or screen.
- It is hierarchical structure (Bower et al., 1969)
- It helps to overcome the limitations of the human working-memory (Cowan, 2001)
- It shows clearly the relationship between the parts of the article.
- All elements of information are in a single compressed file. This makes the file suitable for sending as an attachment to an e-mail message or uploading to a web site using FTP.
- The information contained in the mind map is machine-readable.
- Both paper and digital mind maps are suitable for Collaborative work (Guerrero & Ramos, 2015).
- These results are consistent with those concluded by (Tungprapa, 2015; Awajan, 2013; Mani, 2011; Jbeili, 2013). All results of these studies indicated the

positive effect of using mind maps on the variables under study.

Conclusions

The use of (explanation and model presentation) method has a positive effect on the cognitive achievement and the performance level of some basic skills in handball. The use of digital mind maps has a positive effect on the cognitive achievement and the performance level of some basic skills in handball. The use of mind maps has a positive effect better than (explanation and model) method on the cognitive achievement and the performance level of some basic skills in handball.

Active learning techniques, such as the method of digital mind maps in teaching handball curriculum for the students of Faculty of Physical Education should be used. Training courses for students, lecturers and graduates in how to use active learning techniques, such as the method of digital mind maps in teaching the content of handball curricula should be held. Studies and other research dealing with the impact of using various active learning methods on samples and curricula of other sports activities should be conducted.

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