THE IMPACT OF E-BRAIN STORMING (INDIVIDUAL, COLLECTIVE) IN THE DEVELOPMENT OF EDUCATIONAL DESIGN AND SCIENTIFIC THINKING SKILLS OF GRADUATE STUDENTS

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ABSTRACT

The objective of the current research to identify the most appropriate strategy for e-brainstorming learning (individual-collective) is most appropriate with regard to the development of both the cognitive and cognitive aspect of educational design skills, and the scientific thinking skills of graduate students, and the sample of the research was randomly selected from graduate students of the Division of Education Technology of Imam Abdul Rahman University in Saudi Arabia numbered (90) students, and the actual application of experimental treatment materials was conducted and after conducting statistical treatments, the results of the research resulted in differences indicative between the average statistical The grades of experimental group students in the cognitive achievement test associated with educational design skills, a product evaluation card, educational design skills and scientific thinking skills are due to the fundamental impact of the e-brainstorming strategies (individual versus collective) in favour of collective electronic brainstorming.

Keywords: Electronic Brainstorming, Individual Electronic Brainstorming, Collective Electronic Brainstorming, Educational Design, Scientific Thinking.

INTRODUCTION

Brainstorming Electronics' (EB) strategy was a development of the traditional brainstorming strategy, which was addressed as an alternative to it (Chen & Emity, 2011). The e-brainstorming strategy uses innovative technological innovations to help students generate ideas more effectively than verbal/traditional brainstorming, because it provides the opportunity to track the flow of ideas and the ways in which the idea works in the minds of learners, and it helps the teacher to know the individual differences of learners and their innovative abilities, and this is reflected in dealing with this strategy according to different teaching methods that require the activation of electronic brainstorming strategy patterns according to different learning methods.

The effectiveness of this strategy has been confirmed in both types by a range of Arab and foreign studies whose characteristics and importance have been mentioned, including: (Sek, & Law et al., 2000), Sayed (2015), Anour (2015), Sabry (2014), Zahrany (2016); For the content and topics of previous studies, experimental groups studied by electronic brainstorming outperformed the control groups that studied in the traditional way in their dimensional performance compared to their tribal performance in the development of knowledge and skills

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related to performance and production of different learning subjects and the results related to previous studies reached me The existence of statistically significant differences in favor of the e-brainstorming group in the development of achievement and reduction of cognitive load.

In this context the department Vaughan & Garrison (2006) electronic brainstorming into two types, one of which is individual or formal brainstorming, and in this type ideas and opinions are generated for each individual, then the ideas of each individual are grouped by the teacher as coordinator of the brainstorming session, and then choose the best of these ideas as a solution to the problem, making that strategy a preferred method suitable for the learner according to the individual method as The second type is defined in a type similar to individual or formal brainstorming, namely collective brainstorming or interactive groups, a brainstorming of a number of individuals within one group, and they work in an integrated collective framework, to generate as much thought as possible towards a particular problem presented to them by the teacher/researcher as coordinator of the brainstorming session, making that strategy suitable for learning according to the current collective research method.

In addition to supporting each strategy by education theories, the individual electronic storming strategy is based on the Philosophy of Construct Theory theoryivism Cognitive, which relies on the learner's learning activity, making it an ongoing knowledge-building activity. Theory Social Constructivism's collective cyber-storming strategy, which relies on the building of learning, is driven by social networking among learners who share and interact together to produce their knowledge and experience. (Chen & Emity, 2011; Fathy, 2001)

From the above is clear the relationship between the strategy of e-brainstorming in its individual and collective patterns in the development of educational design skills, where the relationship in the design of lessons through electronic learning environments and digital innovations is shown as the e-brainstorming strategy is one of the most important electronic innovations that use e-learning environments via the web, ensuring that learning occurs according to each student's willingness and ability to learn, and learning within the framework of learner's preferences is one of the most important types of learning because students can interact with each other and enable them to Develop learning skills and products using systematic and systematic scientific thinking methods in generating ideas and suggestions for the problems under consideration, where scientific thinking is a systematic introduction of the procedures and steps used in identifying the systematic design in drawing the steps of problem solving and formulating them within the framework of systematic design.

In the same context, the brainstorming strategy is one of the most important strategies that help to develop many types of thinking, because of its characteristics that make it an effective way to develop thinking skills as previously indicated; The results of previous studies have found statistically significant differences in favor of the e-brainstorming group in the development of achievement and inference and creative thinking, which are types of thinking that lead to scientific thinking, and the results indicated that individuals are more productive of ideas when they work independently in proportion to the strategy of individual e-brainstorming, and that how much less when working in collective and this is consistent with the strategy of brainstorming.

