

The Effect of a Strategy to Accelerate Thinking among Middle School Students

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A current study aimed at identifying the effect of a strategy to accelerate thinking in the achievement of middle school students and develop their mathematical culture. Two divisions were chosen from the second intermediate classes in Makkah for girls, which is affiliated to the education of Nineveh Governorate. The first one is an experimental group that is taught according to speeding up thinking with 33 students. The other is a group of officers who study regularly with 30 students. Thus, the number of individuals appointed to study was 63 students. Equivalence between the two study groups was in variables: the degree of intelligence, time age, and previous knowledge. To achieve the goals, the study prepared a test achievement consisting of 40 paragraphs; it was validated and confirmed and a measure of sports culture. Statistical data were processed using the SPSS program. The results of the study showed that there are statistically significant differences between the average scores of students of both groups in the achievement test and mathematical culture in favour of the experimental group.

Key words: *Thinking strategy, Middle schools, mathematical culture*

Introduction

Research Problem

The development of the quotient in mathematics has clear implications for their educational level, which led to the emergence of many difficulties facing by students. Students suffer from this development because it was not kept up with. That led to a decrease in the level of achievement and their mathematical culture, due to what is related to the teaching methods used free among the educational methods and activities that do not excite the enthusiasm of students to study them. On the contrary, they raise suspicion, and therefore students do not

help to keep pace with the developments in mathematics, deal with numbers and operations, and solve exercises smoothly and increase in their sports culture (Al-Ubaidi, 2016).

Therefore, the researcher decided to use a new teaching strategy, a strategy to accelerate thinking, which is built to activate both sides of the brain. This strategy may contribute to creating awareness and building relationships between parts of the subject and increase students' control of themselves and increase their mathematical culture.

What is the effect of the strategy to accelerate thinking in the achievement of middle-grade students and the development of their culture?

Research Importance

- 1- The current research deals with a strategy to accelerate thinking, whose results are expected to benefit learners in discovering mathematical correlations with daily life, and thus a sense of its importance and benefit from it in solving life problems.
- 2- The results of this research may be useful in directing the attention of those who compose mathematics textbooks by employing the fields of mathematical culture in formulating the content of mathematics books in the intermediate stage.
- 3- Knowing the effect of a strategy to accelerate thinking in the achievement of middle school students and develop their mathematical culture.

Research Objective

Current research aims to examine the impact of the strategy to accelerate thinking on:

- 1- the achievement of middle school students; and
- 2- the development of mathematical culture in the second-year middle school students.

Research Hypothesis

To achieve the aim of the research, the hypothesis was formulated zero.

- 1- There is no statistically significant difference at the level of significance (0.05) between the average scores of students of the experimental group who are studying with a strategy to accelerate thinking and the control group who are studying in a regular way in the achievement test.



2- There is no statistically significant difference at the level of significance (0.05) between the average scores of students of the experimental group who are studying with a strategy to accelerate thinking and the control group who study regularly in the mathematical culture scale.

Research scope: The research is limited to:

- 1- Students of the second intermediate class, in Makkah Intermediate School for Girls;
- 2- The second semester (2018-2019);
- 3- The content of two chapters from the book of mathematics for the second intermediate grade, the seventh edition of 2016.

Search Terms

A- Strategy

1- The term 'strategy' is defined as the processes that the learner uses to assist him in acquiring and using information (Oxford, 1996, p. 21).

B- Speed up Thinking

The term 'speed up thinking' is described as "An educational strategy based on Piaget's theory (cognitive constructivism) and Vokotsky (social constructivism) theory as knowledge is built on the personal and social aspect of learning." (Najdi et al., 2005, p. 293).

C- Collection

The term 'collection' is defined as: "The final result that shows the student's level and progress in learning what to expect to learn." (Al-Khalili, 1997, p. 6).

Mathematical Culture

Pugalee places the mathematical subject in the context of my life meaningful, that is, at the heart of their daily lives, in their literature, stories and other sciences, as well as asking questions and getting to know the history of mathematical subjects, and this would create a class environment that develops Mathematical culture among students (Pugalee, 2001, pp. 296-299).

