

THE EFFECT OF THE PLACE- RESTRICTION STRATEGY ON THE SCIENTIFIC THINKING OF SECOND- GRADE SECONDARY SCHOOL STUDENTS IN PHYSICS AND THEIR ABILITY TO MAKE DECISIONS

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Abstract

The study aimed to find out the effect of the place-restriction strategy on scientific thinking of second-grade secondary school students in physics and their ability to make decisions. The researcher chose the experimental design of the two research groups (experimental and control) with partial control with a post test for scientific thinking and a post test for decision making. The research was limited to second-grade secondary school students in Al-Warka Secondary School for Boys. The sample of the research was 60 students, with 30 students for the experimental group studied according to the strategy of place-restriction, and 30 students for the control group, who studied according to the usual method. The researcher equalized between the two research groups in variables of chronological age in months, IQ and previous achievement. The researcher built a test for scientific thinking after confirming its validity and reliability and adopting the decision-making scale. The researcher used the T-test to find out the results, and the researcher concluded that the strategy of place-restriction has an effective effect on scientific thinking and decision-making ability compared with the control group, and the researcher suggested a number of recommendations and proposals.

Research Problem:

As a result of the development of all aspects of life, the human being has changed in this era and has become a necessity for education, one of the most important objectives of which is to modify the behavior of the individual and the trends of his thinking and cognitive structure to change its methods and tools to keep pace with and suit this new human being, who has become involved in his upbringing and guidance and the formation of many parties, which led to the emergence of the need to pay attention to the development of thinking skills among students (Al-Ahmadi , 2012 : 123).

Many conferences and seminars have been held in order to promote and develop the educational process as well as the development of teaching methods and strategies, including the fifteenth scientific conference for the period (8-9) of March 2013 held at the University of Mustansiriyah – Faculty of Basic Education. This conference was instructed because of the poor scientific level of students to the adoption of teachers of the usual teaching methods, as he stressed that teachers still use the usual teaching methods that provoke the motivation of students to a weak degree and do not develop thinking, and not provide the content of the study materials in an interesting way, not taking into account the nature of the objectives, material and students.

(Mustansiriyah University, 2013 : 47)

Through the experience of the researcher in the field of teaching physics for more than (25) years and his direct contact with teachers in the same specialization, he noticed that the majority of teachers use regular teaching methods based on delivery and indoctrination, so the role of students is negative in receiving the information that comes from the teacher, which negatively affects the weak scientific level of students and their lack of use of thinking. The poor scientific level of students may be due to the lack of teachers' knowledge of modern methods and strategies that stimulate students' thinking. Therefore, modern trends in the learning and teaching process tend towards the use of different thinking methods. This is only done through the use of modern strategies in the teaching process that help the learner to activate his mind, stimulate his motivation and help him complete the learning process.

Therefore, the researcher saw the need to use modern strategies in teaching as a place-restriction strategy, which the researcher believes may be understood in addressing these problems, so the current research came in raising the following question:

Does the strategy of the place-restriction have an effect on the scientific thinking of the students of the second middle grade in physics and their ability to make decisions?

Research Significance

The world is witnessing rapid scientific and technological developments, and we hardly find an aspect of life without science and technology having an effect on it. The possibility of controlling the outputs and effects of learning depends on the possibility of achieving understanding among students about the nature of science and technology and their interaction together and its effect on society or planning to carry out this activity or work (Abdulsalam, 2001 : 62-63).

In light of this scientific development, education has an important responsibility, which is to prepare human cadres capable of keeping pace with this accelerated scientific progress in various areas of life, and this is done by working to develop and modify the experiences of individuals and refine their talents, raise their motivation, and explode their energies, as it aims to prepare individuals a comprehensive and integrated preparation in all mental and social aspects, so that one side does not overwhelm another and be useful members of their society. (Al-Moussawi, 2005 : 82)

The physics curriculum is one of the important natural sciences approaches through which it is possible to research the interpretation of natural and unnatural phenomena in an

experimental manner supported by mathematical laws that describe and interpret the phenomenon and try to benefit from it in our lives(Jarwan , 2007 : 24)

The use of modern teaching methods, by making the learner primarily among the elements of the educational process in order to raise the level of academic achievement and the development of thinking, especially physics, in order to prepare them and participate effectively in urban life and to be productive and educated throughout their lives. (Al-Huwaidi , 2005 : 49)

Hence, the need to use modern strategies in teaching, including the strategy of the place-restriction, which gives the individual in a short time a great ability to agree and succeed in educational situations, as well as the transformation of rigid attitudes into creative attitudes. The goal of using the strategy of the place-restriction in teaching is to develop cooperative work skills and raise enthusiasm among students. This strategy allows learners to take enough time to think by recording ideas and sharing them with their colleagues. In the end, common ideas are taken.

