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BLENDED AND FLIPPED LEARNING: ENTREPRENEURIAL TEACHING STRATEGIES FOR ACQUIRING CREATIVE THINKING SKILLS

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Abstract

Purpose of the study: This study investigated the effect of blended learning and flipped learning strategies on acquiring creative thinking skills at its three levels: fluency, flexibility, and originality by tenth graders in science compared to the traditional method.

Methodology: Quasi-experimental method was used. The study was applied to 54 tenth-grade students from a private school who were divided into 3 sections, one of which was control while the other two were experimental. One of the experimental sections studied using the learning through real-world problems method of blended learning (Real World hereafter) while the other used flipped learning's 3D virtual worlds method. Creative thinking was measured by an immediate achievement test, which consisted of thirty questions designed to measure the three creative thinking skills. Moreover, the validity and reliability of the test were verified.

Main Findings: The findings yielded significant differences in favor of the experimental groups whose scores mean was noticeably higher. Furthermore, the experimental group that studied using flipped learning demonstrated better performance than that which studied using blended learning.

Applications of this study: this research will help to establishment of educational institutions specialized in designing and producing educational 3D virtual activities, such as 3D videos. Such activities need to be suitable for the Arabic educational background and in keeping with its culture and values.

Novelty/Originality of this study: The study reviews two learning strategies that allow educational institutions to break free from classroom restrictions and examines the extent of their ability to develop students' creative thinking. Currently, the need for these strategies has been increased by educational institutions, especially after COVID-19.

Keywords: *Blended Learning, Flipped Learning, Creative Thinking Skills, 3D Virtual Worlds, Real World.*

INTRODUCTION

In today's world, computerized educational programs have become one of the most important educational tools that provide a rich educational environment for students (Al Sarhan et al., 2013). Therefore, it is necessary to use a variety of technology-based teaching strategies that stimulate students' interests, motivate them to learn, and provide them with experiences that develop their thinking and innovation skills. Such strategies would also help them develop their skills in the use of modern technological tools and ultimately facilitate the integration of the teaching and learning processes (Bedolla et al., 2017; Piedra Noriega et al., 2019).

Technological advances have affected education in a way that makes it imperative for educational institutions to reconsider the selection bases of curricula and teaching methods. Therefore, it is necessary to keep up with the information age and create generations that can deal with computer technologies to cope with rapid changes (R. Raja & Nagasubramani, 2018).

E-learning is an integrated system that consists of teachers, students, and electronic content. In this system, the teacher is responsible for facilitating learning while the role of students transcends the mere accessing of information to enable participation, commenting, and giving opinions. The teacher must always guide the learning process and ensure that the electronic content is suitable to students' level. The teacher must also ensure that the content is appealing for the students to promote interaction between the students themselves, between the students and the content, and between the students and the teacher. (Al-Samarraie et al., 2018; Meskhi et al., 2019). In this regard, Murugesan (2019) highlighted the importance of developing modern strategies that serve the learning process. Such strategies should employ technology in curriculum building to improve the quality of education (Saxena, 2017; Kapur, 2019).

Although technology has contributed to enriching the learning process, developed students' cognitive processes; and helped to easily store and retrieve information, some studies such as Meskhi et al. (2019) revealed some shortcomings of e-learning. Such shortcomings include material problems like the lack of financial support, the variations between teachers and students in technical skills; the lack of competencies necessary to use information and communication technology in the educational process; and the unwillingness to deal with technological tools. Also, the traditional method is still heavily used by teachers, and students are still mainly dependent on teachers as the source of information(F. U. Raja & Khan, 2018). Therefore, it is necessary to adopt a strategy that combines the traditional method, which cannot be completely dispensed with, and e-learning. In this way, it is possible to benefit from education

in classrooms and online education. The blended learning strategy emerged as a method that combines the employment of computer technology, particularly the internet, and the traditional styles (R. Raja & Nagasubramani, 2018).

Although blended learning has several advantages, such as flexibility; reduced material costs; and increased interaction between learners (Dziuban et al., 2018; Singh, 2020), it faced some obstacles in its application. These obstacles include the lack of the components of blended learning system such as technical requirements; the unwillingness to move from the traditional methods; the lack of training for teachers in the necessary technical skills; the technological gap between teachers and learners; and the problem of cultural adaptation (Guri-Rosenblit, 2018).

