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The Impact of Designing an Electronic Course of Computer Uses on Developing Academic Achievement and Creative Thinking in a Saudi University

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Abstract
This research aims to measure the impact on academic achievement and developing creative thinking skills by designing an electronic course (e-course hereafter) for computer uses in teaching at a Saudi university. Following a quasi-experimental methodology, forty students (female) were selected and segregated into control and experimental groups for this study. The latter was taught using the designed e-course for 'Computer Uses in Teaching' and the former was taught in a normal class. To achieve research objectives, research tools consisted of an e-course (a cognitive test to measure academic achievement), and Torrance test to measure creative thinking skills. The results demonstrated a significant difference ($\alpha \geq 0.05$) between the experimental and the control groups in the average score of achievement test. The post-test synthesis, analysis, and evaluation levels were found in accordance with the experimental group. The average score of post-test creative thinking test results evaluated at the levels of flexibility, fluency, and originality were also found to be significantly different ($\alpha \geq 0.05$) with respect to the two groups. It is recommended to develop the digital content in accordance with the measures taken during the Corona pandemic and e-learning standards.

Keywords: academic achievement, creative thinking skills, designing course, electronic course

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Introduction

Scientific and technological development has led to rapid and successive changes in all aspects of life which is reflected in the educational process in all disciplines. It is, therefore, necessary to develop the educational system to meet the learning needs resulting from developments in education and technology to meet actual realities and to keep pace with recent global trends. In the 21st century, educational programs based on novel technological approaches and e-communication are found to be the most effective, as they "develop abilities, skills and knowledge of learners" (Aikina et al., 2015, p.58). Appearance of the deadly Corona virus in the last few months of 2019 led to the closing of all educational institutions and proposing e-learning and distance education in emergencies to ensure that students did not drop out of education under the Corona pandemic. Therefore, there was a call to blend the conventional teaching with online teaching to help learners cope with the challenges during the pandemic (Aboagye et al., 2020, p. 1).

E-learning relies on a range of modern technology methods, which can be used to facilitate student learning processes by providing educational contents through the preparation and design of e-courses that are either synchronous or asynchronous (Wheeler, 2012, p. 1109). In Saudi context, Al-Samiri (2021) pointed out that:

> "Most Saudi universities utilized Blackboard, a Learning Management System (LMS), designed to deliver both synchronous and asynchronous modes of learning. However, this software was not used extensively and served a supplementary role prior to the pandemic, and its e-learning users are still discovering its features." (p. 149).

According to Tran et al. (2010), an electronic course is based on computer techniques, offering study material through the Internet and using various multimedia elements as support. Learning, teaching, assessment processes are carried out through the Internet" (p. 11). Several studies have examined the importance of electronic courses and their use by students. Zengin (2012) which has emphasized the extent to which students benefit from e-courses in the learning process. Pereira, Wen and Tavares (2015) focused on the introduction of an e-course capable of promoting knowledge and acquiring skill, along with the research of Trotter (2007), which demonstrates the impact of e-course on students' academic achievement.

The interest in developing thinking skills is increasing in the current century where creative thinking has taken an important place. For Jackson et al. (2012), creative thinking is a mental phenomenon that results in new ideas or concepts or their combination (p. 372). Grégoire (2016) has discussed Woodman and Schoenfeld's (1989) viewpoint and proposed a development model that leads to interaction between three components: "mental abilities and personal traits on one side; family and education on the other side; and the current situation" (p.26). This interaction helps produce the three important elements of creativity, *viz.* fluency, originality, and flexibility. Therefore, education experts emphasize the need to develop the different thinking skills of students and teach them how to think creatively through an approach that focuses on different dimensions of thinking, *viz.* conceptual, cognitive, and metacognitive, in learning (Kusmayanti et al., 2018). Studies on creative thinking skills, (e.g., Bahar & Maker, 2011), have revealed that the creative ability for success and achievement is concerned with developing students' creative thinking skills (Moma et al., 2013).

International and regional conferences have also urged development of education curricula and application of technology. For example, the Second International Conference on the Development of University Education Environment, held in 2012 recommended that a more student-friendly learning environment should be made. It also recommended that the role of e-courses and that of e-learning environments be activated, university-wise, for responding to student's needs. In turn, this study could benefit all Saudi universities, particularly emerging universities, which must establish infrastructure for electronic education centers, planners and developers of curriculum, as well as university education experts to review the contents, objectives and education methods. This will enable university students to acquire knowledge related to technological innovations using e-courses to increase the level of academic achievement; scientific innovation; and making education more interesting.

Research Problem

The research problem can be identified in the following main question:

- What is the impact of designing an e-curriculum on teaching, on students' achievements, and on developing creative thinking skills of female students at a Saudi university?

