

The effect of random convergence stylistics and the thinking cycle on the achievement of fifth-grade students in science

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Summary: The study aimed to identify the effect of teaching science using the random convergence and thinking cycle methods for fifth grade students . I use the experimental method , The study sample consisted of (88) fifth-grade students from one of the Baghdad schools affiliated to the Second Rusafa Directorate of Education.For the first semester of the academic year (2021/ 2022). The school was chosen intentionally. The students were divided into three divisions, the first experimental group, and the number of its members was (28), who learned according to the method of random convergence.As for the second experimental group and the number of its members (29) who learned according to the method of the thinking cycle, and the control group and the number of its members (31) who learned according to the usual method, teaching plans were prepared according to the methods of random convergence and the thinking cycle, and it was confirmed that the three research groups were equal, and a post-achievement test was put in place. After verifying its validity and stability, it was applied to the study subjects after carrying out the experiment to achieve the research objective. The results of the research showed that the first and second experimental group outperformed the control group, and there was no difference between the first and second experimental group. In light of these results, the researcher recommended science teachers to use the two methods of random convergence and the thinking cycle in their science teaching.

chapter one /

First: the research problem /

There are studies that showed a low level of science achievement for the fifth grade of primary school, such as the study (Al-Tamimi: 2006), the study (Al-Maliki: 2008) and the study (Al-Wakeel: 2011). Moreover, the researcher conducted an exploratory sample that included a sample of science teachers whose number was (15), as in Appendix (1), where two questions were asked.

- 1- Do you have knowledge of ways to develop thinking? The answer was: that (85%) of them have no knowledge of this subject
- 2- Do you have knowledge of the random convergence method? The answer was: that (95%) had not heard of this method

Therefore, the researcher decided to conduct his current research experiment on the primary stage, which represents the cornerstone of the education ladder, and because the minds of this age group are prepared to receive information if it is given correctly and in a teaching style that suits the levels of their minds, where the problem of the current research can be formulated by answering the following question: The effect of the random convergence method and the thinking cycle on the achievement of fifth graders in science subject?

Secondly / research importance /

We can summarize from the above that the importance of the research lies in the following justifications:

- 1- The importance of the science subject and the educational goals it achieves .
- 2- The lack of a previous study that dealt with the random convergence methods and the thinking cycle, to the knowledge of the researcher.
- 3- Using modern teaching methods that may help to overcome some of the students' thinking problems and express it through achieving goals in the field of science teaching.
- 4- The possibility of the Ministry of Education benefiting from the results of this study in developing science teaching at the primary level.
- 5- The empty research is a qualitative addition to the educational library that may benefit students to view it as previous studies.

Third / search objective /

The research aims to identify "the effect of random convergence methods and the thinking cycle on the achievement of fifth graders in science"

Fourthly / research assumes /

- 1- There is no statistically significant difference at the level of significance (0.05%) between the average scores of the experimental group students who will study according to the random convergence method and the average scores of the control group students who will study according to the usual method in the science achievement test.
- 2- There is no statistically significant difference at the level of significance (0.05%) between the average scores of the experimental group students who will study according to the thinking cycle method and the average scores of the control group students who will study according to the usual method in the science achievement test.
- 3- There is no statistically significant difference at the level of significance (0.05%) between the average scores of the experimental group students who will study according to the random convergence method and the average scores of the experimental group students who will study according to the thinking cycle method in the science achievement test.

Fifthly / search limits / The current search is limited to

- 1- Primary (governmental) day schools for boys affiliated to the General Directorate of Education in Baghdad Governorate.
- 2- Students of the fifth grade of primary school.
- 3- The second and third units include the chapters (third, fourth, fifth, sixth) of the science book to be taught to fifth grade students.
- 4- The academic year (2021-2022) AD.

Sixthly / define terms /

- 1- The method of random rapprochement defined by: (Mahmoud: 2006) as "is to find rapprochement that did not exist before in individuals' experiences and knowledge. Generate new ideas . (Mahmoud: 2006, 425) The researcher defines it procedurally as a teaching method that helps the learner to link words, images and concepts with each other, in addition to generating new ideas and words.
- 2- The thinking cycle method was defined by: (Bdeir: 2000) as "a mental process by which the mind is operated in order to address what the individual faces in random or organized situations and the environments in which the individual arises, and the levels and types of thinking differ, according to the different tendencies, tendencies and beliefs of the individual. Addressing what confronts the individual contributes to accessing knowledge, generating ideas, analyzing them, and simulating them (Badir: 2000, 46) The researcher defines it procedurally as a teaching method that operates the learner's mind so that he can address some of the situations and problems he faces.
- 3- Achievement was defined by: (Al-Najjar: 2010) as "the level of students' acquisition of information and skills in a subject they had learned through their answers to a set of questions that represent the level of study." (Carpenter: 2010, 134) The researcher defines it procedurally as the sum of information and scientific knowledge learned by the students of the research sample after the passage of a period of time, and it can be measured in degrees.

Or not /

theoretical background /

- ❖ random convergence method : When dealing with a specific idea or topic, we are interested in thinking about matters related to the idea or topic so that the boundaries of the field for this idea and topic can be determined. In dealing with this idea or topic, similar things are put together (teacher - class), (student - book), (lesson - exam), (abilities - resources). As for the random convergence method, it aims to find a convergence that did not exist before in the experiences and knowledge of individuals. Unintended (random) words are chosen and linked to the idea under discussion or the topic through a direct or indirect relationship, and this basically leads to the generation of new ideas. The random convergence method goes through the following steps:
 - 1- Determine the topic that will be thought about and determine its goals.
 - 2- Choose a word or group of random words.

- 3- Attempting to link the random word with the research idea or topic with focus of mind to take advantage of the characteristics of the random word to generate new and innovative ideas related to the research idea or topic. Then the transition to another word in the same way and so on a third and fourth word until the largest number of new ideas related to the idea of the topic is generated. (Mahmoud: 2006, 425-426)
- ❖ Thinking Cycle Style / Thinking is a mental process by which the mind is operated with the aim of addressing what the individual faces in random or organized situations. What faces the individual in accessing knowledge, generating ideas, analyzing and simulating them.

