International Journal of advanced humanities Research" (IJAHR)
Online ISSN: - 2812-5940
https://ijahr.journals.ekb.eg/

Student-Teachers' Beliefs about their Self-efficacy for Utilizing Augmented Reality for Teaching Agricultural and Historical Sciences

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Abstract
The study aimed to identify student-teachers' beliefs about their technical and ethical self-efficacy for utilizing augmented reality for teaching agricultural and historical sciences. The participants consisted of (102) student-teacher, (47) agricultural section students, and (55) history section. The descriptive approach was used, and the study tool consisted of an electronic questionnaire directed to student-teachers in the faculty of education, Tanta University. The results of the study manifested that participants have a high score of self-efficacy of computer use and the self-efficacy of dealing with the Internet are available at a high level, while the self-efficacy of educational software design are available at a high level as well; although, it is the least dimension of the questionnaire. Whereas the participants' ethical self-efficacy when using educational materials from the Internet were available at a very high level and it is the prominent dimension of the questionnaire. There is no difference at ($\alpha \leq 0.05$) between the participants attributed to their specializations. The study has recommended that student-teachers should be trained on all applications of augmented reality because they have all prior capabilities for utilizing augmented reality for teaching agricultural and historical sciences from their perspective

Keywords: - Student-teachers' beliefs, Self-efficacy, Augmented Reality, Agricultural sciences, History.

Introduction

Technology has become a reality that cannot be overlooked in our society today, as it has appeared in all aspects of life in a way that is increasing in depth with the development and spread. To illustrate, it has become necessary to integrate these technologies into learning and teaching process, especially with generation of digital learners who grew up using smart devices and the Internet; and those who consider classroom use an integral part of their daily lives (Hlasna, et al. 2017). Technology by itself will not enhance learning opportunities, improve educational outcomes, and achieve equality and inclusiveness in education unless it is placed in the hands of trained teachers. Therefore, it was necessary to train teachers to make the most of the available technology (UNSCO, 2014).

Although a number of studies indicate that more than (50%) of teachers in schools use information and communication technology in their daily instruction, they need more continuous-planned training that would contribute to the effective use of technology in the classroom (Hlasna, et.al. 2017). Hence, there is a need to train teachers to enable them to play their new roles in light of the era of information and technical and economic developments (Al-Maghribi, 2010) especially in the field of teaching science and agricultural curricula that require the practical application of experiments in school laboratories, and require the presence of many procedural materials, tools and devices. However, these materials and tools may not be available in the school, which calls for technical alternatives to them, such as software or virtual laboratories that facilitate learning and reduce the risks of accidents resulting from failure to conduct experiments or the mistakes of learners in real laboratories (Lee et al, 2016). As a result, there is a demand to identify to what extent pre-service teachers have the essential skills to apply the novel technologies through the teaching.

Augmented reality technology is one of these modern technologies used in virtual laboratories that integrate physical and digintal components together in various curricula such as: agricultural sciences, science, history, and geography, which contribute to understanding the real world by supporting it with a virtual world by adding text, audio, and two-dimensional still and moving images. And the triptych used in the simulation. Augmented reality technology supports the understanding of difficult concepts and complex phenomena by providing unique interactive and water experiences that combine real and virtual information, which helps learners to learn more effectively, maintain the learning effect, and increase achievement and motivation (Billinghurst and Duenser, 2012).

A number of Studies have proven the effectiveness of applying augmented reality in increasing the achievement and motivation of learners (Al-Sharif and Masaad, 2017; Al-Maamawi, 2015; Al-Husseini, 2014) which calls for curriculum and course planners to adopt this technology, which requires defining teachers' beliefs

technical and ethical self-efficacy for applying augmented reality, evaluating the extent of their achievement, and taking the necessary measures that help them use augmented reality in school laboratories, especially in teaching public courses.

