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The Effectiveness Of Using Virtual Reality Technology On Learning The Jump-Shot Skill in Basketball

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Abstract

This study aims to investigate the effectiveness of using Virtual Reality (VR) technology in learning the skill of jump-shot in basketball. Participants were 45 new volunteer students from the Department of Physical Education at Umm Al-Quran University. They had no experience in basketball and jump-shot in particular. They were divided into three groups, the control group, the real training group, and VR training group. Pre and post-tests were applied to the three groups to have a comparison between them. In the VR training group, we used the Virtual Reality headset device (HTC Vivek) to teach them the jump-shot in basketball. The scores were analyzed by using the One-Way ANOVA to measure their performance. Results showed a significant improvement in the level of performance for the jump-shot skill in the real training group and the VR group. While no significant improvement was noticed in the control group. Also, there were no significant differences between the real training and VR training group in post-test at the level of p=0.05 in jump-shot for the basketball skill. The results motivated faculty members in colleges of physical education in Saudi universities to take advantage of modern technological means. Making it one of the new methods in teaching practical courses and conducting more research to identify the impact of using modern technology in learning.

Keywords: Virtual Reality–Basketball- Jump-Shot Skill

INTRODUCTION

Developments in technology in the 21st century have increased by speeding the advancement of apps and software and making it easier to access all kinds of information. Currently, many new technologies particularly in the education sector are being applied to support the teaching and learning processes.

For example, the use of smart boards in classes and plagiarism detectors when students submit their homework are used today. The new generation of learners are highly capable of using computers and want to use innovative technology to facilitate the learning process through academic organizations and institutes.

Academic organizations and institutes, however, will face challenges when adopting emerging technologies. For instance, the high cost of electronic gadgets that will be used and the availability of good internet connection for students and teachers might be some of the challenges they face. To meet the demands of educational progress, effective approaches need to be employed.

The advancement of immersive and interactive technology in different learning and teaching styles may play an important supporting role (Abulrub et al.,2011). One of the innovations of technology that began to appear in the past few years is what is called Virtual Reality (VR).

VR can immerse individuals in an atmosphere that would normally be inaccessible

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because of cost, danger, or restrictions. Burdea and Coiffet (2003) defined VR as a simulation where computer graphics were used to create an environment that looked realistically and reacted to users' input. Also, VR can be defined as "the sum of the hardware and software systems that seek to perfect an all-inclusive, sensory illusion of being present in another environment" (Biocca & Delaney, 1995).

A good VR environment delivers immersion, navigation, and manipulation for users (Hamit, 1993, Heim, 2000). There are many efficient VR applications in different fields such as entertainment, architecture, manufacturing, medicine, education, and training.

This environment is highly sought after for its versatility, reliability, and adaptability, especially in education and training (Alexandra, 2016).

Virtual Education (VE) is a modern revolution in the methods and techniques of education that harnesses the most recent technology findings from devices and programs in learning processes (Bascoul &Amdilis, 2008).

Thus, VE integrates reality with imagination and creates an environment similar to the reality in which we move and live (Bascoul &Amdilis, 2008). Therefore, it is necessary to apply this modern technology in developing education to serve both teachers and learners. VR is characterized by three basic characteristics which are interaction, cooperation, and experience (Fox et al., 2009).

In particular, VR is one technology that students find attractive. Virtual Reality is now commonly used in different areas of education and training (Abulrubet al., 2011), military training (Zyda, 2005), and medical and entertainment training (Stapleton et al., 2002). Moreover, VR has been applied to a broad range of sports such as skiing (Solina et al., 2008), goalkeeping rugby union (Brook, et al., 2007), baseball and basketball(Covaciet al., 2015), pistol shooting (Argelaguet et al., 2015), and cycling speed(Neumann et al., 2017). Indeed, the handball VR system for goalkeepers proved to be so successful that it was adopted by a national handball federation to train young national squad members and for talent identification (Bideau et al., 2003; Vignais et al., 2009).

The proposed simulator can be considered an excellent tool to increase the quality and speed of learning and developing motor skills and motor learning. Virtual Reality is a sophisticated system that utilizes and synthesizes different types of advanced high technology to produce a virtual world of multiple sense experience (Covaci et al., 2012).

The simulation model of education (the simulated world in education) has its benefits in terms of inspiring and engaging students and finding certain challenges for them. This allows students to study and role-play and to learn from the simulation world. By trial and error, this approach has an advantage, which is that the person doing the simulation sees the right result and hence reduces the error.

