

# **The Impact of Teaching Limits and Differentiation Using Blended Learning on Achievement & Motivation Development to Learn**

**By**

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## **Abstract**

This study aimed to investigate the impact of blended learning on students' achievement and their motivation to learn limits and differentiation. To achieve the research goal, the researchers employed a quasi-experimental methodology. The study's population consisted of (65) male students from one of secondary school at the directorate of education in Bukayriyah governorate, divided into two groups of students who were assigned as the control group (32) and experimental group (33). The data were collected by two instruments, one to determine students' mathematical achievement and the other to explore their motivation to learn limits and differentiation. The validity and reliability of the instruments were verified by using scientific methods and procedures. The results showed that teaching limits and differentiation through a blended learning method has an effect on academic achievement and on the student's motivation to learn. The study concludes with suggestions and recommendations that support employing blended learning due to its positive effect on teaching mathematics.

**Keywords:** Blended Learning, Achievement, Motivation, limits and differentiation, Secondary Students.

## **Introduction**

Today, the education system encounters great challenges more than ever. Some of these challenges concentrate on finding new methods and strategies of teaching and learning to follow up with the new technology. The technological revolution and the information era have had an impact on all of all life aspects, especially, in the field of education. Therefore, learners of today need new and creative methods that employ new technology. Moreover, with scientific and technological progress in educational innovations in general and in teaching methods in particular, new movements emerged in teaching and learning methods, taking into consideration individual differences, and the role of communications technology that required active learners who should participate in the learning process.

Blended learning is considered one of the most prominent methods; this method is based on the idea of integration of technology and normal method of teaching with the support of audio-visual devices, educational applications, and various platforms with the availability of the Internet.

According to (Garrison & Kanuka, 2004; Hofmann, 2004), blended learning is a program in which built to equip the learner with the knowledge and skills that in need to allocate a meaningful learning process and in consequence achieve learning outcomes in the best possible way. In addition, (Moon & Michele, 2015; Abdallah et al., 2021; Fannakhosrow et al., 2022) agreed that blended learning includes several principles, such as focusing on the outcomes, rather than the process of transferring knowledge. The main idea of this method is to guide the student through building learning experiences based on self-learning backed by technology.

In terms of the effectiveness of blended learning, (Hamail, 2010; Adcadek, 2011; Tseng & Chiang, 2017) assured that blended learning is one of the most efficient systems; as it improves the effectiveness of the entire educational process, increases communication between the teacher and students, contributes to achieving more successful results, increases the efficiency of students, as it has a great impact on the educational process and leads to radical progress in the effectiveness of education compared to the normal methods of education. It also contributes to making the educational process easier and more flexible.

The definitions of blended learning have varied among educational experts, depending on their different pedagogical and philosophical principles. Blended learning is defined as a term that is used to express education that combines e-learning with regular methods of education to create a new methodology in education (Chupradit et al., 2023; Alsalhi et al., 2021). This method represents a significant change in the basic methods of education, such as a change in the way both students and teachers deal with the learning experience. (Buket, 2006; Rasheed et al., 2021 a) defines it as one of the education methods that combine regular education in its various forms with e-learning, combining the best normal methods of education with those offered through new media such as the Internet. While (Garrison & Kanuka, 2004; Abdallah et al., 2021) defined it as a type of education in which an effective set of multiple means of presentation, teaching methods, and learning styles that facilitate the learning process is used, which is built on the integration basis of methods in which students meet face-to-face with e-learning methods.

Blended learning is also one of the modern strategies in education, as it is gradually replacing e-learning, it could be an acceptable method nowadays (Mansour, 2011). It is an even higher yielding, less expensive, and the most sophisticated type of modern learning as it is the mix of regular teacher roles in regular classrooms with the roles of the e-teacher in virtual classrooms. It is a learning process that combines regular learning and e-learning (Wardat et al., 2021; Al-Qahtani & Higgins, 2013).

