Digital Games, Blended Learning, Core Thinking Skills, and Motivation in Mathematics Among Primary School Students

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Abstract

This study aimed to design digital educational games and measure their effectiveness within the blended learning environment in developing core thinking skills and motivation for learning mathematics among 3rd Basic Grade Students. The study adopted the quasi-experimental design; In order for the study to achieve its objectives, a set of educational games were designed using Wordwall, a core thinking skills scale, and motivation scale for learning. And the validity and reliability of the tools were verified by appropriate methods. The sample of the study consisted of (46) students from the third basic grade, who were randomly selected and distributed into two groups: experimental and control equally. The results of the study indicated that there are statistically significant differences between the two groups attributed to use digital educational games within the blended learning environment on development a core thinking skills and motivation towards learning mathematics between the two groups attributed to the experimental group. The study recommended employing the digital educational games within the blended learning environment in teaching mathematics and conducting other similar studies in different educational stages and with new variables.

Keywords: Digital Educational Games, Blended Learning Environment, Core Thinking Skills, Motivation towards Learning.

1. Introduction

Mathematics has a prominent place among the various branches of knowledge, as it is the main pillar on which social and economic development plans are built as a whole. The purpose of learning mathematics is to build a thinking human who is able to rely on mathematical information that qualifies him to understand the problems of his society and actively contribute

to solve these problems, as it is the lever of higher education in countries. Advanced, in view of the increasing importance of mathematics in our time, this subject and its related subjects receive great attention from educators and parents, and perhaps this is due to the general belief of the people in the strong relationship between mathematics and the ability to think and solve problems. Thus achieving practical progress. (Al-Mansour, 2011).

It seems clear that teaching thinking skills in general has become a slogan advocated by all educational systems that seek to keep pace with the renewed spirit of the age. The pivotal thinking skills, in particular, are the building blocks of thinking and its solid foundations, and they have a strong connection with research and theoretical materials for students, and they play the role of stimuli for thinking. In various fields, and thus help in providing students with the ability to solve the problems they face in their daily lives (Abdul Aziz, 2009). Muhammad and Obeidat (2010) show that mathematics teachers face many difficulties in teaching this subject, including those related to the lack of modern educational techniques to be used in teaching, including those related to students' weak motivation to learn this subject due to its difficulty. Achievement in mathematics in the basic stage in particular is due to the failure to employ effective teaching methods and methods that develop students' motivation to learn this subject, especially since motivation is one of the most important conditions for learning to occur, and plays the greatest role in human perseverance in completing work.

Given the focus of modern educational trends on the need to rely on the latest educational technologies, and activate the role of the learner to become the focus of the educational process, the use of modern educational technologies that take into account technological development has become a binding reality, and many studies have confirmed such as: (Boanani and Karima, 2018; Muhammad (2019) solutions and ways to confront the problem of weakness in mathematics and stimulate the motivation to learn it, including: using attractive educational activities, providing the appropriate school environment to increase motivation, and the need to employ modern technologies to teach mathematics to create suspense and interest in it.

In light of the spread of the Corona pandemic, distance learning and blended learning have been adopted as one of the accepted learning patterns for the follow-up and continuation of education in general, and blended learning is defined as: "learning that mixes both Internet-based learning and face-to-face learning" (Abu Musa and Al-Sous). 2012: 9), where it aims to apply appropriate educational technology and seeks to provide education in an interactive and interesting manner devoid of memorization, which may lead to raising the level of academic achievement if it is presented in the appropriate form, time and electronic content (Ansiyo, 2018).

Perhaps digital educational games are one of the most important modern models that are designed, produced and presented electronically, where the teacher can use them within the blended learning environment, providing information to students through integrated programs rich in multimedia, and helping students to learn freedom by trial and error (Sabirli & Coklar, 2020). Prensky (2008) also asserts that children who play educational digital games show more cognitive development compared to other children who do not play them, and Ke (2014) also indicated that adolescents who play digital games in general think differently than adults who do not play them. They do this, and they also use different parts of their brains, and a study (Xie,

Wang, & Hooshyar, 2021) indicated that there are positive perceptions among teachers, students, and their parents towards the use of digital educational games in teaching and a study by (Alkan & Korkmaz, 2021) confirmed that the rules and levels in Digital educational games facilitate learning and increase motivation.