Thinking has models and strategies, and it has its operations cycle, and the role of thinking includes three basic tasks.

- Exploration /It is a process in which a new field and field of expertise moves to him, so he has a store of ideas as a result of his vitality, activity, observations, and inferences on which he is based. (Mahmoud: 2006, 446) It is an active learning approach that helps students learn through curiosity and inquiry, and learning through exploration as a process that changes the way one deals with a given situation, in fact one can assert that it is the most effective way of learning. Research has shown that students learn best through hands-on experiences where the role of the teacher goes beyond a simple succession of learning materials. Ideas and concepts learned in this way survive, and students also develop a habit of inquiry-based learning by constantly engaging in questions such as why and how ? They analyze and begin to recognize what works and what does not work in a given situation. It leads to independent individuals who are critical thinkers and inquisitive, and they nurture the drive to learn anywhere, anytime. (Khawaldeh: 2004) Learning achieved through exploration builds a foundation It is robust to skills and leads to realizing learning experiences, another term for this can also be discovery learning which includes as the process of preparing the student for the task of discovery learning by providing the necessary knowledge needed to successfully complete the said task. Teachers do not provide solutions and only guide students in which direction to search for the answer that students are looking for. Natural curiosity leads the process of exploratory learning and this natural curiosity will lead to a solid exploration mindset which is vital to decision making and problem solving in life. Learning through exploration helps students to understand the relationship between cause and effect. In such a scenario students unconsciously delve into deeper learning. Through this learning strategy, the student commits to exploration, experiment, investigation and creativity in looking for answers to life situations and develops the ability to appear as fearless students Because they have conquered the ability to face anything. This approach helps form the right attitude and skill so that the student has the potential to thrive and succeed, and exploration-based learning develops practical and mental skills. As an ongoing educational approach, the inherent natural drive to search for new challenges and possibilities is meaningfully nurtured and developed. (Jaber: 2005)
- Creativity / By naming the student the names, words and concepts on the experiences, attitudes and events that took place in the exploration stage by the students. (Mahmoud: 2006, 446) Innovative learning is, in its essence, a social and cultural act that is not devoid of “ontological” dimensions connected to the meaning of the educational existence itself and the experience of schooling at all - one aspect of “pedagogy of the will,” that is, that we live while we learn in a willing manner (Duffly: 1994, 2) Modern educational visions have tended to transform the direction of creative education and the pedagogy of creativity from mere proof of talent and the development of Qariha to betting on the “school project, a project of investment in knowledge and a project of integrating the educated individual into his community and preparing for the consideration of the cultural, civilizational and citizenship dimensions and the needs of the labor market and employment (Zoss: 2011, 28-29) There is no value, then, for an innovative education in which we do not find the effects of successful education for the sake of making life successful, which may necessitate the inclusion of the concepts of “education” on health, the environment, the media and citizenship, which necessarily include “life skills” and consider them a top priority before knowledge and purely formal contents. The school of life and the teaching of innovation may not recognize abstract formal knowledge unless it is embedded in its reality and leaves traces of its “transportation,” which must be positive and insightful at the same time. Innovation is not a breakthrough or a sudden, but rather it is a systematic path with a goal of structuring and orderliness completely consistent with what the teacher and pedagogue builds in terms of educational pedagogical designs and engineering that lead to the establishment of devices and possible scenarios that bring us back to the concept of “the engineering of the possible and the available with merit, realism, reasonableness and equitable educational pedagogy.” Connected to innovation is an engineering that gives learning the meaning of being rooted in its context, surroundings, and reality, closely connected to life.

There is no value for teaching and learning without a permanent revival of what makes the learner live emotionally and mentally, in his behavior, convictions, values, system of actions and the effects of his learning. (Robert: 89, 2010)

- Discovery /Expanding and favoring the concept that was created and employing it in a new way, which leads to the generation of new concepts, which become a topic or a field for the start of its new cycle of operations.(Mahmoud: 2006, 446) Discovery is seen as a process and the way in which the learner arrives at the solution (more than the solution itself) or the results or access to a specific information, so he is interested in the emergence of the process itself and is represented in the ways and methods of reaching the solution.Accordingly, the process eventually becomes a mental ability that results from training in solving problems, and training in formulating and testing the hypotheses that can be achieved to reach the correct solution. (Faraj: 2009, 143)

Objectives /

- 1- That the learner discovers concepts and principles by himself through interaction with the situation and the use of foresight .
- 2- That the learner gets used to seeking knowledge by himself as a result of his effective participation in the learning and teaching process and motivating the learner to learn.
- 3- Discovery learning develops in students training trends and strategies used in problem solving, investigation and research.
- 4- The discovery learning method helps students increase their ability to analyze, synthesize and evaluate information in a sound mental way.
- 5- Preparing individuals who are able to criticize what others have achieved in order to reach the best.
- 6- Preparing individuals who are able to discover new knowledge and not just imitate what others have done.
- 7- Discovery learning helps develop effective ways of teamwork, sharing information, and listening to and using others' ideas.
- 8- There is some evidence that the skills, concepts, and principles learned through discovery are more persistent in students.(Al-Harthy: 2011)

Discovery features /

- Stimulating students' motivation for discovery by investing their thinking in solving many problems that learners encounter in their lives.
- Investing students' experiences and previous knowledge as a basis for discovering things that can be built on these experiences, especially with regard to some concepts, rules and laws that they have already known.
- Providing the appropriate atmosphere that familiarizes them with the appropriate research methods for their developmental levels, gradual with the easy things, and presents it to more profound requirements.
- Helping the student to guess the solution, and this means that the educational situation is based on understanding the dimensions of the issues that the learner is asked to discover, and this role is primarily up to the teacher.
- Confirming the correctness of the guess, and this requires that the teacher instruct the learner to exclude the wrong attempts that he believes will lead him to the solution and advise him to replace them with new attempts that may lead him to the solution.
- Helping the learner on the correct application by applying it and training on its use and employment and relying on it in solving and discovering other issues.
- Questions in a logical manner related to the content of the teaching unit.
- Feedback is ongoing.
- Preoccupation of the student with a specific process that leads to discovery.
- Developing the ability to discover successive things that lead to the discovery of a particular idea.
- Develop the capacity for patience on the part of both the teacher and the student. (Al-Rubaie: 2006, 165)

Secondly /

previous studies / Due to the absence of previous studies on the two methods (random convergence and the thinking cycle), the researcher decided to address some close studies on the thinking cycle method, which is the strategy of the triple learning cycle with achievement to benefit from them in this research.