Although there are a number of studies that dealt with augmented reality (Al-Sharif and Musaad, 2017; Al-Maamawi, 2015; Al-Husseini, 2014). However, it focused on the effectiveness of its use in teaching courses. In general, none of them sought to study the availability of skills necessary for teachers to implement augmented reality, or to determine the necessary competencies for that. Defining competencies, measuring their availability, and striving to enhance and develop them is a new direction in training In accordance with the national initiatives. These studies have been recommended Rehabilitate the teachers through the necessary programs and courses to raise their educational competence in their specialization and develop their teaching and leadership capabilities in light of the concept of competencies, skills and contemporary variables, and to provide them with skills and expertise in the field of information and communication technology to enable them to employ them in the fields of teaching.

While the augmented reality technology provides new educational opportunities for learners, at the same time it creates new challenges for teachers in various fields such as dealing with technical innovations, educational issues and digital ethics for the use of this Augmented reality technology. For this reason, there was a need to assess student-teachers' beliefs about their necessary technical and ethical self-efficacy to implement augmented reality technology in the teaching processes.

Study problem:

The problem of the current research is to answer the main research question*: what are Student-Teachers' Beliefs about their Self-efficacy for Utilizing Augmented Reality for Teaching Agricultural and Historical Sciences?* From the main questioning the following research questions are delivered:

1. What are Student-Teachers' Beliefs about their technical self-efficacy for Utilizing Augmented Reality for Teaching Agricultural and Historical Sciences?
2. What are Student-Teachers' Beliefs about their ethical self-efficacy for Utilizing Augmented Reality for Teaching Agricultural and Historical Sciences?
3. Are there statistically significant differences between the responses of the research sample due to the nature of specialization with regard to the technical and ethical self-efficacy for Teaching Agricultural and Historical Sciences?

Literature review:

Technical innovations have provided new opportunities for teaching and learning that meet the needs of digital learners in the twenty-first century, the most important of which is the Internet, which provides a large number of open source resources and free technologies that constitute an educational resource if they are

employed to achieve the desired goals. The good interaction between the educational resources and the learners depends on the teacher's ability to employ these resources to achieve the goals and direct the learners to invest them in building their education, which led to a change in the role of the teacher, which imposed the availability of educational, technical and moral competencies that qualify him for the new role.

Competencies are defined as the individual's ability to possess a minimum skill level when achieving a specific goal (Al-Dosari, 2015). As for the competencies of teachers, they can be defined as the knowledge, skills and attitudes that enable the teacher to perform his work to a degree not less than a specific level of proficiency that can be measured (Al-Mamouri and Al-Masroori, 2013). In particular, Al-Hazmi (2012) defined the competence of science teachers as the ability that enables them to use The active teaching of the learner's role includes the knowledge, skills and attitudes that qualify them to master these strategies while using the available capabilities to a large degree during the teaching of agricultural sciences to achieve the desired goals, and despite the differences in definitions of competency, all of them refer to the minimum for the teacher to possess measurable skills and qualify him to perform his work.

A group of educational organizations and institutions have identified some standards and technical competencies that the teacher should be familiar with, such as the International Society for Technology in Education (ISTE, 2008) The international society for technology in education, where five basic standards have been developed, each containing four Sub-themes: Facilitate and inspire students to learn and be creative, design and develop digital learning experiences, work and digital learning, and enhance responsibility, digital citizenship, and professional growth. The United Nations Organization for Education Science and Culture (UNESCO), (2011) also defined three standards for teachers' competencies in the field of information and communication technology: digital literacy, knowledge deepening, and knowledge production. Classification of technical competencies in the classroom into: basic competencies for operating a computer, competencies for using the Internet, competencies for employing information and communication technology (Al-Maamari and Al-Masroori, 2013), and competencies for designing and using educational software (Al-Shahri, 2012).