The relationship between e-brainstorming strategy and the development of scientific thinking skills is illustrated by the fact that it relies on generating logical ideas to solve a problem in an individual or collective context, in order to generate a wide range of ideas, and this is consistent with the recommendations of the Conference on Education and Thinking Development (2000), that brainstorming is a process of brain-raising thinking and innovative

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solutions to problems that are directed in groups or in the context of their individual practice to maximize interaction and benefit from them, as noted by the Rashdan (2015) The e-brainstorming strategy is a kind of thinking in general and scientific thinking in particular, as it can be applied whether it is within the framework of a collective or individual e-brainstorming strategy.

In the light of the above, there is a need to identify the most appropriate strategy for electronic (individual, collective) brainstorming with regard to their impact on both the development of educational design skills and scientific thinking.

E-brainstorming Strategy Patterns

Sections: Sayed (2014), Othman (2008), Ebada (2003), Dabbagh & Kitsantasm (2004) e-brainstorming strategy to two strategies:

Individual Electronic Brainstorming

Individual e-brainstorming strategy in which web technologies and applications are employed, where a recording software is set up by its own computer to record ideas from its own point of view independently and connected to a central control to gather opinions and then begin to discuss them.

As the strategy of individual electronic brainstorming in the current research is meant: as it is an organized and deliberate process, the student, through his interaction with the brainstorming environment, tries to acquire for himself the greatest knowledge and skills and apply the methods of scientific thinking while learning, the individual electronic brainstorming is characterized by a set of features that represent his characteristics in: encouraging the student to experiment and learn without worrying about individual differences, taking into account individual differences so that the student learns according to his ability to learn, to focus on his activity and his positive that appears in his motivation and his desire to learn, to evaluate his or her ability to learn. Self-educated according to his level and not compared to other pupils. The individual e-brainstorming strategy has therefore provided expertise that is:

1. Individual: Providing assistance and support in an individual way that is different from what is provided to another learner. The feedback provided to the learner is then individual and immediate.
2. Interactive: The individual e-brainstorming strategy provides greater participation through the dialogue between the learner, the environment and the teacher, in which the two parties exchange questions and answers, while providing instant feedback from the teacher to the learner.
3. Self-track: The learner can control the way educational information is displayed by re-reviewing certain parts of the world as much as he or she wants, or skip some parts when they want to focus on what they do not know or do not master without having to wait for other learners.
4. Safe: Learning occurs individually in a safe environment compared to a classroom/lecture environment in which competition appears and the learner is sometimes under the pressure of the classroom. The e-brainstorming environment allows these feelings to be eliminated by identifying the learner's speed and the way he learns.

Sayed (2006) also points out that the individual e-brainstorming strategy provides teachers with the opportunity to track the flow of ideas and ways of thinking in the minds of learners, and it helps them to know the individual differences of learners and their innovative abilities, in which the student is helped by the possibilities provided by innovative technological innovations so that the student can generate ideas and the teacher encourages the initial ideas of

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practical solutions and selection, and put forward all ideas for interpretation after the session and analysis after the session. The success of e-brainstorming sessions in stimulating active thinking processes and developing constructive skills in scientific thinking in line with individual e brainstorming requires two principles. (Sherbini & Sadik, 2002) are:

> The principle of postponing judgment on the values of ideas: this principle emphasizes the importance of postponing judgment on the ideas put forward by students because the student's feeling that his ideas will be criticized since their introduction leads to incompleteness and places restrictions on innovative thought and limits the amount and diversity of ideas resulting and it also gives an opportunity to study the characteristics of each idea that may be based on it or part of it other ideas.
>
> Quantum principle generates quality: This principle confirms that the amount of ideas put forward during the brainstorming session and the multiplicity of solutions and differences by the student results in the diversity of ideas and their freedom and increases the likelihood of producing new ideas, allowing the student in the session a wide horizon and a fertile environment to produce creative and non-traditional ideas and solutions accurate and scientific that cannot be reached through limited ideas.

Collective Brainstorming

Collective e-brainstorming strategy in which web technologies and applications are employed in interaction, including the use of forums, blogs and wiki technology, these technologies are characterized by the opportunity for everyone to discuss, as there are programs characterized by their high ability to achieve interaction, participation and direct response automatically and reduce the role of leader to devote more important work, and there are specialized websites to conduct group sessions of electronic brainstorming.

