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Research Article

The Effect of Using the Harvest Strategy on the Divergent Thinking Skills of First-Grade Intermediate

Students in Mathematics

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Abstract

The current study aims to identify (the effect of using the harvest strategy on the divergent thinking skills of first-grade intermediate students in mathematics), and for the purpose of achieving this goal, the following null hypothesis was developed:-

There is no statistically significant difference at the level of significance (0.05) between the mean scores of the experimental group (who study according to the harvesting strategy) and the control group (who study according to the usual method) in examining the divergent thinking skills.

The study population included female students of the first intermediate grade, in the morning government schools affiliated with the Salah El-Din Education Directorate for the academic year (2020-2021), and the experimental design of two equal groups and the post-test was approved, and also the study sample was chosen intentionally.

Thus, the sample of the study reached (60) students, including (30) students for the experimental group, and (30) students for the control group. The two study groups were rewarded with variables (chronological age, information test, prior knowledge, previous achievement in mathematics, intelligence test [Otis Lennon]. The study tool was built, which is the divergent thinking skills test, and the psychometric properties of the test were calculated.

In this study, the validity of the test was verified and its reliability was calculated using the Cronbach equation, and the reliability factor was (0, 81). After the end of the experiment, the study tool was applied via using the T-test for two independent samples.

The results showed the superiority of the experimental group students over the control group students. As such, the researchers concluded that (the harvesting strategy) has an effect on the divergent thinking skills of the first intermediate grade students, then they recommend working on training the bodies. Education in schools on how to use the strategy in teaching mathematics, and the two researchers came up with a set of proposals, including the necessity of conducting similar studies using harvesting strategy at other school stages and other variables.

Introduction

The present century is witnessing new changes, in all aspects of public life, and tremendous developments in all areas, and these developments must be kept up, similar to Western societies, which preceded us in the areas of developments, which called for focusing on methods and methods of learning to think, through seminars, conferences and training workshops. And preparing programs for that, and moving away from methods of indoctrination and memorization (Al-Ghariri, 2007: 24).

Thinking is what distinguishes a person from other creatures of God Almighty, and he has received the attention of scholars to reach the solution of the problems that the learner faces in his life with his own different ways of thinking. The Iraqi Ministry of Education and the ministries of Arab countries concerned with education pointed to the importance of learning to think (Al-Kubaisi, 2008: 18).

In view of the importance of thinking in education, this trend has emphasized strategies for developing education in the Arab countries, as they emphasized the development of thinking and its various levels, and plans and programs were drawn up to achieve this goal, and for thinking to become the focus of teaching methods in various subjects (Al-Sulaiti, 2008: 215).

This prompted the two researchers to use a harvesting strategy that stimulates creative thinking and measuring its effect on divergent thinking among an important age group (female intermediate first grade students) in mathematics.

Problem of the Study

The world has become a constant need for pure sciences such as mathematics and others, and as a result of the rapid scientific and knowledge competition between the countries of the world and their institutions, the two researchers have felt that there are problems and difficulties in teaching mathematics, and that mathematics has become the problem and nightmare that the Iraqi student suffers from, and after the researchers investigated a questionnaire about what he mentioned, Parents, teachers, teachers, students, and school records in which the results of their achievement were recorded over the past years, in which it became clear that mathematics is the most academic subject in which students encounter weakness and a low level of education.

The researchers may attribute the students 'weakness in mathematics to the rapid and sudden change in the curriculum, which led to their lack of awareness of what the curricula contained, and the researchers inferred these problems, drawing on the opinions of teachers, and through the statistics obtained from the book Facilitating the Mission (from The Sharqat Education Department affiliated to the General Directorate of Salah al-Din Education) for the years (2016-2017, 2017-2018, 2018-2019).

The success rates ranged between (37% and 53%), and thus it constitutes a problem that must be studied and ways to address it. Also, the methods and strategies that are used in education are traditional and not updated, so the teaching methods have become inconsistent with the modernity of the curricula. The researchers reached several reasons behind this weakness in thinking, making use of the exploratory questionnaire they presented to find out the views of (20) teachers and schools. By submitting an open questionnaire to them that included a question, what is the level of thinking of students in general and the divergent thinking skills in particular for them?