It is a good first impression, as well as taking human diversity into account as each student can explore the curriculum and solve problems and tests in their way. This has been shown in many studies that the use of simulation in the teaching of various science fields is effective and the student therefore quickly understands what suits him(Al-Ghareeb, 2009; Khaled, 2008 &Shaqur, 2007).

Nowadays, if we look at the way sport skills are taught in the Physical Education Department at Umm Al-Qura University, we find students learn by the traditional method.

This method is based on the teacher giving the lecture while students listen without making enough effort to improve their level due to the limited time they have, in addition to the lack of equipment.

Basketball is one of the most interesting sports because it requires a lot of time and effort for the player to learn the skills and master them. Teams earn points in this sport by shooting the ball into the hoop. Therefore, shooting is a very

important skill and directly influences the team's success (Button, Macleod, Sanders, & Coleman, 2003).

The researcher found weaknesses in the player's basketball skills, especially in some basic skills that are characterized by a degree of difficulty and proficiency. Therefore, causing a decrease in learning outcomes(cognitive - skill)including jump shot skill.

This was done by carefully observing the lessons of the educational process of basketball and comparing it to the learning outcomes by describing the approved courses in the general curriculum of the faculty of physical education.

The reason students have weaknesses in some of the basketball skills and difficulty in mastering them maybe because of the traditional methods that are being used in the learning process.

The ability to make a good jump shot gives players the following scoring advantages such as timing, speed, defense from an opponent, and the ability to release the ball from many distances from the basket (Okazaki & Rodacki, 2012).

As a result, the jump shot has proved to be the most effective skill and the most employed shooting strategy, regardless of the position of the player on the team (Nunome et al., 2002). Figure (1) shows that jump-shot skill isa shot with one or both hands in which a player leaps into the air and shoots the ball at the basket at the moment of reaching the highest point of the leap (Victor et al., 2015).

Learning about the impact of virtual reality and how to use it in the stages of learning and education for some basketball skills, will help each a choice of an interactive educational method with innovative and influential technology in learning.

Subsequently, we can raise the level of student performance during the stages of learning. Therefore, this study aims to investigate the effectiveness of using virtual reality technology on learning the skill of jump-shot in basketball.

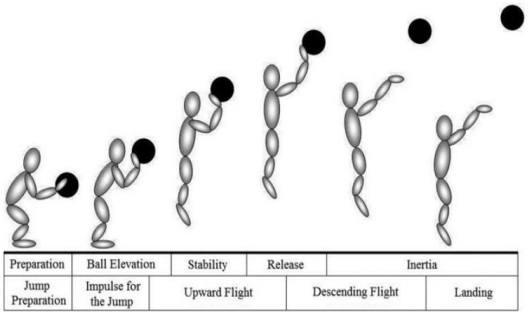

Figure 1 The stages of Jump-Shot

Research aim:

This study aims to investigate the effectiveness of using virtual reality technology on learning the skill of jump-shot in basketball.

Research hypotheses:

1. There are statistically significant differences between the pre and post-test of the control group in learning the skill performance of the jump-shots kill in basketball and in favor of post-test.
2. There are statistically significant differences between the pre and post-test of the real training group in learning the skill performance of the jump-shots kill in basketball and in favor of post-test.
3. There are statistically significant differences between the pre and post-test of the hypothetical training group in learning the skill performance of the jump-shot skill in basketball and in favor of post-test.
4. There are statistically significant differences between the two-dimensional measures of the groups (control - real training - virtual training) in learning the skill performance of the jump-shots kill in basketball.

METHOD

The experimental approach was using the experimental design of the groups (control - real training - virtual training). Pre and post-tests were used to have a comparison between the three groups.

Exploratory experience

The researcher conducted an exploratory study in the basketball gym of the Physical Education Department at Umm Al-Qura University on 7 volunteer freshman students outside the basic research sample, and the exploratory experience aims to ensure:

-The validity of the three training programs of the application.

-The students' understanding of the methods used in the study.

-The validity of the devices and tools used.

-The suitability of the basketball gym to carry out the research experiment.

- There are no obstacles that can occur during the experiment.

Participants

45 new volunteer students from the Department of Physical Education at Umm Al-Qura University in the year 1439-1440 (2018-2019) were randomly chosen, who had no experience in basketball in general and jump-shot in particular. All volunteers had a strong natural vision. Their average age is 18.71 years, and the average length is 174.84 cm.

The Emotional Intelligence Scale was used to identify the consistency of the research sample from the mental side, the interaction with colleagues, the training environment, and the virtual reality device. It consists of five emotional dimensions (self-awareness, emotional management, motivation, human relations management, and empathy) measured through five levels of response (Aljanabi, 2011).