Study (Al-Quraishi: 2000) /

The study aimed to know the effect of using three strategies for teaching physical concepts on the scientific inclinations, achievement and retention of fourth-grade students. The study sample consisted of (93) students, and they were randomly distributed to three groups in each group (31) students. The study lasted six months. The first experimental group studied according to the strategy of the explanatory model or the explainer, and the second experimental group studied according to the strategy of the three-cycle learning stages, and the third experimental group was taught according to the conceptual confrontation strategy, and the researcher taught the three groups himself. The researcher prepared a measure of scientific inclinations and an achievement test, and he used the experimental design with partial control represented by the pre-post test for the inclination and the post test for achievement and retention, and he used the following statistical methods (Kewder Richardson equation -20, one-way analysis of variance, Rolon equation, Cooper's equation, method Toki). Using the Tukey method, the researcher concluded that there are no statistically significant differences between the average scores of the groups, except in the following two cases:

- 1- There are statistically significant differences between the average scores of the second group, which studied using the three-stage learning cycle model, and the average scores of the third experimental group, which studied using the visual confrontation and in favor of the second experimental group.
- 2- There is a statistically significant difference between the average degrees of retention for the second group that studied using the three-stage learning cycle model, and between the average degrees of retention for the third experimental group, which studied using the visual confrontation and in favor of the second experimental group.

Study (Mohamed: 2003) /

The study aimed to know the effect of two models of the learning cycle for teaching biological concepts on the achievement and scientific inclinations of second-grade middle school students. This study was conducted in Mosul, and the study included a sample of (89) students, as (40) of them represented the first experimental group, which studied with the three-stage learning cycle model, and (40) students represented the second experimental group, which studied with the learning cycle model. The five stages, and the research sample was chosen randomly, and the study lasted 12 weeks, and the researcher taught the two groups himself, and used the experimental design with partial control and the post test. The results of the study showed the superiority of the students of the second experimental group, which studied with the five-stage learning cycle model, over the students of the first experimental group, which studied with the three-stage learning cycle model in each of Academic achievement and inclinations.

Study (Al-Suwaidi: 2008) /

This study aimed to know the effect of the learning cycle method on the achievement and science processes of first-year secondary students in biology compared to the traditional method. This study was conducted in Sana'a / Yemen, and the study sample consisted of (210) first-year secondary students in the capital Sana'a, divided into four divisions in four schools, two schools for boys, and two schools for girls, and the people were randomly selected in each school. The members of the experimental group were (100) students (50 males, 50 females), and the experimental groups were taught by the learning cycle method, and the control groups were taught by the traditional method. The study tool consisted of an achievement test of the type of multiple choice and it consisted of (52) items, and a scale of science operations skills of the type of multiple choice, and it consisted of (34) items.) for independent samples, and after the end of the experiment, which lasted nine weeks, the students' achievement in the achievement test and the science processes scale were measured. The results resulted in the superiority of the experimental group that was studied using the learning cycle in the achievement test and the science operations skills scale.

Third /Indicators of previous studies and their implications /

After the researcher has presented a number of studies related to his research, general indicators and indications will be presented in the main aspects, in order to know the similarities and differences between them on the one hand, and the current study on the other hand, as follows:

- 1- Purpose of the study / The previous studies varied in terms of the purpose of the study. The study (Al-Suwaidi: 2008) aimed to know the effect of the learning cycle method on achievement. As for the study (Mohammed: 2003), it aimed to know the effect of two models of the learning cycle for teaching biological concepts on

achievement. As for the study (Al-Quraishi: 2000), it aimed to know the effect of using three strategies for teaching physical concepts on scientific tendencies and achievement. As for the current study, it aimed to know the effect of the random convergence methods and the thinking cycle on achievement.

- 2- Study subject (scientific article) /The study (Al-Suwaidi 2008) and (Mohammed: 2003) dealt with biology, while the study (Al-Quraishi: 2000) dealt with physics, and the current study dealt with science.
- 3- Educational level /The study (Al-Suwaidi: 2008) was applied to the first secondary grade, while the study (Mohammed: 2003) was applied to the second intermediate grade, and the study (Al-Quraishi: 2000) to the fourth year of the year, while the current study was applied to the fifth grade of primary school.
- 4- experimental design /The study (Al-Quraishi: 2000) followed the design of the three groups with partial control, while the study (Mohammed: 2003) used the design of the two experimental groups with partial control and the post-test, while the current study adopted the design of the three groups, one control and two experimental groups with a post-measure only.
- 5- The study sample /The number of sample members in the previous studies ranged between (89) individuals as in the study (Mohammed: 2003) and (210) individuals as in the study (Al-Suwaidi: 2008), and the sample of some studies were males and females as the study (Al-Suwaidi: 2008). The current study is in agreement with the study of (Mohammed: 2003) and (Al-Quraishi: 2000), and it was samples from males only.
- 6- search tool / The current research agrees with all previous studies using multiple-choice achievement tests.
- 7- Statistical means / The current study agreed with previous studies in its use of one-way analysis of variance.
- 8- Results of the study / The results of all previous studies showed the superiority of the experimental groups over the control group and in favor of the independent variable, while the result of the current study resulted in the superiority of the two experimental groups in the variable of random convergence method and the thinking cycle method. The results did not show a difference between the two experimental groups in the mentioned variables.

Fourthly / Aspects of benefit from previous studies /

- 1- The researcher chose the research method and the type of experimental design with three groups (experimental and control).
- 2- Conducting statistical equivalence between the research groups in some variables.
- 3- Preparation of the achievement test.
- 4- Knowledge of research procedures and interpretation of results.
- 5- Determine the statistical means.