Blended learning also enables students to self-improvement and development, reduces their stress, increases self-satisfaction, focuses on the active and effective role of the student in obtaining knowledge and acquiring skills through the integration of individual and cooperative activities, instead of the negative role of the student in receiving information, and allows them to communicate and interact positively between students and the teacher or between the students themselves (Rasheed et al., 2021 a; Chupradit et al., 2023). Blended learning would contribute significantly to achieving more successful results, making the educational process easier and more flexible, increasing the efficiency of students and their sense of responsibility

so that the student becomes responsible for his learning (Akbarov, Gonen, & Aydogan, 2018; Jarrah et al., 2020; Jarrah et al., 2022; Rasheed & Tashtoush, 2023). It also required a type of teacher who can combine the regular teaching process with technology, as the teacher must know how to deal with computer technology and its software, and applications, research on the Internet, design electronic tests, as well as dealing with e-mail and exchange of messages with students. The teacher also must be able to facilitate and explain main concepts and employ effective teaching through multimedia and the Internet (Lin et al., 2017).

It has been noticed all over time, that one of the most important issues of education is the student's academic achievement. Taking into consideration the importance of mathematics in improving students' academic achievement, due to its logical method of teaching critical thinking skills. Recently, however, there is a significant decrease in students' achievement in mathematics (Tashtoush et al., 2020 b; Wardat et al., 2021). This was clear in the results of Trends in International Mathematics and Science Study (TIMSS). The results of the test indicated that there is a significant decrease in the levels of student achievement in mathematical thinking skills for example. In USA, which is considered one of the most developed countries in the world, the results showed a significant decrease in the student's achievements at the level of acquisition of skills in science and mathematical thinking, and basic mathematics skills.

From the foregoing, we conclude that the majority of students suffer from a general impairment in achievement in mathematics, which requires improving students learning and achievement by employing new methods and strategies. More than researchers referred to the reasons behind students' achievement in math (Tashtoush et al., 2022 a), the main reason behind the students' weaknesses and failure to achieve outstanding academic achievement are the students lack awareness, lack of self-confidence, fear of failure, as well as lack of using inappropriate teaching strategies that combine the regular method with e-learning method.

In addition, the physical and psychosocial prevailing in the educational environment, the classroom's environment plays an important role in the development of the student's performance. The teacher can provide an appropriate environment within the classroom to help students develop their level of motivation and performance. Noting a large percentage of our students, we glimpse the low motivation to learn mathematics in them, which is one of the most prominent educational problems that have emerged recently, that requires studying to identify their causes and symptoms and try to find ways to solve them (Tashtoush, et al., 2022 b).

(Yasin & Isik, 2003; Helal, 2020; Lin et al., 2017) believe that the development of motivation to learn is one of the most important objectives of teaching mathematics, it contributes to the development of academic achievement and creativity, as it helps to reach all the goals of teaching mathematics. Learning mathematics cannot be achieved without the presence of motivation to learn, and for learning to be meaningful, it is necessary to link the material with the previous educational structure considering the gradation in concepts from simple to complex. The teacher must use the appropriate strategy to present the lesson, and urge students to have the greatest role in learning. Accordingly, performance motivation is a great indicator for predicting the level of academic achievement referring to (Moon & Michele, 2015).

Education experts believe that it is necessary to enhance the student's motivation to learn mathematics and to reach academic progress and outstanding achievement, by providing the appropriate educational environment that works to engage in activities, and integrate into educational situations that provoke their motivation, sense of surprise, confusion, and

modernity, as well as using the best strategies that increase motivation such as e-learning (Rasheed & Tashtoush, 2023; Al-Qahtani & Higgins, 2013).