In light of the previous premises, the researchers sought the necessity of investing in the teaching and learning of mathematics in a modern way that has proven its effectiveness in various subjects, and in developing the learner's thinking skills, and perhaps the use of digital educational games within the blended learning environment can contribute to the development and development of many aspects of the educational process for the use of media Multiple, elements of suspense and excitement, and bring mathematical concepts closer to the minds of students away from stagnation.

Blended learning is defined as: "a combination of several modes of learning, such as e-learning, face-to-face learning, and self-paced learning, and the best method for integrating is that which combines several methods to obtain the highest productivity at the lowest cost."(Al-Arini, 2016: 176). In this study it is procedurally defined as: the educational environment in which direct classroom learning methods are mixed from dialogue and discussion, and the e-learning method represented by digital educational games for teaching mathematics to third grade students.Therefore, this study came to design digital educational games and their effectiveness within the blended learning environment in developing pivotal and motivational thinking skills for learning mathematics among third grade students.

The Significant of the study appears in two areas: First: Theoretical importance: it may help to provide our Arabic library with a study on the design of digital educational games within the blended learning environment and use them to teach mathematics in order to develop the pivotal and motivational thinking skills for learning mathematics among third grade students. In addition clarifying the requirements for designing digital educational games within the blended learning environment in particular. Its consistency with modern trends in the educational process, and its importance for decision-makers.

Second: Practical importance: The results of this research may be important for researchers in carrying out future studies on the same subject, and education supervisors may benefit from them to hold training courses for teachers to employ digital educational games within the blended learning environment for the basic stage, and curriculum designers may benefit from the results of the study in developing Curricula, and the possibility of directing teachers towards adopting modern teaching methods.

2. Purpose of the Study

The research aims to achieve the following objectives:

1- Designing digital educational games to teach mathematics for the third grade.

2- Identify the effectiveness of using digital educational games within the blended learning environment in developing the pivotal thinking skills of third grade students in mathematics.

3- Recognizing the effectiveness of using digital educational games within the blended learning environment on the motivation of third-grade students towards learning mathematics.

Mathematics is the language of science and the incubator of its growth, and many learners face difficulty in learning this basic subject and mastering its basic concepts, which is a basic building block for learners to complete the study of mathematics, in many studies, including (Akhras, 2018; Muhammad and Obeidat, 2010) confirmed the existence of many difficulties and weaknesses in this subject, which is one of the main reasons for it: the use of the memorization method used in teaching, and the failure to use interesting and attractive teaching methods, and the lack of motivation of learners towards learning.

Several conferences have called to remedy this weakness, including: The International Conference on Teaching Arabic Reading and Writing and Mathematics in Primary Grades, which called for the need to promote the development of high skills in the field of mathematics, and to emphasize the importance of integrating new tools and strategies in teaching and employing modern technology (USAID, 2019).

From this standpoint, the importance of using modern methods in teaching mathematics, which employs technology in an interesting and attractive way, brings mathematical concepts closer to the minds of students in a fertile environment that helps stimulate learners' motivation and urge them to active interaction, and gives them the ability to focus and think in a sound scientific manner, and perhaps the most prominent of these methods Digital educational games, where many studies, such as: (Assistance, 2019) confirmed their effectiveness in acquiring scientific concepts in school subjects, creating positive attitudes towards learning and thus stimulating motivation to learn, and Kapidere study (2021) called for the need to include digital educational games in different study subjects.

From the foregoing, this study attempted to take advantage of the features and characteristics provided by digital educational games within the integrated learning environment in the development of pivotal thinking skills and motivation to learn mathematics, which provides a modern method that combines fun and learning, and employs multimedia such as animation, audio and video, which raises the motivation of learning. It makes the learner the center of the learning process.

The research attempted to answer the following two questions:

1. What is the effectiveness of teaching using digital educational games within the blended learning environment in developing the pivotal thinking skills of third grade students?

2. What is the effectiveness of teaching using digital educational games within the blended learning environment in developing the motivation of third grade students to learn mathematics?

3. Literature Review

Digital educational games

Digital educational games are one of the most important e-learning technologies, as it is an environment that motivates students to actively interact with each other, which increases their interest in learning. In addition to urging them to participate actively in solving problems. (Jayusi, 2020).