After collecting and analyzing the results, reasons were found, including the following:

-Some teachers make themselves the focus of the educational process and the students' role remains passive.

-Weakness in practicing divergent thinking skills was found due to the following traditional methods that emphasize memorization of information by students.

-The urgent need to use modern strategies, methods and methods to teach mathematics, which could help students motivate them to actively participate in the classroom educational process, as well as to advance the level of manifold thinking among first-grade intermediate students in mathematics, so the researchers decided to use one of these strategies, "Serious creativity and a harvest strategy". Perhaps this strategy will provide a solution to the problem.

The problem of the current study came to answer the following question:

-What is the effect of using the Harvesting Strategy on the divergent thinking skills of female students of the first intermediate grade in mathematics?

Importance of the Study:

The importance of the study stems from the following points:

1-The scarcity of studies that dealt with harvesting strategy in the subject of mathematics, and it is considered the first study of its kind that examined the strategy of harvesting in the subject of mathematics and its impact on the manifold thinking skills in Iraq (according to the researchers' knowledge).

2-Harvesting strategy includes sufficient flexibility and a positive role for the learner, which creates an interactive atmosphere in the topic of the lesson and employs brainstorming by asking questions that motivate students to creativity and break fear. This strategy is one of the strategies that help students to think in several aspects and in all directions when they are exposed to a problem in order to reach different answers, by continuing with ideas deprived of stopping.

It works to create an appropriate environment that stimulates the creative abilities of the learner and moves away from the decided scientific content to what affects the life of the learner and diversifies the methods of evaluation of the ideas and opinions put forward for the subject of the lesson and helps to reuse environmental materials, which develops the scientific skills of the student.

3-Divergent thinking leads to the emergence of creativity and the development of creative thinking, and that creative responses are an indication of the bifurcation of thinking, and that each supports the other as the theory of brain-based learning through which the idea of divergent thinking is reached through what the brain does when it is exposed to a problem, And divergent thinking skills make students go in their thinking, to indefinite horizons, and unconventional paths that help them come up with new creative ideas, producing new and varied solutions to a specific problem.

4-The importance of the first intermediate grade, because this age group is in transition and a turning point in mental abilities and ways of thinking, because they face an increase in knowledge and rapidly and permanently changing social and economic conditions.

Aim and Hypothesis of the Study:

The current study aims to identify (the effect of using the harvest strategy on the divergent thinking skills of first-grade middle school students in mathematics). In light of the aim of the study, the researchers formulated the following hypothesis:

The hypothesis of the study "There is no statistically significant difference at the level of significance (0.05) between the mean scores of the experimental group students (who study according to the harvesting strategy) and the control group (who study according to the regular method) in testing the divergent thinking skills.

Limits of the Study:

The current study was limited to:

-**Spatial boundaries**: Intermediate day schools for government girls affiliated to the Salah al-Din Education Directorate.

-**Time limits:** Academic year (2020-2021).

- **Human borders**: female intermediate first graders.

-Cognitive boundaries: the first part of the mathematics book for the first intermediate grade, third edition of 2018 (relative numbers, polynomials, open sentences).

Defining Terms:

Impact: It is defined operationally by the amount of change caused by the harvest strategy in the subject of mathematics and the divergent thinking skills of the first intermediate grade students, and it is measured using the ETA square equation.

Harvesting strategy: it is procedurally defined as a strategy that the researchers use in teaching the prescribed classes of mathematics for intermediate first grade students (the experimental group) and it consists of steps: (listening to the ideas put forward, and writing down ideas in writing through the group's rapporteurs, classifying the proposed ideas into ideas: "negative (Positive, good, exciting), the students search for information from multiple sources, in which some students volunteer to display the information they come up with), with the aim of helping the students to raise their divergent thinking skills.

Divergent thinking skills: It is known procedurally that it is the kind of thinking that requires the intermediate first graders to be able to generate many, new and complex ideas to solve all the problems they face through (verbal fluency, fluency of shapes, fluency of intellectual flexibility, relational fluency, flexibility, adaptive meanings, and automatic elasticity).