Following are the detailed sub-questions originating from the main research problem:

1. What is the perception of an e-course for 'Computer Uses in Teaching'?
2. What is the effect of an e-course on learners' achievements as per Bloom's Synthesis levels?
3. What is the effect of an e-course on learners' achievements as per Bloom's Analysis levels?
4. What is the effect of an e-course on learners' achievements as per Bloom's Evaluation levels?
5. What is the effect of an e-course on learners' creative thinking skills, such as Fluency, Flexibility, and Originality?

Research Hypotheses

1. The average scores of the control and the experimental groups of female students in the post test for Achievement at the Synthesis level exhibit no significant difference ($\alpha \geq 0.05$).
2. The average scores of the control and the experimental groups of female students in the post test for Achievement at the Analysis level exhibit no significant difference ($\alpha \geq 0.05$).
3. The average scores of the control and the experimental groups of female students in the post test for Achievement at the Evaluation level exhibit no significant difference ($\alpha \geq 0.05$).
4. The average scores of the control and the experimental groups of female students in the post test of Achievement for the creative thinking skill evaluation of Fluency exhibit no significant difference ($\alpha \geq 0.05$).
5. The average scores of the control and the experimental groups of female students in the post test of Achievement for the creative thinking skill evaluation of Flexibility exhibit no significant difference ($\alpha \geq 0.05$).

6. The average scores of the control and the experimental groups of female students in the post test of Achievement for the creative thinking skill evaluation of originality exhibit no significant difference ($\alpha \geq 0.05$).
7.

Research Objectives

This study aims at the following objectives:

1. Designing an e-course for the program 'Computer Uses in Teaching' for female students at a Saudi university and to investigate its impact on the academic achievements and creative thinking skills.
2. Identifying the impact of an e-course of 'Computer Uses in Teaching' on the academic achievement as for Bloom's higher levels of thinking (synthesis, analysis, and evaluation) of female students at a Saudi university.
3. Detecting the impact of an e-course of 'Computer Uses in Teaching' on the enhancement of creative thinking abilities (fluency, flexibility, and originality) of female at a Saudi university.

Significance of the Study

The importance of this research lies in its contribution to the following issues:

1. Providing an e-course model to be designed and produced for the program entitled 'Computer Uses in Teaching'.
2. Contributing to the development of education by introducing this e-course which defines the roles of university professor and learner, methods of interaction, and online lessons.
3. Overcoming the problems caused by the increasing demand for higher education and the increasing number of male and female students.
4. Educational program designers, faculty members and educational institutions may benefit from this model.
5. Keeping pace with modern and global trends in the development of education trough placing the learner at the heart of it.

Methodology and Procedures

This research followed the quasi-experimental method that consists of the control group and the experimental group with a pre-test post-test. This method aims to examine the impact of the independent on the dependent variable.

Population & Sample

The population of this study consisted of female students at Hail University, enrolled at the "computer uses in teaching course' in the 2nd semester of the academic year 2020/2021. The sample for the study comprised 40 female students. The participants were selected randomly. They were informed about the Study; the researcher got their consent for participation in the study. They were also told that they were allowed to withdraw from this study if and when they so desired at any stage without incurring any penalty. It was made sure and the participants were told that their data would be kept confidential and would be used only for research purposes. The participants were divided into two equivalent groups: Experimental (20 female students), and Control (the other 20 female students). For the control group, the conventional method was used to teach the

"Computer Uses in Teaching" program, whereas an e-course was used to teach the experimental group the same course.

Table 1. *Demographic information for the participants*

Group	N	Level	Teaching Method
Control	20	2nd semester	Conventional Method
Experimental	20	2nd semester	An e-course
Total Number of Participants		40	

Variables

1. The independent variable: design of an e-course (Computer Uses in Teaching);
2. Dependent variables:
   a) Academic achievement: Bloom's higher cognitive levels (Synthesis, Analysis, and Evaluation) of female students;
   b) Creative thinking skills: Flexibility, Fluency, and Originality of female students.

Research Tools

An Achievement Test was used to gauge the impact of the e-course entitled 'Computer Uses in Teaching' on students' academic achievements and Torrance Test was used to evaluate creative thinking skills. The following methods were adopted for test preparation:

- Test tool: an achievement test for the "computer uses in teaching" course was prepared.
- The purpose of the tool: the achievement test was used to gauge the academic achievement at the "computer uses in teaching" course. The test was prepared according to the high order cognitive levels of Bloom's taxonomy: synthesis, analysis, evaluation. It was consisted of 22-muliple choice items, each with four options, one of which represents the correct answer. The total score of the test was 22 marks.