Despite these constraints, many types of blended learning have emerged in the past few years, such as the rotational model (Wilkes et al., 2020), flexible model (Li et al., 2020), selective model (Uzir et al., 2020), and improved virtual model (Fleischmann, 2020). However, the most common is the rotational model, with its four sub-models. The most important of which is the flipped learning model, which has risen as a result of developments in the blended learning environment. Although flipped learning is a development of blended learning, its concept, and the way it is applied make it a separate strategy (Cabı, 2018).

Flipped learning is a strategy based on the direct interaction between teachers and learners as well as between learners themselves(Akçayır & Akçayır, 2018). In flipped learning, a teacher creates a lesson in the form of videos, audio clips, or other media and then uses technology, particularly the internet, to share the lesson with students who can access it anytime, anywhere(Fielden Burns et al., 2020). During class, the teacher dedicates some time for doing the online-lessons exercises to check the students' comprehension of the lesson(Awidi & Paynter, 2019). The teacher then classifies the students based on their level of comprehension and accordingly helps the students who haven't achieved the lesson's objectives utilizing those who have fully achieved the objectives (Chang & Hwang, 2018; Zhang & Wang, 2017).

Ng & Lee (2019) define creative thinking as a mental process, in which an individual has a high degree of sensitivity to problems, deficiencies, cognitive gaps, as well as missing and contradictory elements. It also includes the ability to identify difficulties and search for solutions. In creative thinking, reaching solutions starts with the formulation of hypotheses about deficiencies and testing and retesting these hypotheses to ultimately achieve results or solutions (Frey, 2018).

Many studies emphasized the importance of paying attention to creative thinking in teaching physics and science (Ng & Lee, 2019; Alzoubi et al., 2016). Also, there is a scarcity of previous studies that deal with learning based on real-life problems and 3D virtual worlds and their effect on creative thinking in general and physics in particular (Chen, 2016; Ferguson, 2011; Palanica et al., 2019; Rive & Karmokar, 2016; Vickers, 2010).

Bower et al. (2017) and Chang & Hwang (2018) recommended in their studies conducting more studies regarding employing the virtual worlds in teaching science. Accordingly, this study investigates the effect of employing 3D virtual worlds and learning based on real-life problems on creative thinking in physics.

This study's theoretical significance stems from being an attitude shaper. Its positive effects on developing creative thinking skills will help teachers, supervisors, and parents form positive attitudes towards blended and virtual learning strategies (Alsalhi et al., 2019; Cohen & Sasson, 2016; Hassan Ja'ashan, 2015; McCutcheon et al., 2018; Shorey et al., 2018). Practically, this study is expected to direct parents' attention to the teaching practices that can be applied outside the classroom to promote their children's creative thinking skills. Besides, the study enables educational supervisors to draw the general guidelines and mechanisms for training teachers on how to plan their lessons by blended and virtual learning strategies.

The modern education orientation is not limited to the emphasis on problem-solving only; rather, it focuses on solving a problem by utilizing creative methods (Gandri et al., 2019; Maskur et al., 2020). Creative thinking represents one of the important outcomes of the learning and teaching processes (Atmojo & Sajidan, 2020; Kartika et al., 2019; Selvy et al., 2020).

The present study aims at answering the following main question: are there any significant differences at ($\alpha \leq 0.05$) between the score means of tenth-grade female students in the creative thinking test and can these differences be attributed to the 3D virtual worlds, the real world, or the traditional method?

LITERATURE REVIEW

Flipped Learning: 3D virtual worlds method

Chang & Hwang, (2018) define 3D virtual worlds as 3D computer simulation, which is classified into three levels according to the degree of immersion. The degree of immersion means the degree to which an individual realizes that they are interacting with the virtual environment rather than their physical environment, in addition to the degree of their distinction between reality and virtuality. The operational definition of the 3D virtual worlds is a three-component teaching method that uses the (3D-HUB) software and three-dimensional videos selected to suit the *Electromagnetics* chapter in the tenth-grade physics textbook. Its third component is the teaching material, whereby the *Electromagnetics*

chapter was reformulated as a step-by-step teaching manual. Besides, the 3D virtual world is utilized as the teaching method of flipped learning.