A Theoretical Framework - Previous Studies

Serious Creativity Theory:

The theory includes trying to look at things in multiple ways, and understanding how the mind uses models, and the extent of the need to get rid of the models restricted in thinking to other models. The theory of serious creativity or what is called lateral thinking returns to the world (De Bono) as it is considered the first He developed this term, and it means the kind of thinking that seeks to encompass aspects of the problem that students face in search of solutions to it (De Bono, 1998: 37).

As students solve the problem, using non-traditional methods, and it is a new vision of creativity without restricting the presentation of ideas, whether in terms of creative skills or the strategies used to achieve skills, it is a unified and integrated creative pattern that helps students produce new ways of thinking or decision-making tools (De Bono, 2006: 17), as serious creativity means that it is a mental trend that includes, desire is not like this (Abu Jadu et al., 2007: 469), as it includes a special group (tactics), or special methods and tools that are put into practice as a systematic way to obtain ideas New concepts and new concepts, and the systematic method is intended to use specific tools or strategies to develop serious creativity (De Bono, 1998: 33).

Harvesting Strategy:

Harvesting strategy is one of the strategies for serious creativity theory that takes into consideration only the ideas identified at the end of the thinking session.

It is an intentional and intentional way through which we try to collect the creative outcomes that appeared during the creative session, so that we can classify the creative effort into various categories (negative, positive, exciting, and unexciting, ...), and we use the harvest lists as an evidence of the creative effort classification (Nofal, 2014-37: 36).

Nou, and Muhammad (2007) states that learners can become completely good at using serious creativity strategies, so that these strategies can be entertaining or exciting and sometimes produce creative results, where some learners may come out with little results in the creativity session, because at the end Creativity usually takes only specific ideas that seem practical, valuable and meaningful, but this is only part of the true creative product, and at the same time we can become more skilled and notice good ideas and new concepts that appear. When harvesting begins, it is important to have clear ideas to practice in the creative session.

The teacher must follow the following steps to implement the "Harvesting Strategy", namely:-

1-Listening to the ideas presented by students.

2-Writing down the ideas put forward in writing, if possible, by group rapporteurs.

3-Classification of the ideas presented into:

-Negative thoughts (Unusable thoughts).

-Positive thoughts (Interesting ideas).

-Good ideas (Unexciting thoughts).

4-Students search for specific information related to the task for which they were trained, from multiple sources, documenting those sources.

5-In the next meeting, some students volunteer to present the information they have obtained from various sources, highlighting these sources to their colleagues (Abu Jadu and Muhammad, 477: 2007-478).

In light of what has been mentioned, students who have graduated from school and who have achieved creative goals can face ambiguous situations with confidence, and apply their mental mechanisms in solving problems that challenge their abilities to acceptable degrees. In transferring and controlling what they know in one context or paths to another context or path, they also successfully respond to new challenges, and intentionally search for situations that require creativity (Magdy and Al-Sayed, 209: 2010 -210).

Divergent Thinking

Divergent thinking is one of the modern educational terms that emerged as a result of the intensification of efforts exerted in the research conducted on the brain and those advocated by specialists in curricula and

teaching methods. The idea of divergent thinking was developed by the psychologist Guilford (Al-Hudaibi, 2012). To four things were centers of divergent thinking, namely:

-Guilford's theory of a global analysis of creativity.

-Piaget's theory of cognitive development.

-Contemporary theories of intelligence, and the most important of which is Gardner's theory of multiple intelligences, and

-Theories of the brain (Al-Hudaibi, 2012: 12).

Principles of Divergent Thinking Skills

Jarwan (2009) indicated a set of principles upon which divergent thinking skills are based, namely:

-Postponing judgment: This principle recommends postponing judgment and evaluation until the generation of a large number of alternatives has been completed, as the issuance of hasty judgments inhibits the thought process of something deeper.

Look for a plurality of ideas: this principle requires creating the largest number of ideas and alternatives without regard for the quality because the distinct ideas are produced among many ideas.

-Acceptance of all ideas: This principle emphasizes not being afraid to present any idea that comes to mind, because ideas that may seem strange or ridiculous in the eyes of a group may be the basis on which others build original ideas.

-Going your thinking to the farthest extent: this principle considers the necessity to abandon the tendency of lethargy in thinking, and to maintain vitality and seriousness in the search for ideas.

