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مجلة علمية محكمة تصدر عن كلية التربية

بجامعة المرقب

العدد السادس والعشرين
يناير 2025م

- المجلة ترحب بما يرد عليها من أبحاث وعلى استعداد لنشرها بعد التحكيم .
- المجلة تحترم كل الاحترام آراء المحكمين وتعمل بمقتضاها .
- كافة الآراء والأفكار المنشورة تعبر عن آراء أصحابها ولا تتحمل المجلة تبعاتها .
- يتحمل الباحث مسؤولية الأمانة العلمية وهو المسؤول عما ينشر له .
- البحوث المقدمة للنشر لا ترد لأصحابها نشرت أو لم تنشر .

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ضوابط النشر:

يشترط في البحوث العلمية المقدمة للنشر أن يراعى فيها ما يأتي :

- أصول البحث العلمي وقواعده .
- ألا تكون المادة العلمية قد سبق نشرها أو كانت جزءا من رسالة علمية .
- يرفق بالبحث تزكية لغوية وفق أنموذج معد .
- تعدل البحوث المقبولة وتصحح وفق ما يراه المحكمون .
- التزام الباحث بالضوابط التي وضعتها المجلة من عدد الصفحات ، ونوع الخط ورقمه ، والفترات الزمنية الممنوحة للتعديل ، وما يستجد من ضوابط تضعها المجلة مستقبلا .

تنبيهات :

- للمجلة الحق في تعديل البحث أو طلب تعديله أو رفضه .
- يخضع البحث في النشر لأولويات المجلة وسياستها .
- البحوث المنشورة تعبر عن وجهة نظر أصحابها ، ولا تعبر عن وجهة نظر المجلة .

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Using electronic resource mobilization to develop mathematical thinking skills among higher institute students.

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College of Engineering Technology ZWARA

Research abstract:
The current research sought to designCrowdsourcing Environmentand know the effect of its useAIn developing thinking skillsThe athleteStudents haveHigher institutes, and the research sample consisted of first-year students 2023/2024 AD as follows: 20 students as an experimental sample who underwent the research experience by mobilizing electronic sources, and 20 students as a control sample who studied in the usual way, and the researcher used measurement tools: a test of mathematical thinking skills, and the researcher used the descriptive method to carry out the theoretical framework for the research, and the quasi-experimental method to answer the research questions, andThe research results showed that the use ofcrowdsourcingIt had a positive impact on developing thinking skills.The athleteStudents haveHigher Institutes, compared to the control group that received the traditional method.The researcher recommended a set of recommendations, including: the necessity of benefiting from the potential of mobilizing electronic resources in developing learners' skills, as well as preparing educational situations, and providing educational activities that help the learner acquire learning experiences, in addition to benefiting from the list of design standards that the current research reached when designing and developing an environment for mobilizing electronic resources.
Keywords: Crowdsourcing - Mathematical Thinking.

- **introduction:**

Web technology and its applications have brought about fundamental and radical changes in web-based teaching and learning contexts, and this has been reflected in learners' learning practices and activities; which has necessitated the development of educational mechanisms, strategies and practices for the growth and improvement of learning. And to reach a deeper understanding and correct and refine learners' performances to enable better learning that achieves desired learning outcomes. Crowdsourcing in education is consideredCrowdsourcing EducationOne of the latest educational technologies and contemporary applications that have been recently introduced in order to develop effective learning practices according to specific educational objectives within a framework characterized by dynamism, activity and participation. In addition to being one of the modern terms in educational presentation, which applies the benefit of the collective intelligence of the learning community, whether inside the educational institution or outside it via the web, to reach appropriate solutions to the learning problems that learners face while performing learning tasks, activities and assignments, and to benefit from them within learning contexts and events.

The methods and techniques available for displaying, organizing, and accessing knowledge structures have increased and diversified significantly with the emergence of the web and its collaborative applications. Learners have the ability to participate and collaborate in creating knowledge and building educational experiences. When a learner encounters any problem, he resorts to searching for it and wanders here and there to know the opinions that have addressed this problem to benefit from the previous experiences of specialists. This approach is called crowdsourcing (Muhammad Khamis, 2020, 419). Crowdsourcing is defined as "an

organized collaborative activity aimed at achieving a specific task and generating new ideas, based on technology."(Blohm, Leimeister & Krcemar, 2013).