Blended Learning: Real-world problems method

Desai (2018) defines learning through real-world problems as the learning activities that achieve learning outcomes by prompting students to focus more on finding solutions to a problem than on the problem itself. The operational definition, however, is the teaching activities of blended learning used to teach the students of the experimental group.

Previous studies

In a previous study related to blended learning and flipped learning, Harb (2013) sought to find out the effect of the blended learning strategy on the immediate achievement and retention of the students of the elementary stage in Jordan. The sample of the study consisted of 60 eighth-grade students from a private school. They were divided into two groups: control and experimental, each consisting of 30 students. An achievement test was used as a tool to collect data. The findings showed that there were significant differences at ($\alpha \leq 0.05$) between the scores mean of the experimental and control groups in immediate achievement, in favor of the experimental group.

In another study, Alsalhi et al. (2019) investigated the effect of blended learning on the achievement of secondary students in studying biology as well as their attitudes towards using the internet in learning. The quasi-experimental methodology was used, whereby two tools were employed. The first was an achievement test and the second was an attitude scale consisting of six dimensions to measure students' attitudes toward blended learning. The sample of the study consisted of 107 students from the ninth grade in a Turkish secondary school. The findings of the study revealed significant differences at ($\alpha \leq 0.05$) between the means of the two groups in the achievement test and the attitude scale in favor of the experimental group, which studied using the blended learning strategy.

A study conducted by Al-Qatawneh et al. (2019) aimed at exploring the effect of using blended learning on the achievement of home-economics students in the secondary stage and their attitudes toward it. Two instruments were used to measure the attitudes of students toward blended learning: the first was an achievement test while the second was a questionnaire. The sample was limited to two vocational secondary schools in Amman. They were selected by using random cluster sampling. One of the two schools was the control group with 22 students, while the other was the experimental group with 17 students. They were taught by using the blended learning strategy. The findings showed that there were no significant differences at ($\alpha \leq 0.05$) between the achievement of the students in both groups.

Hussein El Omari et al. (2016) conducted a study that developed a training program in teaching science based on blended learning to develop students' cognitive thinking skills. The study sample consisted of 140 male and female students of the ninth-grade students from two UNRWA schools in the Hebron area of Palestine, divided into four classes. Two of them were experimental and the other two controlled. A training program in teaching science based on blended learning was prepared for ninth-grade teachers in addition to an achievement test designed to measure students' cognitive thinking skills. The findings of the study showed that there were significant differences at ($\alpha \leq 0.05$) attributed to the effect of the training program in teaching science using blended learning in developing the beyond-cognitive thinking skills of the experimental classes.

Harahap et al. (2019) conducted a study to investigate the effect of blended learning on the development of central thinking skills and achievement in science by basic-stage students. The sample consisted of 135 male and female students in the fourth grade, from two schools in Amman. They were distributed into two groups: an experimental group with 67 male and female students who studied by using the blended learning method while the control group studied by using the traditional method. The findings of the study indicated that there were significant differences at ($\alpha \leq 0.05$) in the development of the central thinking skills in favor of the experimental group.

The study conducted by Albool (2012) examined the effect of utilizing the storytelling strategy in teaching mathematics on the achievement of grade four students and their motivation towards learning mathematics. The study sample consisted of 71 male and female students from Jordanian schools. The experimental group included 38 male and female students, while the control group consisted of 33 male and female students. An achievement test and a motivation-measuring instrument were used as the tools of the study. The findings showed significant differences at ($\alpha \leq 0.05$) between the scores mean in the achievement test of the experimental and control groups in favor of the experimental group.

Ümit Yapici & Akbayin (2012) carried out a study aimed at testing the effect of using blended learning on the achievement of secondary stage students in biology and their attitudes toward it. A sample was selected randomly from a private secondary school. The sample was 51 students who were divided into two equivalent groups, one of which was experimental with 26 students while the other was control consisting of 25 students. The tools of the study were an achievement test and a questionnaire that measured the attitude towards blended learning. The findings showed that there were significant differences at ($\alpha \leq 0.05$) in the scores mean of the achievement test between the experimental and control groups in favor of the experimental group. The findings also revealed that there were positive attitudes toward blended learning.