The aly study (2001) indicated that electronic brainstorming is identified in a type similar to individual or formal electronic brainstorming, namely collective electronic brainstorming or interactive groups, a brainstorming of a number of individuals within a single group, and they work in an integrated collective framework, to generate as many ideas as possible about a particular problem presented to them by the teacher/researcher as coordinator of the brainstorming session.

Dyab (2001) states that there are obstacles to the application of the strategy of collective brainstorming in groups, where these constraints appear in the psychological and cognitive aspects, namely the fear of the learner from failure and appearing in front of the learning group with a ridiculous appearance, because of his lack of confidence in himself and his ability to invent and generate new ideas and convince others of them; I have to have a collective dialogue and convince others of his ideas and opinions, which makes their application in a collective manner a pillar in strengthening this handicap, if applied in a role that allows the student to practice his ideas freely and spontaneously and discuss them in a context of interest.

From the above it is clear that individual and collective electronic brainstorming is different from verbal brainstorming only in the use of innovative technological innovations, as they have the same basic principles and rules. Electronic brainstorming is used as a method of collective or individual thinking to solve many different scientific problems. (Swydan, & Adwany, 2002) and in this regard osborn refers to it (1963) The true founder of this strategy as a strategy based on generating logical ideas to solve a problem in an individual context or to share it in a collective context, in order to generate a wide range of ideas, and this is consistent with the recommendations of the Conference on Education and Thinking Development (2000), that brainstorming is a process of raising the mind in thinking and finding innovative solutions to

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problems are directed in groups or in the context of conducting them individually to achieve maximum interaction and benefit As the Rashdan study (2015) indicated, the electronic brainstorming strategy is a kind of thinking that can be applied both collectively and individually, intended to generate and produce creative ideas and opinions, both individually and collectively, to solve a particular problem, and to have good and useful ideas and opinions; Freedom allows all opinions and ideas to emerge, with the aim of increasing mental abilities and processes, which means using the mind to actively address the problem.

Develop Educational Design Skills and their Relationship using Electronic Brainstorming Strategies

From the above, the relationship between the e-brainstorming strategy and its individual and collective patterns is illustrated by educational design skills, where the relationship is reflected in the design of educational lessons through e-learning environments and their digital innovations, as the electronic brainstorming strategy is one of the most important e-learning environments that use e-learning environments via the web, through which it can develop learning skills and products and implement and skills tasks associated with educational design to determine the full educational conditions and specifications of the educational system with its sources, attitudes, programs, lessons and courses.

The Khalil study (2009) also recommended the need to take advantage of the resources of learning available through the web in providing students with educational design skills, so the current research adopted the strategies of individual and collective e-brainstorming as one of the technological innovations over the web that proved superior in achieving different learning outcomes compared to traditional and e-learning (individually) as indicated by the results of previous studies, where the study Dabbagh & Kitsantas (2004) indicated the effectiveness of the strategy Individual e-brainstorming compared to the collective e-brainstorming strategy in improving, acquiring and developing educational skills, while Bicniick, Rashdan (2015), Sayed (2015) was limited to using a single *"individual/group"* e-brainstorming strategy and the results of each study showed the effectiveness of the two e-brainstorming strategies used by the study to develop learning skills associated with the design of courses and modules.

Individual and Group Electronic Brainstorming Strategies and their Relationship to the Development of Scientific Thinking Skills

Since the e-brainstorming strategies represent a support pattern to provide learning to students in the development of learning skills and scientific thinking on learning topics presented in lessons and topics identified by the researcher in the use of different educational activities, this is consistent with what Holton & David (2006) referred to in their definition of supporting learning as *"additional educational activities offered to the learner so that it allows the learner to interact actively with the world by linking its components, leading to the development of his mental skills and abilities of analysis, composition and evaluation of the principles associated with scientific thinking"*. Therefore, the e-brainstorming environment is aimed at developing the skills of scientific thinking of the learner through the interaction between the new information provided for the first time and the information that is available to him in the light of the strategies of electronic brainstorming, so that the information is processed by processing and organizing it, leading to the improvement of his knowledge and then moving to a higher level of thinking. Accordingly, learners were urged to use information to emphasize the development of their

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scientific thinking skills, hence the current research addresses the variable scientific thinking through Bloom's classification of the higher mental levels *"analysis, composition and evaluation"*.