The test was prepared in three stages:

First Stage: Academic Content Analysis of the course (Concepts, Terminology, Facts and Generalizations) as in Table 2 are the test specifications.

Table 2. *Achievement Test Specifications*

No.	Topics	Cognitive levels of objectives			Lesson Items Sum	Relative weight of topics
		Synthesis	Analysis	Evaluation		
1	Introduction to the computer and its matter	0	5	1	6	27.27%
2	Computer Components	2	3	1	7	31.81%
3	Computer viruses, and application programs	3	3	2	8	36.36%
4	Computer uses in education: advantages and Justifications	0	0	2	2	9.09%
Total		5	11	6	22	100%
Relative weight of cognitive levels of the objectives		22.72%	50%	27.27%	100%	

– Test Formulation: Multiple-choice in the light of behavioral goals.

- Drafting Test Instructions: The title and purpose of the test for research, instructions for conducting the test, its time duration, and the ways to answer the items were duly explained.
- Preparing an answer key: An answer key was prepared for correcting the achievement test. It shows scores distribution, where one score is assigned to each test item, where each correct answer takes one degree, and zero for each wrong answer. The maximum degree is twenty-two (22), and the minimum is zero (0).
-

Second Stage: Ensuring the internal consistency and test reliability

To verify of the internal consistency and reliability of the test, it was conducted on a pilot sample, consisted of 16 female students who did not belong to the actual sample. Results of the verification of internal consistency are presented below:

a. Internal Consistency

Pearson Correlation Coefficient was calculated between the degree of each item in the test with respect to its related total cognitive level degree. Table 3demonstrates the results.

Table 3. *Correlation Coefficients (CC)between the degree of each test item and the total degree of the cognitive level to which it belongs*

Synthesis Level		**Analysis Level**				**Evaluation Level**	
No.	CC	No.	CC	No.	CC	No.	CC
1	0.697**	1	0.574*	7	0.793**	1	0.635**
2	0896**	2	0.704**	8	0.753**	2	0.680**
3	0.854**	3	0.608**	9	0.753**	3	0.712**
4	0.874**	4	0.776**	10	0.740**	4	0.804**
5	0.798**	5	0.525*	11	0.608*	5	0.882**
		6	0.813**			6	0.574*

**Significant level 0.01 * Significant level 0.05

Table 3 shows that all items of the test have a statistically significant correlation coefficient with the cognitive level they measure. The range of correlation coefficient significance levels are from 0.01 to 0.05. Table 4 illustrates the correlation coefficient between the total test degree with respect to each cognitive level degrees.

Table 4. *Correlation Coefficients (CC) between the degree of each cognitive level and the total degree of the achievement test*

Cognitive Levels	**No. of items**	**CC**
Synthesis	5	0.942**
Analysis	11	0.947**
Evaluation	6	0.956**

**Significant level 0.01

Table 4 shows that the degree of each cognitive level (Synthesis, Analysis, Evaluation) depends on the total score of the test, as the correlation coefficient was significant at the 0.01 level. These results demonstrated a high degree of internal consistency for the test.

b. Testing Reliability

To verify the reliability of the test, the Alpha Cronbach coefficient was calculated for the three cognitive levels of the test and the scale as a whole. The results are presented in Table 5.

Table 5. *Reliability coefficient for the achievement test*

Cognitive Levels	No. of Items	Cronbach's Alpha
Synthesis	5	0.879
Analysis	11	0.890
Evaluation	6	0.807
The test as whole	22	0.952

The reliability coefficients have a high degree of Reliability, as alpha – Cronbach coefficients for the test levels ranges from (0.807 – 0.879). Alpha-Cronbach coefficient was 0952 for test as whole. The previous results presented in tables 3,4 and 5 confirmed the validity of the test for achieving the objectives of the current study.

c. Calculating Discrimination and Facility Coefficients of the achievement test

To calculate the discrimination coefficient, the test sheet has been arranged upward or downward based on the overall test score. Two categories are chosen based on the test. If the number of students is less than 30, the answer papers can be divided into two sections by 50% for each section. The discrimination coefficient is calculated by the following equation (Eid, 2012, p. 19):

$$\text{Discrimination coefficient}=\frac{\text{Correct answers No in the higher group}-\text{Correct answers No in the lower group}}{\text{Students No in one group of the two}}=\times 100\%$$

Al-Azzawi (2008) explains that items with a discrimination coefficient greater than 0.39 are items of high discrimination coefficient, and for the Facility coefficient, it is calculated as follows.

$$\text{Facility coefficient}=\frac{\text{Correct answers No in the higher group}+\text{Correct answers No in the lower group}}{\text{Students No in one group of the two}}=\times 100\%$$

The difficulty coefficient = 1 - the Facility coefficient.