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METHODOLOGY

Research Design

This research uses a quantitative approach. Data collection is done Through Test Instrument. The quasi-experimental design was applied to investigate the effect of blended learning and flipped learning strategies on acquiring creative thinking skills.

Participants

The sample of the study was selected using judgmental sampling. It consisted of 54 female students who were divided into three groups: two were experimental and the third was control. Each group had 18 tenth-grade female students. The place in this research is in Modern Montessori School, Amman, Jordan.

Research Instruments

The study employed a creative thinking test as its instrument. The test consisted of thirty questions designed to measure three creative thinking skills: fluency, flexibility, and originality. The instrument's validity was verified by ten experts whose remarks were used to modify the test. Then the instrument was applied to a pilot sample of 30 students, not including the experimental sample. The instrument featured a correlation coefficient at (0.78) which demonstrated a level of validity that allows the application of the instrument. As for the instrument's reliability, it was verified using Half Split method yielding a Cronbach's Alpha Coefficient of (0.86) which showed good reliability. Table (1) shows the correlation coefficient and Cronbach's Alpha according to creative thinking skills.

Table 1: Correlation coefficient and Cronbach's Alpha of creative thinking skills

Creative Thinking Skill	No. of Questions	Validity		Reliability
		Pearson Correlation	Sig	Cronbach's Alpha
Fluency	10	0.82	0.000*	0.91
Flexibility	10	0.77	0.000*	0.81
Originality	10	0.74	0.000*	0.85
Overall	10	0.78	0.000*	0.86

Data Analysis Techniques

To investigate the role of blended learning and flipped learning strategies (Independent Variables) on acquiring creative thinking skills (Dependent Variable with Three levels):

- The Normality distribution were examined by the Kolmogorov-Smirnov Test .the test showed that the sampled population is normally distributed with D(54)= 0.083, P=200.
- Means and standard deviations of the three groups' performances were calculated to find out any differences between these groups.
- To find out whether these differences were affected by any confounding variables, the MANCOVA test was employed.
- Adjusted means and standard deviations were calculated to neutralize the effect of any confounding variables.
- LSD test for post comparisons were calculated to find the effect of each teaching method after neutralizing the differences that resulted from the interaction between the three teaching methods, i.e. the confounding variables.

RESULTS/FINDINGS

The main question is "are there any significant differences at ($\alpha \leq 0.05$) between the score means of tenth-grade female students in the creative thinking test and can these differences be attributed to the 3D virtual worlds, the real world, or the traditional method?

To answer the question, the means, standard deviations, and multi-variance analysis (MANCOVA) of the three groups' performance were calculated as shown in Tables (2-5).

Table 2: The Means and Standard Deviations in the Creative Thinking Test According to the Teaching Methods

Creative Thinking Skill	Teaching Method	No. of students	Pre-test		Post-test	
			Mean	S.D.	Mean	S.D.
Fluency	Traditional Method	18	31.50	6.87	37.56	6.61
	Real World	18	34.72	6.03	45.33	7.35
	Virtual Worlds	18	33.89	6.96	48.67	11.14

Flexibility	Traditional Method	18	24.78	8.60	30.00	7.90
	Real World	18	24.61	6.91	37.78	10.14
	Virtual Worlds	18	25.61	7.65	41.44	10.29
Originality	Traditional Method	18	28.72	10.42	36.22	9.15
	Real World	18	30.78	10.21	45.00	13.93
	Virtual Worlds	18	29.56	10.53	47.00	12.41
Total score	Traditional Method	18	85.00	24.28	103.78	21.03
	Real World	18	90.11	20.80	127.80	25.20
	Virtual Worlds	18	89.06	30.48	137.10	30.48

Table 2 indicates that there were apparent differences between the means of the three groups. The means of the experimental groups which studied using 3D virtual worlds and the real-world were better than the means of the traditional method group. The students of the flipped learning (3D virtual world) method achieved the highest mean in the creative thinking test as a whole with (137.10) and the test's parts: fluency, flexibility, and originality (33.89), (25.61), and (29.56) respectively.

Table 3: MANCOVA of the Study Groups in the Creative Thinking Test

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

Table 3 shows that the "F" value of the fluency skill according to the teaching method was (10.865) (sig=0.000). This result means that there were significant differences in the performance of the three groups in the fluency skill in favor of the 3D virtual world method.