In the same context, the brainstorming strategy is one of the most important strategies that help to develop many types of thinking, because of its characteristics that make it an effective way of developing thinking skills, where it promotes teaching in an attractive and creative way that works to develop active thinking through which it transfers the traditional method of teaching based on the automated preservation of information, which focuses on verbal speech to higher levels of creative thinking related to integrated subjects more advanced and appropriate in this era in which information has accumulated, this, Many studies are consistent in measuring the impact of E-Brainstorming on several research variables. Among them is a study: Gamil (2004), Abdallah (2002), Musalam (2002) and these studies found: an effect on the use of brainstorming online in the development of thinking, and the results of previous studies found Differences of statistical significance in favor of the e-brainstorming group in the development of achievement, thinking and reduction and cognitive load, as some of these studies aimed to know the future trends of electronic brainstorming and the results indicated that individuals are more productive of ideas when working independently in proportion to the strategy of brainstorming Individual e-mail, and that the amount of ideas decreases when they work in groups and this is consistent with the strategy of collective e-brainstorming.

INSTRUMENTS AND METHOD

The current research belongs to the development research category *"Development Research"* DR, which uses some descriptive study methods (descriptive survey, system development) in the study, analysis and design phase, and the experimental approach when measuring the impact of independent variables to research on its dependent variables at the evaluation stage. In the light of the two independent research variables, the experimental design known as the work design (2) was used and the following table illustrated the experimental design of the current research.

Table 1
EXPERIMENTAL RESEARCH DESIGN

Electronic Brainstorming Strategies	
Individual	Collective
Group 1	Group 2

Illustrated by the experimental design of the research as stated in Table 1, two experimental groups, the initial experimental group: studying using the individual e-brainstorming strategy, the second experimental group: studying using the individual e-brainstorming strategy, and the measurement tools consisted of: an achievement test;

The procedural steps taken by the researcher when managing the e-brainstorming session included a set of coordinated and systematically sequenced procedures organized as follows:

Identify and presenting the problem and preparing it for students and groups of electronic brainstorming sessions, so that the researcher had to provoke students to participate in the session procedures, so explain to the students the importance of the topics of the judge to be discussed for them, and the benefit that they can get by participating in solving it, as the researcher or teacher in this step must do the following:

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1. Identify and present the general and basic idea of the problem or topics of discussion.
2. Presenting the general and basic idea of the debate after it has been formulated in the context of a question.
3. Presentation of the rules and standards governing e-brainstorming sessions.
4. View some excerpts from the topics of discussion

An e-brainstorming session, which includes:

1. Recall the problem and ask the main question by the researcher.
2. Identify queries and questions by students if there is confusion in something they have.
3. Express students' opinions, with a time limit that students should not exceed.

Conclusion of the e-brainstorming session: in which generalizations and solutions reached are installed and proposed as solutions to the problem discussed.

The hypotheses of our test are the following:

H1: There are statistically significant differences at the ≤0.05 degree level between the average grades of experimental group students in the cognitive attainment test associated with educational design skills due to the fundamental impact of the e-brainstorming strategies (individual versus collective) in the e-brainstorming environment.

H2: There are statistically significant differences at the level of significance of ≤0.05 between the average grades of students of experimental groups in the Educational Design Skills Product Assessment Card due to the fundamental impact of the e-brainstorming strategies (individual versus collective) in the e-brainstorming environment.

H3: There are statistically significant differences at the ≤0.05 degree level between the average scoring of experimental group students in the Scientific Thinking Skills Scale due to the fundamental impact of the e-brainstorming strategies (individual versus collective) in the e-brainstorming environment.

RESULTS AND ANALYSIS

To ascertain the extent to which the students are familiar with the research sample with concepts and skills of educational design, the researcher prepared an exploratory study on a sample of graduate students in the Division of Education Technology at the Faculty of Quality Education University of South Valley numbered 35 students, consisting of 18 individuals at the rate of three responses for each response identified as follows: I can=2, to some extent=1, I can't=0, i can't identify the extent to which they have these skills and the result of the study as illustrated by the study Table 2.