One of the most important objectives of education is to raise the level of thinking among students to reach the ability to practice abstract thinking processes, and that science plays an important role in creating opportunities and helping students to rise to the level of using abstract thinking processes (Padilla, M.1990: 24).

The topic of thinking has become very important in modern education, which emphasizes the need to develop the ability of students to think , to be able to succeed in the future and contribute effectively to the development of society , and to develop successful and realistic solutions to the problems they face (Ali , 2004 : 193).

And that students do not have the methods of thinking and mental skills through memorization and retrieval of different study topics, that is, intelligent thinking does not grow automatically , it is not an automatic product of experience and study , and this is evident through the resemblance of everyday ordinary thinking to the ability to walk using certain and sophisticated tools (Fitzgerald, 1996:23).

Some people interested in scientific thinking programs believe that it is not enough to establish programs to teach scientific thinking, but it must be included in the curriculum whenever, and this is what the educators supported, as they stressed that the skills of teaching thinking must be included in the curriculum since kindergarten and in every subject, as the teaching of scientific thinking must be within the curriculum, for example, within the curriculum of physics, biology or any other subject, as this is done through starting from concepts and mental changes that are jointly promoted (Al-Fun and Muntaha, 2012 : 37).

A closer look at the reality of our working life shows that we are in most of our time whether we all work individually or collectively in need of making or making a decision. Every aspect of our lives is governed by decisions, whether we are individuals or groups in need of making or making a decision. Every aspect of our lives is governed by decisions, whether we work as teachers , managers, family members, schools , or citizens in society. The decision-making process is a characteristic of the human being, which is distinguished by the Creator Almighty from the rest of the creatures by reason and employment. Therefore, the ability of the

individual to improve the outputs depends largely on the ability of the individual to make the appropriate decision.

(Abu Jadu , Nofal , 2007 : 369)

The decision-making process requires the use of a lot of higher thinking skills such as analysis, evaluation, induction and deduction, and therefore it may be more appropriate to classify them within complex thinking processes such as problem solving, critical thinking, creative thinking and scientific thinking. (Jarwan , 1999: 120)

Many educators and specialists see decision-making capacity as a focal point and associated with problem solving so that researchers and educators see it as a key pillar that must be paid great attention to in the educational process (Mahmoud , 2006 : 114).

From the above, the significance of the research can be highlighted as follows: -

- place-restriction strategy may help the teacher to think scientifically and be able to decide in physics.
- The significance of teaching physics for secondary levels helps students to acquire physical information that helps them interpret cosmic and natural phenomena and make the appropriate decision.
- The significance of teaching scientific thinking and equipping its skills to qualify students for future life.

The Aim of the Research:

The research aims to identify :

The effect of the strategy of the place-restriction in the scientific thinking of the students of the second middle grade in the subject of physics and their ability to make a decision.

Research hypotheses:

- There is no statistically significant difference at the level of (0.05) and between the average scores of the experimental group students who study physics in a strategic way mat the place and the average scores of the control group students who study the same subject in the usual way in scientific thinking.
- There is no statistically significant difference at the level of (0.05) between the average scores of the experimental group students who study physics in a place-restriction method and the average scores of the control group who study the same subject in the usual way in the measure of decision-making ability.

The research limits:

- Students of the second middle grade of Baghdad schools Rusafa I for the academic year (2021-2022).
- The second semester of the academic year (2021-2022).

The first, second, third, fourth and fifth semesters of the textbook of science are scheduled to teach to average second grade students for the academic year (2021-2022).

Identifying Terminology

- Teaching strategy: - Define it (Attia , 2009) as " a systematic plan to achieve the objectives of education that includes methods, methods and techniques that are used and all

the actions taken by the teacher to achieve the specified objectives in light of the available possibilities" (Attia , 2009: 38).

Procedural definition: - A precise and organized plan that includes all methods, methods and activities taken by the teacher to achieve the predetermined objectives of the teaching and learning process.