Theoretical Background

Cognitive constructivism and Vygotsky's theory of learning are what paved the way for the emergence of multiple teaching strategies that contribute to the development of students' intellectual capabilities, and among these strategies is a strategy to accelerate thinking.

According to this paper, we find the most challenge that a teacher faces in teaching are: How to teach the students thinking? And what are the most effective ways to support the learning process in the classroom.

Therefore, there are many strategies based on a constructive theory that can be adopted in the classroom teaching. These modern teaching strategies have taken the theory of Piaget's strategy to accelerate thinking in accelerating mental-cognitive development in teaching. Teachers have found no difficulties in adopting such a strategy that provides study material in them. Students depict problems that challenge their mental abilities and enable them to engage in new types of thought-provoking activities that are appropriate for the growth of their thinking (Adey, 1992, p. 145)

The stages of this strategy are:

The First Stage: Class Discussions

The teacher divides the students into groups and presents the problem to the students. Discussions then are held between the students before, during and after the experimentation. The role of the teacher, in this case, is directed to the activities, and discussions that play an important role in thinking.

Second Stage: Cognitive Conflict

The teacher request through activity is exposed to observations that may not be consistent with their expectations or previous experiences. Therefore they have a state of knowledge conflict that motivates them to carry out an activity motivated and enthusiastic about solving a knowledge conflict and reaching a state of balance.

Third Stage: Thinking in Thinking

This phase aims to get a student to the stage of awareness that makes him realise what he says and what he does and why he thinks this way. Through a group of questions, the teacher directs students to be aware of the thinking that he adopted in solving the problem.

Fourth Stage: Bridging

This phase aims to link the experiences obtained by the teacher's request from an activity that he undertook with his experiences in scientific life and other subjects to help him transfer teaching experiences to various fields of study and to create an integrated picture of knowledge (Najdi et al., 2005, p. 293).

Mathematical culture

We live in an epoch of epistemic explosion, so every individual must have an appropriate amount of mathematical culture including mathematical knowledge, concepts and skills, and sound thinking methods necessary for mathematical knowledge, and understanding its nature and historical development (Mufti et al., 1990, p. 171).

Therefore, how students are mathematically taught, is the same way in which they are taught in reading; mathematics is not just preparation (Jaber, 2004, p. 53). Pugalee (2001) referred to a mathematical culture as placing a mathematical topic in the contexts of his life in their stories and literature, as well as asking and discussing questions and planning appropriate strategies for proposing solutions (Pugalee, 2001, pp. 296-299).

Mathematical Culture is one of the Goals of Teaching Mathematics

One of the aims of teaching contemporary mathematics is to prepare individuals with an appropriate amount of mathematical culture that enables them to continue their studies in later educational stages (Saleh, 2012, p. 256).

The fields of mathematical culture: 1 - Mathematical culture associated with the natural language. The language is a way of thinking, culture, and a means of civilisation, as the language is a tool through which subsequent generations pass on the experiences of their ancestors, and in the language, we run matters of our daily lives (Ashour & Muhammad, 2009, p. 11). Also, mathematics is not only a tool to help a student thinking and solving problems but also is a tool of great importance in exchanging ideas and expressing them clearly, which is also called the international language because people of different languages can use it to communicate and exchange mathematical ideas (Al-Saeed, 2005, p. 1)

Mathematical Culture Related to Life Reality

Mathematics invaded other fields of science, entered everyday life, and lived with the individual to help him solve his daily problems, as well as organising his daily life faster than he had been (Abu Zeinah, 1994, p. 43).

Mathematical Culture Linked to Other Sciences

Mathematics represents a spring from which sciences of different sciences are scattered without taking anything from them. They nurture all fields of science: physics, chemistry, engineering, astronomy, and others since mathematics is like a transit bridge for other subjects (Al-Mashhadani, 2011, p. 44).

Sports Culture Related to History

An interest in studying mathematics allows students to learn about the evolution of human thought on the one hand and the development of mathematical ideas on the other, which makes them realise their importance and appreciate the role of mathematicians who helped their growth and development (Abu Al-Hadid, 2013, pp. 185-187).

Based on the foregoing, a researcher believes that a mathematical culture is a multi-faceted intellectual entity based on several areas, namely:

The mathematical culture associated with the natural language

The mathematical culture associated with life reality

The mathematical culture related to other sciences

The mathematical culture linked to history.