Augmented reality appeared in 1997, when "Azuma" defined augmented reality and identified problems for its application and its latest developments. Augmented reality is defined as adding layers of virtual information to a real scene in order to increase the user's understanding of the real world (Azuma, 1997). It was also known as any situation in which objects are created by the computer from text, image and sound added to the real world (John, 2015). It is also a modern technology by which the real world can be linked to a digital virtual world on the

screen of a smart device. For example, a static image in a specific book, when placed in front of the smart device's camera, can be transformed into a moving image through which the student can follow the steps of implementing a specific experiment until reaching the final results. Al-Maalawi, 2016).The virtual object used in augmented reality can be a simple text, image, sound, 3D shape or video, and each virtual object can be linked to a site or other stored objects prepared in advance for the learner.

The augmented reality is characterized by not isolating the learners from the real environment, but rather adding virtual objects to it by using multimedia to increase the awareness of the senses such as hearing and sight. The use of augmented reality changes the form of current education, due to its ability to install multimedia on the real world, and display it through devices that support the Internet, such as phones and tablets, so that information can be presented to learners at the specified time to meet the actual need; This is to reduce the cognitive overload, which leads to higher levels of independent thinking, creativity and critical analysis (Bower, et al., 2013, Chatzopoulos, et al., 2017). In addition to the fact that the use of augmented reality in the classroom increases students' achievement and motivation and helps them in theoretical understanding of topics (Estapa & Nadolny, 2017), and gives them the opportunity to interact with virtual objects in real time. It helps active learning and thus reduces anxiety during lessons (Salinas & Pulido, 2017).

The educational experiences gained through augmented reality are distinguished by their support for the seamless interaction between the real and virtual environments. The use of a physical aliased interface to manipulate the virtual object and the ability to switch between the real and the virtual environments (Billinghurst & Duenser, 2017); Which leads to the enhancement of direct educational experience (Chatzopoulos, et al, 2017).

These features encourage the use of augmented reality in teaching various subjects, especially science, agricultural sciences, and history in particular, as science and agricultural science curricula require laboratory experiments to support understanding difficult concepts and bring meaning closer to learners, in addition to solving the problem of lack of tools and materials that may not be available in school; Therefore, augmented reality applications enhance the learning of science subjects more than others.

Many applications of augmented reality technology have appeared due to the flexibility of applications as they are used in many areas, such as: education, tourism, navigation, entertainment, media, engineering, military and medical training, etc., and most applications of augmented reality for mobile devices often work on wearable portable devices such as smart glasses and phones. smart phones, tablets and laptops; Mobile applications are classified as augmented reality applications if

they have the following three characteristics: input from the various sensors of the device (camera, gyroscope sensor, microphone, GPS), and processing to determine the type of information displayed on the screen of the mobile device by accessing data stored locally in The device or in a remote database, and the outputs are the projects produced on the device screen and synchronized with the current scene of the user (Chatzopoulos, et al., 2017).

Despite the flexibility of augmented reality applications, there are obstacles to their use in education, such as: the difficulty of detecting collisions between virtual objects when many of them are added, and it is not possible to evaluate the competencies gained from learners using augmented reality applications and the lack of a mechanism to include instructions for use in the application itself (Mota, et al. al., 2016).

The use of augmented reality applications in education requires smart devices, an Internet connection, the ability to download educational applications from stores, and add and create virtual objects to the real scene to support teaching, and learning; Such as: videos, camera images, animations, audio tracks, links, comments, and interactive menus using a number of applications. It is important for the teacher to take the necessary precautions regarding the copyright on the virtual produced materials that will be added to the real scenes, and that the content is free from any racial, class or religious bias in addition to making sure that it is free of viruses to maintain the integrity of the software and hardware; This requires the teacher to be familiar with the moral competencies of using digital technologies.

Method and procedures

a. **Study Methodology**: The current study followed the quantitative descriptive approach for its suitability for this type of studies, where the responses of individuals were obtained by means of a questionnaire to describe reality and convert them into quantitative data, in order to identify the degree of technical competencies and ethics necessary for science teachers to apply augmented reality, and to identify the most applications of reality Reinforcement is commonly used in the classroom.