In the educational context, the term crowdsourcing has been introduced as "an activity in which the teacher relies on a specific type of online educational activity through which assistance is provided in the educational process and a group of learners are proposed who undertake to carry out a specific task through open and flexible communication."(Jiang, Benatallah & Schlagwein, 2018, 3).

While Muhammad Khamis (2020, p. 420) defined it as "a collaborative or online educational activity in which learners work to solve an educational problem or carry out a complex task, by dividing the task or problem into small parts, motivating learners to solve that problem in sequence, and collecting individual solutions to mini-tasks, with the aim of reaching a solution to the main problem. It is also called the term (collective intelligence).

Crowdsourcing is used in education to achieve many educational goals, including collaborative creation., andcrowd vote, andcollective intelligence, andHelps support and evaluate electronic peers, andHelps to present the roles found in traditional environments and in social networks.(Corneli& Mikroyannidis, 2012; Paulin& Haythornthwaite, 2016) Current research uses it in development.Cloud Computing Application Employment SkillsI have a studentBy himTotallyatEducation, as crowdsourcing helps in exchanging educational experiences, performance and knowledge, thus improving the quality of the educational product. Although crowdsourcing can be used in education for the purpose of collaborative co-production of educational content, learning resources, benefiting from the potential of the masses in education and learning, developing e-learning systems and programs, etc., it has not been used in education in the required manner.

There are many definitions of mathematical thinking, according to the many points of view and the different specializations. This indicates the importance of this type of thinking, as mathematical thinking, according to the testimony of scientists and researchers in various specializations and sciences, is one of the most important types of thinking known to man since ancient times.

Mathematics curricula are a fertile field for creativity, due to their nature and special structure, which helps to deduce more logical results for the same data, and a deductive structure that gives some flexibility in organizing and reformulating the content. Mathematics is also rich in situations and problems that can be directed to learners to find various solutions for each situation (Mukhallad Al-Mutairi, 2021, 48).

For this reason, it was necessary to search for a way through which mathematical thinking skills could be developed to obtain successful individuals. Success, as Artino (2008) sees it, is not only individuals who store information, but also those who know how to use this information, apply it in the sports field, and be effective members of work teams. Therefore, it was necessary to look at preparing teachers who are able to think in a way that greatly facilitates their interaction with various life skills.

Mathematical thinking is a scientific, proven thinking that takes the sequential steps of considering a question as a means to discover the unknown or prove the validity of the known. In this way, it is a method in human thinking that looks at the relationships of connection or interdependence between the parts of a single cognitive question, to make it a connected chain that can be proven and abstracted. Mathematical thinking may transform what is perceived by the senses or statistics into what is perceived by the mind, and in this way it makes knowledge rational, even if it is originally transmitted or sensory, because it is a

symbolic abstraction of knowledge, and abstraction often transcends the senses, time, and place (Hassan Al-Malakh, 2007, 15).

Therefore, the aim of the current research ishestudyemploymentcrowdsourcingElectronicIn developmentMathematical thinking skills of higher institute students, to try to take advantage ofHaFor the largest base of learners.

- **Research problem:**

Thinking plays an important role in the learning process, and therefore it is necessary for educational institutions to provide appropriate opportunities that motivate learners to think and practice it in classroom and extracurricular situations. With the rapid changes and the technological and scientific explosion, the educational process no longer aims to provide learners with information, facts, knowledge, and basic skills only, but has gone beyond that to developing learners' abilities in all types of thinking (material thinking, scientific thinking, creative thinking, objective thinking, and mathematical thinking) in order to advance and develop the human being.

Because crowdsourcing providesManyThe potential, as the variable of mobile crowdsourcing is characterized by speed and ease of access, and spread to a large audience, especially young people, and the successive developments in the design of this environment, and the desire to reveal the effects of the design variables of this environment, which develop day after day, and the need to study the levels of this crowd, and measure its impact on the learning process, and developmentMathematical thinking skillsAnd other skills, in addition to its impact on cognitive achievement, so it is the most appropriate for developing skills, and there is a need to use crowdsourcing in developing achievement.and mathematical thinking skills.

