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The Effect of Using 3D-Virtual Worlds and Real Worlds on Creative Thinking

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Abstract

This study aimed at inquiring the effect of using 3D virtual worlds and real worlds on the creative thinking of basic tenth-grade female students in physics via a quasi-experimental methodology. The findings indicated that there were significant differences at ($\alpha \leq 0.05$) between means of students in creative thinking tests, attributed to teaching methods, in favor of the group that studied by using 3D virtual worlds. In conclusion, the effect of 3D Virtual World to renovate pedagogy in learning institutions is impartial and vital for the sustainability of the process.

Keywords: Virtual, Worlds, Real, Creative, Thinking.

El efecto del uso de mundos virtuales 3D y mundos reales en el pensamiento creativo

Resumen

Este estudio tuvo como objetivo indagar el efecto del uso de mundos virtuales 3D y mundos reales en el pensamiento creativo de las estudiantes básicas de física de décimo grado a través de una metodología cuasi-experimental. Los hallazgos indicaron que hubo diferencias significativas en ($\alpha \leq 0.05$) entre las medias de los estudiantes en las pruebas de pensamiento creativo, atribuidas a los métodos de enseñanza, a favor del grupo que estudió utilizando mundos virtuales en 3D. En conclusión, el efecto de 3D Virtual World

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para renovar la pedagogía en las instituciones de aprendizaje es imparcial y vital para la sostenibilidad del proceso.

Palabras clave: virtual, mundos, real, creativo, pensamiento.

1. INTRODUCTION

Multimedia worldwide and the latest 3D virtual worlds have received great attention, as an effective aid in the transfer and display of the educational messages, in order to reach meaningful and effective learning, through increasing the learner's cognitive effectiveness. Theories were set, and researches were conducted to achieve promising hope for learning by using multimedia. The first appearance of the virtual world was in 1950, but the actual attention started at the end of 1980. Thanks to the pioneer of computer science Jaron Lanier who was considered as the first to call them virtual reality concepts. Searching in this reality continued until 1990. The appearance of 3D virtual world's technology, that characterized by its compatibility with the visual origin, opened a world of wonders in various fields. The virtual worlds were helpful to the educational institutions, to find to their learners a world that impossible becomes possible, to empower the learner from clarifying many concepts and theories that cannot be represented in the real world.

AL-DEFARI (2010) Defined virtual worlds as a system model, a case, or a real problem, and if the system or the problem included some formulas, they will be programmed by the computer to represent the exchanged relations among their components accurately. While

AL-DEFARI (2010) defined the concept as a simulation to the real world, based on 3D computer graphics that can achieve real levels of interaction. JARWAN (2008) Listed several types of virtual worlds, among them: (a) immersion virtual world, in which the user feels with full immersion in a three dimensional – environment as a result of using certain tools. This type of virtual worlds has applications in medicine, aviation training, military exercises and education, (b) three – dimensional virtual worlds without any feeling with the immersion experiment or semi immersion completely. The experiment is partial, and special glasses are used, as they used in the three – dimensions cinema. These words are used for entertainment and education, (c) the 3D virtual worlds free from the experience of immersion such as simulation software, 3D models, virtual laboratories and others, without using any device except the computer and screens. They are used in education, medicine and other fields.

The study of JARWAN (2008) dealt with the effect of the three-dimensional virtual worlds on the academic achievement in biochemistry and organic compounds, as compared with the ordinary method (2D) in Palestine. The sample consisted of (234) twelfth-grade students, who were divided into three groups (one control and the others are experimental). The most prominent results were that the 3D virtual worlds reinforce the conceptual understanding and spatial abilities of students, as well as increase the academic achievement of students. Conducted an experimental study aimed at investigating the effect of online 3d virtual laboratories on developing concepts and practical science skills, for basic fourth-grade pupils in science in

Egypt. The sample consisted of (70) pupils who were divided into two groups: experimental which had taught by using online 3D virtual laboratories, while the control group had taught in traditional atmosphere.

The most prominent results were: the performance of the experimental group pupils was higher in the conceptual understanding of concepts and the pupils were better in practical science skills. AL-HILEH (2009) Conducted a study to find out the effect of employing virtual laboratory on students understanding in Ormoz, in the Republic of Slovenia. The sample consisted of (38) students. An achievement test was used after finding its validity and reliability. The findings indicated that there were significant differences, in favor of the virtual chemical laboratory comparing with the traditional laboratory in the improvement of student's achievement.