All of which must be integrated to develop a culture within the mathematical subject and to achieve its goal of meaningful learning.

Research Methodology

Experimental design: The researcher relied on one of the semi-experimental designs, with partial tuning for two equal groups (experimental and controlling) as in Table 1.

Table 1: The semi-experimental design

Measure the independent variable	Not adjacent variable	Adjacent variable	Equivalence between two groups	Groups
-TEST the collection	-the collection	accelerate the thinking	Intelligence-otis lennon	Experimental
		Normal way		- Previous collection - Chronological age
-math culture Scale				

Society and Research Sample

Research community: The research group identified the second intermediate grade students in middle and high schools affiliated to the Nineveh Governorate Center for the academic year (2018-2019).

Sample research: A sample was selected intentionally through the equation. Division C was chosen to represent the first group that will study its strategic students to accelerate thinking, as the number of its students (33). Division B represents the second group, which will be taught in the usual way with the number of 30 students.

Adjustment procedures: The two groups were rewarded with variables, namely mathematical knowledge of precedence, age of time, and intelligence. The students' previous knowledge was obtained by testing, examining their answers, and determining their scores. This test was applied for two independent samples to know the significance of a difference between the variance of the students' scores for the two groups, and the knowledge of its value (F), at a specific significance level, and the significance level for the value of F, for each of the equivalences greater than the approved significance level (0.05), and this means that two groups Homogeneous in this variable, described in Table 2 below.

Table 2: Equivalence of the Research Sample according to their Age, Previous Achievement and Intelligence

Statistic al ignifican ce at 0.05	df	t-test for Equality of Means		Levene's Test for Equality of Variances		Standard deviation	Average calculatio n	Order numb er	Divion	group	variable
		sign	t	sign	F						
No sign	61	0.182	1 .36	0.50	0.49	3.6	17.5	33	G	Experiment al	Chronologic al age
						3.0	16.4	30	B	Control	
No sign	61	0.86	0.19	0.58	0.32	3.22	145.5	33	G	Experiment al	Intelligence otis lennon
						3.04	147.4	30	B	Control	
No sign	61	0.60	0 .55	0.85	0.03 8	4.1	24.0	33	G	Experiment al	Previous collection
						3.9	23.5	30	B	Control	

Research Supplies

Defining a scientific subject: The scientific subject was determined by chapters (Fifth - Engineering, Sixth - Measurement/Spaces and Volumes) from a mathematics book for the second intermediate grade / second part, first edition, for the year 2011 AD.

Determining behavioural goals: Specific goals were set for teaching the course in the form of behavioural purposes according to six levels of Bloom, and it was presented to a group of arbitrators and took a 95% agreement on each goal and adopted it in teaching plans.

3- Preparing teaching plans: Teaching plans for each group were prepared, presented to a group of arbitrators, amended, and finalised.

Search Tools

1- Achievement Test: One of the requirements for research is to prepare an achievement test within chapters included in an academic subject, so a researcher followed the following steps:

Determining the goal of the test;
Defining a scientific subject; and
Drafting behavioural purposes.

4. Determine the number of test items.
5. Prepare the test map.

Table 3: Specification table

Number of paragraphs	Cognitive domain levels						The relative weight of the class	Chapter title	Chapter
	evaluation 6%	installation 6%	analysis 7%	Implementation 25%	16 % understanding	remember 38%			
19	1	2	1	5	3	7	43.5%	Engineering	fifth
21	1	2	2	5	3	8	52.5%	Spaces and sizes	VI
40	2	4	3	10	6	15	100%	total	

6. Formulating achievement test paragraphs: After preparing the specifications table (40 paragraphs), two types of questions were formulated for the first, objective type, which includes 32 paragraphs from multiple choice and the second type of pans, and it includes eight paragraphs that include steps for solving the students.

Answer instructions:

7. Preparing test instructions
- 7a. Answer Instructions

Exam instructions are necessary instructions that guide the students in the performance of the test. The instructions have been formulated for answering a test, as well as a total score for each of the first and second questions and taking into account the reading of each paragraph.