The researcher divided the research sample into 15 students as a virtual training (VR) group that learns by the virtual reality technique, 15 students as a real training (RT) group learns by the traditional way (verbal explanation - provide a practical model - and practical implementation) and15 students as a control group who do not learn the selected skill.
Then apre-test jump-shot was done for the entire sample.

Table (1) Research Sample

Group	Weight	Length	Age	Intelligence
All	65.667 ± 6.620	174.844 ±4.079	18.71 1 ±0.45 8	65.844 ± 4.661
Control	68.067 ±6.330	175.200 ± 4.507	18.80 0 ±0.41 4	66.000 ± 3.780
Real training	63.467 ± 7.029	175.133 ± 4.291	18.73 3 ±0.45 8	66.400 ± 5.235
VR training	65.467 ±6.069	174.200 ± 3.590	18.60 0 ±0.50 7	65.133 ± 5.069

Apparatus

The pre-test, post-test, and training were performed in the basketball gym. Participants used the official ball size and basketball tower in the Department of Physical Education at Umm Al-Qura University. To use the Virtual Reality technique in learning jump-shot in basketball, the virtual reality headset device(HTC Vive) was placed on a table 1.5 meter beside the throwing line on the basketball tower. This was done so that the virtual throws can be implemented in the same traditional educational environment.

The HTC Vive is an HTC and Valve-developed virtual reality headset (Figure 2). The headset uses gym scale tracking technology, allowing the person to move in 3D space and to use handheld controls with motion tracking to communicate with the environment. It requires a VR SHOOT AROUND application to perform the jump-shot skill during the study. VR SHOOT AROUND is an application that helps simulate the basketball shoot that can have spatial simulations, sounds, and a fantastic rich court.

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System Requirement

The computer has the following:
Operating system: Windows10
Processor: Intel Core i5-4590
Memory: 4 GB RAM
Graphics: NVIDIA GeForce GTX 970
Storage: 250 MB available space

Study design

Initially, participants conducted five throw runs to learn about the correct performance of the skill and get a feel of the learning environment and the gym on 1440/5/11. These throws were not recorded and were not part of the test. All participants received the same instructions for the technical steps to properly perform a jump-shot in basketball. All participants completed (20) throws on the real basketball tower, (10) throws during the pre-test in 1440/5/14 and (10) throws during post-test in 1440/6/9. The balls that went through the hoop were the only ones counted as correct.

Training protocol

During the period 1440/5/14-1440/6/9, pre and post-test sessions were conducted, the virtual training group received jump-shot training on the tower using the virtual reality device. The actual training group also received training in the gym by throwing the ball to the basketball tower using the technical steps. While the control group did not practice any training or was given any guidance at all. Each participant in a total of four weeks completed a training course consisting of 40 throws twice during one week for four weeks, which means that each participant threw 320 times.

Data analyses

Scores on all measures for the (control - VR training- real training) groups were analyzed by repeated-measures One Way ANOVA.

RESULT AND DISCUSSION

Result Research

Table (2) ANOVA table between Control group- Real training- VR training pre-test

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.844	2	0.422	0.455	0.637
Within Groups	38.933	42	0.927		
Total	39.778	44			

F (2,44) = 3.21, p =0.50

The results for the analysis of variance in a table (2) revealed no significant differences between the (control - VR training- real training) groups in pre-test for the jump-shot basketball skill accuracy, F (2,44) =3.21, p=0.50.

Table (3) ANOVA table between Control group- Real training- VR training post-test

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	130.133	2	65.067	33.058	0.000
Within Groups	82.667	42	1.968		
Total	212.800	44			

F (2,44) = 3.21, p =0.50

The results for the analysis of variance in a table (3) revealed significant differences between the (control- VR training- real training) groups in post-test for the jump-shot basketball skill accuracy, F (2,44) =3.21, p=0.50.

Table (4) LSD between groups Control- Real training- VR training post-test

Groups	Mean	Control	Real training	VR training
Control	3.8667		3.73333*	3.46667*
Real training	7.6000			0.26667
VR training	7.3333			

F (2,44) = 3.21, p =0.50

Table (4) shows the real training group and the VR training groups improved between pre and post-tests, F (2,44) = 3.21, p =0.50, while

the control group did not show a recognizable improvement in jump-shot for the basketball skill.