To verify the research problem, the researcher conducted an exploratory study on a sample of (10) students from higher institutes - the research community - and applied it to them to know the extent of their familiarity with mathematical thinking skills. The study concluded that: 90% of students need to learn mathematical thinking skills, 80% of students confirm the scarcity of training courses in the field of mathematical thinking, and 80% of students confirm the desire for a flexible method that suits the time and circumstances to learn mathematical thinking skills in light of technological transformations and widespread epidemics that require not being directly present in the educational process. Here, the role of technology appears in proposing solutions that help overcome these problems.

From the above, it is clear that there is a decline among students of higher institutes in the skills of employing mathematical thinking, which required the researcher to search for a strategy that would enable him to develop these skills.

Therefore, the research problem is defined in the following declarative statement:

"Measuring the use of crowdsourcing in developing mathematical thinking skills among higher institute students."

- **Research questions:**

In light of the above, the current research problem can be addressed by posing the following main question:

What is the impact of employing electronic crowdsourcing on developing mathematical thinking skills among higher institute students? The following sub-questions branch out from this main question:

1- What mathematical thinking skills should be acquired by students of higher institutes?

2- What are the criteria for designing a crowdsourcing environment to develop the cognitive and skill aspects of mathematical thinking skills among higher institute students?

3- What is the appropriate educational design for mobilizing electronic resources to develop mathematical thinking skills among higher institute students?

4- What is the impact of employing electronic resource crowdsourcing in developing mathematical thinking skills among higher institute students?

- R

esearch objectives:

The current research aims to achieve the goalfollowing:

- Identifying the mathematical thinking skills that need to be developed among higher institute students.
- Determining the design criteria for crowdsourcing electronic resources to develop mathematical thinking skills among higher institute students.
- Determine the impact of crowdsourcing onskillsMathematical thinking among higher institute students.

- **Importance of research:**

The importance of the current research lies in the following points:

- **The research results may help in designing learning** environments that are suitable for learners according to their characteristics and readiness, in order to provide them with an integrated base to build and organize the mechanisms for employing crowdsourcing in a typical form in order tothedevelopmentThis is amazingEnvironments for this category and improving different learning outcomesEspecially mathematical thinking skills.
- Providing those responsible for designing and developing learning environments with a set of foundations andRStandard criteria are taken into consideration when designing and developing them, in relation to developing crowdsourcing mechanisms through which they are used in developing these environments in order to:usedIn acquiring the cognitive and performance aspectsFor mathematical thinking skillsThey have.
- Providing those responsible for teaching various courses to university learners with a set of standard principles and guidelines on employing crowdsourcing, which can be used effectively across learning environments for this group to raise their level of performance and improve their learning outcomes.

- **Research methodology:**

The researcher followed the developmental research method as defined by Al-Jazzar.(El Ghazzar, 2014))It is an integration of: a) The descriptive approach: to answer the first and second sub-questions. 2) The approach to developing learning systemsISDThe researcher uses it to answer the third sub-question by applying the educational design model for the learning environment based on crowdsourcing to developMathematical thinking skills3) The experimental method: This is when measuring the effect of the independent variable.andcrowdsourcing on the variableThe followerAnd heand,Mathematical thinking skills of higher institute students; and the answer toThe questionSubFourth.

- **Research sample:**

The research sample will consist of a sample of (40) fromFirst year higher institute studentsThey are intentionally selected and distributed toTwo groups, the first experimental

group (20) male and female students, and the second control group (20) male and female studentsAccording to the experimental design of the research, and those who have no previous experience with the subject of learning.

- **Study assignments:**

- There is no statistically significant difference at the level of≥(0.05) between the average scores of the experimental and control groups in the pre-application of the mathematical thinking skills test.
- There is a statistically significant difference at the significance level.≥(0.05) between the average scores of the students of the experimental and control groups in the post-application of the mathematical thinking skills test in favor of the experimental group.
- The use of crowdsourcing achieves an eta square effect size.n2 ≥0.14 in the test of mathematical thinking skills for students in the experimental group.

- **Study limitations:**

Time limits: The study will be held during the academic year 2023/2024 AD.
Spatial boundaries: The study will be held at the Higher Institute in Ajdabiya.
Objective limits: The study will include a study unit that will be used to develop the mathematical thinking skills of the institute's students.