A study (ÇİFTCİ, 2018) indicated the use of many names for digital educational games, including: digital games, computer games, game-based learning, video games, and electronic educational games are defined as: "organized activities through the computer that make the child active and interactive." By mixing learning and entertainment, it presents some mathematical concepts in an exciting and attractive way for the student." (Atifi and El-Meligy, 2014: 117). Abdel-Al and Al-Najjar (2014) defines it as: "a competitive activity governed by certain rules between two individuals or teams that play concurrently or consecutively using the computer, or between the learner and the program itself, and it requires the learner to respond correctly and timely to achieve certain educational goals." The researchers believe that digital educational games are the modern version of traditional educational games, which may be an effective way to increase the learner's motivation, and work to gain learning experiences in an enjoyable and faster way.

Digital educational games achieve many educational benefits, as they work on: individualizing and organizing education to confront individual differences, giving learners an opportunity to see things in completely different ways from what they are, helping to grow the learner's memory, activating mental abilities, perception, imagination and developing his thinking skills, learning through games E-education is superior to learning from books, as it is more successful in communicating information as it breaks the deadlock between the learner and the subject. (Al-Qarni, 2016).

In order for digital educational games to achieve the interaction of the learner with their components, (Simkova, 2014) refers to the necessity of providing a number of elements and foundations in them, and these elements are: the goal as each educational game has a clear and specific educational goal, the rules and laws that determine the method of playing, the challenge and imagination to activate the learner's mind , and increase his desire and motivation to learn, entertain, and adapt as the difficulty level of the game changes according to the skill level of the learner, stimulus and positive response, feedback and immediate reinforcement that pushes him to continue playing.

Abdul Majeed and Al Muzaini (2014) point out the need to adhere to criteria for designing or choosing electronic educational games represented in educational standards: which refer to the necessity of achieving the educational goal, with the consistency of the desired goal scientific content, and taking into account the educational level, developmental characteristics, and mental abilities of the learner, while it refers The technical standards point to the need for new, innovative, and unfamiliar activities for learners, with the need to use visual and audio stimuli, to be of gradual difficulty, and to employ various stimuli such as images, graphics, shapes and

sounds to ensure continuity of learning, and to be easy to use in terms of operating, dealing with and exiting its components.

Digital educational games also go through different production stages, including: Design stage: It is the stage in which the designer sets a conception of the electronic educational game, and draws outlines of what the game should contain of objectives and scientific material, and the stage of preparation and processing, which is the stage in which design requirements are collected and processed. The stage of implementing the scenario in the form of an electronic game, and the stage of experimentation and development, where the electronic educational game is presented to a number of arbitrators with the aim of improvement and development. (Al-Far, 2004).

It is clear from the foregoing that there is a close relationship between games, thinking and motivation, as playing takes place within organized steps that affect and are affected by each other, and learning as a mental process, thus immersing the learner in the learning environment and creating a real internal motivation to continue learning and this was indicated by the study of Abdel Rahim (2015).

In this study the researchers defined digital educational games procedurally as: activities based on the principle of play, using multimedia technology, for the purpose of displaying the content of the first unit of the mathematics book, first chapter of the third grade, where these games are presented electronically through Word-wall over the Internet.

Core Thinking Skills

Thinking is the main tool for acquiring knowledge that contributes to the development and advancement of society. Accordingly, many thinking lists and educational programs have been designed, and many educational and psychological research aimed in all its dimensions has been conducted to organize the thinking of learners. Thinking is defined as: "a process by which we consciously process sensory inputs and information to form ideas, inferences, or judge them" (Hafez, 2015: 10).

Al-Shawi and Al-Mayahi (2018) indicated that thinking represents a comprehensive, holistic process of gaining experience, while thinking skills are a mental process that we intentionally use to process data to achieve the goals of education. Higher thinking that includes basic (central) thinking skills.

The core thinking skills are seen as: "the mental processes that we perform in order to collect, preserve or store information, through the procedures of analysis, planning, evaluation, reaching conclusions and making decisions" (Saada, 2009: 45). While Abu Jadu and Nofal (2007: 74) define them as: "cognitive processes that can be considered as basic building blocks in the structure of thinking, and there are twenty-one critical thinking skills that can be put into eight main categories."