Chapter Three / Research Method /

First of all / experimental design

It means "the action plan that the researcher follows in his experiments, starting with the method of selecting the units of the experiment and distributing them through a specific system and ending with the method of measuring the outcomes and effects of the experiment." (Ben Jakhdal: 2019 , 66)

There are two main purposes of the experimental design, the first is to help the researcher to find answers to the research questions. The design tells us what observations should be collected, and the methods of collecting and analyzing them. The second: is to control the variance, whether it is the result of the experimental (independent) variable or the result of extraneous variables. (Al-Batsh and Farid: 2002, 231-232). The researcher chose the design of equivalent groups with partial control of the type of post-test, and the design can be clarified in the following table :

Table (1): Experimental design of the research

dependent variable	independent variable	parity	the group
achievement test	random convergence method	-intelligence	The first experiment
	thinking cycle style	-Previous information	The second experience
	normal method	-previous collection -Chronological age - Parents' education	control

Secondly /Research community and sample /

The research community consists of students of the fifth grade of primary school from primary schools for boys in the province of Baghdad / Directorate of Education Rusafa II, represented by (49) schools, and the school of Ammar bin Yasir was chosen intentionally because it contains three classes within the fifth grade of primary school and for the cooperation of the school administration with the researcher. The sample of the research consisted Of (88) students divided into three divisions, Division (A) was chosen randomly to be the control group and includes (31) students, and Division (B) to be the first experimental group, which will be studied according to the method of random convergence and includes (28) students, while Division (C) It was the second experimental group, which will be studied according to the method of the thinking cycle and includes (29) students, and the students who failed were excluded, as it is expected that they have previous experiences in the science subject, which may affect the internal safety of the experiment, and they were excluded in analyzing the test results only, meaning that they They participated with their colleagues in all the requirements of the experiment, and Table (3) illustrates this.

Table (3) The distribution of the research sample to the groups, the number of students before and after exclusion, and the final number of the research sample.

Final number	The number of excluded students	The number of students before exclusion	the group
26	2	28	The first experiment (random convergence method)
25	4	29	Second Experiment (Thinking Cycle Method)
28	3	31	Control (the usual method)
79	9	88	Total

Third /

Parity of groups /

In order to reach the equivalence of the members of the groups before applying the experimental procedures, the researcher carried out the equivalence processes in the variables believed to affect the results of the experiment. Not a function, as shown in the tables below

1- IQ test /Table (4) analysis of variance of the scores obtained by the three groups in the intelligence test

Significance level at 0.05	tabular value	Calculated value	squares averages	degree freedom	total squares	Contrast source
nonfunction	3.07	0.00	0.001	2	0.001	between groups
=	=	=	43.573	76	3311.543	within groups

2- Previous information / Table (5) analysis of variance for the scores obtained by the three groups in the previous information test

Significance level at 0.05	tabular value	Calculated value	squares averages	degree freedom	total squares	Contrast source
nonfunction	3.07	2.159	12.049	2	24.098	between groups
=	=	=	5,580	76	424.080	within groups

3- Previous achievement / Table (6) analysis of variance for the three research groups for students' scores in science for the previous academic year.

Significance level at 0.05	tabular value	Calculated value	squares averages	degree freedom	total squares	Contrast source
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nonfunction	3.07	0.29	0.017	2	0.034	between groups
=	=	=	0.590	76	44.827	within groups

- 4- Chronological age / Table (7) analysis of variance for the three research groups in the variable age of students, calculated in months

Significance level at 0.05	tabular value	Calculated value	squares averages	degree freedom	total squares	Contrast source
nonfunction	3.07	0.219	1,974	2	3.947	between groups
=	=	=	9.23	76	685.774	within groups

- 5- Parents' education /

- Academic achievement of mothers: Table (8) educational attainment of mothers

College	institute	Secondary	medium	Primary	Reads and writes	ignorant	the group
5	9	5	3	3	/	1	empiricism the first
2	5	5	8	4	/	1	empiricism the second
7	8	8	4	/	/	1	Control

- The educational attainment of the fathers / Table (9) the educational attainment of the fathers

College	institute	Secondary	medium	Primary	Reads and writes	ignorant	the group
12	8	/	3	3	/	/	empiricism the first
7	7	5	3	2	/	1	empiricism the second
10	7	4	3	1	3	/	Control

Fourthly /Adjust extraneous variables /

It is intended to control the phenomenon to be studied by conducting stabilization or equality between them so as not to affect the results of the experiment. Therefore, these factors are stabilized in terms of quantity and type. (Abdul-Rahman, Zangana: 2007, 480) and experimental research is exposed to many variables that affect internal safety. And externality of the experimental design and for the purpose of reducing errors in the results resulting from the presence of this variable, which must be controlled. (Abbas and others: 2009, 67). The researcher deliberately controlled a number of variables, which he believed may affect the dependent variable, and it was confirmed that they were controlled in all fields, and as follows

- 1- Experiment place
- 2- Study subject
- 3- time period
- 4- Subject teacher
- 5- Allocation of quotas
- 6- The confidentiality of the experiment

- Experimental conditions and associated accidents /

They are all the circumstances and accidents that may happen to the sample members during the duration of the experiment, as the prior planning and preparation of the experiment reduce the impact of this factor, and

the sample of the current research was not accompanied by any of these circumstances and accidents that lead to obstructing the experiment or affecting its results, praise be to God

• Processes related to maturity /

It means the biological and physiological changes that occur in the structure of the organism, and this type of change may occur in many individuals at the same age.(Melhem: 2000, 398) These changes had no effect on the course of the research experiment because it was standardized for the three research groups and the duration was short, so the processes related to maturity had no effect on the experiment.