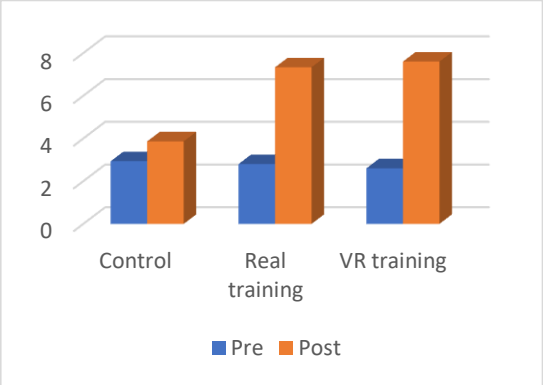

Figure 3demonstrates the interaction of groups and testing the jump-shot basketball skill throwing accuracy in both conditions combined.

Table (5)the post-hoc LSD between-group Control- Real training- VR training post-test

Groups	Pre	Post	%
Control	2.9333	3.8667	31.82
Real training	2.6000	7.6000	192.31
VR training	2.8000	7.3333	161.90

Table (5) indicates, there is a significant difference between the three groups in favor of the real training group at the level of p=0.05. There is no significant difference between the real training group and VR training group in the post-test at the level of p=0.05in jump-shot for the basketball skill.

Table (6) T-Test between Pre and Post Test for (Control group- Real training- VR training)

Groups	Differences Mean	t	df	Sig. (2-tailed)
Control	0.9334	2.064	14.000	0.058
Real training	5.000	13.693*	14.000	0.000
VR training	4.5533	8.646*	14.000	0.000

T = 2.145, p =0.50

In the table (6), there are no significant differences in jump-shot for the basketball skill between the pre-test and the post-test for the control group, while there are significant differences between the pre-test and the post-test for the real training group and the VR training group in favor of the post-measurement, at the level of, T = 2.145, p =0.50.

Discussion

The first hypothesis was that the control group will lead to statistically significant results and better skill performance; however, the results showed no significant differences between the pre-and post-test for the jump-shot skill in basketball. This result is because the participants did not have practice or demonstration for the jump-shot skill during the study period.

The second hypothesis was that the real training group will lead to statistically significant results and better skill performance. The results did show significant differences between the pre-and post-test for the skill performance of the jump-shot skill in basketball. This result is because the participants have had enough time to practice and were demonstrated how to do the jump-shot skill during the study period. This indicates that the traditional method is useful to teach a jump-shot skill. Traditional education is still effective and has an impact on some educational areas that require the learner to obtain feedback from the teacher directly (Abbas, 2013).

The third hypothesis was that the VR training group will lead to statistically significant results and better skill performance. The results did show a significant difference in ATP (0.5) between the pre-and post-test for the skill performance of the jump-shot skill in basketball.

This result is because participants have had time to use virtual reality technology to learn jump-shot skills during the study period. This means that using VR technologies useful to teach a jump-shot skill. These results show the efficiency of our training intervention not only on

motor learning and performance but also on the interacting perceptual processes (Schorer et al., 2015).

The fourth hypothesis considered the significant differences between the two-dimensional measures of the groups (control - real training - virtual training) in learning the skill performance of the jump-shot skill in basketball. In tables (3,4,5)and figure (3), the researcher attributes the differences between the three groups(control, real training, and the virtual training) in favor of the real training group in the skill of jump-shot to the extent of interaction of participants with the teacher and peers in the traditional way using real basketballs and the gym.

After that, we found improvement for the virtual training group in the skill of jump-shot and that refers to the interaction of students with the use of virtual reality technology in a way to learn basketball skills. While the control group did not have a chance to learn from a teacher or use modern technology. In table (5) data shows that there are no significant differences between the real training group and VR training group in post-test at the level of p=0.05in jump-shot for the basketball skill. This indicates that both the real and the VR training can improve participants.

Educators can merge these two ways to have better new teaching methods to learn motor learning and movement performance skills. In fact, Abbas (2013) announced that traditional and new learning methods are very consistent and differ in the means. The purpose of these two types of education is to obtain high-level outputs characterized by advanced knowledge and good qualification.

From table (6) researchers perceived that the use of VR technology was raising students' motivation for achievement and success because virtual reality attracts the attention of students, helps them to gain motor experiences, learn from personal mistakes, and use new ways to learn. All these experiences are integrated through VR technology.

Also using VR helps to achieve the desired goals efficiently and effectively through sequential images, slow and fast three-dimensional videos that explain the typical performance of the skills to be learned and provide a stereoscopic vision. This is consistent with the employment of virtual reality technology that contributes effectively to making a great interaction between the student and the educational content of the program, especially in academic subjects that require real-life experience but is difficult to achieve, so this type of technology is the best means(Schorer et al., 2015), (Alexander et al.,2016).

Indeed, in a table (6) the researcher explains the differences between the pre and post measurements of the real training group in favor of the post measurements as a result of applying the traditional educational program followed. As it is not possible to overlook the traditional method, which depends on the verbal explanation of the motor skill to be learned and provide a practical model by one of the students or the teacher for the skills.