- **Search terms:**

- **crowdsourcing :**

He knows it Mohamed Khamis(2020, 420) as: "A collaborative or online educational activity in which a group of individuals contribute to solving or implementing a difficult problem, by dividing it into small parts, motivating individuals to solve these tasks in sequence, and collecting these individual solutions to the mini-tasks, to reach a solution to the larger or main problem."
And he knows itThe researcher procedurally states that:"A collaborative learning activity carried out by learners while carrying out specific educational tasks and assignments assigned to them through participation, interaction and commentary, which are placed sequentially until the desired learning objectives are achieved."

- **Mathematical thinking:**

Mathematical thinking is known as: A pattern of thinking that an individual performs when exposed to a mathematical situation, which is represented by one of the following manifestations: induction, deduction, expression in symbols, logical thinking, mathematical proof (Muhannad Muqaddadi, 2021, 71).
It is known procedurally.It is the method by which the learner attempts to reach a solution to a mathematical problem in a specific situation, through the use of mental processes, and its degree is determined by the degree the learner obtains in the mathematical thinking test prepared by the researcher.

Theoretical Framework

- **Firstly: Crowdsourcing:**
- **Crowdsourcing concept Education Crowdsourcing:**

It is mentioned by everyone who Morschheuser, Hamari, Koivisto & et al., (2017, p.27) Crowdsourcing is a collaborative model that primarily uses web-based technology and is centered around individuals to solve a problem.
In the educational field, crowdsourcing is defined as a type of online activity in which the educational institution proposes a group of learners who interact through flexible and open communication to help solve a problem in the teaching and learning processes.(Jiang, Schlagwein & Benatallah, 2018, 3)

- **Crowdsourcing objectives:**

Crowdsourcing seeks to achieve the highest benefit from learners' experiences and expertise and to reach the highest and best result for the contributions and ideas collected as a result of the interaction and collective intelligence among them, as crowdsourcing uses collective intelligence to collect information and data and exchange experiences among a number of learners participating on the network to study a specific topic or problem to reach the best solutions.(Kronk, 2017).

From the above, the researcher concludes the following objectives of mobilizing sources: Exchange of experiences - Collective intelligence - Sharing content - Collecting and exchanging opinions - Social interaction - Reaching the best solutions - Evaluation of the crowd.

- **Benefits of crowdsourcing in education:**

Crowdsourcing is seen by engaged learners as active workers, seeking to accomplish a specific task in an integrated manner with each other. The benefits of crowdsourcing appear in that it helps provide diverse, high-quality solutions. These benefits are represented in the following points:(Hills, 2015, 51):

- Trying to benefit from the abilities, skills and potential of all learners.
- Trying to benefit from the largest number of specialists available on the Internet, and their skills and experiences.
- Improving educational, technological services and products.
- Achieving the satisfaction of beneficiaries and learners with the educational process.
- Increasing learners' interest in education and achieving competitiveness among them.
- Providing educational products and services that suit the differences and needs of learners.
- Teachers' involvement in the learning and teaching process.

Mobilizing resources is one of the strategies that can be used in the educational process, especially since it has many advantages and benefits that are reflected in the educational process, as it:

It helps to provide a distinctive educational product due to the difference in ideas and solutions - reaching the best scientific solutions - developing the team spirit - increasing motivation among learners - developing speaking and listening skills among learners - taking responsibility for learners individually and collectively.

Crowdsourced learning theories:

Muhammad Khamis (2020) stated that crowdsourcing has many theoretical foundations, including:

- **Motivation theory:**This theory shows that motives are what drive learners to participate in the activity or task, and these motives greatly influence human behavior. The theory of motivation is linked to collective intelligence and resource mobilization, as motivation is the basis for learners' participation in resource mobilization. Numerous studies and research have confirmed that resource mobilization depends primarily on motivation.