The items with facility or difficulty coefficients in the range between 0.2 to 0.8 are acceptable. Table 6 shows the values of the discrimination, facility and difficulty coefficients.

Table 6. *Test items' Discrimination, Facility and Difficulty coefficients*

No.	Discrimination coefficient	Facility coefficient	Difficulty coefficient	No.	Discrimination coefficient	Ease coefficient	Difficulty coefficient
1	0.50	0.63	0.37	12	0.50	0.25	0.75
2	0.63	0.31	0.69	13	0.50	0.25	0.75
3	0.63	0.44	0.56	14	0.50	0.25	0.75
4	0.50	0.25	0.75	15	0.50	0.38	0.62
5	0.50	0.25	0.75	16	0.50	0.50	0.50
6	0.50	0.5	0.50	17	0.50	0.50	0.50
7	0.50	0.38	0.62	18	0.50	0.25	0.50

8	0.50	0.5	0.50	19	0.63	0.56	0.44
9	0.50	0.38	0.62	20	0.75	0.63	0.37
10	0.50	0.38	0.62	21	0.75	0.38	0.62
11	0.63	0.31	0.69	22	0.50	0.50	0.50

The results in Table 6 clarify that all test items have discrimination, facility and difficulty coefficients that fall within the acceptable range in the educational studies.

d. Pre-test application for the achievement test

To examine the equivalence of the achievement in the "computer uses in teaching" course, the Achievement Test was administrated on both groups (experimental and control) before applying the study. Thereafter, the "Man-Whitney *U*" test was used to evaluate the significant difference between the average scores of the two groups in the pre-test. The results are presented in Table 7.

Table 7. *Results of Pre-test application of the achievement test*

Test Cognitive Levels	Study Groups	Total Ranks	Ranks' Average	U – Value	Z-Value	Significant Level	Significance
Synthesis	Experimental	437	21.8	173	1	0.478	Insignificant
	Control	383	19.15				
Analysis	Experimental	426	21.33	183.5	0.488	0.659	Insignificant
	Control	393	19.68				
Evaluation	Experimental	364	18.20	154	1.43	0.153	Insignificant
	Control	456	22.80				

The results illustrate that the levels of ranking in the Pre-test application of the Achievement test for the experimental and the control groups are not significantly different. This validates that the two groups are equal with respect to higher cognitive levels (such as Synthesis, Analysis, and Evaluation).

Torrance Verbal Test (A) tool

To measure creative thinking skills, Torrance's Verbal (A) Test was used, as it is one of the most important global measures of creativity that many studies have used to measure creative thinking skills, efficiently. It is rationalized to the Saudi context, is accredited by Saudi Ministry of Education, and is suitable for use at all education grades.

First Stage: Planning and preparing the test through

- Identifying test aim: It is to evaluate the creative thinking ability of female students in Computer Uses Courses, Faculty of Education, Hail University.
- Specifying creative thinking skills measured by the test: They are: fluency, flexibility, and originality.
- Torrance Creative Thinking Test (A) consists of seven subtests, which take five minutes to answer. These tests are as follows: questioning, predicting causes, predicting results, enhancing production, and uncommon uses such as unusual questioning, and suppose. Verbal type (A) was used in this research. The Creative Thinking Test of Torrance was restricted only for the first three subtests, i.e., questioning, predicting causes, and predicting results for the 'uses of computers in teaching' course.

– Test instructions formulation: The activities in the handbook will give you the opportunity to use your imagination and think of ideas. Answers in these activities will not be regarded right or wrong. The goal is to find out how many ideas you can offer.

Attesting internal consistency and reliability of Torrance Test for Creative Thinking (A)

a. Calculating validity of test internal consistency

To verify the internal consistency validity, the test was applied to the pilot sample, which calculates the correlation coefficients among various dimensions and every test dimension's degree along with the calculation of correlation coefficients among the total test score and every dimension's degree. Table 7 demonstrates the results.

Table 8. *Correlation coefficients of the dimensions of Torrance test "a"*

Test Dimensions	Fluency	Flexibility	Originality	Total Degree
Fluency	1	0.681**	0.763**	0.894**
Flexibility		1	0.723**	0.883**
Originality			1	0.929**
Total Degree				1

**Significant level 0.01

The results shown in table 8 indicates that Torrance test dimensions are associated with each other, as the correlation coefficients between these dimensions was significant at the level of 0.01.

b. Test Stability:

Test-retest was done to establish the validity of Torrance test (a). The post-test was conducted four weeks after the pre-test. Then, an analysis of the results was done and Pearson correlation coefficient was calculated between scores of the two applications, as shown in Table 9.