Practice and repetition by the learner with correcting mistakes from the teacher positively affect the efficiency of the performance level. It is also an indication that the program followed has a positive impact on the learning process, and this allows the opportunity to learn properly and also provide the knowledge and information accompanying when learned skills during the educational units have helped to increase the knowledge and student information(Alexander et al.,2016; Lin et al.,2011). Based on the previous results and literature review, this study will present and discuss the benefits of VR for educational purposes, specifically for teaching student's movement skills.

Implementing VR in education will offer tremendous benefits such as promoting and

enhancing teaching and learning processes. In a general educational context, several research studies have explored the efficacy of various learning strategies, but fewer studies have explored the effects of VR on education (Thorsteinsson et al., 2010). However, several experiments were performed to examine the usefulness of VR as an instructional tool (Winn, 1993).

Students should exchange their ideas in groups, share perspectives, and collaborate in a collaborative/cooperative environment while acquiring information during their learning process (Dimitropoulos et al., 2008). Taxén and Naeve (2002), therefore, suggested that teachers needed to change their teaching methods to the VR environment.

VR applications that enable interactive learning have significant advantages in collective and cooperative learning for social experiences (Hodge et al., 2008). Collaborative learning experiences often promote strategic thoughts, allowing learners to improve problem-solving skills. So, these environments also foster greater participation between learners (Dimitropoulos et al., 2008). A shared VR atmosphere will, thus, be a valuable resource for promoting learning processes.

VR will play a significant role in promoting and enhancing innovative thinking for students. The creative component of VR in particular will encourage learners to improve their ability to solve problems, particularly open-ended problems. Innovative simulation is one of the strategies that will help learners grow their creativity and help consumers explore topics of interest in the VR world.

For example, Sims (2007) implemented interactive learning and role-playing to enhance the memory and morale of the learners in a VR learning environment. As a result, VR technology needs more recognition as a teaching resource to promote innovation from educators as well as policymakers, because it can explicitly help the imagination of learners in different ways.

Finally, applying Virtual Reality technologies to physical education in Saudi education is considered a brand new idea. In modern physical education, the standard form of instruction is now followed by most colleges. Some schools have begun using digital technology in teaching while others have adopted the technology of Virtual Reality. However, Virtual Reality technology is not yet mainstream because of the relatively high hardware device prices.

As a modern educational tool, we must understand the teaching opportunities and tremendous promise of Virtual Reality technology. Liao (2015) claims that the VR introduced to physical education should be seen as a jump in physical education's technical growth. It will bring in interactive scenes and build an individual learning experience.

Not only can VR save time for training, it can also show clear and practical effects. Therefore, students will develop their self-training knowledge and capacity to innovate, especially in preventing injury during physical lessons, compensating for bad situations, creating virtual characters, overcoming room and time constraints, and helping to unlock talent in school. The use of VR technologies in physical education can make athletic methods incredibly exciting and gain prominence such that the physical training approach becomes more detailed.

CONCLUSION

The traditional method (verbal explanation and model performance) has a positive effect on learning basketball skills in general and the jump-shot in particular for the real training group. VR has a positive effect on learning basketball skills in general and the jump-shot in particular for the experimental group.

The percentage of improvement in the level of performance of the jump-shot skill for the real training group and the VR group was

much better than the rate of improvement of the control group that did not practice the selected skill.

The results of the study proved the effectiveness of the virtual reality method in stimulating and focusing students to use the maximum extent of their abilities to reach the optimal performance of the jump-shot in basketball.

The educational program prepared using virtual reality was good enough for the traditional method (verbal explanation and model performance) for learning the skills of the jump-shot in basketball.

Recommendations

Based on what the results indicated and the findings, the researcher recommends the following; Using modern technological means to learn basketball skills because of its positive impact in learning jump-shot and the technical aspects related to it.

Carrying out similar studies on different sporting activities and at various age, stages to keep pace with the development occurring in developed countries and raise practical and educational efficiency and work to produce much virtual reality software in other sports activities in cooperation with experts and specialists in educational technology.

The use of modern technological means in teaching practical approaches in particular and theoretical approaches in general in the field of physical education for the effectiveness of this method and the confirmation of many previous studies on its effectiveness.

Urging the faculty members of the colleges of physical education in Saudi universities to take advantage of modern technological means as one of the specific methods in teaching practical courses and conduct more research to identify the impact of the use of modern technology in learning.

The necessity of conducting training courses for teachers and faculty members to train them to use modern technological means in teaching.

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