The study conducted by NASEREDDIN (2011) aimed at inquiring about the effect of realistic simulation and 3D virtual simulation on student's achievement and their abilities to retain their learning in biology in Malaysia. The sample consisted of (136) students, who were divided into two groups. Each group consisted of (68) students. The experimental group had taught by employing the real simulation, while the control group had taught by 3D virtual simulation, for three weeks. Three tools were used after assuring their validity and reliability. The findings indicated that both real and 3D virtual simulations had retained learning, and there were significant differences in favor of the real simulation which discovered high positive perceptions and attitudes toward it.

The study conducted by TRUMAN (2011) aimed at investigating the effectiveness of a curriculum based on 3D virtual laboratories, compared with the traditional laboratories, in teaching chemistry in Malaysia. The sample consisted of (61) male and female students, who were divided into two groups: experimental and control. The experimental group studied by using the virtual laboratory, while the control group studied by using the traditional laboratory. The findings showed that the virtual laboratories were abler than the traditional laboratories in reinforcing the higher thinking skills of students.

Creative thinking is the ability of the creator to generate ideas characterized by newness and originality, whether those ideas were creative artwork, assumptions or unprecedented solutions for problems. One of the most famous models is the Wallace model in 1926. Its stages were: preparation, incubation, radiance and checkout. Creative thinking components mean the thinking skills required for the creative personality, until the creative process occurs, and the thinking becomes creative. The most important abilities and creative skills, that researchers tried to measure them like in the early 1960s are fluency, flexibility, originality, and sensitivity to problems and shortcomings.

who BAKAR, ZAMAN, KAMALRUDIN, JUSOFF & KHAMIS (2013) was mentioned in HERGA & DINEVSKI (2012) divided creativity into five levels. They include: expressive, productive or technical, inventive, innovative and imaginative. The last one is the highest level of creativity, through which a principle, theory or assumption is reached as in the works and theories of (Einstein).

Conducted a study aimed at investigating the effect of a modified learning cycle on achievement and creative thinking of fifth-grade female pupils in the State of Kuwait. The sample consisted of (48) female pupils, who were divided into two groups: experimental and control. Two tools were used to collect data, after finding their validity and reliability. The findings indicated that there were significant differences between the means of the two groups, in favor of the experimental group.

The experimental study conducted by EL-SABAGH (2010) aimed at finding out the relationship between creative thinking and academic achievement of secondary school students in Pakistan. A random sample consisted of (256) students, drawn from the population of the study. FRYER & FREEMAN (2012) Test for Creative Thinking (TTCT) was used as a tool to collect data, and students' scores in general scholastic academic achievement. The findings showed that there was a significant relationship between creative thinking and academic achievement on creative thinking skills (fluency, flexibility, originality and details). MAZEN (2010) Conducted a study aimed at investigating the relationship between mental imagination and creativity abilities among agriculture students in Taiwan. This descriptive study conducted in three stages: (a) the exploratory stage, which included (390) male and female students, in order to prepare the tools, (b) the verification stage, that included validity and reliability of the tools, (c) the application stage, which included (430) male and female students. The findings indicated that there was a strong

relationship between mental imagination abilities in creative imagination levels and creative abilities.

2. METHODOLOGY

A quasi-experimental methodology was used, for its relevance to the purposes of this study. The sample of the study was selected purposively. It consisted of (54) female students, who divided into three groups: two were experimental and the third was control. Each group had (18) basic tenth-grade female students. Three tools were prepared for the purposes of this study. They are teacher's guide, the British (3D – HUB) software, and creative thinking test, which consisted of six subtests. The validity and reliability of the test were assured (ALHROUT & NASEREDDIN, 2018).

3. FINDINGS

The findings related to the question of the study that states: are there any significant differences at ($\alpha \leq 0.05$) between the means of basic tenth-grade female students on creative thinking test, attributed to teaching methods (3D virtual worlds, real worlds and ordinary methods) in teaching physics? To answer the question means, and standard deviations of the three groups' performance were calculated. Table (1) clarifies that there were apparent differences among the three

groups in their means on creative thinking test and the total score. To find out whether the differences between the means of the post creative thinking test at ($\alpha \leq 0.05$), MANCOVA was calculated. Table (2) clarifies the findings.