(Helal, 2020; Aboqdayre, 2021; Alsalhi et al., 2021; Jarrah et al., 2022) studies indicated that low motivation to learn mathematics is a condition that students experience during, before, or after studying, which leads to laziness and lack of effort, which loses them the enthusiasm and positivity necessary to study seriously. The manifestations of low motivation to learn mathematics in students are represented in the weak desire to learn mathematics in some, lack of enthusiasm and positivity for school work, lack of sufficient effort commensurate with students' preparations and ability, low interest in creative duties, lack of response to the teachers' instructions and school or university administrations, and neglect of the materials necessary to learn as books, tools, and instructional media. Therefore, the reasons for low motivation to learn mathematics problems in students are mainly having wrong ideas about the importance of mathematics in general and the subjects of limits and differentiation in particular, the difficulty of the material that does not suit their abilities, and the lack of an appropriate educational atmosphere for the student's psyche.

## **Problem Statement**

Limits and Differentiation is one of the important areas taught at the secondary schools. It is considered a main pillar in the disciplines of engineering, mathematics, physics, economics, and administrative sciences. However, based on the researchers' experiences in schools and higher education, they noticed that the majority of students feel that these areas are characterized by abstraction and difficulty, an obstacle for many of them as it is an abstract subject that has nothing to do with reality or life. They feel mathematics has nothing to do with their daily lives. Perhaps one of the most prominent reasons is due to the teaching methods used in these subjects, which was confirmed by frequent observations of the researchers that there is a cumulative weakness in the academic achievement, the lack of motivation to study these subjects, and the frequent complaints from students about it. Since the regular teaching methods used in educational situations make the role of students negative and ineffective, the researchers considered using a blended learning strategy as a teaching method that combines the regular method and e-learning as a scientific attempt to know the impact of teaching limits and differentiation using blended learning in the developing motivation and academic achievement. More specifically, the problem with the study generated by the following two questions:

1. What is the impact of Blended Learning on students' achievement to learn limits and differentiation?
2. What is the impact of Blended Learning on students' motivation to learn limits and differentiation?

## **Study Significance**

The study derives its importance from the importance of its subject, as it deals with an important dimension of the educational process. The study of the impact of blended learning indicates the actual reality of succeeding in the teaching and learning processes, thus knowing the main challenges resulting from applying blended learning, in line with international trends that call for introducing a computerized curriculum in teaching mathematics; to suit the technological progress and information technology development. The importance of this study is also in using a modern method in education that tries to benefit from the pros of both regular

education and e-learning and overcome the cons of each one of them. This study can provide feedback to those who teach mathematics to include such a method in their plans teaching mathematics, and feedback also to those who prepare the computerized curriculum and modify the study plans in light of this study's results.

## **Study Objectives**

This study aims to improve the teaching quality and increase the effectiveness of learning, participating with students and supporting their performance through engaging technological innovations, increase interaction directly or indirectly between teachers and educational content, as well as reducing the expenses of teaching and learning, as the researchers hopes that the results of this study contributes to developing the mathematics curriculum computerized material and another curriculum, whether undergraduate or school and give a clear picture of it, improve the methods of teaching mathematics, and help decision makers to know the effectiveness of applying the idea of computerized platform.

## **Limitations**

- The study is limited to the students of the of High school male students in schools affiliated to the directorate of education in Al Bukayriyah governorate during the second semester 2021/2022.
- This study is limited to developing motivation and improving the academic achievement level of students of AL-Helaliya High school male students.
- This study is limited to its instruments and psychometric properties of reliability and validity acceptable for scientific research purposes, prepared to achieve the study objectives.

## **Procedural Definitions**

- Blended Learning: A type of education that combines regular education in its various forms with e-learning, it mixes the best regular methods of procedural education with those materials offered through electronic media, such as computers, the Internet, and E-learning system (Moodle).
- Motivation to Learn Mathematics: A special case of the desire to learn, which pushes the learner to pay attention and desire to learn mathematics through the computer, pay attention to the educational situation and actively demand it, and continue this activity until learning is achieved. The motivation mark for learning mathematics is determined by the score students receive on the motivation scale prepared for this purpose.
- Mathematical Achievement: The number of facts, concepts, generalizations, theories, and laws that students acquire, which is measured by the degree that students obtain in the achievement test prepared according to the purposes of this study.