7b. Correction Instructions

Instructions for answering the achievement test were prepared and given, score 1 for the correct answer and zero for the wrong one. The first question included 32 items, and the second question included eight article paragraphs. The overall score was 19, and thus, the total score for the achievement test as a whole is 54 points.

8. The validity of the test: The achievement of the achievement test was extracted as follows.

8a. Al-Dhaheri

The researcher presented the achievement test paragraphs with behavioural purposes for each paragraph to a group of arbitrators and experts specialised in the methods of teaching mathematics and methods of teaching science, to ensure the integrity of the paragraphs and their suitability for purposes and an agreement rate of 85%.

8b. The veracity of the content

This was achieved by preparing a test map, and in light of the previous procedures, an achievement test became ready for application.

9. Information sample and statistical analysis sample for the achievement test

9a. Sample information:

To determine the time required to answer an achievement test, and to know the clarity of paragraphs and instructions, an achievement test was applied to a survey sample. The first of which is composed of 32 students in the second intermediate class in Al-Maqassed Girls 'Medium according to an important facilitation book. It was an average time of 40 minutes.

9b. Statistical Analysis Sample

The test was applied to a second survey sample consisting of 100 female students from the second intermediate class in the intermediate schools for girls. After making sure that students completed studying classes covered by the research and after it was agreed with the management of a school and a teacher of a subject in a school, they are mentioned to take the test application and notify all students a week before the test date.

10. Statistical analysis of the achievement test paragraphs.

The results of the test were determined and sorted by the group with the highest scores (high), as well as the scores of the group with the lowest (minimum) scores through the use of a higher (27%) and lower (27%) for both groups for statistically analysed.

10a. Difficulty coefficient

The objective difficulty was a value ranging between 0.21 and 0.52 and article paragraphs. It was found that its value ranges between 0.44 and 0.63 as (Allam, 2006, p.114). Difficulty between (0.60-0.85) is good. in table 2.

10b. Discriminatory Strength

It was found the range is between 0.32 and 0.75, and the Discriminatory Strength calculated paragraphs between 0.32 and 0.61). All paragraphs are acceptable according to Ashardlimy and Adnan (2005, p. 90).

10. Stability of achievement test

A stability factor was calculated according to the equation (Elfa-Kronbach), as this equation is suitable to be applied to the test consisting of article and article paragraphs. The value of the stability of the achievement test (0.84) is considered a good value.

11. Achievement test in its final form and application

The achievement test was applied in its final form, at the same time to the two research groups on 28th April 2019 after the teacher (researcher) informed the students a week before the test date.

Mathematical Culture Scale

* Steps to build a scale

1. Determine the goal of the scale;
2. Defining areas of mathematical culture: In light of reviewing the literature and previous studies and the opinions of arbitrators in the methods of teaching, education and psychology, the researcher identified four areas of mathematical culture, which are:

- i) Mathematical culture is linked to the natural language;
- ii) Mathematical culture is linked to real-life;
- iii) Mathematical culture is linked to other sciences; and
- iv) Mathematical culture is linked to history.

3. Paragraphs for each field

Paragraphs for each field were formulated after he identified areas, as the number of paragraphs reached a scale of 40 paragraphs, including a scale of positive and negative paragraphs to reveal the sincerity of a responsive response, as well as paragraphs distributed between areas.

4. Formulating the instructions of the mathematical culture scale, and the instructions for the scale were developed, which included giving an idea about the goal of the scale.

5. Method of Correcting and Calculating Grades

For each of the three paragraphs of scale, three alternatives are specified (applies a lot, applies sometimes, and does not apply). Positive paragraphs take one of the three values (3, 2, and 1), while negative paragraphs are given grades (1, 2, and 3). Hence, the range of degrees of the scale is between 45 and 135 degrees.

6. Salah paragraphs of the mathematical culture scale

The paragraphs of the mathematical culture scale consisting of 40 paragraphs were presented to a group of arbitrators in the methods of teaching mathematics and educational and psychological sciences. Because a ruling issued by them is an indication of the sincerity of the scale, and the percentage of agreement was 84% of the arbitrators' opinion. This indicates a ready-to-measure scale.

7. Clarity of scale instructions and its paragraphs

It was confirmed the clarity of paragraphs of scale, and time taken to answer for paragraphs was calculated by calculating the average time of the answers of all students, and the average time taken to answer was 35 minutes.