B. Participants: The study population consists of student-teachers in the faculties of education, and all participants consist of 102 student-teachers, which were selected from the student- teachers of agricultural sciences (47) and history (55) at the Faculty of Education - Tanta University.

c. **Study tools:** An electronic questionnaire was prepared to collect data, consisting of two parts: The first part: preliminary data about the participants such as their specialization. The second section: It includes four main dimension: The first dimension:: the competencies of using the computer and includes (6) items; The second dimension: the competencies of dealing with the Internet and includes (9) items; The third dimension: educational software design competencies and includes

(8) items; the fourth dimension: the ethics of computer use when using educational materials from the Internet and includes (6) items, for a total of (29) items.

Validation and Reliability:

To ensure the apparent honesty of the questionnaire, a questionnaire was prepared for the arbitrators, and then presented to (7) specialized arbitrators from Tanta University in the field of curricula and methods of teaching and educational technology, with the aim of verifying: the linguistic formulation, the clarity of pronunciation of the scale expressions, and deleting or adding phrases, and the amendment has been made According to the opinions of the arbitrators. The Pearson correlation coefficient was also calculated to know the internal validity of the questionnaire by computing the correlation coefficient between the degree of the statement and the total degree of the dimension to which the statement belongs. It means that there is a high degree of internal consistency, which reflects a high degree of honesty for the paragraphs of the questionnaire. The reliability of the study tool was also measured by computing the alpha cronbach reliability coefficient, and Table (1) shows the value of Cronbach's alpha for the tool's dimension, which ranged between 0.63 and 0.881, which indicates that the scale has a high degree of reliability.

Table (1)

Alpha cronbach coefficient to measure the reliability of the study instrument.

N	Main dimensions	Number of phrases	Alpha corobanch
1	Competencies of using a computer.	6	0.813
2	Competencies of dealing with the Internet.	9	0.853
3	Instructional software design competencies.	8	0.881
4	Ethics of computer use when using educational materials from the Interne.	6	0.639
The overall reliability of the resolution.		29	0.926

Statistical analysis

To achieve the objectives of the study and to analyze the data collected, appropriate statistical methods were used using Statistical Package for Social Sciences (SPSS).

To determine the length of the cells of the triangular scale (lower and upper limits) used in the dimensions of the study, the range (3-1 = 2) was computed, then divided by the number of cells of the scale to get the correct cell length, (2/3 = 0.66). Adding this value to the lowest value in the scale in order to determine the upper bound for this cell, and thus the cell length became as follows: From (1.00) to (1.66) is weak or rarely, from (1.67) to (2.33) represents good or sometimes and from (2.34) to (3.00) represents excellent or always. Then the following statistical

methods were used: Frequencies and percentages to identify the professional and ethical competencies of the members of the study sample and determine the responses of its members towards the main dimensions statements included in the study tool, weighted arithmetic mean and standard deviation.

Results:

The problem of the current research is to answer the main research question: *what are Student-Teachers' Beliefs about their Self-efficacy for Utilizing Augmented Reality for Teaching Agricultural and Historical Sciences?* Therefore, both researchers applied the instrument study on student- teachers in Faculty of Education- Tanta University.

Firstly: What are Student-Teachers' Beliefs about their technical self-efficacy for Utilizing Augmented Reality for Teaching Agricultural and Historical Sciences?

Table (2)

The average and standard deviation (S.D) of the phrases of fourth dimension: competencies of computer use. (Sorted Descending)

N	Phrases	Mean	S.D
1	I use presentation software Power Point or similar software.	2.8302	.42679
2	I use Microsoft Word or similar word processing software.	2.8113	.52097
3	I use PDF readers (Acrobat) similar programs like Adobe.	2.7736	.50541
4	I use audio and video programs such as Media-Player, Real player or similar software.	2.5849	.60237
5	I deal with different storage units.	2.5472	.57399
6	I connect the digital camera to the computer and use it.	2.1509	.81798
Totally		2.6164	.33427

It is obvious that the mean student-teachers ability for computer use is 2.61, which means it is a high score. Besides, the two top phrases were I use presentation software PowerPoint or similar software and I use Microsoft Word or similar word processing software (2.83, 2.81 respectively). On the other hand, the least phrase was "I connect the digital camera to the computer and use it (2.1509)".