## **Literature Review**

By reviewing the previous studies, several studies have shown the impact of blended learning in teaching and learning mathematics at different school levels for different age groups. In this field (Faraj Alla, 2018) conducted a study aimed at investigating the impact of using blended learning in mathematics teaching curricula on the student's achievement of primary education at Al-Aqsa University and their attitudes towards it, to achieve this goal the researcher used the analytical descriptive approach, the study sample consisted of (100)



students distributed in two groups; experimental and controlled, the study data was collected from its two tools: Mathematical achievement test and a measure of students' attitudes towards blended learning, the study concluded that there is a significant impact of blended learning on students' achievement and attitudes towards of mathematics.

The study of (Al Qahtani, 2018) aimed to investigate the impact of teaching mathematics using blended learning on seventh-grade students' achievement and critical thinking skills development in mathematics, the researcher used the semi-experimental approach with two equal groups: experimental and controlled, where she designed an integrated electronic program and prepared two tests to measure mathematical achievement and critical thinking skills for a random sample of (50) students in KSA, the results showed that there is a significant impact on raising the level of mathematical achievement and developing critical thinking skills in the study subjects.

The study of (Lin, Tseng, and Chiang, 2017) aimed to reveal the effectiveness of a teaching strategy based on blended learning via the teaching platform (Moodle) on high school students' mathematical achievement and the development of motivation towards learning mathematics by using the semi-experimental approach. The results showed that the blended learning experience benefited students in the experimental group through its positive impact not only on raising their level of academic achievement but also on developing their motivation towards learning mathematics, students also showed great satisfaction as a result of using the teaching platform (Moodle).

As for the kindergarten level, (Abdalhameed, 2014) conducted a study aimed at developing mathematical concepts for kindergarten children through the use of modern methods in blended learning and combining online e-learning activities with active learning activities to address the shortcomings of regular teaching methods. The study sample consisted of (60) children between 5-6 years, the study tools were a list of mathematical concepts, experimental processing tools, and the mathematical concepts test for kindergarten children. The results showed that the integration of children into an interactive learning environment led to the development of their mathematical concepts and had a positive role in understanding mathematical concepts at this age. The results confirmed that this educational environment is rich in many stimuli such as sound, image, and video work to raise the senses of children at this age, as well as having fun and suspense, which makes the child master mathematical concepts and increases his desire to learn easily and attractively.

The study of (Al- Qahtani & Higgins, 2013) aimed to investigate the relationship between e-learning, blended learning, and classroom education with the mathematical achievement of Umm Al-Qura University students in Saudi Arabia. The results of the study that used the experimental approach with the two experimental and control groups on (148) students, showed that there are statistically significant differences between the three methods in terms of students' mathematical achievement in favor of the experimental group which studied with the blended learning strategy.

The study of (Alzoubi & Banidomi, 2012) is also aimed to investigate the impact of the blended learning method on achievement in mathematics and the development of motivation towards learning it, the sample of the study consisted of (71) male and female students, divided into two groups: Experimental (38) student, and controlled (33) student, the achievement test and the motivation scale towards learning mathematics were used to collect data after confirming their honesty and stability. The results of the study showed that there is a significant

impact of teaching using blended learning on achievement and motivation development toward learning mathematics.

In the same context, (Mansour, 2011) conducted a study aimed at revealing the effectiveness of using blended learning in developing mathematical skills such as classification, sequence, counting, mono-symmetry, measurement, and arrangement in kindergarten students, activities based on blended learning were prepared in developing these skills at this level. The results showed the effectiveness of using blended learning in developing sports skills in kindergarten students.

## **Methodology**

The current study followed a semi-experimental approach to uncover the impact of teaching limits and differentiation using blended learning on motivation to learn mathematics and improve the academic achievement level, based on two groups: An experimental group studied using blended learning, and a control group studied traditionally.

