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THE IMPACT OF AUGMENTED REALITY TECHNOLOGY ON DEVELOPING HAND EMBROIDERY SKILLS AMONG STUDENTS OF THE COLLEGE OF EDUCATION

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ABSTRACT
Due to the lack of studies related to the use of augmented reality technology in the field of education, the impact of augmented reality technology on the educational environment for higher education students needs further exploration. Therefore, the current study aimed to know the effect of augmented reality technology on developing hand embroidery skills. The participants were 20 students from the College of Education at Najran University. They were divided randomly into two groups (experimental and control), each group included 10 students. Where the experimental group studied the "hand embroidery" course through the augmented reality technique, and the control group studied the same course in the traditional way. A product evaluation card was used as a tool to achieve the objective of the study. The study found the effectiveness of augmented reality technology in enhancing the students' skills in hand embroidery. The results provide important evidence of the advantages of augmented reality technology in the studies and development of the educational field.

Keywords: augmented reality technology; hand embroidery; Home Economics; fabrics; spinning

INTRODUCTION
Many researchers have indicated that augmented reality technology has great potential in enhancing learning and teaching (Ahmed, Alharbi, & Elfeky, 2022; Bower, Howe, McCredie, Robinson, & Grover, 2014; Cai, Chiang, Sun, Lin, & Lee, 2017; Elfeky & Elbyaly, 2017). A technology supports seamless interaction between real and virtual environments. At the same time, it allows the use and borrowing of a flexible and tangible user interface to manipulate virtual objects in the real environment (Masada, 2017). Therefore, augmented reality technology is gaining popularity within the commercial and educational community, and is becoming more widespread and influential (Bower et al., 2014; A. I. M. Elfeky & Elbyaly, 2019). Recently it has matured enough and therefore its applications can be found in both mobile and non-mobile devices (Bacca Acosta, Baldiris Navarro, Fabregat Gesa, & Graf, 2014; A. I. M. Elfeky & Elbyaly, 2021b). However, few studies have been conducted in the field of education (M. Y. H. Elbyaly & Elfeky, 2022b; Saidin, Halim, & Yahaya, 2015). Researchers and experts who promote the use of augmented reality technology believe that it provides learners with more opportunities to be more skilled and knowledgeable (A. I. M. Elfeky, Alharbi, & Ahmed, 2022). Moreover, augmented

reality aims to simplify the user's life by bringing virtual information not only to his immediate surroundings. Also to any purpose indirect to a real-world environment, such as live video streaming. AR technology features can be categorized into image-based and location-based AR, with respect to recognition technology (Almalki & Elfeky, 2022; Cheng, 2018), where image-based AR provides amplified information through images to be tracked and digital information is embedded on top of it (Alharbi, Elfeky, & Ahmed, 2022; Palanivel Rajan & Vivek, 2016). Location-based augmented reality, on the contrary, provides virtual information and calculations of the user's real-world location through GPS. In addition to using the GPS system, devices that diagnose the area and the image are used (M. Y. H. Elbyaly & Elfeky, 2022a; Küçük, Yýlmaz, & Göktaþ, 2014). In addition, location-based AR ensures contextually relevant virtual data is provided to the user in geographically significant locations (Bower et al., 2014; Masadeh & Elfeky, 2016). Image-based AR can also support students' learning regarding spatial ability, practical skills, and conceptual understanding of knowledge (Cheng, 2018). Hand embroidery is defined as a handicraft for decorating fabrics or other materials using needle and thread or yarn (A. Elfeky, 2017; A. I. M. Elfeky & Elbyaly, 2016). It is mainly performed for decorative purposes by stitching different types of materials into a layer of cloth to create patterns. In addition, designs are usually a reflection of the beauty of nature. Hand embroidery is a favorite art among fashionistas in many countries with different motifs (A. I. M. Elfeky & Elbyaly, 2021a). It is commonly used in the bodices, cuffs, waistline and neckline of costumes. In general, hand embroidery is used to incorporate depth and texture into garments (Della Torre & Rajabi, 2022). Moreover, the results of some studies showed that hand embroidery has been applied in various textile products such as pillows, costumes, and curtains from the Middle Ages to the present (So & Jiang, 2014). In addition, hand embroidery was responsible for the fit and aesthetics of garments (A. I. M. Elfeky, 2019). However, so far, the relevant literature review does not reveal a rigorous effort to use AR technology in developing hand embroidery skills. Therefore, the current study attempts to investigate the effect of using AR technology on developing hand embroidery skills.