Rest a little until the ideas brew: This principle emphasizes the necessity of practicing an activity or a hobby that has nothing to do with the problem for some time, as original ideas may jump to mind if they come to mind in advance.

-Try to combine ideas - Be intrusive: this principle requires that the individual be alert at all times to what others offer of ideas, and he may be able to reach an original idea by linking various ideas from here and there " (Jarwan, 2009: 26).

Divergent Thinking Skills

First: Fluency: Fluency means fluency as defined by (Jarwan, 1999: 85) the ability to generate a greater number of alternatives or synonyms, or ideas when responding to a specific stimulus, or the speed and ease in generating them.

a. Verbal fluency, or fluency of words: he defined it as: "the ability of the individual to produce the largest number of words so that the expression has certain characteristics" (ibid).

B. Intellectual fluency, or fluency of meanings: he defined it (Abu Jadu and Nawfal, 2007) that "he does not care in this type about the quality or quality of the response, as much as it is concerned with the number or quantity of responses that are generated" (Abu Jadu and Nawfal, 2007: 160).

C- Fluency, shapes: (Al-Harith, 1999) defined it as: "the ability to change shapes with simple additions, and the ability to quickly draw a number of examples, in response to a specific visual stimulus" (Al-Harith, 1999: 67).

D- Associative fluency: It is mentioned (al-Kanani, 2005) that it refers to: "the ability of the individual to think quickly about words associated with a specific situation" (Al-Kanani, 2005: 83).

Second: Flexibility: Flexibility (Zaitoun, 1987) defined it as: "the diversity or difference of ideas that a creative individual brings." (Olive, 1987: 57), and flexibility, as a whole, takes on two aspects:

1-Automatic flexibility: it means the person's ability to automatically give a number of responses that do not belong to one category, and it is represented in the freedom to change the mental direction, the freedom not

directed towards a specific solution in new directions to produce the largest number of different ideas in ease and ease. It is learned to mention as many different titles as possible for a given idea.

2-Adaptive flexibility: It is the ability of the individual to modify his behavior in order to reach a solution to a problem, and it is related to the learner's change of his mental direction, directed change (Khalaf Allah 2007: 37).

Previous Studies:

Previous studies that dealt with harvesting strategy were:-

-Al-Maliki's study (2013 AD) that was conducted in Iraq aimed at identifying the effectiveness of two strategies for serious creativity in modifying the wrong understanding of chemical concepts and developing the decision-making for the fifth scientific students, and the sample of the study consisted of (90) students in the preparatory stage, the study concluded the clear effect of the two strategies serious creativity in Amending the wrong understanding of chemical concepts and decision-making among middle school students.

-The study of Al-Jubouri (2014 AD) that was conducted in Iraq, and aimed to identify the effectiveness of the harvest strategy for serious creativity in the collection of scientific organic chemistry and cognitive motivation among students of the Department of Chemistry, and the sample of the study consisted of (26) male and female students, at the university level, the study concluded the effect The clear strategy of harvesting in the achievement and cognitive drive of undergraduate students.

-As for the study of Al-Jubouri (2018 AD), which was conducted in Iraq, and aimed at identifying the effect of the harvest strategy on fourth-grade students 'academic achievement and positive thinking in physics, and the study sample consisted of (68) middle school students, the study concluded the clear effect of the harvest strategy In the achievement and positive thinking of middle school students in the subject of physics.

Studies That Dealt With Divergent Thinking

-The study of Al-Hinnawi (2013 AD) that was conducted in Egypt aimed to identify the use of mind maps in developing the skills of divergent thinking among intermediate school students in mathematics.

-The study of Al-Aboudi (2015 AD) that was conducted in Iraq aimed at identifying the effectiveness of an educational procedural model based on the guidelines of knowledge economy in the collection of the subject of growth and the development of divergent thinking skills among students of colleges of education, and the study sample consisted of (63) undergraduate students. The study concluded with the apparent effect of the model's effectiveness in developing divergent thinking skills and educational activities among undergraduate students.

-As for the study of Al-Mansouri (2017 AD) that was conducted in Saudi Arabia aimed at identifying the effectiveness of divergent thinking strategies in developing mathematics achievement for the ninth grade in the State of Kuwait, and the study sample consisted of (80) students in the basic stage, and the study concluded with a clear impact on the effectiveness of strategies Divergent thinking in developing mathematics achievement.