Place-restrictioning: -

Defined by: -

- (Badawi , 2010): -

One active learning strategy consists of five steps that allow students to think and record their ideas in groups where independent thinking is encouraged, and then collective participation by adopting a striped paper into parts based on the number of members of the group, each part of which represents a specific idea and its center represents ideas common to them.

(Badawi , 2010 : 463)

Procedural definition of the strategy of the place-restriction: - It is an educational strategy that includes a set of educational activities overlapping within specific steps, followed by the researcher in teaching physics for the research sample.

Scientific Thinking

Defined by :

- (Al-Feki , 2008) It is "a regular sequential mental activity used by the individual to identify the problem and choose the appropriate purpose to solve problems, address situations, interpret them objectively and generalize them." (Al-Feki , 2008: 93)

- Procedural definition of scientific thinking: -

It is a set of mental processes used by the students of the two research groups in physics to identify the problem and choose what suits them to solve the problems and can be measured by the level of students through the scientific thinking test adopted by the researcher for this purpose.

- Decision-making

Defined by:

(Marzano, 2006): The process of generating and applying criteria for choosing from equal alternatives " (Marzano, 2006: 73)

(Jarwan, 2013): It is a complex thinking process, aimed at choosing the best alternatives or solutions available to the learner in a specific situation, in order to reach the desired goal (Jarwa , 2013: 105).

Procedural Definition of Decision Making:

It is the ability of the students of the research sample to choose an alternative among several alternatives developed when faced with a particular problem or situation, depending on the steps of decision-making.

Chapter Two

A theoretical framework and previous studies

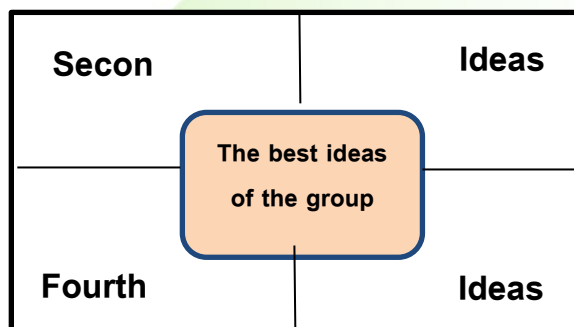
Theoretical Framework

First : The strategy of the place-restriction: -

(Ambo Saidi and Al-Husseiniya, 2016) believes that the strategy explains as follows: -

The Strategy in Brief	Objective of the strategy	Strategy Implementation
The idea of the strategy is to allow students to think and record their ideas , and then share them , with each member writing his ideas in the space specified for him in the form of the mat , and then write the common ideas in the center of the paper	Developing cooperative work skills in addition to stimulating enthusiasm among students	When you achieve a specific goal or the end of a class.

- **Steps to implement the strategy :**
 - The teacher explains the subject of the lesson in any way he deems appropriate.
 - The teacher forms groups , so that the number of members of each group is preferably four students.
 - The teacher gives each group a large chart paper, and each student a pencil , which represents the strategy chart.



- The teacher divides the paper based on the number of members in each group, preferably the number of students in each group is 4.
- The teacher asks students to write their ideas in the section allocated to them , in the spaces , then share their ideas and write common ideas in the center of the paper . (Emposaidi and Hosseiniya, 2011 :290)

Scientific thinking The concept of thinking :

The views of scientists and educational researchers differed on the concept of thinking , as they provided different definitions based on the foundations and directions of multiple theory, and there is no doubt that each individual has his own style of thinking , which may be affected by the pattern of his upbringing, motivation, abilities, cultural background and others, which distinguishes him from others, which led to the absence of a unified vision among scientists and researchers regarding the definition of thinking.

As DeBono (1984) defines it, thinking is the process by which IQ exercises its activity on experience :

Costa and Kallic (Costa & Kallic, 2001) defined thinking as the mental processing of sensory inputs in order to form thoughts in order to perceive and judge sensory stimuli, and Groan (1999) believes that thinking is a series of mental activities carried out by the brain when

exposed to a stimulus that is received by one or more of the five senses: touch, sight, hearing, smell, and taste.

It is clear from the previous definitions of the concept of thinking as a complex concept that reflects the complexity of the human mind and its processes, where we find out, like other abstract concepts that are difficult for us to measure directly or determine what they are easily (Abu Jadu and Nofal, 2007 : 27-28).

Scientific Thinking:

Scientific thinking is a necessity for thought and not only a need to have effective education with high efficiency, and sound scientific thinking is the way to theoretical creativity and applied rooting in various fields of science and knowledge, so educational systems should focus on developing the student's abilities in scientific thinking.

