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The (4H) strategy's effectiveness in achieving science and creative thinking among second-grade intermediate students

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Abstract--- The study aims to identify the strategy's effectiveness (4H) in achieving science and creative thinking among students in the second intermediate grade. The study sample included two groups, one of them was the experimental group, and its number of students was (30) students, and the control group represented the other group, and the number of its students was (30). Intentionally, the researcher chose Birir Intermediate School for Boys from the research community represented by the middle schools affiliated with the Directorate of Education of Diyala Governorate / Baquba. The researcher adopted the experimental study method for conducting his research, which includes one independent variable (the 4H strategy) and two dependent variables (scholastic achievement and creative thinking). The researcher chose the experimental design to control the research variables. Before starting the experiment, the researcher rewarded the two research groups for obtaining accurate results with the following variables: chronological age calculated in months, previous achievement of students, Raven test of intelligence, and the test of creative thinking. After making parity between the two research groups, the researcher prepared the requirements for the application of plans, objectives, and tests for the two research groups, and after completing the experiment application, the researcher applied his research tools to the two research groups. The researcher obtained data for the two research groups, as these data were processed statistically by t-test for two independent samples, and the results showed; The students of the experimental group outperformed the students of the control group who studied according to the strategy (4H) in the achievement test and the creative thinking test.

Keywords---Strategy (4H), academic achievement, creative thinking, second-intermediate students, science subject.

Introduction

Science is a natural science that includes theories, facts, and inventions. Despite the importance of science, we find that the actual reality of its teaching is still characterized by stagnation and boredom. This is due to following the usual teaching methods in the teaching process and the teacher's fear of losing the classroom control process due to his weak teaching skills and reliance on explanation in the teaching process. Some educational studies and research have indicated teachers' shortcomings in using modern teaching methods and limiting them to memorization and indoctrination as a study (Dayea, 2020) and (Saleh, 2021). Hence the primary research problem arises as there has become an urgent need to raise a generation that depends on thinking skills in an integrated manner through the development of students' minds and their creative thinking. Thus, the research problem can be determined by the following question:

What is the effectiveness of strategy (4H) in achieving science and creative thinking for second-grade students in intermediate school?

Second: The Importance of the study

The strategy (4H) is considered a basic rule affecting academic achievement and is responsible for developing thinking skills as it represents one of education's goals due to its educational importance in the learner's life. (Al-Shahri, 2016: 71). The main objective of any educational process is to bring about changes at the level of quality and quantity in the learning outcomes. Perhaps the most prominent of these outcomes for the learner in the educational field is academic achievement. Where the educational system works to improve it for learners, it represents the criterion for the learner's progress in his studies and his transition from one stage to another. Its importance does not stop at this point; instead, the learner uses what he has learned and absorbed from information and experiences to face the challenges and problems in his daily life. (Fadil et al., 2019: 16). Thus, creative thinking is the nerve that drives all thinking activities in the world, whereas (Guilford) indicated that creativity had become the key to education in completing its meanings and also a key to solving most intractable problems. (Al-Khalayleh and Afaf, 1998: 157).

Thirdly: Objectives and Hypotheses

The current research aims to identify the effectiveness of the 4H strategy in the achievement of science and creative thinking among second-grade intermediate students.

To verify the objective of the research, the following two null hypotheses were developed:

1. There is no statistically significant difference at the level of significance (0.05) between the average scores of the experimental group students who study science according to the 4H strategy) and the average scores of the control group students who study the same subject according to the usual method in the achievement test for science.
2. There is no statistically significant difference at the level of significance (0.05) between the average scores of the experimental group students who study science according to the strategy (4H) and the average scores of the control group students who study the same subject according to the usual method in the creative thinking test.

Fourthly: Limitations of the study

The study was limited to:

1. Spatial boundaries: Intermediate and secondary schools (governmental day schools) for boys only, affiliated to the General Directorate of Education in Diyala Governorate / Baquba
2. Temporal limits: the first semester of the academic year (2021-2022)
3. Human limits: second-grade intermediate students.

Fifthly: Defining Terms

1. Strategy (4H) was defined by:

Ambo Saidi and Al Hosaniah (2016) defined it as: "One of the active learning strategies that activate the student's role, provoke enthusiasm and break the routine, in which the learner uses his thoughts and feelings, as well as some senses and links them directly. It consists of four stages: the head, the hand (hand), heart, and heat to increase student achievement" (Ambo Saidi and Al-Hosanieh, 2016: 140).

The researcher defined it procedurally as a set of planned and organized stages that the science teacher follows with the members of the experimental group in the second intermediate grade to acquire information, facts, and concepts in science according to four stages:

The head (the mental processes in the brain), in which the student's thinking takes place, and the expression of those ideas freely, the hand (skills of all kinds), in which a drawing and a summary of the most important things that came in the topic of the lesson take place to achieve the objectives of the lesson, the heart (emotions and feelings), in which the student's feelings towards the subject of the lesson are aroused and expressing those feelings, and the heat (interaction and homogeneity), in which students cooperate and interact with each other to reach appropriate solutions.