Table (3)

The average and standard deviation (S.D) of the second dimension phrases: Competences of dealing with the Internet. (Sorted Descending)

N	Phrases	Mean	S.D
1	I use search engines like Google.	2.9057	.35432
2	I browse websites.	2.8491	.41120
3	I communicate with others online and share information.	2.7736	.50541
4	I download various programs from the Internet.	2.7547	.51537

5	I can provide my students with educational materials such as texts, images, sounds or videos available online in education.	2.7358	.48639
6	I use email.	2.6981	.57462
7	I like to Participate in social media sites such as Twitter and Facebook.	2.6981	.50326
8	I could make educational content available to students online.	2.6415	.65323
9	I use electronic libraries.	2.5094	.72384
Totally		2.7296	.30313

It is obvious that the mean student-teachers' Competences of dealing with the Internet is 2.72, which means it is a high score. Besides, the two top phrases were I use search engines like Google and I browse websites"(2.9057, 2.8491 respectively). On the other hand, the least phrase was " I use electronic libraries" (2.5094).

Table (4)

The average and standard deviation (S.D) of the third dimension phrases: Educational software design competencies. (Sorted Descending)

N	Phrases	Mean	S.D
1	I can integrate multiple media such as text, audio, image and video to the educational content.	2.8679	.34181
2	I Use educational resources that help students understand the course such as the You-tube platform or similar resources.	2.7547	.47659
3	I could Create educational images using (photo shop) or similar program.	2.6038	.59935
4	I evaluate the quality of the educational software of the course technically	2.4906	.57588
5	I could create a video tutorial using I move or a similar application.	2.4151	.69154
6	I could Use classroom management apps like Edmodo or something similar.	2.3774	.79000
7	I can use applications to design course learning activities such as Ed-puzzle or similar software.	2.3585	.73627
8	I could create a tutorial audio clip using Grageband or a similar application.	2.3208	.80320
Totally		2.5236	.42464

It is obvious that the mean student-teachers' Competences of Educational software design is 2.52, which means it is a high score. Besides, the two top phrases were "I could connect multiple media such as text, audio, image and video to the educational content, and I use educational resources that help students understand the course such as the You-tube platform or similar resources"(2.8679, 2.7547 respectively). On the other hand, the least phrase was "I could create a tutorial audio clip using Grageband or a similar application" (2.3208).

Thus, it can be said that the participants have high technical competencies for teaching agricultural and historical sciences by using augmented reality.

The second question: What are Student-Teachers' Beliefs about their ethical self-efficacy for Utilizing Augmented Reality for Teaching Agricultural and Historical Sciences?

Table (5)

The average and standard deviation (S.D) of the third dimension phrases: Ethics of computer use when using educational materials from the Internet. (Sorted descending)

N	Phrases	Mean	S.D
1	I always choose a content that does not conflict with religion and local culture.	2.9811	.13736
2	I Make sure to detect that they are free of viruses to maintain the safety of devices and software	2.9811	.13736
3	I observe the permission to use (respect for the individual property of others)	2.9623	.27472
4	Ensure that the content does not carry any ethnic, class or religious bias	2.9434	.30478
5	I mention the sources of educational materials such as ideas, pictures and articles taken from open sources in the Internet.	2.9057	.29510
6	I Make sure that the content does not infringe on the privacy of others.	2.8868	.37521
Totally		2.9434	.11759

It is obvious that the mean student-teachers' Competences of Ethics of computer use is 2.94, which means it is a high score. Besides, the two top phrases were "I choose a content that does not conflict with religion and local culture and I Make sure to detect that they are free of viruses to maintain the safety of devices and software"(2.9811, 2.9811 respectively). On the other hand, the least phrase was "I make sure that the content does not infringe on the privacy of others" (2.8868).