Table (1): statistical of the study subjects' performance on the post creative thinking test

Creative thinking skill	Teaching method	No. of students	Pre test		Post test	
			Mean	S.D.	Mean	S.D.
Fluency	Ordinary method	18	31.50	6.87	37.56	6.61
	Real worlds	18	34.72	6.03	45.33	7.35
	Virtual worlds	18	33.89	6.96	48.67	11.14
Flexibility	Ordinary method	18	24.78	8.60	30.00	7.90
	Real worlds	18	24.61	6.91	37.78	10.14
	Virtual worlds	18	25.61	7.65	41.44	10.29
Originality	Ordinary method	18	28.72	10.42	36.22	9.15
	Real worlds	18	30.78	10.21	45.00	13.93
	Virtual worlds	18	29.56	10.53	47.00	12.41
Total Score	Ordinary method	18	85.00	24.28	103.78	21.03
	Real worlds	18	90.11	20.80	127.80	25.20
	Virtual worlds	18	89.06	30.48	137.10	30.48

Table (2): MANCOVA findings of the study subjects on the post creative thinking test

Source of Variation	Creative Thinking	Sum of squares	Degrees of Freedom	Mean of squares	F-value	Level of significance	Scheduled value
Teaching Method	Fluency	663.478	2	331.740	* 10.865	0.000	3.94
	Flexibility	848.651	2	424.280	* 11.219	0.000	
	Originality	774.853	2	387.426	* 5.550	0.007	
	Total	**6813.766**	**2**	**3406.883**	*** 16.586**	**0.000**	
Error	Fluency	1465.530	48	30.532			
	Originality	1815.205	48	37.817			
	Originality	3350.591	48	69.804			
	Total	**9859.633**	**48**	**205.400**			
Adjusted Total	Fluency	4940.815	53	93.223			
	Flexibility	5843.648	53	110.257			
	Originality	8522.370	53	160.799			
	Total	**44768.537**	**53**	**844.689**			

Table (2) shows that the "F" value of fluency skill, according to the teaching method was (10.865) at (0.000). This result emphasizes that there were significant differences among the performance of the

three groups on fluency skill attributed to teaching method of physics for basic tenth grade.

With regard to the F-value of flexibility skill, according to teaching method was (11.219) at (0.000) which indicates that there were significant differences among the performance of the three groups on flexibility skill attributed to teaching method of physics for basic tenth grade. But regarding originality skills, according to teaching method was (5.550) at (0.007), which indicates that there were significant differences among the performance of the three groups on originality skill attributed to teaching method of physics for basic tenth grade.

It has been shown that the "F" value of the total score of creative thinking test according to teaching method was (16.586) at (0.000) that indicates that there were significant differences among the means of the three groups on the total score attributed to the teaching method of physics for basic tenth grade.

Based on these findings, the first null hypothesis that states there were no significant differences at ($\alpha \leq 0.05$) between the means of the scores of the basic tenth-grade female students on creative thinking test attributed to employing 3D virtual worlds, real worlds, and 3D ordinary method, in teaching physics. In order to find out the return of differences, adjusted means for the groups' performance on the post creative thinking test, according to teaching method were calculated. Table (3) shows that.

Table (3): Multivariate analysis of variance (MANOVA) on the post creative thinking skills test

Creative thinking	Teaching method	No. of students	Adjusted mean	Standard error
Fluency	Ordinary method	18	39.443	1.347
	Real worlds	18	43.910	1.348
	Virtual worlds	18	48.202	1.307
Flexibility	Ordinary method	18	30.944	1.500
	Real worlds	18	37.192	1.501
	Virtual worlds	18	40.808	1.455
Originality	Ordinary method	18	37.590	2.037
	Real worlds	18	43.622	2.039
	Virtual worlds	18	47.010	1.977
Total Score	Ordinary method	18	107.977	3.455
	Real worlds	18	124.725	3.497
	Virtual worlds	18	136.021	3.391

Table (3) indicates that the adjusted means of the experimental group performance that studied physics by using 3D virtual worlds were the highest on fluency, flexibility, originality and the total score. They are (48.202), (40.808), (47.010) and (136.021) respectively, followed by the adjusted means of the experimental group performance that studied physics by using real worlds. They are: (43.910), (37.192), (43.622) and (124.725) respectively. The control group that studied physics by 2d ordinary method, their adjusted means was the lowest. These means are (39.443), (30.944), (37.590) and (107.977) respectively.