- intellectuality
- **Cumulative** : Science and scientific thinking are characterized by accumulation, where the new is built on submission and science is characterized by cumulative construction in the great edifice of knowledge throughout the ages. Science advances and grows by coordinating efforts, exchanging experiences and constructive fruitful cooperation.
- **Objectivity** : - It consists in giving the idea supported by evidence and evidence and moving away from bias and subjective judgments.
- **Quantity** : Science and scientific thinking do not stop at describing phenomena qualitatively (qualitatively), but go beyond quantitative and expressive description of truth in numbers.
- **Organization** : Where scientific thinking is carried out according to organized steps that begin with observation and end with results through hypotheses, investigation and experimentation.
- **Comprehensiveness and certainty**: There is no knowledge except what is general, as the scientific knowledge that is reached includes all examples of the phenomenon in an unquestionable manner and with convincing logical evidence.
- **Search for the reasons** : - It is intended to seek to reveal the reasons that led to the existence of the phenomenon under study and the link between the results and the introductions.
- **Accuracy and abstraction** : - Scientific thinking includes examples of the phenomenon in a certain way that does not bear doubt and with convincing logical evidence. Scientific thinking works on observation and many phenomena that increase the degree of certainty of the accuracy of the data and conclusions.
- **Integration**: Science always seeks perfection in the search for truth and uses all the tools of scientific research, and the integration of science is one of the most important characteristics of science.(Saladin , 2006 : 140)

- Decision-making

The concept of decision-making: (Al-Obeidi , 1987) believes that the decision-making process is one of the very important issues in the lives of individuals and groups , and it is a basic function that requires a degree of intellectual energy and emotion , which prompted researchers to study decision-making in its various dimensions, aspects and skills.

(Abu Jadu and Nofal , 2007 : 370)

It is defined by (Jarwan , 1999) : The decision-making process is a complex process of thinking, aimed at choosing the best alternatives or solutions available to the individual in a particular situation to achieve the desired objectives. (Abu Jadu and Nofal , 2007: 370)

Steps of Decision Making: -

Huitt (1992) points out that there are four stages through which problems can be solved and decisions made: -

1. Receive the problem and try to understand and diagnose it.
2. Submitting or generating alternatives , working on studying them , and testing the effectiveness of each of the alternatives offered.
3. Planning the implementation of the solution .
4. Implementation to solve the problem and make a decision. (Abu Jadu and Nofal , 2007 : 374)

Previous studies

- Studies on the place-restriction strategy: -

Study (Al-Shammari , 2020): The study was conducted in Iraq and aimed to know (the effect of the strategies of the mat of the place and the four pillars in the skills of mathematical bonding among middle first grade students).

The research sample consisted of (89) students of the first intermediate grade by (30) students of the first experimental group and (29) students of the second experimental group and (30) students of the control group. The groups were rewarded in variables (chronological age in months , previous achievement, previous mathematical knowledge test, IQ test, sports bonding skills test). The research tool was built by testing mathematical bonding skills. The results were analyzed using statistical means, including the one-way ANOVA test.

Scheffe's test, the results of the treatment resulted in a statistically significant effect of the place-restriction strategy on the first experimental group and the second experimental group on the control group, and Dal statistically outperformed the four pillars strategy in sports bonding skills on the place-restriction strategy. (Al-Shammari , 2020)

Study (Zarkani, 2020):

The study was conducted in Iraq , and aimed to know (the effect of the place-restriction strategy on the achievement of the Arabic language among fifth grade primary students).

The research sample consisted of (64) pupils by (32) pupils representing the experimental group and (32) pupils representing the control group. The researcher used the pupils of the two research groups in variables (the chronological age in months , the academic achievement of parents , and the grades of the previous year in the Arabic language subject). The experiment

continued for one semester. The researcher prepared a test consisting of (36) items of the test type of multiple. The researcher used the statistical means represented by the T-test for two independent samples, and the K-square (Ka^2). The results resulted in the experimental group surpassing the control group in achievement , and the researcher proposed a number of suggestions and recommendations.

(Zarkani , 2020)

- A study on scientific thinking: -

* Study (Zarkani , 2016) :

The study was conducted in Iraq and aimed to know (the effect of intertwined waves in the achievement of physics for middle first grade students and their scientific thinking).