Therefore, it can be said that the participants have high ethical competencies for teaching agricultural and historical sciences by using augmented reality. It means that the participants' beliefs about their self-efficacy are high, whether their technical self-efficacy or ethical self-efficacy.

The third question: Are there statistically significant differences between the responses of the research sample due to the nature of specialization with regard to the technical and ethical self-efficacy for Teaching Agricultural and Historical Sciences?

To answer this question t-test for independent groups had used and the results have been shown in table (6):

Table (6):

Results of t-test for the differences between agriculturist and historical specialization student-teachers.

N	Dimensions	sample	Mean	Deg.f	Std.D	t-test	Sig.
1	Competencies of computer using.	Agri.	2.8077		.17803	2.492	.016
		Hist.	2.5542		.35080		
2	Competences of dealing with the Internet.	Agri.	2.6581		.32855	-.978	.333
		Hist.	2.7528	101	.29503		
3	Educational software design competencies.	Agri.	2.6250		.36799	.991	.326
		Hist.	2.4906		.44070		
4	Ethics of computer using.	Agri.	2.9487		.10507	.186	.853
		Hist.	2.9417		.12259		
Totally		Agri.	2.7599		.19009	.991	.326
		Hist.	2.6848		.25008		

It is clear that there are no any differences between the participants attributed to their specializations totally and likewise the technical and ethical self-efficacy.

Discussion

The results related to the technical self-efficacy necessary for student-teachers to apply augmented reality showed that student-teachers have sufficient competencies to use and apply augmented reality in the teaching of agricultural sciences and history to a high degree according to their beliefs, and the most prominent of those competencies came in their use of the presentation program, and the word processing program as the most used computer skills at a high level; this may be due to the use of Word processing software to write questions and use the presentation program frequently in lectures, as for the skills of using media programs multiple came at a high level as well, which are applications that student-teachers need to use augmented reality technology. The skill of connecting a digital camera to a computer and using it at a lower level than other skills but high compared to the overall degree, which is also a necessary skill for the use of augmented reality applications. These results differ in their entirety with the studies of Al-Quraini (2015), Al-Ma'mari and Al-Masrouri (2013) and Al-Shehri (2012), where the results of the studies concluded that the degree of availability of technical competencies in the use of computers among teachers came with an average degree in total.

It was also found that the students-teachers of agricultural sciences and history at the Faculty of Education deal with the Internet with high skill and this is evidenced by: the use of electronic search engines, browsing websites, the employment of educational materials available on the Internet in education and the use of e-mail, and this may be attributed to the decisions of the Ministry of Higher Education in the

recent period to follow hybrid education, and the necessity of using e-mail by all students. While the skills of using electronic libraries in the participants came lower, but high if compared to the total degree. This may be due to the lack of electronic libraries available to undergraduate students compared to graduate students. These findings differ with the study of Maamari and Masrouri (2013) in that the degree of availability of teachers' competencies associated with the use of the Internet came to an average degree totally, and is consistent with a study Hlasna, P., et al.(2017) which found that (89%) of teachers use the Internet to access multimedia easily.

The results of the study also revealed that student-teachers are able to design some educational software, as they recorded high responses on this dimension. Although it is the least dimension; it is high when compared to the overall score. These results differ with Al-Quraini (2015) and Al-Shahri (2012) studies in that the degree to which teachers possess the competencies of integrating multimedia into educational software came to a weak degree.

It also turned out that the responses of the participants on the dimension of ethics of using the computer when using educational materials from the Internet came to a really high degree, which indicates that the ethics of using the computer when using educational materials from the Internet are practiced permanently among the participants, the most important of which is that it does not conflict with religion and local culture and does not carry any ethnic, class or religious bias, and those results are consistent with the study of that Brain's study, (2012) where she pointed out.

Recommendations

The current study recommends training student-teachers on the different applications of augmented reality, and training them with models of specialization lessons, as it turns out that they have enough technical and ethical self-efficacy which qualify them for this; so it is crucial to support continuous learning.

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