Opinions varied about the pivotal thinking skills, but there are common skills agreed upon by the majority of researchers. Al-Khatib (2015) mentioned these eight categories and sub-skills for each category as follows:

First: Focus skill: where my skills include defining problems and setting goals.

Second:collecting information skill: This skill includes two sub-skills: the skill of observation and the formulation of questions.

Third: Memory skills: This skill includes two sub-skills: the skill of coding and recall.

Fourth: Organizing skills: This skill has four sub-skills: the skill of comparison, classification, arrangement and representation.

Fifth: Analysis skills: The analysis skill has four sub-skills: identifying features and components, identifying patterns and relationships, identifying main ideas, and identifying errors.

Sixth: Generation skills. This skill includes the skills of inference and prediction.

Seventh: Integration skills: This skill has two sub-skills: the skill of summarizing and reconstructing.

Eighth: Evaluation skills, and this skill has two sub-skills: the skill of building standards and verification.

(Abdulaziz, 2009) emphasized the importance of core thinking skills in helping learners to visualize thanks to generation skills related to detailing and representing information, liberating learners' thought and motivating them to objectively evaluate what they learn, and employ previous knowledge and work on adding it to new knowledge, not to mention playing the role of motivators. To think in various concrete and abstract domains.

In this study the researchers defined the core thinking skills procedurally as: the degree that the student obtains on the scale of pivotal thinking skills prepared for this purpose.

Motivation towards Learning

Motivation is one of the most important topics in psychology of importance at the personal and societal levels. It is not possible to address psychological problems without identifying the motives of humans, as standing on the motivation of individuals contributes to the individual's understanding of himself and others dealing with them (Al-Rufa', 2015), Motivation receives the attention of all those working in the educational process, and everyone related to the educational process. Motivation in general and motivation towards learning in particular have received a great deal of research and study as one of the most important tribal requirements for teach (Abu Jadu, 2012).

Motivation has received a large share of definitions, as it has been defined as: "a latent internal force that moves the static organs and provides them with movement to reach a specific goal" (Al-Halayqa, 2012: 207), as it is defined (Hartnett, George, and Dorn, 2010:2) as: A goal-oriented process so that the activity is stimulated and sustained. Motivation to learn is defined as: "It is an internal state that urges the learner to strive by any means to possess the tools and materials that create an environment that achieves adaptation and happiness and avoids failure" (Qatami, 2004:133). Motivation to learn is divided into two types according to the source of its arousal: Intrinsic Motivation, where the source of internal motivation is the student himself, so

that he accepts to learn with an internal desire to satisfy himself, Extrinsic Motivation, which has an external source, such as a teacher, peers or parents, so the student's willingness to learn in order to obtain moral incentives or materialism (Abu Awad, 2009).

Al-Hila (2014) confirms that the supporting opportunity to make students more motivated to learn is through effective motivation by making the activity self-motivated by including a number of stimuli in the classroom educational situation or the educational program, the most prominent of which are: the use of positive educational activities in the content of the lesson in order to Ensuring the continuity of student activity and arousing his motivation to learn, adding important elements when designing the educational program, such as jokes and riddles, and providing students with multiple options, such as the multiplicity of content forms and the diversity of learning methods, And the multiplicity of educational media so that the student can choose according to his needs, capabilities, tendencies, and social interaction, based on the fact that man is social by nature and does not like isolation. Opportunities for school social interaction including collaborative learning, small group discussions, learning with and from peers, decision-making, and solve problems in a group way.

Students' motivation is related to mental abilities and methods represented in intellectual flexibility and ability to face problems, and personal characteristics, including self-confidence, extroversion and emotional stability, in addition to positive attitudes towards learning and good personal interaction with school activities. Perhaps one of the most prominent reasons for the low students' motivation to learn, which was mentioned by Kazem (2015) as follows: the student's lack of sense of responsibility, the lack of coherence between the scientific and theoretical curricula, and the failure of the study to achieve the students' ambition due to the lack of activities.

In this regard, Abu Jadu (2012) refers to general principles in providing motivation to learn, including: the necessity of providing a learning environment that allows students to participate and exchange ideas without criticism or sarcasm, and to help students search for what motivates them to learn and participate in activities that arouse surprise and curiosity and integrate into the learning process, There is also a clear role for the way the teacher organizes the teaching/learning situation in providing motivation for learning.