There are two types of motivation: intrinsic motivation and extrinsic motivation:

- Internal motivation: It is the pleasure and satisfaction resulting from the activity among learners, as the learners themselves show a desire to participate, even if there is no moral or material return.
- External motivation: individuals obtain moral and material returns.(CAI, 2016)
- **activity theoryActivity Theory:**The activity theory consists of: individuals, tools, community rules, objects, and the laboratory department. This theory sees that human

experiences are formed through a set of signal systems and tools that are used, and that there is no direct connection between the environment and the individual, and that this happens through media that direct him towards a specific object, and that these tools affect interactions with the world. These tools are integrated with the individual's activities that he performs to obtain a specific experience, and community rules allow the work department to participate in carrying out a specific task. This activity is based on standards and rules of participation between individuals. This is clearly evident in the crowdsourcing application, because crowdsourcing is the system that constitutes the activity, through the platform prepared for crowdsourcing. (Muhammad Khamis, 2020).

Second, mathematical thinking:

- **The concept of mathematical thinking:**

Mathematical thinking is one of the diverse fields of thinking. It is a process through which meaning is sought in a situation or experience related to a mathematical context. It is thinking in the field of mathematics, where the elements or components of the situation or experience are represented in numbers, symbols, shapes, or mathematical concepts. It is the broadest type of thinking (Farid Abu Zeina and Abdullah Ababneh, 2007, 273).

It is a mental activity based on a set of mathematical skills, and requires inference and deep thinking about mathematical ideas, and through which problems are solved (Mohamed Abdel Shafi, 2016, 46).

It is a set of higher thinking abilities in mathematics that include the skills of expressing symbols, induction, deduction, and mathematical proof (Hanfy Muhammad, 2017, 300).

- **Mathematical thinking objectives:**

Mathematical thinking is not only used in mathematics, but its effect is transferred to the study of other subjects, and its effectiveness appears in solving academic, practical and life problems alike (Magdy Ibrahim, 2009, 18).

Learning mathematical thinking skills helps to benefit from the concepts, generalizations, and mathematical skills acquired by the student teacher to derive new results based on logical foundations and rules, which help to invent new solutions to the mathematical and life problems that he faces (Yahya Madi, 2011, 102).

Developing mathematical thinking skills is one of the most important goals that mathematics seeks to achieve, given its importance and effective role in helping the student to effectively confront problems (Maha Al-Sarhani, 2014, 34).

Jawdat Saada (2003) adds that the importance of developing teachers' mathematical thinking skills is represented in the following:

- Helping them to become familiar with different learning styles, and taking that into account in the educational process.
- Increase motivation, activity and vitality among teachers.
- Make the teaching process exciting, engaging, and collaborative between them and the students.
- Reduce the focus on the delivery of the course material.
- Boost teachers' morale and self-confidence.

- **Characteristics of mathematical thinking:**

- Thinking is a purposeful behavior and does not occur in a vacuum or without a goal. When acquiredStudentsWith this behavior, they become confident in their abilities, and have the motivation to be thinkers and creatives.II wanted them.
- Thinking is behavior evolutionYIt becomes more developed and sharper as the individual grows and accumulates experience.toThus, involving the student teacher in

acquiring and linking information, not just memorizing it, allows them to break free from rigidity in thinking..

- Effective thinking is thinking that is based on the best possible information available, and is guided by the right methods and strategies. Through thinking development programs, the student becomes curious, open-minded to the ideas and opinions of others, and appreciative of...ICreative achievements in all its forms.
- Thinking is formed from the interaction of the elements of the environment, which include time and situation, or the occasion and the subject around which thinking is conducted. Therefore, thinking development programs Make students more aware of the nature of the factors and conditions associated with thinking, and the skills to overcome them..
- Thinking occurs in different forms and patterns (verbal, symbolic, quantitative, spatial, formal).) Each form or pattern has its own characteristics, and the student teacher practices it through thinking development programs.
- Thinking development programs, make the student teacher more aware of the problems around him.hM, and more able to confront them with useful and appropriate creative solutions.) .Hanfy Muhammad, 2018, 303).