As for the F-value of the flexibility skill in the 3D virtual world method, it was (11.219) with (sig= 0.000), which indicates that there were significant differences in the performance of the three groups in the flexibility skill in favor of the 3D virtual worlds method. However, when it comes to the originality skill, the 3D virtual world method was (5.550) with (sig= 0.007), which indicates that there were significant differences in the performance of the three groups in the originality skill in favor of the 3D virtual world method.

It is shown that the "F" value of the total score of the creative thinking test according to the 3D virtual worlds method was (16.586) with (sig= 0.000) which indicates that there were significant differences among the means of the three groups in the total score in favor of the 3D virtual world method.

Based on the above, it is concluded that the higher means of the 3D virtual worlds group was affected by confounding variables, which necessitate calculating the means and adjusted standard deviations to neutralize the effect of these confounding variables.

Table 4: Adjusted Means of the Study Groups in the Creative Thinking Test

Creative Thinking	Teaching Method	No. of Students	Adjusted Mean	Standard Error
Fluency	Traditional Method	18	39.443	1.347
	Real World	18	43.910	1.348
	Virtual Worlds	18	48.202	1.307
Flexibility	Traditional Method	18	30.944	1.500
	Real World	18	37.192	1.501
	Virtual Worlds	18	40.808	1.455
Originality	Traditional Method	18	37.590	2.037
	Real World	18	43.622	2.039
	Virtual Worlds	18	47.010	1.977
Total Score	Traditional Method	18	107.977	3.455

	Real World	18	124.725	3.497
	Virtual Worlds	18	136.021	3.391

Table 4 indicates that the adjusted performance means of the experimental group, which used 3D virtual worlds, were the highest in fluency, flexibility, originality, and the total score. They were (48.202), (40.808), (47.010), and (136.021), respectively, followed by the adjusted performance means of the experimental group which used the real world. They were (43.910), (37.192), (43.622), and (124.725), respectively. On the other hand, the control group that was taught by the 2Dtraditional method had the lowest adjusted means. These means are (39.443), (30.944), (37.590), and (107.977) respectively.

Table 5: LSD test for Post Comparisons among the Adjusted Means in the Creative Thinking Test

Creative Thinking Skill	Teaching Method	Adjusted Mean	Traditional Method		Real Words	
			Mean Diff	Sig	Mean Diff	Sig
Fluency	Traditional Method	39.443				
	Real World	43.910	4.467*	0.028		
	Virtual Worlds	48.202	8.759*	0.000	4.292*	0.027
Flexibility	Traditional Method	30.944				
	Real World	37.192	6.249*	0.006		
	Virtual Worlds	40.808	9.865*	0.000	3.616	0.091
Originality	Traditional Method	37.590				
	Real World	43.622	6.031*	0.048		
	Virtual Worlds	47.010	9.419*	0.002	3.388	0.240
Total score	Traditional Method	107.977				
	Real World	124.725	16.747*	0.002		
	Virtual Worlds	136.021	28.043*	0.000	11.296*	0.025

Real World Method Vs Traditional Method

Table 5 clarifies that there were significant differences between the control group and the experimental group which studied physics using the real world. The difference was (4.467) in the fluency skill at (0.028) in favor of the real world. The difference between the two groups concerning the flexibility skill was (6.249) at (0.006) in favor of the real world. While the difference was (6.031) at (0.048) about the originality skill, the difference in the total score was (16.747) at (0.002) in favor of the real world.

3D. Virtual Worlds Method Vs the Traditional Method

Table 5 also shows that there were significant differences between the control group and the experimental group that studied physics using 3D virtual worlds. The difference was (8.759) at (0.000) in the fluency skill in favor of the virtual worlds. For flexibility, the difference was (9.865) at (0.000) in favor of the virtual worlds. The difference was (9.419) at (0.002) in originality in favor of the virtual worlds. As for the total score of the creative thinking test, the difference was (28.043) at (0.000) in favor of the virtual worlds.