In this study the researchers defined motivation towards learning procedurally as: the score obtained by the third-grade student on the motivation scale prepared in this study.

Previous studies

After the researchers reviewed previous studies related to digital educational games, the following studies were used, arranged in chronological order, from newest to oldest: The study (Sabirli & Coklar, 2020) aimed to investigate the impact of the use of digital educational games on academic achievement and motivation to learn English and their attitudes towards its use in They were taught in Turkey, where the study followed the quasi-experimental approach, and an achievement test, motivation scale, and attitude scale were prepared. These tools were applied to a sample of (90) students who were randomly divided into two groups: control and experimental with (45) students for each group. Attitudes scale, and the study recommended

employing electronic educational games more in the education of primary school students and including them in the curricula.

While the study of Jayyousi (2020) aimed to find out the effectiveness of educational games on developing creative thinking among children enrolled in kindergartens in Palestine. Randomly divided into two groups: control and experimental with (12) boys and girls for each group. The results showed that educational games increase creative thinking. The study recommended that kindergarten curricula should include educational games to stimulate creative thinking.

Marei and Ramadan (2020) study investigated the effectiveness of using digital educational games on academic achievement and creative thinking in science among fifth grade students in Palestine. (80) Students, they were distributed into two experimental and control groups of (40) students for each group. The results showed a positive effect of using digital educational games in developing academic achievement, and no effect on developing creative thinking skills. The study recommended the need to employ educational games the computer-designed electronic system in the education process, and its inclusion in the curricula in general.

As for the study of Al-Warekat and Al-Shawa (2016), it investigated the effectiveness of teaching mathematics using the learning strategy by playing on the acquisition of mathematical skills, and the improvement of social communication skills among first-grade students. The study followed the quasi-experimental approach. They were applied to a sample of (50) male and female students from the first grade, who were randomly divided into two groups: a control and an experimental group with (24) students for the control group, (26) students for the experimental group, and the study concluded that there is a statistically significant difference between the average scores of the two groups and in favor of the experimental group, and recommended the necessity of employing the learning strategy by playing in acquiring mathematical skills.

While Wali study (2016) aimed to identify the effectiveness of using indirect digital educational game programs and direct educational game sites in developing self-learning skills and achievement in science for seventh grade students in Egypt. The study followed the quasi-experimental approach, and a skills scale was prepared Self-learning and achievement test, which were applied to a sample of (125) seventh-grade students, who were randomly divided into three groups: a first experimental group with (38) male and female students, which studied using indirect digital educational games, And a second experimental group of (41) male and female students, which studied using direct digital educational games, and a control group of (46) male and female students, which studied using the usual method. The study concluded the effectiveness of indirect digital educational games programs in developing self-learning skills, and the effectiveness of direct educational games sites in developing cognitive achievement in science.

Looking at previous studies, the current study agreed with previous studies in terms of the goal, which is to employ digital educational games in raising academic achievement and the availability of positive trends towards employing them in the learning process, and their role in motivating students to learn. In terms of the methodology used, the quasi-experimental approach

was used to apply this study, and the tools used in terms of developing a scale of pivotal thinking skills, and a scale of motivation towards Learning.

Current study also benefited from previous studies in preparing and organizing the theoretical framework related to digital educational games within the blended learning environment, pivotal thinking skills, and the learning motivation scale. Discussing and interpreting the results, in addition to supporting the results of the current study with previous studies, benefiting from the references and recommendations of previous studies, and defining the study problem precisely.

Current study was unique from previous studies by employing digital educational games within the blended learning environment specifically, and the first study - to the knowledge of researchers aimed at employing digital educational games in developing core thinking skills, and developing motivation towards Learning in mathematics.

4. Method

This Research used the quasi-experimental method for its suitability to the nature of the study and the achievement of its objectives.

Participants

The Research population consisted of all third grade students in public schools for the 2021-2022 academic year. The study sample consisted of (46) male and female students from the third grade in one of the public schools affiliated to Marka District, which provided the necessary facilities to apply The study, where one division was chosen randomly and by lottery method to be the experimental group and its number was (23) male and female students, and the second division is the control group and its number was (23) male and female students.