- **Mathematical thinking patterns:**

- **abstract thinking**:Thinking characterized by the ability to comprehend and use concepts and generalizations. It is the most complex and final stage in the development of cognitive thinking in which ideas are characterized by adaptability and flexibility, and by the use of concepts and generalizations, such as characteristics or patterns that are common to a variety of elements or events, so that solving or dealing with problems is accomplished by drawing logical conclusions from a set of observations, and by formulating and testing hypotheses.
- **critical thinking**:He knows itFahimMustafa (2005) It is the individual's ability to express a supportive or opposing opinion in different situations, while providing convincing reasons for each opinion. It is sufficient for the individual to have an opinion on the issues raised and to support his opinion with convincing evidence in order to be among those who think critically.A.He seesMagdy EIbrahim (2009) said that there are several factors that hinder critical thinking, including:: Using sentences and symbols inaccurately, not taking students' opinions into consideration, reaching incorrect generalizations, giving insufficient information, repeating sentences and giving many of the same types of examples, deviating from the main point of the solution
- **Creative thinking**:It focuses on the creative environment that provides a conducive climate that encourages creativity. Gil Ford saw that the creative process is synonymous with the problem-solving process, and in terms of origin, the creative process is more distinctive and sophisticated.And he knows it.tigerMustafa (2011) It is looking at the familiar from an unfamiliar angle, then developing this view to transform it into an idea, then into a design, then into an innovation that can be applied and used. It consists of elements that are not available in other thinking processes..

- **Study method:**

Use the researcherThe developmental research method as defined by Al-Jazzar(El Ghazzar, 2014))It is an integration of: a) The descriptive approach: to answer the first and second sub-questions. 2) The approach to developing learning systemsISDThe researcher uses it to answer the third sub-question by applying the educational design model for the learning environment based on crowdsourcing to developMathematical thinking skills3) The

experimental method: This is when measuring the effect of the independent variable.andcrowdsourcing on the variableThe followerAnd heAnd mathematical thinking skills among students of higher institutes; and the answer toThe questionSubFourth.

- Study community and sample:

The research sample will consist of a sample of (40) fromFirst year higher institute studentsThey are intentionally selected and distributed toTwo groups, the first experimental group (20) male and female students, and the second control group (20) male and female studentsAccording to the experimental design of the research, and those who have no previous experience with the subject of learning.

Experimental framework of the research:

The experimental framework of the research will be presented according to the following axes:

Axis 1: Design and development of the experimental treatment environment.

- **First, define the structural design criteria for crowdsourcing electronic resources.**

The list of structural criteria for crowdsourcing electronic resources has been prepared as follows:

The conditions that must be met in the e-resource crowdsourcing environment and its suitability for learners were determined, and the initial image was prepared with a list of criteria for designing the e-resource crowdsourcing environment, educational content, its activities, learning objectives, and evaluation processes across these educational environments for learners.Show it to the judges,The suitability of these standards and their specific indicators was reached and agreed upon, and they consisted of (9) main areas and (99) standard levels that were relied upon when designing the mobilization of electronic resources for learners.

- **Second: Determining the standards for designing educational content to mobilize electronic resources.**

The conditions that must be met in designing learning content in an e-crowdsourcing environment and its suitability for learners were determined. The initial image was prepared with a list of criteria for designing educational content and was presented to the arbitrators and their amendments were taken to ensure the validity of the criteria and the amendment according to their opinions.

Third: Design and development of the electronic sourcing and content environment:

The researcher concluded by adopting the model of “Muhammad Ibrahim Al-Dasouqi 2015"On the basis that it is a modelٌSpecially designed for this type of e-learning and teaching style.,This is done with some modifications to the model to suit the current research..

- **Axis II: Study tools:**

First: The achievement test:

The researcher prepared the achievement test according to the following steps:

1- Determining the purpose of the test: Use it as a pre/post-test to measure the extent of the research sample students’ familiarity with scientific information related to mathematical thinking skills.

2- Determining the type of test items and their scientific formulation: After the researcher reviewed books, references and studies that dealt with evaluation methods and tools in general and objective tests in particular. The test consisted of (20) paragraphs at a

rate of (5) paragraphs for each type of mathematical thinking (deductive, creative, critical, abstract) and the questions varied between multiple choice and essay questions.

3- The test scores were estimated for each paragraph, so that the test score as a whole was (20) points, and the test time was estimated at one hour.

4- The levels of mathematical thinking were classified according to thinking skills (abstract, critical, deductive, and creative), as each pattern contains 5 paragraphs of questions, as shown in Table (1).

Table (1) Mathematical thinking skills according to their analysis in the Mathematical Thinking Test.

type of thinking	Paragraph number
abstract thinking	Q1, Q6, Q18, Q11
critical thinking	Q2, Q7, Q10, Q15, Q11
Creative thinking	Q4, Q14, Q16, Q19, Q20
Deductive reasoning	Q3, Q4, Q9, Q12, Q13

5- Programming the test and preparing it in its initial form.