RESEARCH PROBLEM

The problem of the current study arose due to the noticeable and repeated decrease in the skills of the students of the Department of Home Economics in the "hand embroidery" course, which hinders the achievement of the objectives of that course. Augmented reality technology has great potential in enhancing the learning and teaching processes and achieving educational goals (Bower et al., 2014; Cai et al., 2017; Plunkett, 2019). Researchers and experts who promote the use of augmented reality technology believe that it provides learners with more opportunities to be more skilled and knowledgeable (A. I. M. Elfeky, Masadeh, & Elbyaly, 2020). In addition, augmented reality technology is a particularly attractive technology, which is one of its important characteristics, as it is believed that augmented reality encourages learners to benefit from it (Yilmaz, Kucuk, & Goktas, 2017). Hand embroidery is also responsible for the fit and aesthetics of clothing (M. Y. H. Elbyaly, 2016). Hand embroidery involves a number of objectives such as controlling the fullness of the fabric by creating ensembles, and enhancing the elasticity of the garment through the combination of stitches, pattern, weave and threads, which must be considered

in coordination and sometimes given priority to find a suitable solution. He believes that augmented reality technology is very valuable in developing hand embroidery skills to increase craftsmanship. This provides many opportunities to make great progress using combination embroidery stitches, pattern, fabrics, and threads. Thus, the impact of augmented reality technology in making a difference in the accuracy and composition of hand embroidery stitches should be investigated (Hwang, Sanders, & Damhorst, 2014). However, little is known about whether augmented reality technology is effective in developing embroidery skills among female students of the College of Education at Najran University. Based on the above, the problem of the current study can be formulated in an attempt to identify the impact of augmented reality technology on developing hand embroidery skills among female students of the College of Education at Najran University.

RESEARCH AIMS

The main objective of this study is to explore the impact of augmented reality technology on developing hand embroidery skills among female students of the College of Education at Najran University.

RESEARCH IMPORTANCE

The results of the current study are expected to contribute to the following:

- Benefit from digital transformation in the educational process to achieve educational goals.
- Employing augmented reality technology to contribute to achieving the objectives of the "hand embroidery" course.
- Directing attention towards the use of augmented reality technology in university education.

RESEARCH LIMITS

The current study has a number of determinants as follows:

Objective Determinants

This study is limited to exploring the effect of augmented reality technology on developing hand embroidery skills in the "hand embroidery" course for students of the College of Education at Najran University, where the Aurasma application on the mobile phone was used to present the content of the course to the students of the experimental group using augmented reality technology.

Human Determinants

The sample of this study is limited to female students of the College of Education - Najran University.

Temporal Determinants

The research was conducted during the first semester of the academic year 2021/2022.

Spatial Determinants

The College of Education, Najran University, Saudi Arabia, is the spatial determinant of this study.

Research terms

Augmented Reality Technology

Augmented reality technology is a new, easy-to-use and interesting technology. It is defined as a virtual object generated by a computer through the real environment that a mobile phone or tablet sees (Fazel & Izadi, 2018; Hsieh & Lee, 2018). In the current study, the procedurally augmented reality is defined as a way to enhance the real world by overlaying additional virtual information to develop hand embroidery skills and solve complex problems in the "Hand Embroidery" course.

Hand Embroidery

Hand embroidery is a handcraft for decorating fabrics or other materials using needle and thread or yarn (M. Elbyaly & El-Fawakhry, 2016). The researcher adopts this definition as a procedural definition for the current study.

METHODOLOGY

The methodology of the study was to use the experimental approach (with quasi-experimental designs), in order to find out the impact of the independent variable (augmented reality technology) on the dependent variable (hand embroidery skills), and as a result, the design shown in Table (1) was used using two groups (experimental and control).

Table (1): Study design

	Treatment	**Post-test**
Experimental Group	Augmented reality technology	Product evaluation card
Control Group	Traditional way	

RESEARCH TOOL (PRODUCT EVALUATION CARD)

A product evaluation card was prepared in order to measure the level of performance of the study sample in Handmade Embroidery Skills. The validity of the card by ensuring the soundness and clarity of the procedural wording of the card, and the possibility of observing performance through it. The stability of the product evaluation card was also calculated through the multiplicity of observers on the performance of one student, and then calculating the coefficient of agreement between their estimates using the Cooper equation.

$$\text{Agreement ratio} = \frac{\text{The number of sub-skills that have been agreed upon}}{\text{The number of sub-skills that have been agreed upon + the number of sub-skills that have been disagreed on}} \times 100$$

This is done through the assistance of two female colleagues in the Department of Home Economics. This is after presenting the product evaluation card to them to learn about its content and instructions for its use. Then observe the performance of three of the students, and then calculate the agreement coefficient of the three observers for each student separately. The

following table shows the coefficient of agreement of observers on the performance of the three students.

Table (2): Coefficient of agreement among observers on the performance of the three female students

Coefficient of agreement on the performance of the first student	Coefficient of agreement on the performance of the second student	Coefficient of agreement on the performance of the third student	Average agreement coefficient for the three female students
85%	%87	87%	85%

From the previous table, we see that the average coefficient of agreement of the observers on the three female students was (85%), which means that the product evaluation card is stable to a degree that qualifies it to be applicable as a measurement tool.

RESEARCH SAMPLE

The sample of the current study consisted of (20) female students of the College of Education at Najran University during the first semester of the year 2021/2022 AD, with an average age of 18.5 years, and a standard deviation of 2.73. They were randomly divided into two groups (experimental and control), each group included (10) female students. Where the experimental group studied the "hand embroidery" course through the augmented reality technique, and the control group studied the same course in the traditional way.

RESEARCH VARIABLES

- The independent variable: Augmented reality technology.
- Dependent variable: Hand embroidery skills.