Research tools and materials

The researchers prepared a measure of core thinking skills for the third-grade students by following the following steps:

1. Review the educational literature related to the study, and determine the purpose of the scale.

2. Determining the pivotal thinking skills based on the previous literature review, which are: (representing information, identifying errors, classifying, arranging, comparing). Table (1) shows the distribution of the scale items on the five core thinking skills.

Table (1) Distribution of the scale items on the five core thinking skills

skill	question number
representing information skill	16،11،6،1
identifying errors skill	17،12،7،2
classify skill	18،13،8،3
arrange skill	19،14،9،4
comparison skill	20،15،10،5

Scale validity and reliability

To verify the validity of the scale, it was presented to a group of arbitrators from faculty members in Jordanian universities, who are specialized in curricula and teaching methods, educational technology, measurement and evaluation, and educational psychology, in addition to educational supervisors and teachers, and the paragraphs of the scale were modified according to the opinions of the arbitrators. In terms of linguistic formulation, and in terms of modifying the alternatives, whether in terms of deleting or adding some words to the questions, In order to verify the reliability of the scale, it was applied to a sample of (20) male and female students from outside the study members using the repetition method and a difference of two weeks, and then the Pearson correlation coefficient between the two times was calculated and its value was (0.85), and the internal consistency coefficient between its paragraphs was calculated using the equation Cronbach's alpha and its value was (0.75), and the scale degrees ranged between (0 - 20) degrees.

Second: Motivation Scale

Scale of motivation developed in the form of a questionnaire, through the following steps:

1. Reviewing previous studies that benefited researchers in drafting paragraphs, including the following studies: (Kazim, 2015; Samawi, 2017; Waza, 2017) the Scale consisted of (28) paragraphs, and each paragraph was formulated in the form of a sentence that was followed by an answer scale consisting of five answers, namely: (strongly agree, agree, neutral, disagree, Strongly Disagree).

2. Verifying the validity of the motivation scale using the validity of the arbitrators. The scale's (30) paragraphs were presented to a group of arbitrators from faculty members in Jordanian universities, with specialization in curricula, educational technology, educational psychology, special education, and educational supervisors. And teachers, in order to ensure their suitability for the purpose for which they were prepared, and to verify the accuracy of the wording, and the clarity of the paragraphs, and their amendments and observations were taken, and all the paragraphs that the arbitrators agreed on remained at a rate of (70%), and some paragraphs were reformulated, and some paragraphs were deleted, so that the scale remains In its final form, it consists of (25) paragraphs.

3. Verify the reliability of the learning motivation scale by calculating the internal consistency of the paragraphs using Cronbach's alpha equation. The stability coefficient calculated for the scale reached (0.79), which is an acceptable stability coefficient.

B- Materials used: Teaching guide and digital educational games

The researchers prepared a teaching guide for the experimental group using the electronic educational games method within the blended learning environment in mathematics according to the following stages:

1. Reviewing educational literature and previous studies that dealt with the use of digital educational games in teaching.

2. Determining the content, where the researchers chose the first unit of the mathematics book for the third grade, the first part entitled: (Numbers within 9999), due to its importance and the rest of the book units being based on its foundations and concepts, and consisting of six lessons. The educational objectives were determined and the content related to the unit was analyzed with the help of the teacher's guide to the mathematics book, part one, third grade.

3. Designing digital educational games: It was designed according to the following steps of designing digital educational games: defining the goal, topic and content of digital educational games, and producing the scenario and content of the game. (Wordwall), a website for designing direct digital educational games, where educational games were produced The 12 digital educational games, and finally the presentation of the digital educational games in front of a group of arbitrators to evaluate them and make any observations on them.

4. Presenting the teaching guide, which includes the prepared digital educational games, to a number of specialized arbitrators to express their opinion and observations.

5. Determining display tools such as computers and data show devices, and ensuring that students have the Internet in their homes.

6. Determining the teaching and implementation procedures for each lesson by mixing the usual methods of dialogue and discussion, and the electronic method based on digital educational games within the integrated learning environment adopted under the conditions of the outbreak of the Corona virus.

7. The teaching guide is validated by presenting it to a group of arbitrators to express their opinion and observations.

Research design

The quasi-experimental design with pre- and post-test was used for two groups (control and experimental) as follows:

O2   O1   X   O2   O1   EG:

O2   O1   _   O2   O1   CG:

EG the experimental group (using digital educational games).