6- The test was presented to the arbitrators to ensure the validity of the arbitrators: The arbitrators indicated the deletion of (3) words from the test, and making some linguistic modifications to them. The researcher made all the modifications that were agreed upon, and as a result the test became composed of (20) words.

7- Conducting a pilot test for the achievement test:-

The researcher conducted a pilot test on a sample of students from the Higher Institute (outside the research sample). The number of students in the sample was 15 male and female students. The aim of the pilot test for the achievement test was as follows:

- Calculating the test reliability coefficient: The reliability coefficient of the results of the exploratory experiment for the scientific achievement test was calculated using the Cronbach's alpha equation, where its statistical value reached "0.91", which is a high value, indicating the reliability of the test.
- Calculating the difficulty and ease coefficient for each of the test items: The difficulty coefficients for the test items ranged between (0.58:022), and from the above it is clear that all the test items are within the specified range, and that they are neither very easy nor very difficult. The test items were re-arranged based on their degree of difficulty, and thus the test is in its final form.

Stage Three: Conducting the Basic Experiment:

The main research experiment was conducted during the period from Sunday 4/7/2024 AD until Wednesday 4/8/2024 AD, according to the following:

- Conducting the pre-achievement test on both the control and experimental groups.
- Ensure that the control and experimental groups are equivalent by:

The researcher analyzes the results of the pre-test application using a program. SPSS This was to determine the difference between the two groups and the significance of each of them, as the results showed no statistically significant differences between the two groups.

- Implementation of the field experiment:

The researcher held preliminary meetings with the experimental group for the research to determine the following:

a. The aim of the experiment:

b. Determine the requirements of the existing educational environment and mobilize electronic resources.

c. The importance of performing activities for students.

d. How to perform activities.
e. Explain how to use and interact with the environment's user guides.
f. Directing students to the electronic environment to go through the educational experience.
g. Monitor student performance, motivate them and provide feedback.
h. Applying the post-test measurement tools (mathematical thinking skills test) to the experimental and control groups, and processing the data statistically.

Search results and their interpretation:

The research questions, answers, and results will be reviewed and explained below:

The answer to the first question and its text What mathematical thinking skills should be developed among middle school students in mathematics?

The researcher reviewed Studies and literature which dealt with Visual thinking skills that can be developed in students Search present Which It was completed Signal To her in the chapter the second, The researcher reached existing The skills to be developed, which appear in their final form in Appendix (2), consist of (4) main skills and (45) sub-skills, which were previously mentioned.

The answer to the second question and its text What are the design criteria for an electronic crowdsourcing environment to develop mathematical thinking skills among higher institute students?

This question was answered by arriving at a list of design criteria for the electronic crowdsourcing environment in its final form, which consists of (9) criteria and (99) indicators that indicate the achievement of these criteria. It was based on the design of the electronic crowdsourcing environment.

Answer to the third question What is the existing educational design for mobilizing electronic resources and its impact on developing mathematical thinking skills among higher institute students?

This question was answered by finding an environment for crowdsourcing electronic resources and using them to develop mathematical thinking skills. GuestFor students of higher institutes, it consists of five steps or stages, which are:(Introductory evaluation stage - Preparation stage - Analysis stage - Design stage - Production - Evaluation - Application)

Answer to the fourth question Its text: What is the effect of using electronic resource mobilization in developing mathematical thinking skills among higher institute students?

This question was answered by reviewing the results of the first, third, and fifth hypotheses, which relate to students' mathematical thinking skills, as follows:

The first hypothesis states However, "there is no statistically significant difference at the level of≥(0.05) between the average scores of the experimental and control groups in the pre-application of the mathematical thinking skills test.

In order to verify the validity of this hypothesis, the researcher compared the average scores of the experimental group and the scores of the control group in the pre-application of the achievement test of mathematical thinking skills using the "t" test.

Table (2) shows the difference between the average scores of the experimental and control groups in the pre-application of the achievement test of mathematical thinking skills.