Study of Methodology and Procedures

Study of methodology: The two researchers adopted the experimental design with partial control for two equal groups and the post-test as shown in the following chart:

Figure (1)

dependent variable	independent variable	parity	Group

Divergent Thinking Skills	Harvest Strategy	1.Chronological Age 2.Examining Previous Mathematics Information 3.Previous Academic Achievement In Mathematics 4.Intelligence 5.Manifold Thinking Skills Test	Experimental
	The usual way		Control

Figure (1): the experimental design of the research

Defining the study population and its sample:

The current study population is represented by all female students of the first intermediate grade in middle schools and day high schools of the Salah al-Din Education Directorate - the Sharqat Education Department for the academic year 2020-2021.

The study sample was represented by the female students of the first intermediate grade in Al-Atyaf Secondary School for Girls, which were deliberately chosen, and the school contains two divisions for the first intermediate grade. The female students who had failed were statistically excluded when analyzing the data in order to preserve the integrity and objectivity of the experiment, so that their previous experiences did not affect the results of the study, and there were (3) students in both divisions. Division (A) represented the experimental group that was studied using the harvesting strategy, and Division B The control group that was studied by the traditional method. The number of female students for both groups was (63), of which (32) were students from class (A), and (2) were excluded from them, and (31) female students in class (B) were excluded (1) from them. Thus, the sample size will be (60) students.

Parity of the two study groups: The following table shows the equivalence of the two study groups as in table (1):-

Table (1): Results of the t-test of parity of the two study groups

T-test value		Control		Experimental		Group
tabular	computed	arithmetic mean	arithmetic mean	standard deviation	arithmetic mean	parity variables
2.00	0.22	2.33	12.53	2.31	12.40	Previous knowledge
2.00	0.81	11.61	74.70	12.75	75.27	Previous academic achievement
2.00	0.79	6.75	22.47	6.59	21.10	Intelligence
2.00	0.311	7.85	160.80	5.18	160.27	Chronological age calculated in month
2.00	0.33	4.52	36.80	4.96	37.20	Divergent thinking skills test

Not significant at the level of significance (0.05) and the degree of freedom (58

Study Supplements

The teaching plans were prepared by formulating a number of behavioral objectives according to Bloom's classification, in the cognitive domain limited to levels (remembering, comprehension, application, analysis, synthesis, evaluation), and they were presented to a group of experts and referees, to express their views on the accuracy of formulating the behavioral objectives, And the extent of its coverage of educational content, and determining the level that each paragraph measures, and all of the (189) behavioral purposes adopted a behavioral purpose.

Divergent Thinking Skills Test:

The test aims to measure the extent of acquisition of divergent thinking skills among first-grade intermediate students in mathematics, and after reviewing the studies and literature available to the researchers, such as the study (Al-Hinnawi 2013), (Quality 2015), (Al-Mansouri 2017), which dealt with divergent thinking skills, (6) skills that suit the level of complex thinking skills for the first intermediate grade have been identified (verbal fluency, fluency of shapes, fluency of intellectual flexibility, relational fluency, flexibility of adaptation to meanings, and automatic flexibility), and the test items were formulated with (20) items, which were distributed on the skills of divergent thinking as follows:-

(verbal fluency (4), fluency of shapes (4), fluency of intellectual flexibility (3), relational fluency (3), flexibility in adapting meanings (3), automatic flexibility (3)).

Test paragraphs are clear and understandable for each paragraph, three scores were given for the correct answer, and zero for the wrong answer.

-Validity of the test: The validity of the test was verified by :-

•**Apparent honesty:** This type of honesty was verified by presenting the test to a group of specialists in teaching methods of mathematics to judge the validity of the paragraphs in measuring divergent thinking skills and their relevance to them.

•**Construct validity:** The veracity of the construction was verified by extracting the paragraphs difficulty factors and distinguishing them, and as will be mentioned later.