CG: The control group (using the usual method).

O1: A scale of core thinking skills (before and after).

O2: Motivation towards learning Scale (pre and post).

X: Processing (use of digital educational games).

-: Implementing the usual method of teaching (not using digital educational games).

5. Findings

First: 1. what is the effectiveness of teaching using digital educational games within the blended learning environment in developing pivotal thinking skills for third grade students? To answer this question, the arithmetic averages and standard deviations of the performance of the two study groups were calculated on the scale of axial thinking skills, before and after, and table (2) shows that:

Table 2. Arithmetic averages, and standard deviations of the performance of the experimental and control groups on the dimension and pre- and core thinking skills scale

group	number	total mark	pretest average	standard deviation	post test average	standard deviation
control group	23		9.10	2.10	11.65	2.01
experimental group	23	20	9.55	2.21	15.10	2.46
Total	46		9.25	2.14	13.61	3.30

It is clear from Table (2) that the arithmetic mean of the students of the experimental group who used digital educational games within the blended learning environment on the scale of dimensional pivotal thinking skills was the highest (15.10), while the arithmetic mean of the students of the control group who used the usual method was (11.65), and to determine If the differences between the averages of the study groups are statistically significant, an analysis of concomitant variance (ANCOVA) has been applied, and Table (3) shows that:

Table 3. Analysis of the concomitant variance on the scale of core thinking skills for third grade mathematics for the experimental and control groups

Source of variance	sum of squares	degrees Freedom	sum of squares	(F) value	Indication level	Eta value
pretest	11.022	1	11.022	1.536	0.225	0.05
Teaching method	115.1	1	115.1	14.955	0.000	0.366
error	227.23	44	7.745			
total average	353.352	45				

* Statistically significant ($\alpha \geq 0.05$)

Table (3) indicates that the value of (P) for the teaching method amounted to (14,955), which indicates that there are statistically significant differences between the average performance of the two study groups according to the different teaching method (digital educational games within the blended learning environment, the usual method). In order to know in favor of the result, the arithmetic averages adjusted for the performance of the study groups on the post core thinking scale were extracted, and Table (4) shows those averages.

Table 4. Modified arithmetic averages and standard errors according to the different teaching method (digital educational games within the blended learning environment, the usual method) on the scale of dimensional core thinking skills

group	number	Total	Corrector average	Corrector standard deviation
control group	23	20	11.61	0.64

experimental group	23			15.07	0.70

It is clear from Table (4) that the arithmetic mean averaged for the students of the experimental group who studied using digital educational games within the blended learning environment on the scale of core thinking skills (15.07), while the arithmetic mean of the students of the control group who studied using the usual method was (11.61), and this It means that the difference was in favor of the students of the experimental group who studied using digital educational games, and the effect size of the teaching method was (0.366), which means that there is an effectiveness of using digital educational games within the blended learning environment in developing the core thinking skills of the third grade students.

Second: 2. what is the effectiveness of teaching using digital educational games within the blended learning environment in developing the motivation of third grade students to learn mathematics? To answer this question, the arithmetic averages and standard deviations of the performance of the two study groups on the post-learning motivation scale and their tribal score were calculated, and the following table shows that:

Table 5. Arithmetic averages, and standard deviations of the performance of the two study groups according to the different teaching method (digital educational games within the blended learning environment, the usual method) on the post-learning motivation scale and their tribal scores

group	number	total mark	pretest average	standard deviation	post test average	standard deviation
experimental group	23		68.92	6.55	98.97	6.55
control group	23	125	70.03	6.91	81.88	7.60
Total	46		69.01	6.76	90.41	9.46

Table (5) indicates that the arithmetic mean of the students of the experimental group who studied using digital educational games within the blended learning environment on the scale of motivation for post-learning was the highest, reaching (98.97), while the arithmetic mean of the students of the control group who used the usual method was (81.88), In order to determine whether the differences between the averages of the study groups are statistically significant, the associated (joint) variance analysis (ANCOVA) was applied, and the results of the analysis came as shown in Table (6):

Table 6. Analysis of the accompanying variance of the performance of the two study groups according to the different teaching method (digital educational games within the blended learning environment, the usual method) on the scale of motivation for post-learning