The research sample consisted of (62) students, (31) students representing the experimental group studying physics according to the strategy of overlapping waves, and (31) students representing the control group studying the same material according to the usual method. The two research groups were rewarded with variables (chronological age, IQ , previous achievement in science , scientific thinking, and previous information).

The researcher prepared an achievement test of the multiple choice type and the researcher adopted the scientific thinking test after the researcher confirmed its psychometric properties. The data was processed statistically by adopting the Statistical Portfolio of Social Sciences (SPSS) program and the following results were reached:

The experimental group outperformed the control group in achievement and scientific thinking, and in light of the results, the researcher made a number of recommendations and suggestions (Al-Zarkani, 2016).

Al-Rubaie Study,(2008): -

The study was conducted in Iraq and aimed at knowing (the effect of teaching middle second grade students in physics according to Vikotsky's theory of their academic achievement and scientific thinking). The research sample consisted of (62) middle second grade students distributed to two experimental groups studied according to Vikotsky's theory and the control group studied according to the usual method. The researcher used an achievement test and a measure of scientific thinking and using the T-test for two independent samples. The results showed the experimental group's superiority over the control group in a test to achieve and measure scientific thinking. The researcher proposed a number of recommendations and proposals (Al-Rubaie, 2008).

* A study on decision-making: -

Study (Zaidi , 2014): - The study was conducted in Iraq , and aimed to know (the effectiveness of teaching the theory of TR12 in the achievement of students of the second intermediate grade in physics and their ability to make a decision) , the research sample consisted of (53) female students of medium-guitar students for girls divided into two groups , the experimental group studied using the theory of TRIZ The number of students reached (29) female students and the control group studied according to the usual method reached the number of students (24) female students were rewarded the students of the two research groups in variables

(previous achievement, previous information, IQ , decision-making) , the researcher prepared an achievement test consisting of (40) items verified his face validity and the validity of the content after presenting it to a group of arbitrators.

As the researcher prepared the decision-making test, the researcher used a number of statistical means, and using the T-test for two independent unequal samples, the research results showed the superiority of the students of the experimental group over the students of the control group in achievement and decision-making , and the researcher developed a number of recommendations and proposals. (Zaidi , 2014)

(Al-Obaidi Study, 2017) : -

The study was conducted in Iraq , and aimed to find out (the effect of employing the strategy of graduated activities according to the dimensions of sustainable development in the achievement of fourth-grade female students and decision-making) , the research sample consisted of (67) female students, the number of female students of the experimental group reached (34) female students studied in a way of employing the strategy of graduated activities according to the dimensions of sustainable development and the control group studied according to the usual method. The number of female students reached (33) female students. The two research groups were rewarded in variables (the chronological age in months, previous achievement, previous statistical information, IQ , decision-making scale). The researcher applied the two research tools, an achievement test consisting of (46) items that were built by the researcher. The researcher also used a decision-making scale. The statistical results showed that the experimental group exceeded the control group in collection and decision-making , and the researcher proposed a number of recommendations and proposals. (Al-Obaidi , 2017)

Chapter Three

Procedures of the Research

* Experimental Design

The process of selecting the appropriate experimental design for research is an essential process in every experimental research to provide the researcher with the means to reach the desired results and appropriate answers to his research questions and choose his hypotheses. The researcher adopted the experimental design with partial control with two groups (experimental and controlled) with a post-test for scientific thinking and decision-making. The experimental design of the research can be expressed as (1).

Figure (1) The experimental design adopted in the research

Group	Valence	The independent variable	The dependent variable
*Experimental place-restriction strategy	* Chronological age in months IQ . * Previous Achievement in Science intellectuality Decision making*	* Place-restrictioning Strategy The usual method	intellectuality Decision making*

- **The research community and its sample: -**

The identification of the research community is one of the methodological steps in educational research, and it requires great accuracy, as it depends on the conduct of research, its design and the efficiency of its results

The research community means " all the vocabulary of the phenomenon studied by the researcher, that is, all individuals, people and things that are the subject of the research problem (Obaidat and others , 2001 : 99).

The research community was determined by the middle second grade students in the morning middle and secondary schools in the education of Baghdad / Rusafa I, where the average Warka for boys was selected as an intentional sample, where the number of students in the research sample was (69) students , the researcher randomly selected two divisions out of four people , to represent the two groups (experimental and control).