Table 9. *Correlation coefficients for Torrance Test (a)*

Test Dimensions	Correlation coefficients
Fluency	0.582*
Flexibility	0.553*
Originality	0.714**
Total Degree	0.816**

**Significant level 0.01 * Significant level 0.05

The results confirm that the test has a high degree of stability, with correlation coefficient values ranging from 0.582 to 0.714 at a significant level of (0.01), (0.05), and a total reliability factor of 0.816 at a significant level of (0.01).

Previous findings on the validity and stability of the test indicate the test validity and relevance to achieve the objectives of the study.

c. Pre-test application of Torrance creative thinking test

Torrance Creative Thinking Test was previously applied to both the groups of this study, and Man-Whitney Test was then applied to recognize the statistical significance of the differences between the average scores of female students in both groups. Results were as follows:

Table 9. *Results of Torrance Creative Thinking Pre-test Application*

Plastic Creativity Skills	Group	Total Ranks	Average ranks	U Value	Z Value	Significant Level	Significance
Fluency	Experimental	420	20	190	0.350	0.799	Insignificant
	Control	400	21				
Flexibility	Experimental	403.5	20.18	193.5	0.213	0.826	Insignificant
	Control	416.5	20.83				
Originality	Experimental	436	21.80	174	0.801	0.495	Insignificant
	Control	384	19.20				
Total Degree	Experimental	407	20.35	197	0.084	0.933	Insignificant
	Control	413	20.65				

No significant difference was observed between the grade results of the control and the experimental groups in Torrance Creative Thinking Pre-test application, which confirms the equality of the two groups before the experiment, in terms of creative thinking abilities (flexibility, fluency, and originality).

Research Materials

First: Designing an e-course for the program entitled 'Computer Uses in Teaching'

In the light of one of the research objectives, which is to arrive at a proposed e-course for 'Computer Uses in Teaching' course to the female students at the Faculty of Education, Hail University, the e-course is designed according to the five stages of the general educational design model (Analysis, Design, Development & Production, Implementation, and Evaluation).

1. First Stage: Analysis

This stage consists of the following:

Analysis of Objectives: The overall objective of designing the e-course was to provide the academic material of the course of 'Computer Uses in Teaching' to measure its impact on the academic achievement of female students and to develop their creative thinking skills. In addition, the procedural behavioral objectives were determined and presented to a group of validators to verify their scientific accuracy, formulation soundness, and their correct level.

2. Second Stage: Design

At this stage, specifications of the e-course were written to be implemented in the development phase as follows:

- Procedural Objectives Identification: Objectives were formulated to be comprehensive, relevant to the general objectives and measurable.
- Educational Content Design: Educational content is determined in the light of educational objectives to be achieved. Ideas are broken down and written in brief.
- Learning and Teaching Strategies Identification: The e-course content was presented using visual thinking, participatory learning and e-discussion strategies.
- Designing e-course scenario: It includes the operational steps to build the e-course on the learning management system (Blackboard), as in Table 10.

Table 10. *Operational steps to build an electronic course*

First Step	Second Step	Third Step
Start Here Page	Course Information (Course Manual)	Course Lessons
Welcome Message	Course Description	Lessons' Objectives
Course Overview	Course Tutor Information	Academic achievement Map
Survey in the course	Course Evaluation	Educational content
Student's Manual	References & Resources	Activities
Dating Activity	Course Policy	Evaluations

3. Third Stage: Development

It consists of the following steps:

- Developing the e-course scenario where the educational content of the course has been distributed into (4) topics and includes (4) video clips, (4) fixed images, structural & closing tests, and learning activities.
- Identifying the software used in online course design, namely, Microsoft PowerPoint, Microsoft Word, and Learning Management System (Blackboard) website.
- Producing and developing multimedia using fixed and moving images, video recording, PowerPoint and text writing and coordination.
- Programming e-course content: Audio-visual multimedia has been integrated into the electronic course.
- Developing the posting medium: The e-course website is developed as an intermediary for posting on the Blackboard Learning Management System on the website of a Saudi university.
- The initial pilot of the e-course: After completing the development processes, the program is tested for application to a group of female students to detect and revise errors.
- Validation: It is conducted by a group of specialists in teaching techniques, who have agreed on the usability and applicability of the e-course.

4. Fourth Stage: Implementation

The e-course was applied to the research sample of female students in order to measure its effectiveness in the academic achievement, develop their creative thinking, and ensure that the product works well.

5. Fifth Stage: Evaluation:

The positive and negative aspects were identified through observing the implementation on the main sample. For improvement, it was presented to a group of validators and education technology specialists. A modification was made in the light of their observations, thus answering the first research question, "What is the proposed perception for designing an e-course for Computer Uses in Teaching?"