Source of variance	sum of squares	degrees Freedom	sum of squares	(F) value	Indication level	Eta value
Pretest	0.228	1	0.228	0.004	0.950	0.000
Teaching method	2260.917	1	2260.917	36.372	0.000	0.450
error	1623.647	44	55.988			
total average	14287.928	45				

* The difference is statistically significant

Table (6) indicates that the value of (P) for the teaching method reached (36,372) at the level of significance (0.000), which indicates that there are statistically significant differences between the performance averages of the two study groups on the scale of motivation for post-learning according to the method of teaching (Digital educational games within the blended learning environment, the usual method). In order to know in favor of who the difference was, the arithmetic averages adjusted for the performance of the study groups were extracted on the scale of motivation for post-learning, Table (7) shows those averages.

Table 7. The modified arithmetic averages and standard errors according to the different teaching method (digital educational games within the blended learning environment, the usual method) on the motivation scale for post-learning

group	number	Total	Corrector average	Corrector standard deviation
control group	23	125	98.93	1.70
experimental group	23		81.84	1.88

Table (7) indicates that the adjusted arithmetic mean of the students of the experimental group who studied using digital educational games within the blended learning environment on the scale of motivation for post-learning was the highest, reaching (98.93), while the arithmetic mean of the students of the control group who studied using the usual method reached (81.84), and this means that the difference was in favor of the students of the experimental group who studied using digital educational games within the blended learning environment, and the effect size of the teaching method amounted to (0.450), and this means the presence of digital educational games within the blended learning environment in increasing the motivation to learn among students Third grade primary.

6. Discussions and Conclusion

First Question: This result can be explained by the fact that the students in the experimental group who used digital educational games within the blended learning environment were immersed in a dynamic and participatory environment, in which immediate feedback was provided and in a motivating way to continue playing, which led to an improvement in their performance and better acquisition of the five pivotal thinking skills. The nature of providing digital educational games is characterized by organization, smoothness and fun, and gradation from easy to difficult, which contributed to the development of their skills and speed of thinking and answering, and this was indicated by the study of Abdel Rahim (2015).

The result may also be attributed to the method of designing digital educational games within the blended learning environment related to core thinking skills, which were characterized by interactivity and the presence of visual and audio effects, which contributed to attracting and drawing the attention of learners, in addition to focusing on providing information in an organized and enjoyable manner based on the playing strategy, which is a pillar It is essential and important for effective application, and contributed to discovering errors in the mathematical issues presented to them in the form of digital educational games. Which contributed to the

development of the five core thinking skills (representing information, identifying errors, classifying, arranging, comparing) Students and their effective use in acquiring and mastering mathematical skills, and the result of this study agrees with the study of Jayyousi (2020) that educational games increase creative thinking skills, and differed with the study of Marei and Ramadan (2020), which showed that there is no effect of digital educational games in the development of creative thinking skills.

Second Question: The result can be attributed to the use of different multimedia included in digital educational games, which included many effects; Such as written and readable texts, sound effects, images and colored static and animated graphics, and the use of a modern digital method that is enjoyable and popular for students of the basic and intermediate stage, which is characterized by digital educational games and the great diversity in digital games, which contributed to the involvement of several senses, and the integration of students in an atmosphere of fun and suspense. , which contributed to raising their motivation and reflected positively on the development of their thinking skills. The results of this study agree with the study (Sabirli & Coklar, 2020), which confirmed the effectiveness of using electronic educational games in developing the motivation to learn.

In light of the results of the research, the following recommendations and suggestions were reached:

1. Employing technological innovations in the basic education stage and updating teaching methods, especially digital educational games, because of their clear impact on developing core thinking skills, and raising students' motivation to learn.

2. Holding workshops for teachers to raise their skills in computing curricula by using appropriate authoring programs.

3. Implementation of several empirical studies aimed at investigating the effect of digital educational games in developing the various pivotal thinking skills of basic stage students in various academic subjects.

4. Conducting more studies in this important field dealing with the impact of using digital educational games within the integrated learning environment on other dependent variables such as: developing critical thinking skills, developing visual thinking.

5. Motivating teachers to motivate students to learn by employing the elements of modern technology.

6. Implementation of descriptive studies aimed at identifying teachers' attitudes towards employing modern technologies in education, especially digital games based on online websites.

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