The manifold thinking skills test was applied to an initial exploratory sample consisting of (20) female students from the first intermediate grade, for the purpose of determining the time required to answer the test, the clarity of its paragraphs and instructions, and the diagnosis of ambiguous paragraphs of it, and after extracting the average time for the end time of the first five students, from the answer and another Five students. The average time was (40) minutes, and the test was applied to a second exploratory sample consisting of (100) students, and after correction the items of the test were analyzed, by taking papers with the highest 27% of the answers of the students (27) and the lowest 27% of the answers of the students (27) to represent Minimum group to find the following:

The discriminatory strength of each of the test items was calculated by using the T-test for two independent samples. Its values ranged between (2.95 - 9.47).

The difficulty level of each paragraph of the complex thinking skills test was calculated, and the difficulty level values ranged between (0.28 - 0.77).

Stability of the test: After the test was applied to the exploratory sample, the reliability of the test was verified, using the Alpha Cronbach equation through the scores that they obtained in the complex thinking skills test. With a number of (20) paragraphs, and the test was applied to the original sample on (2-14-2021 AD).

Presentation and interpretation of results:

The results of the null hypothesis:

For the purpose of verifying the validity of the null hypothesis, which states that "there is no statistically significant difference at the level of significance (0.05) between the mean scores of the experimental group students (who studied using the harvesting strategy), and the average scores of the control group (who studied using the usual method) in Divergent thinking skills. The two researchers did the following:

- Using the T-test for two independent samples to find out the significance of the difference between the experimental and control groups.

Table (2): The results of the T-test to know the significance of the difference between the mean scores of the two study groups in the complex thinking skills test

T-value and the statistical significance	standard deviation	arithmetic mean	**No.**	Groups

significance **(0.05)**	tabular	Computed				
Sig. at a degree **(58)** of freedom	**2.00**	**6.39**	**4.47**	**45.20**	**30**	Empirical
			5.20	**37.20**	**30**	Control

The result obtained in Table (2) indicated that there is a statistically significant difference at the level of (0.05) between the mean scores of the two groups (experimental and control) and in favor of the experimental group. The researchers may attribute the reason to the use of the harvest strategy in teaching mathematics that has an effect on skills **Divergent thinking among first-grade intermediate students.**

-The size of the impact of the Harvest strategy in testing the skills of divergent thinking: to judge the size of the impact, the following table determines the reference for that effect.

Table (3): The reference for determining the levels of impact size according to the three classifications in the psychological and educational sciences

large	Medium	small	Impact size
0.14	0.06	0.01	Impact value (Eta square)
0.80	0.40	0.20	value of (d)

After applying the law of the size of the effect in the way ita square, it appeared that it is equal to (0.41), and after calculating the value of (d), its value was (1.66), and compared to Table (3), the value of (e) square, whose value is (0.41) and the value of (d), which is (1.66), we find that the size of the effect is large, as shown in Table (5).

Table (4): The size of the impact of the Harvesting strategy in testing divergent thinking skills in the (Eta square) method

effect size	value (d)	square of Eta (n^2)	value of T-computed	The variable
Large	1.66	0.41	6.39	Divergent thinking

Interpretation of the results: The results obtained from Tables (2) may be attributed to the harvesting strategy that:

-This worked to transfer the students from the state of direct reception of information to the searchers for it themselves, by asking questions in a way that stimulates the thinking of the students, and makes them search for it in all directions and from all angles, as it made the students the center of the educational process that was, and this is the opposite of the usual method, In which the teacher is the focus of the educational process, and the students are only a recipient of information, and his role is limited only to preserving and implementing information.

The implementation of its steps helped the students to distinguish the alternatives and solutions developed, by classifying the ideas presented from groups into ideas (negative - positive - exciting - not exciting), which made them easily learned by the students, and the selection of the best ideas, which are applicable.

-The participation of students in discussing ideas and generating them was enhanced by dividing the students into groups, which led to the exchange of ideas among all students, and to generate the most number of answers possible.

Conclusions:

-Teaching using the harvest strategy had a clear effect on the divergent thinking skills of the first-grade intermediate students in mathematics.

-The effect of the harvest strategy on the divergent thinking skills of first-grade intermediate students was significant.

Recommendations and proposals:

•The current study recommends the necessity of teaching mathematics for the first intermediate grade, according to the harvesting strategy for its effect on divergent thinking skills.

•Conducting a study that uses the harvest strategy and its effect on evaluative thinking among first-grade intermediate students.

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