As Division (B) represented the experimental group, the number of students reached (34), studied according to the strategy of the place-restriction. The (C) Division of the control group reached the number of students (35) studied in the usual way, and after excluding the (4) failed students in the (B) and (5) Division in Shebaa (C) , and thus the number of the final sample reached (60) students by (30) students in the experimental group and (30) students in the control group.

- * Control procedures: -

Equivalence in the characteristics of the control and experimental groups to know the effectiveness of the independent variable in the dependent variable , because the dependent variable is affected by the characteristics of the individuals of the research sample (Obaidat et al., 1998 : 282).

Before starting the experiment, the researcher verified: -

- **Internal validity of the experimental design: -**

It is intended that the results of the research are true to the extent that the difference between the results of the experimental group and the results of the control group can be attributed to the influence of the independent variable and not to other extraneous factors (Abdul Rahman and Zanka, 2007 : 478).

Sample equivalence:

The following table shows the arithmetic mean, standard deviation, and the calculated and tabular T-value of the variable (chronological age in months , IQ , previous academic achievement, scientific thinking and decision-making scale).

Table (1) Sample equivalence

variable	Group	No.	Arithmetic mean	Standard Deviation	T value		Statistical significance at an average of 0.05
					Calculated	tabular	
Chronological age in months	Experimental Place-restriction strategy	30	161,63	6.599	0.791	2.00	Not significant
	Control Group the usual way.	30	162.93	6.117			
IQ .	Experimental group	30	27	7.213	0.425	2.00	Not significant
	Control group	30	26.13	7.76			
Previous Academic Achievement	Experimental group	30	67.8	14.192	0.378	2.00	Not significant
	Control group	30	69.13	12.979			
intellectuality	Experimental group	30	18.76	2.43	0.627	2.00	Not significant
	Control group	30	19.13	2.538			
Decision-Making	Experimental group	30	24.43	4.463	0.916	2.00	Not significant
	Control group	30	25.5	4.577			

Controlling the conditions of the experiment and preventing the accompanying accidents: -

It means the incidents and conditions that can occur and which students are exposed to during the duration of the experiment, which are: -

- Teacher : The researcher himself taught the experimental and control research groups throughout the duration of the experiment to determine the effect of teaching excellence.
- Subject : The same subject was identified for the two research groups represented by chapters (first, second, third, fourth and fifth) of the textbook of science for the academic year (2021-2022).
- Weekly Lessons Schedule: It was agreed to organize the weekly lessons schedule with the school administration, where the researcher taught physics for two groups (4) sessions per week, two sessions for each group distributed over two days and as scheduled in the weekly classes schedule by the school administration.
- Duration : The time period of the experiment was equal for the experimental and control research groups, which is the second semester of the academic year (2021-2022), as the experiment began on 6/2/2022.

– School building: The researcher applied the experiment in one school, and in similar rows in terms of distance, lighting and ventilation, which indicates that there is no effect of this factor.

• **Ensure the external validity of the experimental design: -**

External validity means the extent to which the experimental members represent the research community to which they belong and the extent to which the results of the experiment can be generalized to the research community in the same circumstances and procedures (Abdul Rahman and Zanganeh, 2007 : 479).

In order to provide external validity conditions, the researcher carried out the following procedures:

– The interaction of experimental positions: - The two research groups were not exposed to more than one experimentation process during the research period and the effect of experimental procedures was removed through the researcher teaching the two research groups himself.

– The selection interacts with the experiment: - The effect of this variable was limited, as the researcher randomly selected the sample members as an experimental group and a control group.

– The interaction of the test with the experiment: - To reduce the effect of this variable, the scientific thinking test and the decision-making scale were applied before the start of the experiment for the purpose of tribal equivalence by the subject teacher, where the students were told that this test is by the school administration for scientific research purposes.

*** Preparation of research requirements: The researcher identified the scientific material taught during the experiment, which is represented in chapter 1 (movement) and chapter 2 (laws of movement) and chapter 3 (work, power and energy) and chapter 4 (simple machines) and chapter 5 (wave movement and sound)**

From the book of science, part II, the training course for middle second grade students for the academic year (2021-2022).

Preparation of training plans: - Teaching plans mean " preconceptions of the teaching situations and procedures carried out by the teacher and his students, certain educational objectives, and this process includes setting objectives and choosing methods that help to achieve them (Jamil, 2002 : 23).

The teaching plan was prepared according to the strategy of the place-restriction for the experimental group and according to the usual method for the control group. A model of each of these plans was presented to a number of specialists in the methods of teaching physics (Appendix 1) to ensure its validity and modify what they deem appropriate.