## **Participants**

The study population consisted of students of high school male students in schools affiliated to the directorate of education in Al Bukayriyah governorate during the second semester 2021/2022. The sample study consisted of (65) male students, was selected by the Cluster method, and divided into two groups; experimental group (33) male students, and control group (32) male students were selected by the simple random method.

## **Instruments**

### ***Academic Achievement Test***

According to the theoretical and research literature (Tashtoush, 2008; Anton et al., 2010; Tashtoush & Jawarneh, 2011; Tashtoush, 2013; Rasheed et al., 2021 b; Az-Zo'bi et al., 2022), the researchers prepared a test in academic achievement consisting of (20) items of multiple choice according to the three levels of Trends in International Mathematics and Science Study (TIMSS): (Cognitive, Apply, Inference), the test contains various mathematical tasks that covered all concepts and skills contained in the school students curriculum. A table of specifications of the mathematical achievement test was prepared, one score was given for each correct answer of the test items, and zero for the wrong answer, so the maximum score of the test is (20) and the minimum score is (0). To verify the reliability of the instrument, it was presented to a group of arbitrators of university professors specializing in mathematics, mathematics curricula and teaching methods, measurement, and evaluation. They were asked to give their opinions and observations on its suitability to the objectives it was designed for, and the task's suitability to the fields it measured. Based on the arbitrators' opinions and in light of their observations, some of the test items were amended to the final form. The difficulty and discrimination coefficients were also investigated by applying them to a survey sample of (20) male students, calculating the difficulty and discrimination coefficients of the test items in the light of the analysis of the student's answers, where the values of the difficulty coefficients ranged between (0.55-0.82), and the discrimination coefficients between (0.38-0.70), therefore all items are appropriate and acceptable for this study (Odeh, 2010). To verify the validity of the instrument, it was applied to the survey sample, and the coefficient of stability was calculated by the test-retest method, where it was applied twice with a time difference of

two weeks between the two applications. The values of Pearson's Correlation Coefficient were calculated among the students' overall scores in the two times of application, where it was found that the correlation coefficient was (0.865). This value confirms that to be used for this study (Odeh, 2010).

### ***Motivation Scale***

According to the theoretical and research literature (Lin, & Chiang, 2017; Fannakhosroew, et al., 2022; Faraj Alla, 2018), the researchers developed a motivation scale for learning math in the form of a questionnaire according to the 5-Likert scale, the scale consisting of (20) items. To answer the items of the questionnaire, 5-choices were allocated to each: (strongly agree, agree, unsure, disagree, and strongly disagree) were given the scores (5, 4, 3, 2, 1) respectively, the max score of the scale is (100) and the min score is (20). To verify the reliability of the instrument, it was presented to a group of arbitrators of university professors specializing in educational technology, educational psychology, measurements and evaluation, mathematics curricula, and teaching methods. They were asked to give their opinions and observations on the instrument items and their suitability to the objectives it was developed for, as well as the integrity of the language formulation and the extent to which the fields of study belonging. Based on the arbitrators' opinions, the amendments were made until the scale was finalized. To verify the validity of the instrument, it was applied to the survey sample, and the coefficient of stability was calculated by the method of retesting (Test-Retest) and was applied twice with a time difference of two weeks between the two applications, and the calculation of the Pearson Correlation Coefficient between the students' overall scores in the two times of application, where the correlation coefficient of the scale is (0.926). This value confirms that to be used for this study purposes (Odeh, 2010).