Second: Student's Manual:

It is the guide for female students of the experimental group to use the e-course, consisting of: introduction, manual purpose, the objective of using the e-course and the method of its use. The e-course was exposed to a group of validators specialists in teaching/learning techniques. In the light of their notes and guides, some modifications were carried out to have come at the final draft of the manual.

Steps of Study Tool Implementation

After checking the validity and reliability of the tool of the study, the researcher has taken the following steps:

- Random selection of the control and experimental groups.
- Conducting the Pre-Test (Torrance Test for Creative Thinking Skills) for the students (female) of the control as well as of the experimental groups.
- Conducting the research on the experimental group by teaching the e-course designed for the program 'Computer Uses in Teaching' via the Internet and teaching the control group in the traditional style for four weeks, two hours a week.
- Conducting the Pre-Test (Achievement, Torrance Creative Thinking Skills Test) for the students of both the groups.
- Test correction (Achievement, Torrance Creative Thinking Skills) so that one score is given for the correct answer, and zero for the wrong answer.
- Making appropriate statistical treatments.

Statistical Tools

The following statistical tools have been followed:

- Pearson Correlation Coefficient, to verify the validity of the internal consistency of the Achievement Test and Torrance Test (A), as well as the latter reliability.
- Cronbach's Alpha factor to attest reliability of the Achievement Test.
- Man-Whitney U test, which is a non-parametric test, is employed, instead of the T-test, to study the differences between two independent samples if comparisons are made between small-number groups. It was employed for evaluating the significant difference among the test scores of controls as well as experimental groups in the Pre-test and Post-test applications of both the Achievement Test and Torrance Creative Thinking test (A).
- Effect of Impact Equation: It was used to gauge the effect of electronic-course on the progression of Bloom's Cognitive Levels (i.e., Synthesis, Analysis and Evaluation) and Creative Thinking abilities (such as Fluency, Flexibility and Originality) of Experimental Group, and the Size of Impact is calculated by this Equation:

$$E_s = \frac{|z|}{\sqrt{n}}$$

Where $|z|$: is the absolute value of the standard degree z. n is the total sample size, (Corder & Foreman, 2011, p. 308). The degree of the impact is estimated by the following values: $0.1 \leq E_s < 0.3$ is a small impact size; $0\ 0.3 \leq E_s < 0.5$ is a medium impact size, and $E_s \geq 0.5$ is a large impact size.

Results & Discussion

This section is devoted to the research results statement and discussion through attesting the research hypotheses.

Testing the first hypothesis

The research hypothesis 1 stated that "The average scores of the control and the experimental groups of female students in the post test for Achievement at the Synthesis level exhibit no significant difference ($\alpha \geq 0.05$)."

Table 11 lists the results for Man-Whitney *U* value for the first hypothesis.

Table 11. *The difference between the results of the post-test application for the Synthesis level*

Group	Total Ranks	Average ranks	U Value	Z Value	Significance	Significant Level
Experimental	583	29.35	23	4.95	0.00	Significant
Control	233	11.65				

Table 11 demonstrates that the results of the post-test application of the Achievement Test at the Synthesis level were considerably different ($\alpha \geq 0.05$) for the control and the experimental groups and the differences supported the experimental group. The impact size (Es) of the e-course at the Synthesis level of the experimental group was 0.78, which is significantly large.

Testing the second hypothesis

The research hypothesis 2 stated that "The average scores of the control and the experimental groups of female students in the post test for Achievement at the Analysis level exhibit no significant difference ($\alpha \geq 0.05$)."

Table 12 lists the results for Man-Whitney *U* value for the second hypothesis.

Table 12. *The difference between the results of the post-test application for the Analysis level*

Group	Total Ranks	Average ranks	U Value	Z Value	Significance	Significant Level
Experimental	584.50	29.23	25	4.777	0.00	Significant
Control	235.50	11.78				

Table 12 demonstrates that the results of the post-test application of the Achievement Test at the Analysis level were considerably different ($\alpha \geq 0.05$) for the control and the experimental groups and the differences supported the experimental group. The impact size (Es) of the e-course at the Analysis level of the experimental group was 0.75, which is significantly large.

Testing the third hypothesis

The research hypothesis 3 stated that "The average scores of the control and the experimental groups of female students in the post-test for Achievement at the Evaluation level exhibit no significant difference ($\alpha \geq 0.05$)."

Table 13 lists the results for Man-Whitney *U* value for the third hypothesis.