Fifth /Research Supplies /The researcher found that one of the requirements of the research is to do the following

1- Determine the scientific material /Before starting the application of the experiment, the researcher determined the content of the scientific material to be taught to students of the three research groups (experimental and control) in the first semester of the year 2021-2022 for science for the fifth grade of primary school, fourth edition, year 2019, and the chapters included the following topics

- Chapter Three: Circulation and Respiration
- Chapter Four: The Digestive and Urinary System
- Chapter Five: The Elements
- Chapter Six: Compounds and Mixtures

2- The formulation of behavioral goals /Behavioral objectives are carefully written statements that describe what the learner is expected to do at the end of the learning situation. (Touq and Adas: 1982, 32) Therefore, it was necessary for the researcher to prepare and formulate behavioral objectives, so the researcher formulated (191) behavioral objectives in light of Bloom’s classification in the cognitive domain, as the behavioral objectives were distributed (remembering, comprehension, application, analysis, installation, evaluation) respectively because it is considered the most Classifications are common, preferred and used. (Bloom:1989,107) The behavioral goals were presented to a group of arbitrators, and in the light of their opinions and observations, some behavioral goals were reformulated and the level they measure was modified, Appendix (7), and thus the behavioral goals became distributed according to the four seasons and as in the following table:- Table (11) Distribution of behavioral goals according to Bloom's cognitive classification

cognitive domain							levels	numbering	
Total	Calendar	collect	analyzing	Application	assimilating	remember	Study content		
55	3	1	7	10	15	19	Circulation and breathing apparatus	Chapter Three	unit two
47	1	5	7	7	8	19	Digestive and urinary systems	chapter four	
44	2	1	5	10	10	16	the elements	Chapter Five	unit three
45	2	4	6	8	13	12	Compounds and mixtures	Chapter six	
191	8	11	25	35	46	66	Total		

3- Preparing teaching plans /

The daily teaching plan is a visualization process that precedes the lesson and includes multiple procedures that the subject teacher takes and implements during a specified period of time to ensure his success in it by achieving the desired goals (Al-Saadi: 2016, 53). After analyzing the study material, the researcher prepared (10) study plans for all research groups (ten teaching plans for the first experimental group according to the method of random convergence, ten teaching plans for the second experimental group according to the method of the thinking cycle, and ten teaching plans for the control group according to the usual method), so that The plans cover the educational material and the behavioral goals, and a sample of those plans was presented to the group of arbitrators, Annex (4), and a summary of the random convergence method and the thinking cycle method was attached with the study plans

to clarify the steps of teaching according to these methods and to express their opinions and observations about them. Modify some study plans and come out in its final form. accessory(8)

Sixth / Set up the search tool /The current research requires the preparation of a tool to measure the effect of the research variable (the achievement test). The following is a detailed presentation of the procedures followed by the researcher in preparing the research tool

Preparing the achievement test in science: The achievement test is an important part of the educational process and is considered an organized and pre-planned process that goes according to specific goals. (Al-Ajili et al.: 2001, 18) To achieve the goal of the research, the researcher measured the achievement of fifth-grade students in science, and the researcher worked on preparing a test characterized by honesty and reliability and containing the specific topics. The four are from the science book to be taught for the fifth primary school year (2021-2022), and the researcher followed the following steps in preparing the achievement test

- 1- Determining the goal of the test: The goal is determined by measuring the achievement of the research sample for the cognitive aspect of the scientific content included in the science book and within Bloom's levels (remembering, comprehension, application, analysis, synthesis, evaluation). The researcher prepared an achievement test for the content of the science book for the fifth grade of primary school. With the aim of measuring the achievement of the research sample of the fifth grade students of the cognitive aspects of the scientific content
- 2- Determining the scientific subject: The scientific subject has been determined for the four chapters, starting from the third semester, where (the first and second chapters) were deleted from the science book for the fifth grade of primary school for the academic year (2021-2022), and as follows
 - Chapter Three: Circulation and Respiration
 - Chapter Four: The Digestive and Urinary System
 - Chapter Five: The Elements
 - Chapter Six: Compounds and Mixtures
- 3- Formulation of behavioral goals: Behavioral goals were formulated for the need for them in constructing the achievement test, and were presented previously and based on the educational material on the opinions of the arbitrators. Composition, calendar) as shown in Appendix (7).
- 4- Determining the educational outcomes: The researcher determined the educational outcomes with the students' ability to (remember, comprehend, apply, analyze, structure, evaluate), then the researcher determined the number of test items with (36) test items, depending on the directions and opinions of a number of experts and specialists in the methods of Teaching science, taking into account the relative importance of each of the content and objectives, as will be mentioned later
- 5- Preparing the specification table (experimental map): The specification table is an expression of a "two-dimensional matrix that attempts to link the educational goals in the content elements directly and determine the number of items for each goal related to each element of the content." (Al Kubaisi and Rabie: 2008, 109)

The specification table is one of the main procedures in preparing achievement tests because it is characterized by objectivity and comprehensiveness, as it takes into account both the behavioral objectives and the academic content that have been identified and formulated in advance. Specifications according to the following steps

- Determining the relative weights of the content of the four chapters (the third chapter, the fourth chapter, the fifth chapter, the sixth chapter) of the science book for the fifth grade in the light of the number of pages for each semester according to the following relationship: The weight of the goal in the level =
$$\frac{\text{Number of chapter pages}}{\text{Total number of chapter pages}} \times 100$$

The semesters were (third, fourth, fifth, sixth) respectively (0.24%, 0.25%, 0.26%, 0.25%) of the total number of pages.

Determining the weights of the behavioral goals for each level of Bloom's classification of the cognitive domain as follows: (Relative importance) The weight of the goals at the goal level

$$= \frac{\text{The number of behavioral goals at one level}}{\text{The total number of behavioral goals}} \times 100$$

The relative importance of the four seasons was (0.35%, 0.24%, 0.18%, 0.13%, 0.06%, 0.04%) of the total number of behavioral goals, respectively.