Search tool: -

• **Scientific thinking test:** The researcher adopted the scientific thinking test that you are used to (Al-Khafaji , 2007) because it was prepared to apply to the intermediate study and in the field of physics and because it was applied to the Iraqi environment, as well as it has high honesty and reliability, as the test consists of (39) test items in introductions , and each introduction has four results that represent possibilities for the answer , only one of which is

the correct answer and three is wrong and to ensure the psychometric characteristics, the researcher took the following measures: -

- **Test validity:** To verify the face validity of the scale, the items of the scale of scientific thinking were presented to a group of experts and specialists in education and psychology (Appendix 1) to indicate their views and verify the validity of its content , as the researcher relied on the agreement of (80%) of the opinions of the arbitrators on the validity of the items and their validity. The scale settled on (39) items , and it became ready to be applied to the exploratory sample.

The first exploratory application of the test: -

To verify the clarity of the test instructions and the clarity of its items and how to answer them and determine the time taken to answer, the test was applied to a random sample of (25) students from the Abdul Mohsen Al-Kazemi Middle School for Boys of the General Directorate of Education of Baghdad Rusafa I , where the average total time was calculated at all items, reaching (45) minutes.

- **The second reconnaissance application of the test: -**

The researcher applied the test to a second reconnaissance sample of middle second grade students (100students) randomly selected from the average age of the chosen boys to find the reliability of the scale.

- **Reliability of the test:** - Reliability is intended to give the test the same results if repeated on the same individuals and in the same conditions, and this is measured statistically by calculating the correlation coefficient between the grades , that is, the measurement tools are of a high degree of accuracy and mastery. (Imam et al., 1990 : 145)

After the test was applied to the exploratory sample, the test reliability was calculated using the Kuder-Richardson equation (20-Kuder-Richardson)from the scores obtained in the scientific thinking test.

The reliability coefficient reached (85%) and (Salah al-Din , 2000) believes that the test is characterized by reliability if its reliability is 80% or more (Salah al-Din , 2000 : 543)

- **Decision making Scale:**

The researcher reviewed a number of local studies that adopted the decision-making scale, and the researcher adopted the scale (Al-Zaidi , 2014), as the researcher found in it an appropriate tool to measure decision-making among second grade students for the following justifications:

- Prepare the scale for middle school students in physics and thus it is similar to the research sample and its community.
- Honesty and consistency as mentioned in the lesson
- It is suitable for the Iraqi environment.

The validity of the scale to verify

- **the face validity** of the scale. The decision-making scale was presented to a group of experts and specialists in education, psychology, measurement and evaluation (Appendix 1) to indicate their views and verify the validity of its content. In light of their observations, the wording of some items was amended.

- **Application of reconnaissance in the first scale: -**

In order to verify the validity of the instructions for answering the scale and its items and the extent of students' understanding of the alternatives to answering, the test was applied to a first exploratory sample consisting of (30) students from the middle second grade students in the average age of the chosen boy , where the average total time was calculated (45) minutes.

- **The second exploratory application of the scale: -**

For the purpose of verifying the psychometric characteristics, the scale was applied to the second reconnaissance sample on the middle second grade students consisting of (100) middle grade students Abdul Karim Qasim for boys after agreeing with the school administration and the subject school to conduct the test to find reliability.

- **Reliability of the scale: -**

The researcher used the alfa kronbach equation, which is one of the methods that measure internal consistency, i.e. homogeneity, and is used to calculate tests that contain substantive and essay items , as the average internal correlation coefficients are the best estimate of the average reliability coefficient, and this can be achieved by several methods, including the Fakronbach equation. (owdah , 1998 : 254-255)

Where the reliability reached 88% and sees (dowran , 1985) that the tests are of high reliability if the reliability coefficient is between (0.80- 0.95). (Duran , 1985: 133)

* Procedures for applying the experiment: -

- The researcher began applying the experiment to the two research groups on 6/2/2022, with two sessions per week for both the experimental group and the control group, and the experiment continued until 17/4/2022.

- The researcher taught the students of the two research groups the subject of physics based on the teaching plans developed by himself , and according to the strategy of the place-restriction for the experimental group, and according to the usual method for the control group.

- The researcher applied the post-scientific thinking test to the students of the two research groups simultaneously on 18/4/2022.

- The post-Decision making Scale was applied to the students of the experimental and control groups simultaneously on 19/4/2022.