3D. Virtual Worlds Method Vs Real World Method

Comparing the experimental groups, Table 5 shows that there were significant differences in fluency between the group which used the real world and the one which used 3D virtual worlds. The difference was (4.292) with (sig= 0.027) in favor of the virtual worlds. Inflexibility, the difference between the two groups was (3.616) with (sig= 0.091), which was not significant at ($\alpha \leq 0.05$). The difference between the two groups in originality was (3.388) with (sig= 0.240) and, therefore not significant at ($\alpha \leq 0.05$). The difference between the two groups in the total score was (11.296) with (sig= 0.025) which was significant at ($\alpha \leq 0.05$) in favor of the virtual worlds.

DISCUSSION/ANALYSIS

The following sections present an analysis of the results of the group which studied using the 3D virtual world method. Each part of the creative thinking test is discussed separately.

Effectiveness of Using 3D Virtual Worlds on the Fluency Skill

The means of the fluency questions were the highest for the students who studied using blended learning's 3D virtual worlds method (Reisoğlu et al., 2017). This significant difference can be attributed to the method's role in providing clearer procedures for the learning process, which increased the interaction between the students themselves and between the students and the teacher (Cho et al., 2015). This increased interaction was evident in the high number of students who responded to class activities. On the other hand, the students who used the real-world method scored higher than those who used the traditional method. This can be due to the role of real-world activities in enhancing creative thinking, which leads to better fluency (York, 2020).

Effectiveness of Using 3D Virtual Worlds on the Flexibility Skill

In the questions of the flexibility skill, the students who studied using flipped learning and blended learning had the highest means (X. Zhang et al., 2017). These differences were significant as they reflected the capabilities of these strategies in broadening the students' thinking faculty. In blended and flipped learning, students are exposed to a wide range of activities that require the students to think in different directions to solve a problem (Halasa et al., 2020). Consequently, they acquire thinking flexibility as opposed to the traditional method, which forces students to think in a preordained direction. On the other hand, the lack of differences between the means of the flipped learning (real world) and blended learning (3D virtual worlds) can be attributed to the diversity of their activities which leads to the students becoming more flexible thinkers as they use either one of these strategies.

Effectiveness of Using 3D Virtual Worlds on the Originality Skill

The means of the originality questions were the highest for the students who studied using flipped and blended learning. Such an advantage can be viewed as a result of these strategies' imaginative activities, which require students to break free of routine solutions and think more outside the box to come up with creative solutions (Leveaux et al., 2019). On the contrary, to tackle activities in the traditional method, students need only abstract knowledge. As for the lack of differences between the means of the flipped learning and blended learning, it can be associated with the nature of the activities of these strategies where students deal with activities that focus on finding creative solutions to a problem. Needless to say, originality is an integral part of a creative solution (Lin et al., 2017).

Effectiveness of Using 3D. Virtual Worlds on Creative Thinking Skills

In total, there were significant differences in the means of creative thinking in favor of the students who studied using flipped learning's 3D virtual worlds. The significance of this result is that it serves as a testimony to this method's capability of creating a learning environment conducive to creativity (Burton & Martin, 2017). This is due to the method's potential in providing creative learning processes that combine the three creative skills: fluency, flexibility, and originality. However, in the real world method, students spent less effort in their activities since the fluency skill was less evident than in the 3D virtual worlds (Hu et al., 2016).

CONCLUSION

- Blended learning strategy has an effect on acquiring creative thinking skills at its three levels: fluency, flexibility, and originality for tenth graders in science compared to the traditional method.
- Flipped learning strategy has an effect on acquiring creative thinking skills at its three levels: fluency, flexibility, and originality for tenth graders in science compared to the traditional method.
- Flipped learning strategy has an effect on acquiring creative thinking skills at its three levels: fluency, flexibility, and originality for tenth graders in science compared to the traditional method.
- There were significant differences in Creative thinking skills generally and particularly in fluency, between the group which used blended learning and the one which used flipped learning. in favor of flipped learning.
- There were no significant differences in flexibility and originality between the group which used blended learning and the one which used flipped learning.

LIMITATION AND STUDY FORWARD

This study was restricted to the tenth-grade female students from a private school in Amman, in the first semester of the academic year 2019/2020. The generalization of the findings is determined by the extent of the validity and reliability of the instruments and by the objective responses of the study subjects.

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AUTHORS CONTRIBUTION

The First author is wiring the paper, analyzing the data, revision, and making study improvement, the second author is responsible for the related literature and referencing, the third author is collecting data as well as refining the language of the study.

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