To find out the return of differences, the LSD test for post comparisons was used. Table (4) clarifies that there were significant differences between the control group that studied physics for basic tenth grade by using the ordinary method (2D) and the experimental group which studied physics by using real worlds. The difference was (4.467) in fluency skill at (0.028) in favor of the real worlds. The difference between the two groups with regard to flexibility skill was

(6.249) at (0.006) in favor of the real worlds. While the difference was (6.031) at (0.048) with regard to originality skill. With regard to total score, the difference was (16.747) at (0.002) in favor of the real worlds. Table (4) shows also that there were significant differences between the control group that studied physics for basic tenth grade by using the ordinary method (2D), and the experimental group that studied physics by using 3D virtual worlds. The difference was (8.759) at (0.000) on fluency skills in favor of the virtual worlds. The difference was (9.865) at (0.000) on flexibility skills in favor of the virtual worlds. The difference was (9.419) at (0.002) on originality skill in favor of the virtual worlds. While the difference was (28.043) at (0.000) on the total score of the creative thinking test, in favor of the virtual worlds.

Table (4): LSD test for post comparisons among the adjusted means of performance on creative thinking test

Sub test	Teaching method	Adjusted mean	Ordinary method		Real words	
			Mean differences	Level of significance	Mean differences	Level of significance
Fluency	Ordinary	39.443	-			
	Real worlds	43.910	* 4.467	0.028	-	
	Virtual worlds	48.202	* 8.759	0.000	* 4.292	0.027
Flexibility	Ordinary	30.944	-			
	Real worlds	37.192	* 6.249	0.006	-	
	Virtual worlds	40.808	* 9.865	0.000	3.616	0.091
Originality	Ordinary	37.590	-			
	Real worlds	43.622	* 6.031	0.048		
	Virtual worlds	47.010	* 9.419	0.002	3.388	0.240
Total Score	Ordinary	107.977	-			
	Real worlds	124.725	* 16.747	0.002		
	Virtual worlds	136.021	* 28.043	0.000	* 11.296	0.025

* The difference is significant at ($\alpha \leq 0.05$).

Table (4) indicates that there were significant differences between the two experimental groups, the experimental group that studied physics for basic tenth grade by using real worlds and the

experimental group which studied the same subject by using 3D virtual worlds on fluency skill. The difference was (4.292) at (0.027) in favor of the virtual worlds. While the difference between the two groups was (3.616) at (0.091) on flexibility skill, which means not significant at ($\alpha \leq 0.05$). The difference between the two groups was (3.388) at (0.240) on originality skill. It is not significant at ($\alpha \leq 0.05$). While the difference between the two groups was (11.296) at (0.025) on the total score, which means significant at ($\alpha \leq 0.05$) in favor of the virtual worlds.

The positive differences of the effectiveness of using 3D virtual worlds and real worlds, compared with the ordinary method (2D), with a difference in favor of the 3D virtual worlds on fluency skill may be attributed to the details it added to learning process, which considered as keys to increase the number of responses, taking into consideration that both methods (real worlds and 3D virtual worlds) effect on fluency skill positively. Reals worlds' method had a great role in increasing the experiences that considered as a base for creative thinking.

The positive differences of the effectiveness of using 3D virtual worlds and real worlds compared with the ordinary method (2D), on flexibility skill without any significant difference between using 3D virtual worlds and real worlds methods, may be attributed to the convergence and diversity of ideas and experiences compared with the ordinary method (2D), as they excel the ordinary method and provide a fertile environment with experiences that improve creative flexibility, and brings one-way thinking to multiple directions.