Table 2
EXPLORATORY STUDY TO IDENTIFY STUDENTS' KNOWLEDGE OF THE RESEARCH SAMPLE CONCEPTS AND SKILLS ASSOCIATED WITH EDUCATIONAL DESIGN SKILLS

N	Phrases (Desired Behavior) I Can	To Some Extent I Can 2	Can't 1	I Can't 0	Average Relative Weight Relative Importance	Ranking %	Arrange
1	I can define the full educational specifications of the design/program material, create learning through it and identify its sources in order to achieve efficient and effective education.	5	10	20	0.57	28.57	8

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2	I have the ability to experiment with content and navigate through the software in a variety of ways based on links and various sailing tools between key ideas and information.	4	6	25	0.20	20.00	7
3	Able to organize the world in order to attract the attention of the learner towards the presentation and enable him to practice all educational activities during his interaction with the show.	0	0	35	00.00	00.00	1
4	I can estimate educational needs in light of the potential for software production.	0	4	31	0.11	5.71	3
5	I have the ability to identify educational tasks by selecting educational design models associated with the field of educational design.	0	0	35	00.00	00.00	1
6	Capable of analyzing the steps and stages of the appropriate educational design for the topic of construction and training.	1	0	34	0.05	2.85	2
7	I have experience in the logical interconnection of design interventions and their ability to achieve quality educational outputs.	2	1	32	0.14	7.14	4
8	I can analyze the characteristics and elements of educational groups in providing the educational content to learners.	0	0	35	00.00	00.00	1
9	I can determine the appropriate learning method and the way the content is presented to learners.	8	4	23	0.57	28.57	8
10	I can design the measuring tools to evaluate students' performance in learning the content of the programs.	0	0	35	00.00	00.00	1
11	I have knowledge of technical and educational standards for designing interaction screens in different educational programs according to the field of work and presentation.	0	0	35	00.00	00.00	1
12	I can describe every screen that appears in front of the learner "output boards" and identify icons interacting with the software.	7	7	21	0.60	30.00	9
13	I have experience in designing a learning path panel through software to guide the learning process.	0	0	35	00.00	00.00	1
14	I have prior experience of how to distribute and employ learning goals to achieve the learning outcomes of design software.	0	0	35	00.00	00.00	1
15	I can specify the type of interaction, fork points, and student response methods within the software/tutorial.	2	3	30	0.20	10.00	5
16	I can determine the requirements for the production of programs of material and	0	0	35	00.00	00.00	1

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	human potential in accordance with the nature of the educational design.						
17	I have a good level of technical literacy for the mainly educated.	6	9	20	0.60	30.00	9
18	I can develop a high-level interactive e-curriculum.	4	4	27	0.34	17.00	6

By extrapolating the results of Table 2 It is clear that the resolution selections were categorized as tasks by tasks in five key dimensions: analysis, design, development, implementation, use, and use, and were classified in the light of vocabulary that did not achieve high responses to stand up to the level of educational design skills and the results of the questionnaire in its entirety indicated that graduate students lacked some educational design skills, and that they needed to know, learn and develop them in an organization linked to what they were learning and applied in environments that were linked to what they were learning and applied in environments. Different learning through e-learning software and software.

Based on the fact that the exploratory study (Table 2) confirmed the lack of student level in terms of skills related to educational design and how to apply them, the study of Mohamed (2012) attributed this deficiency to the fact that teaching the basic concepts and skills of educational design and how to apply them effectively and efficiently needs more interaction with students and more activities related to the stages of educational design.

The results of the research were also statistically processed using the SPSS in the two experimental groups for cognitive achievement of educational design skills, for standard averages and deviations, according to current research variables and a Table 3 showing the results of this analysis.

Table 3
AVERAGE AND STANDARD DEVIATION OF THE DISTANCE APPLICATION SCORES OF THE COGNITIVE ATTAINMENT TEST ASSOCIATED WITH EDUCATIONAL DESIGN SKILLS

Electronic Brainstorming Strategies		**TOTAL**
Individual	**Collective**	
AV=12.10	AV=15.25	AV=13.76
SD=0.92	SD=2.49	SD=3.41
NU=54	NU=54	NU=90

By extrapolating the data contained in Table 3 it is clear that the average earnings for e-brainstorming strategies (individual versus collective) vary among themselves in the degrees of experimental groups, with the average score of earning in the collection of the individual e-brainstorming group (13.76) and The average gain in cognitive achievement of design skills for a group that uses individual electronic brainstorming (12.10) versus an average (15.25) in the two group of collective e-brainstorming, the results show different averages in favor of a collective e-brainstorming strategy.

The following Table 4 also shows the results of two-way analysis of cognitive achievement of educational design skills.