EXPERIMENTAL PROCESSING MATERIAL

Fundamentally aligned with topical and constructivist learning theory, AR technology places the learner in an authentic physical and social context (Dunleavy & Dede, 2014). At the same time, it is in line with the concepts of constructive learning where learners can control and monitor the learning process through active interactions with the real and virtual environments. Therefore, the augmented reality technology system was used to explain the hand embroidery skills included in the paper book of the course for the experimental group. A review of several instructional design models was conducted to devise a set of indicative steps that could achieve the objectives of the "Hand Embroidery" course. Whereas, the educational design followed in teaching this course included defining the objective (development of hand embroidery skills among female students), the content (a paper book), the investigation conditions (educational videos provided through augmented reality technology and in the classroom), and the procedures (educational activities), and evaluation. The Aurasma application was used with educational videos to design the system that provides these skills to the students in the experimental group. This application was chosen because it is one of the most popular and widely used applications, and this was evident when searching for augmented reality applications (Carmigniani et al., 2011). It is a free app for Android

and iOS device users uses the smartphone camera and provides an improved user interface, providing flexibility to the users. In this application, the picture of the knitting stitch in the book was replaced by a video with the same dimensions as the image, and the students of the experimental group only had to download this aurasma application from Google or apple store, run it, and then click to follow the course that the researcher developed and share it. When each student of the experimental group points her smartphone camera at the picture of the stitch in the book, they can watch the video tutorial to learn the hand embroidery skills of this stitch. Thus, students in the experimental group can easily review the details of each skill they have learned without any financial cost by using augmented reality technology. The hand embroidery skills of the students in the control group were practically developed through traditional learning supported by educational videos similar to those that were included with the experimental group that were taught using augmented reality technology (by displaying them using a projector in the classroom).

STATISTICAL PROCESSING

To analyze the data collected for the first question, mainly to assess the students' skills in hand embroidery, the Independent t test was used to determine the difference between the mean scores of the participants in the experimental and control groups.

RESULTS

To answer the study's main question, by extracting the arithmetic mean scores for the post application of the product evaluation card for the two study groups, in order to try to find out if there are statistically significant differences between the experimental and control groups due to the use of augmented reality technology. Table (3) shows the results of the T. test to compare the average scores of hand embroidery skills for the two study groups.

Table (3): The difference between the mean scores of hand embroidery skills for the two study groups (experimental and control)

Group	M	SD	T. Ratio	Sig.
Experimental Group	23.1	2.418	7.21	.039
Control Group	17.9	3.684		

From the previous table, it is clear that the value of "t" for the difference between the mean scores of hand embroidery skills for the two study groups (experimental and control) amounted to (7.21). The average score of the experimental group students was (23.1). While the average score of the control group students was (17.9). Thus, we find that the value of "t" is statistically significant, and in such cases the statistical significance is directed in favor of the group with the highest average, which is the experimental group, as the arithmetic mean for it was (23.1) by an increase of (3.2) over the control group. This indicates that there is a statistically significant difference at the level (0.05) between the mean scores of the students of the experimental group (studied through augmented reality technology) and the control group (studied in the traditional way) in hand embroidery skills in favor of the students of the experimental group. Thus, the study reached the answer to the study question.

DISCUSSION

The current study mainly aimed at investigating the effect of using augmented reality technology on developing hand embroidery skills among female students of the College of Education at Najran University. The results related to the study question confirm the fact that the augmented reality technology was effective in enhancing and developing the hand embroidery skills of the female students participating in the experimental group. The average scores of female students in the experimental group who studied via augmented reality technology were higher than the average scores of their peers in the control group who learned through the traditional teaching method supported by educational videos provided in the classroom. In other words, this study demonstrates the benefit of augmented reality technology in developing hand embroidery skills among female participants in the experimental group. This is largely because a well-designed AR environment can help learners relate the task to the real world and create new meanings for them (Alanzi & Alhalafawy, 2022; Alzahrani & Alhalafawy, 2022; Wu, Lee, Chang, & Liang, 2013). This result also confirms that AR technology is a very flexible tool that can be used in many educational environments and settings and for very different purposes if applied fully (Alzahrani, Alshammary, & Alhalafawy, 2022; Diegmann, Schmidt-Kraepelin, Eynden, & Basten, 2015). The above findings are in line with previous studies in the context of traditional science learning (Cheng, 2018; Ho & Liang, 2015; Sadi & Dağyar, 2015). This is because the benefits and beneficial uses of AR technology are able to engage learners in learning processes and help improve their skills (Alshammary & Alhalafawy, 2023; Saidin et al., 2015).

RECOMMENDATIONS

In light of the findings of the current study, I conclude the following recommendations:

- Training the teaching staff on the skills of using augmented reality technology in the educational process.
- Using other various technical products to develop hand embroidery.

SUGGESTED RESEARCH

In light of the study problem, the following suggestions can be made:

- Conducting similar research and studies at another educational stage, to confirm the success of using augmented reality technology in other environments.
- Using virtual reality to conduct further research and studies to develop hand embroidery skills.
- Conducting studies to develop hand embroidery skills for detection using the project method.

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