Table 13. *The difference between the results of the post-test application for the Evaluation level*

Group	Total Ranks	Average ranks	U Value	Z Value	Significance	Significant Level
Experimental	583.50	29.18	26.5	4.88	0.00	Significant

Control	236.50	11.83				

Table 13 demonstrates that the results of the post-test application of the Achievement Test at the Evaluation level were considerably different ($\alpha \geq 0.05$) for the control and the experimental groups and the differences supported the experimental group. The impact size (Es) of the e-course at the Evaluation level of the experimental group was 0.77, which is significantly large. This can be attributed to the effectiveness of the e-course and its attractive ways and interaction with students. The results of this research are consistent with the findings of Pereira, Wen & Tavares (2015), which indicates positive achievement test results, and with those of Zengin (2012), which confirmed students' benefit from an e-course in learning. In addition, the results are also in line with the findings of Trotter (2007), which illustrates the impact of the syllabus on academic achievement.

Testing the fourth hypothesis

The research hypothesis 4 stated that "The average scores of the control and the experimental groups of female students in the post test of Achievement for the creative thinking skill evaluation of Fluency exhibit no significant difference ($\alpha \geq 0.05$)."

Table 14 lists the results for Man-Whitney *U* value for the fourth hypothesis.

Table 14. *The difference between the results of the post-test application of the creative thinking test for Fluency*

Group	Total Ranks	Average ranks	U Value	Z Value	Significance	Significant Level
Experimental	590	29.50	20	5.51	0.00	Significant
Control	230	11.50				

Table 14 demonstrates that the results of the post-test application of 'Torrance Test' for 'Creative Thinking' in Fluency skill were significantly different ($\alpha \geq 0.05$) for the control and the experimental groups and the differences supported the experimental group. The impact size (Es) of the e-course on the Fluency skill of the experimental group was 0.87, which is significantly large.

Testing the fifth hypothesis

The research hypothesis 5 stated that "The average scores of the control and the experimental groups of female students in the post test of Achievement for the creative thinking skill evaluation of Flexibility exhibit no significant difference ($\alpha \geq 0.05$)."

Table 15 lists the results for Man-Whitney *U* value for the fifth hypothesis:

Table 15. *The difference between the results of the post-test application of the creative thinking test for Flexibility*

Group	Total Ranks	Average ranks	U Value	Z Value	Significance	Significant Level
Experimental	530	26.50	80	3.82	0.00	Significant

Control	290	14.50				

Table 15 illustrates that the results of the post-test application of 'Torrance Test' for 'Creative Thinking' in Flexibility skill were significantly different ($\alpha \geq 0.05$) for the control and the experimental groups and the differences supported the experimental group. The impact size (Es) of the e-course on the Flexibility skill of the experimental group was 0.60, which is significantly large.

Testing the sixth hypothesis

The research hypothesis 6 stated that "The average scores of the control and the experimental groups of female students in the post test for the creative thinking skill evaluation of Originality exhibit no significant difference ($\alpha \geq 0.05$)."

Table 16 lists the results for the Man-Whitney *U* value for the sixth hypothesis:

Table 16. *The difference between the results of the post-test application of the creative thinking test for Originality*

Group	Total Ranks	Average ranks	U Value	Z Value	Significance	Significant Level
Experimental	540	27	70	4.10	0.00	Significant
Control	280	14				

Table 16 illustrates that the results of the post-test application of 'Torrance Test' for 'Creative Thinking' in Originality skill were significantly different ($\alpha \geq 0.05$) for the control and the experimental groups and the differences supported the experimental group. The impact size (Es) of the e-course on the Originality skill of the experimental group was 0.65, which is significantly large. Thus, it can be said that the e-course greatly affected the Fluency, Flexibility, and Originality skills of the experimental group, which demonstrates the effectiveness of e-course in developing the ability of female students to find and express ideas in an unfamiliar manner and to produce as many ideas creatively as possible. These results are in line with Bahar and Maker's (2011) study which aims to discover the relationship between creative ability in mathematics and mathematical achievement. Furthermore, the results are also in line with the study of Moma et al. (2013) in which the test subjects of the experimental group were found to be the best when evaluated for identifying the creative thinking abilities in mathematics.

Conclusion

Following is the summary of the result outcomes of the present research work:

1. The average scores obtained by the female students in the post-test for Achievement at the Synthesis level exhibit significant differences ($\alpha \geq 0.05$) between the experimental and the control groups, favoring the experimental group.
2. The average scores obtained by the female students in the post-test for Achievement at the Analysis level exhibit significant differences ($\alpha \geq 0.05$) between the two groups, favoring the experimental group.
3. The average scores obtained by the female students in the post-test for Achievement at the Evaluation level exhibit significant differences ($\alpha \geq 0.05$) between the two groups, favoring the experimental group.