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Table 4
RESULTS OF TWO-WAY CONTRAST ANALYSIS BETWEEN E-BRAINSTORMING STRATEGIES ON COGNITIVE ACHIEVEMENT OF EDUCATIONAL DESIGN SKILLS

Source of Variance	Total Squares	Degree of Freedom	Average Squares	Value (F)	The Significance
Electronic brainstorming	2432.206	1	2432.206	96.071	*
Interaction between electronic brainstorming (individual and group)	156.657	1	156.657	8.463	*
Error variance	1336.928	86	13.163	.....	.....
Total variation	3925.791	89	.....	.....	.....
**Function at ≤ 0.05*					

The results of the four groups were analyzed for educational design skills, for standard averages and deviations, and according to current research variables, a Table 5 shows the results of this analysis.

Table 5
STANDARD AVERAGES AND DEVIATIONS OF THE EDUCATIONAL DESIGN SKILLS CARD

Electronic Brainstorming Strategies		TOTAL
Individual	Collective	
AV=19.95	AV=27.16	AV=23.55
SD=9.1	SD=3.14	SD=2.41
NU=45	NU=45	NU=90

Table 5 Shows the results of the descriptive census of the two experimental groups in relation to educational design skills, and notes from the data presented by the table that average student scores for e-brainstorming strategies (individual versus collective) are relatively different among them, with the average score of e-brainstorming group students Individual (19.95) and average grades of students of group e-brainstorming groups (27.16), indicating a difference between the average student grades of the individual and collective e-brainstorming strategies in favor of the collective e-brainstorm strategy and therefore the effect is in favor of The impact of a collective electronic brainstorming strategy.

The following table 6 also shows the results of two-way analysis for educational design skills.

Table 6
RESULTS OF TWO-WAY CONTRAST ANALYSIS BETWEEN E-BRAINSTORMING STRATEGIES ON EDUCATIONAL DESIGN SKILLS

Source of Variance	Total Squares	Degree of Freedom	Average Squares	Value (F)	The Significance
Electronic brainstorming	246027.38	1	246027.38	977.770	*
Interaction between electronic brainstorming (individual and group)	156.65	1	156.65	8.463	*

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Error variance	2114.68	36	251.62	.....	.....
Total variation	248298.71	39	.....	.....	.....
**Function at ≤0.05*					

View the descriptive results of the scientific thinking skills scale.

The results of the two experimental groups for scientific thinking skills were analyzed for standard averages and deviations, and according to current research variables, a Table 7 shows the results of this analysis.

Table 7
AVERAGES AND STANDARD DEVIATIONS OF THE SCIENTIFIC THINKING SKILLS SCALE

Electronic Brainstorming Strategies		**TOTAL**
Individual	**Collective**	
AV=20.56	AV=27.41	AV=23.98
SD=2.46	SD=1.37	SD=1.91
NU=45	NU=45	NU=90

Table 7 Shows the results of the descriptive census of the two experimental groups in relation to scientific thinking skills, and notes from the data presented by the table that average student scores for e-brainstorming strategies (individual versus collective) are relatively different among them, with the average score of students of the individual e-brainstorming strategy group (20.56) The average score of students in the Group E-Brainstorming Strategy Group (27.41), indicating a difference between the average student grades of individual and collective e-brainstorming strategies in favor of the collective e-brainstorming strategy, thus being Impact in favors of the impact of the collective e-brainstorming strategy on the development of scientific thinking skills.

The following table 8 also shows the results of two-way analysis for educational design skills.

Table 8
RESULTS OF THE TWO-WAY CONTRAST ANALYSIS BETWEEN THE TWO STRATEGIES OF E BRAINSTORMING ON THE DEVELOPMENT OF SCIENTIFIC THINKING SKILLS

Source of Variance	**Total Squares**	**Degree of Freedom**	**Average Squares**	**Value (F)**	**The Significance**
Electronic brainstorming	26.06	1	26.06	5.42	*
Interaction between electronic brainstorming (individual and group)	28.04	1	28.04	5.61	*
Error variance	306.20	36	5.6	.....	.....
Total variation	360.3	39	.....	.....	.....
**Function at ≤0.05*					

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LIMITATIONS

The current research adheres to the following limits:

- Objective determinant: The scientific content is limited to a set of lessons that address the basic skills of educational design and its applications in the design of educational computer programs. There are six lessons. Basic concepts of educational design and development, educational design models, behavioral goal design, content design and learning strategies, learning resource selection processes and means, development and evaluation processes.
- Human determinant: The content was taught to graduate students of the Division of Education Technology - Master's Degree (1st, II, 3rd).