Statistical means

- TheT-test of two independent samples that are equal in the equivalence of the two research groups and knowing the significance of statistical differences between the arithmetic means of the scores of the students of the two research groups in the scientific thinking test and the decision-making scale.

- Keoder Richardson-20 equation to calculate the reliability of the scientific thinking test.

- The alfa kronbach equation for calculating the reliability of the Decision making Scale.

Chapter Four

Presentation and analysis of results:

First : Presentation of the results

- Scientific Thinking Test: -

After applying the test to the experimental and control research groups and correcting the students' answers using the T-test as a statistical method, the results were shown as shown in Table (2).

Table (2) The arithmetic mean, standard deviation, variance, and the calculated and tabular T-value of the scores of the members of the two research groups in the scientific thinking test and the tabular value (theoretical)

Group	No.	Arithmetic mean	Standard Deviation	Variance	Degree of freedom	T value		Statistical significance at the level of 0.05
						Calculated	tabular	
- Experimental place-restriction strategy	30	24.53.	4,565	20,848	58	3,891	2,00	Significant at 0.05
- Control Group the usual way.	30	19.86	4.793	22.973				

- Decision making Scale:

The researcher used the T-test for two independent samples to identify the significance of the difference between the average scores of the two research groups in the decision-making scale as shown in Table (3).

Table (3) The arithmetic mean, standard deviation, variance, and the calculated and tabular T-value of the scores of the members of the two research groups in the measure of post-decision making and the tabular value (theoretical)

Group	No.	Arithmetic mean	Standard Deviation	Variance	Degree of freedom	T value		Statistical significance at the level of 0.05
						Calculated	tabular	
- Experimental place-restriction strategy	30	72.8	8,964	80,36	58	6,421	2.00	Significant at 0.05
- Control Group the usual way.	30	56,83	10,264	105,366				

INTERPRETATION OF RESULTS

- Scientific Thinking Test: -

It is clear from Table No. (2) that the experimental group that studied according to the strategy of the place-restriction exceeded the control group that studied according to the

usual method in the scientific thinking test, as this study agrees with the results of previous studies such as a study (Al-Shammari , 2020) and this can be explained to the following reasons: -

- 1) Teaching using the place-restriction has an effective effect in stimulating scientific thinking among the students of the experimental group by researching and investigating the facts and information, revealing the ambiguity they have in the subjects required of them, deducing what is true and judging the validity of the information in them, which led to stimulating scientific thinking.
- 2) Teaching using the place-restriction strategy provided students with the opportunity to express their opinions, discuss the subject of the lesson among themselves and scientific cooperation with their colleagues and enhance this through the participation of the subject teacher (the researcher) led to their superiority over the students of the control group in the scientific thinking test.
- 3) The use of the place-restriction encouraged students to practice various types of thinking, including scientific thinking, as it made students open-minded , and helped them to show courage in putting forward their ideas and providing distinctive and new solutions, which led to an increase in the ability of students to think scientifically.

*** Decision-making scale: - It is clear from Table (3) that the experimental group that was studied according to the strategy of the place-restriction exceeds the control group that was studied according to the usual method in the decision making scale and this can be explained to the following reasons: -**

*** The presentation of the study material objectively, comprehensively and accurately in the organization led to an increase in knowledge for students, as they were born with a high ability to understand, broad participation and effective activity throughout their study of the material, which enhanced their ability to make decisions.**

*** The teaching of the strategy of the place-restriction had an effective effect on the decision-making process of the experimental group students by building new ideas and integrating common ideas and their ability to ask ideas and questions without fear, which increased their self-confidence.**

CONCLUSIONS:

1. The advantage of the place-restriction strategy in scientific thinking compared to the usual method.
2. Moving away from indoctrination in teaching, which eliminates the thinking of the student and makes him a conservative future, but must be enlightened, active, research and innovation, so we must focus on modern strategies in teaching , including the strategy of the mat of the place because of its role in scientific thinking.

Recommendations:

1. Holding programs and workshops to train supervisors, specialists and teaching staff on how to use modern strategies in teaching such as the place-restriction strategy.
2. Enriching curricula and textbooks with scientific thinking skills.

Suggestions:

- 1- Carrying out other studies using the strategy of place-restriction at other stages of study and in all subjects of science such as chemistry, biology and mathematics.
- 2- Conduct a comparative study between the place-restriction strategy and other strategies to find out which is more effective in scientific thinking.

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