4. The average scores obtained by the female students in the Achievement post-test for 'creative thinking skills for Fluency' exhibit significant differences ($\alpha \geq 0.05$) between the two groups, favoring the experimental group.
5. The average scores obtained by the female students in the Achievement post-test for 'creative thinking skills for Flexibility' exhibit significant differences ($\alpha \geq 0.05$) between the two groups, favoring the experimental group.
6. The average scores obtained by the female students in the Achievement post-test for 'creative thinking skills for Originality' exhibit significant differences ($\alpha \geq 0.05$) between the two groups, favoring the experimental group.

Recommendations

On the basis of the results of this study, it is recommended to:

- Develop digital content in line with e-learning standards, taking cues from the Corona pandemic and beyond.
- Train faculty members in courses concerned with e-course designing.
- Carry out experimental studies to measure the impact of e-courses for developing the skills of digital citizenship considering the pandemic disease of the Corona virus.
- Conduct research works on female students in the field of education for evaluating the effect of e-courses on the progression of graphical thinking abilities.

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References

Aboagye, E., Yawson, J. A., & Appiah, K. N. (2020). COVID-19 and E-Learning: the Challenges of Students in Tertiary Institutions. *Social Education Research*, 1-8.

Aikina, T. Y., Sumtsova, O. V. & Pavlov, D. I. (2015). Implementing electronic courses based on Moodle for foreign language teaching at Russian technical universities. *International Journal of Emerging Technologies in Learning*, *10*(3), 58-61.

Al-Azzawi, A. (2008). *Measurement and evaluation in the teaching process.* Amman: Degla House.

Al-Samiri, A. R. (2021). English Language Teaching in KSA in Response to the COVID-19 Pandemic: Challenges and Positive Outcomes. *Arab World English Journal (AWEJ),* Special Issue on Covid 19 Challenges April 2021, 147-159

Bahar, K., & Maker, J. (2011). Exploring the relationship between mathematical creativity and mathematical achievement. *Asia-Pacific Journal of Gifted and Talented Education*, *3*(1), 33-48.

Corder, G. & Foreman, D. (2009). *Non parametric statistics for non-statisticians: a step by step approach.* Willey sons Inc.

Eid, G. K. (2012). *Educational measurement and evaluation with SPSS applications*. Kuwait: Al Falah Library for Publishing and Distribution

Grégoire, J. (2016). Understanding creativity in mathematics for improving mathematical education. *Journal of Cognitive Education and Psychology*, *15*(1), 24-36.

Jackson, L., Witt, E., Games, A., Fitzgerald, H., von Eye, A. & Zhao, Y. (2012). Information technology use and creativity: Findings from the Children and Technology Project. *Computers in Human Behavior*, *28*(2), 370-376.

Kusmayanti, I., Sumantri, S. & Noornia, A. (2018). The Effect of Concept-Rich Instruction on the Ability of Mathematical Study School Students Under reviewed from Math Anxiety. *International Journal of Scientific and Research Publications*, *8*(8), 430-436.

Le, D. L., Tran, V. H., Nguyen, D. T., Nguyen, A. T. & Hunger, A. (2010). Applying Pedagogical Analyses to Create an On-Line Course for e Learning. In Setchi, R., et al. (Eds.), 14th International Conference on *Knowledge- Based and Intelligent Information & Engineering Systems* (KES 2010% 8- 10 September, Cardiff, Wales, UK, Lecture Notes in Computer Science, Vol. 6277, pp. 114- 123.

Moma, L., Kusumah, S., Sabandar, J. & Dahlan, A. (2013). The enhancement of junior high school students mathematical creative thinking abilities through Generative learning. *Mathematical Theory and Modeling*, *3*(8), 146-157.

Pereira, C. A., Wen, C. L., & Tavares, H. (2015). Alcohol abuse management in primary care: an e-learning course. *Telemedicine and e-Health, 21*(3), 200-206.

Trotter, A. (2007). School Subtracts Math Texts Add E-Lessons, Tests. *EducationWeek*, *26*(36), 10-11.

Wheeler, S. (2012). E-Learning and Digital Learning. In N. M. Seel (Ed.), *Encyclopedia of the Sciences of Learning* (pp. 1109–1111). Boston, MA: Springer.

Woodman, R. W., & Schoenfeldt, L. F. (1989). Individual differences in creativity. In *Handbook of creativity* (pp. 77-91). Springer, Boston, MA.

Zengin, O. (2012, April). A Case Study on Moodle: Investigating Students Perceptions on the Use of Moodle. Paper Presented in the *Ireland & UK Moodle moot 2012 Conference Publication.*