The positive differences of the effectiveness of using 3D virtual worlds and real worlds compared with the ordinary method (2D) on originality skill without a significant difference between using 3D virtual worlds and real worlds, may be attributed to both worlds (virtual and real) that provide a fertile environment for creative imagination, and come out thinking from routine to novelty and originality, through providing a fertile environment for mental images that considered as a raw material for creative, new and original thoughts, while the ordinary method (2D) don't develop creative imagination, and allow the individual differences to appear in all areas, including the creative field.

With regard to the clear positive effect of the real worlds and 3D virtual worlds on the total score of creative thinking tests, it may be attributed to their effective role in the creative process and creating a motivational environment. Regarding the superiority of the 3d virtual worlds group on the total score of creative thinking test, may be attributed to the superiority of the 3D virtual worlds in details, and increased experiences which considered as visual experiences that increase mental imagination and spatial abilities related to it, so a more fertile environment for creative thinking created, and therefore reducing individual differences in this respect.

4. CONCLUSION

Effective learning environments engage learners by allowing them to construct meaning and reasoning with regard to available

resources in their environment. As new technologies are fashioned and applied in the field of education, they have the potential to either improve or hamper the learner engagement of that particular learning event. Currently, educators are considering or already including 3D virtual learning environments in their instruction. This study confirms that 3D-Virtual World is appealing and powerful in motivating the learners' creative thinking abilities. Moreover, this study establishes that 3D-Virtual World technologies support the mental activity of the learner's fluency, flexibility and originality skills. The strengths of 3D Virtual World technology to boost critical thinking abilities and skills are noteworthy developments substantiated by current and past studies. The effect of 3D Virtual World to renovate pedagogy in learning institutions is impartial and vital for the sustainability of the process.

REFERENCES

AL-DEFARI, B. (2010). "The effect of modified learning course (5Es) on achievement and creative thinking of elementary fifth grade female pupils in science in the State of Kuwait (Unpublished Master Thesis)". **Middle East University**. Amman, Jordan.

AL-HILEH, M. (2009). "Instructional technology: In order to develop thinking between saying and practice 2nd ed." **Amman: Dar Al-Maserah for Publishing and Distribution**. Jordan.

ALHROUT, A., & NASEREDDIN, H. (2018). "From the fantasy world to reality: smart cities". **International Journal of Research and Reviews in Applied Sciences**. Vol. 35, Nº 2: 42- 46. USA.

BAKAR, N., ZAMAN, H., KAMALRUDIN, M., JUSOFF, K. & KHAMIS, N. (2013). "An effective virtual laboratory approach for

chemistry". **Australian Journal of Basic and Applied Sciences**. Vol. 7, Nº 3: 78-84. Australia.

EL-SABAGH, H. (2010). "The impact of a web-based virtual lab on the development of students' conceptual understanding and science process skills". **Faculty of Education, Dresden University of Technology, Saxony State: German**. Germany.

FRYER, L., & FREEMAN, J. (2012). "Presence in those with and without Sight: Audio description and its potential for virtual reality applications. Virtual reality medical institute". **Journal of CyberTherapy & Rehabilitation, Spring**. Vol. 5, Nº 1: 15-23. Germany.

HERGA, N., & DINEVSKI, D. (2012). "Virtual laboratory in chemistry – experimental study of understanding, reproduction and application of acquired knowledge of subject's chemical content". **Research papers Organizacija**. Vol. 45, Nº 3: 108-116. UK.

JARWAN, F. (2008). "Talent, excellence and creativity, 3rd ed." **Amman: Dar Al-Fiker: Publishers and distributors**. Jordan.

MAZEN, H. (2010). "Modern strategies in teaching and learning computer, 1st ed". **Kofer Al-Sheak: Al-Elm and Al-Eyman for Publishing and Distribution**. UK.

NASEREDDIN, H. (2011). "Digital watermarking a technology overview". **International Journal of Research and Reviews in Applied Sciences**. Vol. 6, Nº 1: 89- 93. USA.

TORRANCE, E. (1965). "Scientific views of creativity and factors affecting its growth". **Creativity and Learning Journal**. Vol. 94, Nº 3: 663-681. Netherlands.

TRUMAN, S. (2011). "A generative framework for creative learning: A tool for planning creative – collaborative tasks in the classroom". **Border crossing transnational working papers, Regent's Centre for Transnational Studies (RCTS)**. Nº 1101. USA.

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