- Find the number of questions for each cell in the specification table as follows: Number of paragraphs per cell = Content weight X Level weight X Total number of paragraphs. (Al-Azzawi: 2008, 66-68) Thus, the researcher distributed the achievement test items between the classes of the subject and the levels of the cognitive domain in a

more accurate and objective distribution and arrangement, Table (12) the test map with the achievement test items (prepared by the researcher)

Total number of questions	Calendar	collect	analyzing	Applicati on	assimilati ng	remembe r	mental levels		numbering	
							Study content			
							Relative weight (%)	number of servings		
191	8	11	25	35	46	66				
100 %	0.4%	0.6%	0.13%	0.18%	0.24%	0.35%				
number of vertebrae										
9	0	1	1	2	2	3	0,24%	16	Circulati on and breathing apparatus	Chapter Three
9	1	1	1	1	2	3	0.25%	17	Digestive and urinary systems	chapter four
9	0	1	1	2	2	3	0..26%	18	the elements	Chapter Five
9	1	1	1	1	2	3	0.25%	17	Compound s and mixtures	Chapter six
36	2	2	4	6	8	12	%100	68	Total	

6- Formulation of achievement test items: Tests vary in the educational field, and have become important tools for measuring the impact of achievement for the research sample. It is one of the most prominent evaluation tools that teachers use, and in light of its results, appropriate decisions are taken, that is, students evaluate time and then evaluate them. (Nassar: 2010, 234), the researcher chose the multiple-choice formula to formulate the paragraphs of his test, which consists of (36) objective paragraphs. Formulate the alternatives as follows:

- It should be free from unfamiliar and ambiguous terms.
- Balanced distribution of the correct answer topics.
- To be specific and uninterpretable. (Muhammad: 1999, 17-18)

7- Formulation of test instructions: When constructing any test, its instructions must be prepared accurately, as (Al-Gharib, 1985) indicates the need to prepare test instructions before conducting the experiment, in order to give good results, as some educational experiments have proven that the test gives different results if His instructions were not laid out precisely and clearly. (Stranger: 1985, 616)

- Accordingly, the researcher put instructions on how to answer his paragraphs, which included the following
- The objective of the test.
- Determining the areas, quality and number of questions.
- Refer to each question carefully and attentively.
- Pay attention to the fact that the answer is placed on the question paper itself through a circle around the correct answer
- Be careful not to leave any paragraph unanswered.
- Determining the grade for each test item

8- Validity of the test: It means the extent to which the test meets the specific purposes and uses for which it was designed. Validity is considered a relative characteristic, as there is no valid test in all situations. Rather, the test's

validity depends on its function and purpose. For example, the test that is prepared for the purpose of prediction may not work to the same degree as the accuracy of the diagnosis. (Mikhail: 2015, 86-87)

To verify the validity of the test by finding the following types of validity:

- Apparent honesty /:
It is based on the apparent initial examination of the test to confirm the extent of its sincerity in the features it measures from the test. (Spring: 2010, 194)

In order to achieve apparent honesty, the researcher performed the achievement test items on a group of experts and arbitrators in the methods of teaching science, measurement and evaluation (Appendix) with the content of the material and the behavioral objectives measured by the test items to explore their opinions about their validity, as some of them were reformulated and modified, and no paragraph was deleted. Where it reached (36) items, and the percentage of agreement reached (80%) according to Cooper's equation of agreement, and thus the validity of the test in its final form, the accuracy and clarity of its paragraphs were verified.

- Content validity /:
This type of validity is considered an important basis in constructing the achievement test, due to its ability to measure certain areas of behavior, and the specification table (test map) is a clear evidence of the content validity. (Abd al-Rahman and Zankaneh: 2007, 79)

In contrast, the specification table was adopted to put a sample of the paragraphs that represent the academic content and the behavioral goals that the researcher seeks to achieve, and this in itself is considered a guide to the validity of the content.

- ❖ The first exploratory experiment :- The aim of it is to know the clarity of the paragraphs and instructions, the time that the student takes to answer and the questions it raises about the paragraphs of the achievement test. The second consists of 30 students, and after agreement with the school administration and the subject teacher to take the test in the prescribed subject, the students were informed of the test date a week in advance so that they could study the subject well and in an integrated manner. It was found that the test instructions and paragraphs were mostly clear and understood by the students, and no inquiries were directed from the students indicating the opposite. The average time was calculated, and the time taken by the students to answer the test items was (40) minutes, using the following equation

$$\text{average time span} = \frac{\text{Average time of the last three students} + \text{Average time for the first three students}}{2}$$

The average response time for the first three students for the achievement test items = 36

The average response time of the last three students for the achievement test items = 39

$$40 = \frac{36s + 39}{2}$$

- ❖ The second reconnaissance experiment /
The goal of the second exploratory experiment is to conduct a statistical analysis and extract the psychometric properties of the achievement test paragraphs by finding the values of the difficulty, ease and discrimination coefficient to evaluate the test, meaning issuing a judgment on their validity or not to achieve the objectives of the test and to determine the efficiency of those paragraphs. (Al-Zamili, et al.: 2009, 367) The researcher applied the test to a second exploratory sample consisting of (100) students from the fifth grade of primary school in (Al-Tala'i) School affiliated to the General Directorate of Education in Baghdad / Al-Rusafa II who completed the four chapters of the science book for the fifth grade Elementary, 4th edition, 2019, after an agreement was reached with the science teacher in the mentioned school, and the students were notified of the test date two weeks before it was held, follow the following steps

- 1- Correct the answers and according to the total score for each student.
- 2- Arrange the scores in descending order for statistical analysis
- 3- He took the highest (27%) of the students' answers to represent the upper group and the lowest (27%) of the students' answers to represent the lower group, as (Abu Libdeh: 2008) indicated that if the sample size is (100) or more, a percentage (27%) is adopted. For the upper or lower category (Abu Libdeh: 2008, 309)

Psychometric properties were calculated to find the following /

- ❖ The difficulty and ease coefficient of the paragraphs: The difficulty coefficient is meant as “the level of complexity that students face when answering the test items” (Al-Zamili, et al.: 2009, 368). The importance of extracting the difficulty coefficient of the paragraphs is determined as an indicator to identify the percentage of students who answered correctly and who answered incorrectly. (Majid, Eyal: 2012, 30), as for the coefficient of ease, it means “the ratio of students who answered wrongly for the paragraph to the total number of students” and its value ranges between zero and one, and the lower the difficulty index, the greater the ease index. (Al-Dulaimi, Adnan: 2005, 84)

The difficulty and ease coefficient was calculated for the test items, by applying its own equation, and it was found that the value of the difficulty coefficient ranged between (0.41-0.74), and the value of the ease coefficient ranged between (0.33-0.57), Supplement (10). Many metrology and evaluation scholars indicate that the acceptable range for the difficulty coefficient is the one that ranges between (0.20-0.80) (Melhem: 239, 2000.)