## **Procedures**

The theoretical and research literature related to the study subject was reviewed and used in the study tools preparation. The study population was identified, and its sample was selected before the study instruments application started, the study instruments were prepared in their initial form, arbitrated, ensured their honesty and stability, then reformulated and modified based on the recommendations, suggestions, and opinions of the arbitrators. The study instruments were applied to the survey sample which was selected from the study community and from outside its sample. The validity and stability were calculated, pre-application by the researchers of the two study instruments was made, and at the end of the semester, the post-application of the two study instruments were done. The responses of students to the test of mathematical achievement were corrected, the final grade of each student was monitored and the student's grades were entered on the motivation scale to learn mathematics into the computer memory according to the Likert scale. Finally, the mathematical achievement test and motivation scale for learning mathematics results were analyzed using the SPSS program, to answer the study questions, compare them with the results of previous studies, and make suggestions and recommendations.

## **Data Analysis**

Means and standard deviations of students' grades were extracted to reveal the apparent differences in means. As the ANCOVA test was used to analyze the results of both the mathematical achievement test and the motivation scale for learning mathematics.



## Finding

To verify the first question: What is the impact of Blended Learning on students' achievement to learn limits and differentiation? the means and standard deviations of the two study groups were calculated for the pre and post math achievement test, table (1) shows this.

**Table (1): Means and SD for the math achievement test**

Group	Application	Mean	SD
Control	Pre-test	8.89	2.452
	Post-test	9.18	1.956
Experimental	Pre-test	9.06	2.451
	Post-test	13.82	1.325

Max score for the math achievement test is (20)

Table (1) shows that there are differences between the means scores of the two study groups' performance on the post-mathematical achievement test, and to detect whether these differences are statistically significant, the ANCOVA test was used, table (2) shows this.

**Table (2): ANCOVA test for the post-math achievement test**

Source of Variance	Sum of Squares	df	Mean of Squares	F	Sig	$\eta^2$	Effect Size
Group	869.66	1	869.66	25.36	0.015*	0.598	Large
Error	2195.19	64	34.29				
Total	3985.96	65					

Statistically Significant ( $\alpha = 0.05$ )

It is noted from table (2) that there are statistically significant differences between the means of the two study groups in favor of the experimental group, which indicates the effectiveness of the blended learning method in increasing the mathematical achievement level compared to the results of education in the traditionally. In order to reveal the effect of blended learning on improving the achievement of the study individuals, the effect size was found using the Eta square ( $\eta^2$ ), as it was found to be equal to (0.598). This indicates that teaching using blended learning explains about (59.8%) of the variation in improving achievement among the sample. study, while the rest of the variance (40.2%) is unexplained and may be due to external influences or to other factors

To verify the second question: What is the effectiveness of Blended Learning on students' motivation to learn limits and differentiation? the means and standard deviations of the two study groups were calculated for the pre and post motivation scale, table (3) shows this.

**Table (3): Means and SD for the Motivation Scale**

Group	Application	Mean	SD
Control	Pre-test	62.35	12.52
	Post-test	63.19	12.39
Experimental	Pre-test	63.02	12.49
	Post-test	74.58	14.34

Max score for the motivation scale is (100)

Table (3) shows that there are differences between the means scores of the two study groups on the motivation scale for post-mathematics learning, and to detect whether these differences are statistically significant, the ANCOVA was used, table (4) shows this.

**Table (4): ANCOVA test for the post-motivation scale**

Source of Variance	Sum of Squares	df	Mean of Squares	F	Sig	$\eta^2$	Effect Size
<b>Group</b>	1895.32	1	1895.32	31.13	0.024*	0.645	Large
<b>Error</b>	3895.92	64	60.87				
<b>Total</b>	5791.24	65					

Statistically Significant ( $\alpha = 0.05$ )

It is noted from a table (4) that there are statistically significant differences between the means scores of the two study groups in favor of the experimental group, which indicates the effectiveness of the blended learning method in developing the motivation to learn mathematics compared to the education in the traditionally, which indicates the effectiveness of activities that attract attention and stimulate motivation which the students of the experimental group were exposed to through teaching using the blended learning method, which was reflected in the motor development towards learning mathematics. In order to reveal the effect of blended learning to developing the motivation of the study individuals, the effect size was found using the Eta square ( $\eta^2$ ), as it was found to be equal to (0.645). This indicates that teaching using blended learning explains about (64.5%) of the variation to developing the motivation among the sample study, while the rest of the variance (35.5%) is unexplained and may be due to external influences or to other factors