Search variables consisted of:

- Independent variables: The research included two main independent variables:

The two strategies of e brainstorming are:

- Individual electronic brainstorming strategy.
- Collective electronic brainstorming strategy.

Child variables: The current search included the following child variables:

- Developing educational design skills (cognitive and performance).
- Developing scientific thinking skills.

CONCLUSION

From the foregoing, it is concluded that *"the collective electronic brainstorming strategy is best in influencing the content through the e-brainstorming environment, which is one of the most appropriate strategies used to provide students with knowledge about educational design skills"* and therefore through the collective participation of individuals according to their respective role in this strategy. In the same context, the reasons for this result can be explained to:

This finding also indicates that the main effect of the strategy of collective electronic brainstorming led to the realization of the student of the strategy of collective electronic brainstorming that the success of his group depends on his success in doing his role within the group and will not succeed the group if he violates his role, and therefore he strives to master his mission. This gives the group as a whole the required learning and increases their motivation for achievement, and this is consistent with what Awdat (2006), Ebied (2000), Saad (2001) indicated that the success of the e-brainstorming group depends on the effort of the learner to make it a success. The results of this study also differed with those of Vaughan & Garrison (2006), which noted the success of the individual e-brainstorming strategy by achieving students' personal expectations, developing their own competence, and noting improved control over the direction of students' behavior.

The researcher believes that the superiority of the strategy of collective e-brainstorming over the strategy of individual e-brainstorming in the cognitive achievement test associated with educational design skills is due to what this strategy allows the student to participate effectively in the selection of appropriate activities and applications to achieve the goals of learning between the designer/researcher and peers, which led to increase disorientation of students towards

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effective and effective participation in learning activities. This was confirmed by the trends of many learning theories, including Information Processing Theory, Attribution Theory and Motivation Theory, which emphasized that student participation and control in learning will increase both motivation and alignment of learning, as well as learners' expectations of success in achieving different learning outcomes and thus greater participation in learning activities.

From the foregoing, it is concluded that *"the collective electronic brainstorming strategy is best in influencing the content through the e-brainstorming environment, which is one of the most appropriate strategies used to provide students with knowledge about educational design skills"* and therefore through the collective participation of individuals according to their respective role in this strategy. In the same context, the reasons for this result can be explained to:

This finding of the current research indicates that the main impact of the collective e-brainstorming strategy provides capacity and flexibility in the design and production of learning programs that focus particularly on educational design skills; Advice and technique, and in view of this the strategy of collective electronic brainstorming this test in the exchange and sharing of information between the members of the sample, which leads to the benefit of students from the information and experiences that they have and each other, and the strategy provides the opportunity for the student to reflect his thinking by presenting his ideas in an atmosphere of security and freedom of expression.

The collective e-brainstorming strategy also provided an opportunity for the learner to socialize with his peers by sharing opinions about the scientific world, which of course reflected on the performance level of educational design skills, as opposed to an individual e-brainstorming strategy in which the learner is less in touch with his peers. This finding is consistent with the findings of the Kolb & McCarthy Study (2005), Chen & Emily (2001)

She also agrees with the study of Sayed (2006), Sabry (2014) that the e-brainstorming strategy uses innovative technological innovations to help students generate ideas more effectively than verbal/traditional brainstorming because of its characteristics, including: It allows teachers to track the flow of ideas and ways of thinking in the minds of learners, and it helps in dealing with this strategy according to different teaching methods, in which the student is helped with the possibilities provided by innovative technological innovations to enable the student to generate ideas in accordance with the strategy of individual electronic brainstorming. (Shrbiny & Sadik, 2002).

This finding is also consistent with a study: Gamil (2004), Abdallah (2002), Musalm (2002), in the presence of an effect on the use of online brainstorming in the development of learning skills, and the results of previous studies found statistically significant differences in favor of the brainstorming group E-mail, the results indicated that individuals are more productive of learning skills when working independently, and that the amount of ideas is reduced when working in groups, so a system of web interaction is proposed to support work in groups based on simultaneous and asynchronous interaction methods in supporting group interaction through electronic brainstorming in the development of different learning methods and processes.