- ❖ Paragraph discrimination coefficient: It means the ability to distinguish between the scores of students with higher levels and lower levels who possess the trait measured by the clause (Stanly & others: 1972,450).(0.29-0.81) The paragraph can be considered acceptable if its discrimination coefficient is (0.20) or more. (Spring: 2010, 223)
- ❖ The effectiveness of wrong alternatives: is the process of judging the validity of the alternative, by comparing the number of respondents from the upper and lower groups, and that the number of the lower group who chose it is higher than the number of the upper group. The alternative is effective and acceptable when its value is negative and large (Al-Afoun, Wasn: 2013, 210)

Wrong alternatives are effective enough if the test is of a multiple choice type, so that some students make mistakes and not everyone, there is no benefit from an incorrect alternative that everyone makes mistakes, or everyone knows, so the number of incorrect answers should be less for the group. The higher of the lower group, and the greater the value of the negative false alternative, the more effective, and in the case of an alternative that did not attract one of the two groups (higher and lower), it will be clear the error and must be excluded from the alternatives of the paragraph. (Ali: 2010, 71)

The effectiveness of the wrong alternatives was calculated for the achievement test items (objective items) by applying the alternatives effectiveness equation. All results were negative, ranging between (-0.07 - -0.40), Supplement (11). This means that the wrong alternatives attracted to it a number of students in the lower group more than the students of the upper group, which indicates the effectiveness of the wrong alternatives and thus the alternatives were kept

9- Stability /

Test reliability /

Reliability means “that the test gives the same results if it is re-applied the next time to the same persons and in the same conditions, or an equivalent test is applied to the same sample and in the same conditions.” It is considered one of the characteristics of a good test. The honest is steadfast. (Al-Ghurairi, Eman: 2021, 118) The researcher used the Kewder-Richardson equation 20 to calculate the stability of the objective test items of the multiple-choice type, as they are the most common and appropriate for objective tests with a two-way answer (0-1), as it reached (0.84), which is a good indicator of the stability of the test. The tests are good if their stability coefficient is (0.70) and above (Al-Yaqoubi: 2013, 266). Thus, all test items were retained

After the researcher has found the validity and stability of the test and the statistical analysis of its paragraphs, the test is ready in its final form for application to the students of the three research groups (the two experimental and control groups), as it consists of (36) objective paragraphs of the type of multiple choice, and each paragraph contains four alternatives, one Some of them are correct and the rest three are incorrect, appendix (12).

Seventh / Procedures for applying the experiment /

- 1- The researcher started applying the experiment to the students of the three research groups (experimental and control) starting from Monday (15/11/2021) until Saturday (15/1/ 2022) in the first semester of the academic year (2021-2022). Two sessions per week for each group
- 2- The researcher studied the material himself for the research groups, as he studied the first experimental group according to the method of random convergence and according to the teaching plans prepared according to the steps of random convergence, and the second group studied according to the method of the thinking cycle, and according to the teaching plans prepared according to the steps of the thinking cycle, while the control group studied in the time period The same in the traditional way and according to the teaching plans prepared for that

- 3- After the completion of the teaching of the research groups, the achievement test was applied to the students of the groups on Saturday (15/1/2022), as the students were notified a week before the test date, then the researcher corrected the answers and thus the researcher obtained the test scores for the three research groups

Eighth /Statistical means /

- 1- Chi-square (X²)
- 2- One- Way Analysis Variance
- 3- Difficulty- Equation
- 4- Percentage
- 5- Pearson
- 6- Discrimination Equation
- 7- Effectiveness Distractors
- 8- Seheffe- Method

Chapter Four /

First / show the results /This chapter includes a presentation of the results reached by the researcher according to his goal and hypotheses as follows: The researcher used one-way analysis of variance as a statistical method for data processing to find out the significance of the differences between the results of the three research groups in the science achievement test. After conducting an analysis of variance to balance the scores of the three groups, Annex (12) for the achievement variable, the results indicated the following:

The calculated t value was (8.663) and when it was compared with the tabular value of (3.07) for the degree of freedom (76) at the significance level (0.05), it was found to be greater than the tabular value, which indicates the existence of statistically significant differences between the three research groups. And the following table shows that

Table (15) results of the one-way analysis of variance for the three groups' scores in achievement

Significance level at 0.05	Valuef		squares averages	degree freedom	sum squares of	Contrast source
	tabular valuef	Calculated valuef				
nonfunction	3.07	8.336	131.526	2	263.051	between groups
			15.183	76	1153.886	within groups

And since the one-way analysis of variance reveals to us whether the differences are statistically significant between the three research groups or not, but it does not determine the direction of the differences between the groups, nor the group for which the differences are in favor (Badr and Emad: 2007, 339), and therefore the researcher used Scheffe's equation To find out the differences between the averages and determine the direction of these differences, in order to verify the three hypotheses as follows:

- 1- first null hypothesis /

Which states (there is no statistically significant difference at the level of significance (0.05%) between the average achievement scores of the experimental group students who will study according to the random convergence method and the average achievement scores of the control group students who will study according to the usual method in the science achievement test). When testing the significance of the difference between the two averages of these two groups using Scheffe's method, there were statistically significant differences between the two groups at the level of significance (0.05) in favor of the first experimental group, as the calculated Scheffe value (3.3709) was greater than the critical Scheffe value (3.156), and the following table showsthat:

Table (16) calculated and critical Scheffe value between the mean scores of the first experimental groups and the control group in achievement

Significance level at 0.05	Chevy value	Arithmetic		

	the critical	applicable	average	Sample volume	Group
nonfunction	3.156	3.2709	26.692	26	The first experiment
			23.321	28	control