2. Creative thinking was defined by:

Ali (2011) as: "the individual's ability to think correctly to produce ideas that depart from the known cognitive framework in which the individual thinks, despite the information prevailing in the surrounding environment to emerge new ideas" (Ali, 2011: 200).

The researcher defined it procedurally as the set of skills and abilities possessed by the second intermediate grade students (the research sample) to come up with ideas characterized by fluency, flexibility, and originality, as measured by the degrees they obtain after their answers to the creative thinking test adopted by the researcher.

Section two: Theoretical Background and Previous Studies

The first axis: Theoretical Background:

1st. Active learning

Active learning is "that type of learning that depends on the participation and positive interaction of students in all educational situations in the classroom, and that depends on a group of effective methods such as role-playing, brainstorming, problem-solving, and decision-making, under the supervision and guidance of the teacher." (Khairy, 2018: 26).

2nd. Strategy (4H)

Hendrix from the University of Iowa in the United States of America was the first designer of the 4H strategy, and its idea arose at the beginning of the twentieth century due to the reluctance of young people in rural areas to learn. Rural teachers tried to reach these young people through the idea of practical learning, which is a crucial point. So they worked to link university education to life. (Lee, B. 1995: 17).

The learner performs the four activities according to each word:

1. Head (representing mental processes):(Write your thoughts on the topic) Where the learner expresses his thoughts on the topic.
2. Hand (representing the skill acquired):(Write, Draw, Design) It relates to the learner writing down what he understood and learned during the lesson in the form of drawings or diagrams.
3. Heart (emotional aspect):(Write your feelings about the topic) The learner expresses his feelings about the lesson's topic.
4. Heat (Working Atmosphere):(Express the working atmosphere inside the classroom) The learners' interaction represents it during the lesson and how they cooperated and formed cooperative groups. (Mujahid, 2021: 112)

Third: Creative Thinking

The issue of creativity has received wide attention, especially as societies are moving in concrete steps for their progress. In our Arab world, we urgently need to take advantage of our creative energies to confront various issues and problems and propose alternative solutions—this phenomenon is considered one of the most acceptable mental activities required to build human civilization. (Al-Tal, 2013: 15).

The Second Axis: Previous Studies:

After reviewing the previous studies and literature, the researcher did not find any study that dealt with (4H) strategy as an independent variable, nor any study that dealt with creative thinking as a dependent variable.

Section Three: Research Methodology and Procedures

First: Experimental Design:

The researcher chose the experimental design with partial adjustment, as shown in Figure (1).

Groups	Independent Variable	Dependent Variable	Study Tool
Experimental	Strategy (4H)	Academic achievement + Creative thinking	Academic achievement test + creative thinking test
Controller	The usual way		

Figure (1): Experimental Design

Second: The Study Community and its Sample:

1. Research community: The current research community represents the morning intermediate schools for boys only affiliated with the Diyala Education Directorate / Baquba
2. Research sample: The research sample is divided into:
3. School sample: The researcher chose (Birir Intermediate School for Boys) in Diyala Governorate / Baquba to conduct his research.
4. Sample of students: After the researcher chose (Birir School for Boys) to apply the experiment, he found that it contains two divisions, as shown in Table (1).

Table (1): distribution of the research sample to the experimental and control group before and after exclusion.

No.	Groups	Number of Students before Exclusion	Number of Exclusion Students	Number of Students after Exclusion
1	Experimental	32	2	30
2	Controller	32	2	30
Total		64	4	60

Third: Equality of the two study groups:

The researcher was keen to make equivalence with the following variables: (the chronological age of the students calculated in months, the student's previous academic achievement, previous information, the intelligence test, the creative thinking test), and the following Table showing the equivalences above:

Variable	Group	Count	SMA	Standard deviation	Variance	Temp	The two t values		Statistical significance
							Calculated	Tabular	
Chronological age	Experimental	30	159.36	4.49	20.16	58	0.24	2.000	Not statistically significant
	Controller	30	159.60	3.50	12.25				
Previous achievement of students	Experimental	30	7.13	2.54	6.45		1.716		
	Controller	30	8.20	2.26	5.10				
IQ test	Experimental	30	24.00	5.99	35.88		0.598		
	Controller	30	23.03	5.51	30.36				
creative thinking test	Experimental	30	19.83	2.24	5.01		0.868		
	Controller	30	19.33	2.21	4.88				

Table (2): Arithmetic mean, standard deviation, and the two T values of the research variables for the two research groups

Fourth: The Study Tools:

Procedures involved in building each of these two tools:

1. The achievement test: The researcher prepared the achievement test according to the following steps:
 - a. Determining the objective of the test: The test aims to measure the amount of information acquired by students of the second intermediate class (the research sample) during the duration of the experiment.
 - b. Determining the number and type of test items: The researcher adopted objective tests of the type (multiple choice) to measure Bloom's cognitive levels, which are (remembering, understanding, application, analysis, synthesis, and evaluation). The total number of items for the achievement test was (40) multiple-choice test items.
 - **Test validity:** To ensure the validity of the achievement test, the researcher adopted two types of validity:
 - ✓ Apparent honesty: The researcher distributed the achievement test, accompanied by the behavioral objectives and the specification table, to a group of arbitrators, and in light of their opinions, the percentage ranged between (85% - 100%), and therefore the test items were kept (40) items.
 - ✓ Content Validity: The researcher prepared a table of specifications and confirmed its validity through the specification table that was presented with the achievement test to a group of arbitrators.
 - **The exploratory application of the achievement test:** The achievement test was applied in two stages:
 - ✓ The first exploratory application: After verifying the validity of the test, the achievement test was applied in its first exploratory stage on Wednesday (12/1/2022) to a group of students of the second intermediate grade in (Al-Hassan bin Ali (peace be upon) secondary school for boys), where the number of students was (30) students and the purpose was to know the clarity of the instructions, paragraphs, and instructions of the test.
 - ✓ The second exploratory sample: It numbered (100) students of the second intermediate grade in (Martyrs of Islam Intermediate School for Boys) on Sunday (16/1/2022), and the students were notified a week before the test. The researcher extracted the coefficient of difficulty, coefficient of ease, discrimination, and the effectiveness of the wrong alternatives for the achievement test by using the method of the two extreme groups (27%) for the upper group, which amounted to (27) students, and (27%) for the lower group, which amounted to (27) students from the sample of statistical analysis. After that, the scores

for both the upper and lower groups were statistically analyzed to extract the psychometric properties of the achievement test.

➤ **Statistical analysis of the achievement test items:**

- a) The difficulty coefficient of the test items: Its value ranges between (0.35-0.70), and thus, the achievement test items are reasonable and appropriate in terms of difficulty, ease, and acceptability.
 - b) Discrimination coefficient: the researcher found that it ranges between (0.22 - 0.55)
 - c) The wrong alternatives' effectiveness is limited between (0.03 - 0.25)
 - d) Test reliability: The researcher verified the test's reliability by:
- Kewder-Richardson 20 method: When calculating this equation, the stability coefficient was (0.936).

2. **Creative thinking test:** Creative thinking represents the second dependent variable of the research, and after the researcher reviewed several tests related to creative thinking, he found that the verbal (Torrance) test to measure the ability of creative thinking composed in its verbal form is the appropriate test for the current research.

Fifth: Statistical Means: The researcher used the (Microsoft Excel-2010) and the (spss) system by adopting the statistical means.

Section Four: Presentation and Interpretation of Results

First: Presentation of the results: The researcher prepared an achievement test for science and a test for creative thinking, and they were applied to the two research groups, and after applying the two tests, the researcher corrected the papers of the two groups and recorded their scores. Then, the arithmetic mean of the scores of the students of the two research groups and the standard deviation was calculated, and then the t-test was applied to two independent samples as shown in Table (3) and (4):

Table (3): The scores of the students of the two research groups in the science achievement test and the creative thinking test.

Variable	Group	Count	SMA	Standard deviation	Variance	Temp	The two t values		Statistical significance
							Calculated	Tabular	
achievement test	Experimental	30	28.033	3.671	13.476	58	3.272	2.000	Significant
	Controller	30	24.933	3.666	13.439				
Creative thinking	Experimental	30	34.933	4.193	17.581		4.317		
	Controller	30	29.533	5.418	29.354				

Table (4): The arithmetic means, standard deviation, and the calculated and tabulated T-values for the scores of the students of the two research groups in the creative thinking test.

Group	Count	SMA	Standard deviation	Variance	Temp	The two t values		Statistical significance
						Calculated	Tabular	
Experimental	30	34.933	4.193	17.581	58	4.317	2.000	Significant
Controller	30	29.533	5.418	29.354				

Through the results, it is clear that the experimental group students outperformed the control group students in the achievement and creative thinking tests.

Second: Interpretation of the results: The (4H) strategy contributed to making the student interact productively and positively with activities and colleagues and enhancing cooperative work.

Third: Conclusions: The strategy (4H) is positively effective in increasing the achievement of second-grade students in the science subject, increasing their abilities to understand information, facts, and knowledge, and raising their academic level.

Fourth: Recommendations: It is necessary to include the strategy (4H) in the vocabulary of methods of teaching science for the initial stages and postgraduate studies in the faculties of education and primary education.

Fifth: Suggestions: The strategy's effectiveness (4H) in the achievement and probing thinking of fifth-grade students in science.

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