8. Statistical analysis of the paragraphs of the mathematical culture scale

The mathematical culture scale was applied to an exploratory sample consisting of 100 female students in a secondary school. A first group represented 27%, which is a higher

group, while a second group represents the lowest (27%), which is a minimum group, then two statistical analyses were conducted on two groups. Latte:

8.1 Distinguishing power for scale paragraphs

A t-test was used for two independent samples between two extremist groups to find a discriminatory force for paragraphs of a mathematical culture scale. It became clear that all paragraphs of a scale are statistically significant at the level of significance of 0.05 and the degree of freedom of 62. Therefore, I returned all paragraphs of the scale are able to distinguish between students of two groups, upper and lower.

8.2 The validity of the scale

To ascertain the validity of the scale, the researcher used two indicators for validity as follows.

8.2.1 Sincere Validity

It was verified by presenting the paragraphs of the mathematical culture scale to a number of arbitrators in the methods of teaching mathematics, to judge the validity of the paragraphs of the mathematical culture scale.

8.2.2 Certified building:

This kind of honesty can be achieved by finding the correlative relationship between:

- a) The degree of the overall degree of the scale:

The Pearson correlation coefficient was used to extract the correlation between the degree of each paragraph of the scale and the overall degree of the scale and ranged between 0.27 and 0.57, which is considered good.

- b) Paragraph degree in the overall degree of the domain to which you belong.

The researcher used the Pearson correlation coefficient to extract the relationship between the degree of each vertebra and the domain to which the vertebra belongs, and the results ranged between 0.38 and 0.67 that all vertebrae are statistically significant.

9. The scale stability

Use the equation Alpha-Kronbach, and the stability factor has reached 0,89, which are its values, and this indicates that a scale has a high degree of stability (Allam, 2006, p. 236), and the scale is ready to be applied to its sample search.

The Fourth Chapter

The First Hypothesis: There is no statistically significant difference at the level of significance (0.05) between the average grades of the first group students who studied according to the strategy of accelerating thinking and the average of the degrees of female students in the second group who studied according to the usual method of achievement, as shown in Table 4.

Table 4: Statistical results of the achievement test for the two research groups experimental and control)

Statistical significance)0.05 (at	df	t-test for Equality of Means		Levene's Test for Equality of Variances		Arithmetic mean error	Standard deviation	Average calculation	Order number	The group
		Sig. (2-tailed)	t	sign	F					
sign	61					0.77	4.4	33,6	33	Experimental
		0.002	3.47	0.37	0.83	0.98	5.4	29.3	30	Control

There is no statistically significant difference at the level of significance (0.05) between the average grades of first group students who studied according to the strategy to accelerate thinking and the average degrees of female students in the second group who studied according to the usual way in the scale of sports culture, as shown in Table 5.

Table 5: Statistical results of the sports culture scale for the two research groups (experimental and control)

Statistical significance)0.05 (at	df	t-test for Equality of Means		Levene's Test for Equality of Variances		Arithmetic mean error	Standard deviation	Average calculation	Order number	The group
		Sig. (2-tailed)	t	sign	F					
sign	61					2.0	11.5	112.5	33	Experimental
		0.007	2.80	0.88	0.02	2.1	11.8	104.3	30	Control

Conclusions

1. The scale of the effect of the strategy to accelerate thinking in mathematical culture was significant, and this indicates that it has helped to improve the level of mathematical confidence of students, and in achieving the effect was significantly helped to raise the level of attainment in achievement.



2. A strategy helped increase the interest of female students in learning mathematics, by exploring a new mathematical topic themselves, drawing their attention and drawing them to the information provided by linking it to life.

Recommendations: It is necessary that the mathematics textbooks, especially the second mathematics average, contain some historical glimpses of Arab and Muslim scholars who contributed to the discovery and development of mathematical subjects, such as presenting some methods that Arab scientists used to solve first-degree equations, which increases students' mathematical culture.

Suggestions

1. Conducting a study similar to this study in other dependent variables, such as (mathematical problem solving, mathematical thinking, creative thinking, and the trend towards mathematics).

2. Building an enrichment program according to the fields of mathematical culture and its impact on both achievement and mathematical thinking skills.



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