2- The second null hypothesis /

Which states (there is no statistically significant difference at the level of significance (0.05%) between the average achievement scores of the experimental group students who will study according to the thinking cycle method and the average achievement scores of the control group students who will study according to the usual method in the science achievement test). The differences between the averages of these two groups using Scheffe's method showed that there were statistically significant differences between the two groups at the level of significance (0.05) in favor of the second experimental group, as the calculated Scheffe value (4.158) was greater than the critical Scheffe value (3.156), and the following table illustrates this: (17) The calculated and critical Scheffe value between the mean scores of the second experimental and control groups in achievement

Significance level at 0.05	Chevy value		Arithmetic average	Sample volume	the group
	the critical	calculated			
nonfunction	3.156	4.158	27.480	25	The second experience
			23.321	28	control

3- Third null hypothesis /

Which states (there is no statistically significant difference at the level of significance (0.05%) between the average scores of the experimental group students who will study according to the random convergence method and the average scores of the experimental group students who will study according to the thinking cycle method in the science achievement test). The averages of these two groups using Scheffe's method showed no statistically significant differences between the two groups at the level of significance (0.05), as the calculated Scheffe value (0.7877) was less than the critical Scheffe value (3.156), and the following table shows that

Table (18) calculated and critical p-value between the mean scores of the first and second experimental groups in achievement

Significance level at 0.05	Valuef		Arithmetic average	Sample volume	group
	the critical	calculated			
nonfunction	3.156	0.7877	26.692	26	first experience
			27.480	25	second experience

• Effect size /

The effect size was calculated to show the effect of the two independent variables, the random convergence methods and the thinking cycle on the dependent variable (achievement), as shown in Table (19)

Table (19) is the effect size on the achievement test

Amountsize Trace	Impact size value (d)	dependent variable	independent variable
big	0.49	collection	1- random convergence method 2- Thinking cycle style

It is clear from Table (19) that the effect size on achievement has reached (0.49), which is a high indicator according to the criteria shown in Table (20).

Table (20) is a suggested reference table for determining the levels of the effect size for each of the measures of the effect size

Effect size			tool used
big	Average	Small	η
0,14	0,06	0.01	

Second / Interpretation of the results:

- 1- It was found from the results of the current research that there were statistically significant differences between the first experimental groups, which were studied in the method of random convergence, and the control group that studied in the usual way, as well as the presence of statistically significant differences between the second experimental group, which was taught in the style of a thinking cycle and the control group. This is due to several reasons, according to the researcher's opinion, which are:
 - The method of random convergence and the cycle of thinking that the researcher used with the students of the experimental group provided students with opportunities to practice alternative methods of traditional school learning, which provided opportunities for the majority of students to improve their scientific level and their thinking.
 - The methods of random convergence and the cycle of thinking helped create longing and motivation among students who listen to everything that is new and lead to better results, because it allows students to rebuild the material and treat ideas, arrange and organize them in a special way, which leads to better understanding.
 - Teaching using the methods of random convergence and the cycle of thinking contributes to keeping the information in the students' memory for a longer period, because students have reached the formation of their knowledge building on their own, and this thus weakens the forgetting factor because the results of the information and experiences that the student gains as a result of his effort and diligence.
 - The random convergence and thinking cycle methods inspire in the students a spirit of vitality and activity and spread the spirit of cooperation and love of participation in the lesson
 - The use of random convergence and thinking cycle methods in teaching increases the interaction between students with each other and allows them to express opinions, put forward ideas, and generate a mental image, and this leads to meaningful learning, which raises their scientific level and they become more serious and conclusion in an application Learn it
 - It works to increase the spirit of cooperation between the teacher and the student through the discussions that revolve between them revolving around the topic of the lesson
- 2- It was found from the results of the current research that there are no statistically significant differences between the first experimental group, which was studied using the random convergence method, and the second experimental group, which studied in the way of thinking cycle in achievement.
This is due to the similarity between the random convergence method and the thinking cycle method in linking ideas and generating the largest number of new ideas related to the idea of the topic.

Third: Conclusions /

In light of the results of the current study, the researcher concluded:

- 1- The effectiveness of the methods of random convergence and the thinking cycle in teaching science, which was positively reflected on the achievement of fifth grade students
- 2- Increasing the effectiveness of students in participating in the lesson and drawing their attention to it
- 3- Ease of using the random convergence and thinking cycle methods, but on the condition that students interact positively.
- 4- The effect of the random convergence and thinking cycle methods is equal, compared to the control group that was taught in the traditional way.
- 5- Teaching according to the methods of random convergence and the thinking cycle requires training and practice by the teacher and students alike, so that teaching according to the two methods becomes easy and without obstacles.

Fourth: Recommendations /

Based on the findings and conclusions of the study, the researcher recommends:

- 1- Teaching science at different academic levels according to the random convergence and thinking cycle methods for its impact on achievement
- 2- Paying attention to the involvement of students in learning and giving them the freedom to express their opinions and viewpoints and not to impose restrictions that hinder their learning.
- 3- Organizing training courses for science teachers on how to use the random convergence methods and the thinking cycle, under the supervision of qualified trainers to teach and train them.
- 4- Encouraging teachers to use teaching methods and models that allow students to learn in cooperative groups and not be restricted to one method of teaching and move from one method to another smoothly in a way that achieves the educational goals to be achieved.
- 5- Holding seminars and courses to encourage teachers to take care and pay attention to the methods of random rapprochement and the thinking cycle in all stages of learning.

Fifth: Suggestions /

To complement this study, the researcher suggests conducting studies aimed at knowing the impact of:

- 1- My method is random convergence and the cycle of thinking for different stages of study, in other study subjects (Biology, Chemistry,)
- 2- My method is random convergence and the thinking cycle, with other dependent variables that were not addressed in the current study, such as (motivation to learn, attitudes, scientific curiosity,etc).
- 3- Conducting descriptive studies that include the analysis of science books in the light of the two methods of random convergence and the thinking cycle and the extent to which teachers possess the required qualifications.
- 4- Conducting a study to compare the two methods of random convergence and the thinking cycle with other methods and methods of achievement and to show which of them are more effective and feasible to serve the educational process

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