## Conclusions

It is noted from the previous results, there is a statistically significant difference between the mean scores of the two study groups in favor of the experimental group on the test of mathematical achievement, which indicates that there is the effectiveness of blended learning to modified the mathematical achievement level compared to the traditional method, and this may be attributed to blended education led to a type of active learning that allows students to discover information and concepts themselves through computers, technology, and multimedia in the form of text, color images, sounds, and simulations, as for students in blended learning who deal with activities in which there is a movement of a certain type, which led to the understanding of the subject of limits and differentiation correctly and then better performance on the achievement test. As well as working with these activities led to the acquisition of many mathematical skills, because the student solves the activities after training in these skills through various exercises and gets immediate feedback on his performance, which improves performance and better learning of the skill.

The method of blended learning also allows the student to learn self-learning using the means of technology, where the student solves the activities contained in the self-computerized educational material with the help of the teacher, which enables the student to learn according to the speed of his comprehension, correct mistakes without feeling ashamed of his colleagues, also allows the student to re-review the computerized educational material, in addition to providing the student with feedback and reinforcement if his answer is correct, and asking him to try again if his answer is incorrect. All of these increase the motivation of students to learn mathematics, which increases their academic achievement, as can be attributed to the fact that

the method of blended learning gives the teacher a greater opportunity to follow up on the student's work, which leads to increased student achievement. Also, the blended learning method indicates a set of interactions between the student and the teacher and the student with the computerized educational material, it also provides a modern educational and technical educational environment that is flexible and considers the needs and tendencies of students and helps to apply the material in practice, which contributes to a better understanding of the material and increase the level of mathematical achievement. These results are consistent with the results of studies that used strategies and teaching methods based on the student's activity in raising the mathematical achievement level, such as the study of (Rasheed & Tashtoush, 2023; Fannakhosrow et al., 2022; Rasheed et al., 2021 a; Al-Qahtani, 2018; Tseng & Chiang, 2017; Tashtoush et al., 2023; Alzoubi & Banidomi, 2012; Mansour, 2011).

The students who were exposed to blended learning have been provoked by their motivation through the activities and scientific material provided through computers and the accompanying movements, sounds, and multimedia that cannot occur in the regular learning environment, and it has been observed to increase the enthusiasm of students through follow-up during lectures and their great keenness to follow up activities, solving exercises and worksheets which reflected on their positive attitude and increased their motivation towards learning mathematics. This is also due to the element of unfamiliar modernity in presenting limits and differentiation subjects through computers, as the news always arouses interest and suspense, which increases the motivation to learn. The presentation of shapes and images and their movement during the explanation of the scientific material attracts attention and makes the student rush into the learning environment rich in multimedia, as well as containing the computerized material elements of suspense such as colors, images, sound and movement, which provokes the students' motivation to learn mathematics. This is indicated by many studies (Tashtoush et al., 2022 a; Tashtoush et al., 2020 b; Faraj Alla, A., 2018; Al-Qahtani & Higgins, 2013; Tashtoush et al., 2023; Alzoubi & Banidomi, 2012).

## **Recommendations**

- Reconsider the regular teaching strategies used in school education and provide teachers with the required level of competencies related to using the blended learning strategies, and encourage them to use blended learning in educational classes, which contributes to increasing the level of mathematical achievement and developing motivation to learn mathematics.
- Adopt the use of blended learning strategy in teaching instead of methods, especially in teaching mathematics, benefit from it in improving critical thinking skills, and encourage students to use the strategy of blended learning.
- Work on computerizing mathematics subjects taught in universities and putting them on CDs to make it easier for students to obtain them.
- Conduct more similar studies that look into the effectiveness of blended learning, covering various other mathematics subjects, different stages of study, and their relationship to other variables.
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