From the foregoing, it is concluded that the collective electronic brainstorming strategy is best in influencing the content through the e-brainstorming environment, which is one of the most appropriate strategies used to provide students with knowledge about educational design skills" and therefore through the collective participation of individuals according to their

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respective role in this strategy. In the same context, the reasons for this result can be explained to:

This finding also indicates that the main effect of the strategy of collective electronic brainstorming led to the realization of the student of the strategy of collective electronic brainstorming that the success of his group depends on his success in doing his role within the group and will not succeed the group if he violates his role, and therefore he strives to master his mission. This gives the group as a whole the required learning and increases their motivation for achievement, and this is consistent with what Awdat (2006), Ebid (2000), Saad (2001) indicated that the success of the e-brainstorm group depends on the effort of the learner to make it a success. The results of this study also differed with those of Vaughan & Garrison (2006), which noted the success of the individual e-brainstorming strategy by achieving students' personal expectations, developing their own competence, and noting improved control over the direction of students' behavior.

This finding of the current research indicates that the main effect of the collective e-brainstorming strategy provides capacity and flexibility in the design and production of learning programs that focus in particular on educational design skills; The strategy also provides an opportunity for the student to reflect his or her thinking by presenting his ideas in an atmosphere of security and freedom of expression.

The collective e-brainstorming strategy also provided an opportunity for the learner to socialize with his peers by sharing opinions about the scientific world, which of course reflected on the performance level of educational design skills, as opposed to an individual e-brainstorming strategy in which the learner is less in touch with his peers.

The results indicated that individuals are more productive of learning skills when working independently, and that the amount of ideas is reduced when working in groups, so a system of web interaction is proposed to support group work based on simultaneous and asynchronous interaction methods in supporting group interaction through electronic brainstorming in the development of different learning methods and processes.

The collective electronic brainstorming strategy, which depends on the student listening, watching and discussing with his peers in the group, helped to remember what he heard and saw and thus build sound scientific ideas based on a good knowledge structure full of data and information he gained from the panel discussions and exchange of opinions and proposals and formulate them in the form of logical and mental solutions espoused by scientific thinking. This has led to the consolidation of information and its stabilization in memory and retention for a longer period of time and thus in the retention of learning.

The results also agreed with Khamis (2003), that the theory of social structural learning in the strategy of collective electronic brainstorming depends on the distribution of the role of each learner in the knowledge, analysis and discussion of information in an atmosphere of constructive cooperation that leads to reliable results, and comes the entrance to participatory learning in achieving the principle of the strategy of collective electronic brainstorming, which this educational approach depends on the collective participation of learners in conducting joint educational tasks, where Icaza & Perez (2005) that sharing contributes to the building of scientific knowledge through collective participation in the interpretation of different tasks, and this achieves the principle of scientific thinking related to problem solving and discussion of ideas and proposals put forward by students sample current research, in addition to developing skills of social interaction among learners. The elements of this approach are determined in:

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interaction and mutual interdependence between members of the group, individual responsibility, and collective reward.

From the above it is clear that the strategy of electronic brainstorming depends on the generation of logical ideas to solve a problem in an individual context or to share it in a collective context, in order to generate a wide range of ideas, and this is consistent with the recommendations of the Conference on Education and Thinking Development (2000), that brainstorming is a process of brain-raising and innovative solutions to problems that are directed in groups or in the context of conducting them individually to maximize interaction and benefit from them, as the Rashdan study (2015) indicated. E-mail, which is a kind of thinking in general and scientific thinking in particular, can be applied whether within the framework of the strategies of collective or individual electronic brainstorming, i.e. putting the mind in a state of excitement and readiness to think in all directions to generate the greatest ideas about the problem or the subject at hand, so that the individual has an atmosphere of freedom that allows the emergence of all opinions and ideas, with the aim of increasing mental abilities and processes, which means using the mind to actively address the problem.

It also agrees with the study Fakhro & Hussien (2002) that electronic brainstorming is "a method based on two types of collective individual thinking, with the aim of provoking and diversifying ideas, thus generating a list of ideas that can lead to a solution to the problem of the research, where mutual ideas between the individual and groups contribute to the generation of new ideas, conduct various scientific projects, and form groups for many purposes whether to participate in the development of ideas in the development of scientific thinking skills and training skills of educational design that are associated with other types of thinking skills. In general, scientific thinking in particular.

Based on the above, the studies and literature on the strategies of electronic brainstorming (individual, collective) show the difference in the ratio of agreement and difference on the most appropriate strategy that can be used in the development of knowledge and skills related to different learning aspects. One of the strategies between them is various variables and research topics.

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DECLARATION OF CONFLICTING INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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