The group	Number of students	Average score	Standard deviation	T value	Significance level
empiricism	20	12.81	3,12	0.121	0.812
The officer	20	12.92	3.29		

It is clear from the previous table (2) that the value of "t" reached (0.121), and that the level of significance reached (0.812), which is greater than the level of significance (0.05), and this

indicates that there is no statistically significant difference, and this indicates the equivalence of the experimental and control research groups in mathematical thinking skills. Thus, the validity of the first hypothesis has been proven.

To verify the validity of the second hypothesis and its text: There is a statistically significant difference at the significance level.≥(0.05) between the average scores of the students of the experimental and control groups in the post-application of the mathematical thinking skills test in favor of the experimental group. The difference between the average scores of the experimental group and the scores of the control group in the post-application of the mathematical thinking skills test was calculated using "t".

Table (3) shows the difference between the average scores of the experimental and control groups in the post-application of the mathematical thinking skills test.

The group	Number of students	Average score	Standard deviation	T value	Significance level
empiricism	20	32.76	0.71	21.76	0.001
The officer	20	16.31	4.31		

It is clear from the previous table (3) that the average score of the experimental group in which students studied using electronic crowdsourcing was (32.76), and the average score of the control group in which students studied using the traditional method was (16.31), and the value of "t" was (21.76) at a significance level of (0.001), which is less than (0.05), which shows the existence of a statistically significant difference in favor of the experimental group, and accordingly the second hypothesis was accepted.

To verify the validity of the third hypothesis Its text is: "The use of electronic crowdsourcing achieves an effect size of eta squared."n2 ≥0.14 in the test of mathematical thinking skills for students in the experimental group.

To calculate the size of the effect of mobilizing electronic resources in developing the mathematical skills of the experimental group students, the Eta square equation was used. Table (4) shows the results of the statistical analysis.

Table (4) shows the value of Eta square to show the size of the effect of mobilizing electronic resources in developing mathematical thinking skills.

Application	Average score	Eta square	Effect size
tribal	14.82	0.96	big
The dimension	30.76		

It is clear from the previous table that the value of Eta squaredn2It is equal to (0.96), and this indicates that the size of the effect of mobilizing electronic sources is equal to 96% of the size of the total variance in the dependent variable, which is mathematical thinking skills, meaning that mobilizing electronic sources has a large effect on students' achievement, and this is evident through the progress of the students of the experimental group in the post-application over the pre-application of the mathematical thinking skills test, and this confirms the validity of the hypothesis.

The researcher attributes this result reached by the current research to the nature of the electronic crowdsourcing environment that allowed dealing and interacting with educational content according to each learner and according to his individual abilities. This is consistent with the study (Ibrahim Mahmoud, 2015; Raja Ahmed, 2018; Ahmed Atallah et al., 2019) where they mentioned that some theories related to the design of electronic crowdsourcing, such as the constructivist theory, which is the most closely related theory to electronic crowdsourcing, are based on the activity of learners in acquiring knowledge, which is one of the foundations and principles of crowdsourcing, which appears through the design of

electronic crowdsourcing content in its partial form, using electronic means and displaying content on mobile phones and web applications. In the same context, the communication theory supports the idea of networks and communities that wish to learn and exchange opinions about the educational experience, through contributions by providing scientific content via mobile phone or the web, with continuous feedback provided immediately upon completion of each required task and moving to the next skill, all of which helps to develop personal skills effectively.

Research recommendations and suggestions:

In light of the research results, the researcher recommends the following:

- Utilizing the potential of crowdsourcing technology in developing mathematical thinking skills.
- Preparing the educational situation, providing distinct interactive educational environments, and providing feedback that helps learners acquire new educational experiences and link them with the learners' previous experiences.
- Applying the method of crowdsourcing electronic resources in educational environments, especially in the primary stage, improves the environment and increases the efficiency and effectiveness of learners.
- **The researcher also suggests the following:**
- Conducting research and studies similar to the idea of the current research, with a different research sample, such as the secondary stage sample, to know the effect of crowdsourcing on that sample.
- The current research dealt with "mathematical thinking skills" as dependent variables. Therefore, future research could address the study of employing electronic resource mobilization in developing educational activities and achievement.
- Conducting research and studies to determine the impact of using the electronic crowdsourcing method on developing some methods of ethical self-regulation and some values among learners.

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