

Effect of the Active Thinking Model in the Achievement of Students of the Fifth Grade Applied Science of Physics and Their Pivotal Thinking

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Abstract: *The aim of the current research is to identify the effect of the active thinking model in the achievement of students of the fifth grade applied science of physics, and their pivotal thinking by verifying the two zero hypotheses, where there is no significant difference at the level of significance (0.05) between the average scores of the experimental group who studied physics using the active thinking model and the average scores of the control group students who studied the same material in the usual way in the achievement test, as well as in the pivotal thinking test. The research sample consisted of (77) students of the applied fifth grade students in two divisions (a) and (b), randomly selected (a) to be the experimental group, and (b) to be the control group, Two methods were used to measure the dependent variables: achievement, and pivotal thinking, and after applying the research experience, which lasted (9) weeks, the search tools were used to obtain the data. After analyzing and processing the data using the statistical program(SPSS) The results of the study resulted in the superiority of the students of the experimental group who studied during the period of the experiment using the active thinking model on the students of the control group who studied in the usual way in the achievement test. The results also showed that the students of the experimental group were more successful than students of control group, In the test of pivotal thinking and for the benefit of the experimental group, thus rejecting the two zero hypotheses. In light of the results of the research, a number of recommendations were made.*

Keywords: Active Thinking, Core Thinking

1. Introduction

The problem of research Physics is one of the basic natural sciences, which is famous for its difficulty because it contains many concepts that are difficult to understand because they were presented abstractly, which led to difficulties in learning and teaching this article. This is what many studies have pointed out in this area. To ascertain the existence of this problem, the researchers conducted a survey of the views of a random sample of (20) teachers and schools who study physics for students of the fifth grade applied science in the schools of the General Directorate of Education Baghdad / Karkh first for the academic year (2016 - 2017) by asking them a questionnaire that included questions about both variables achievement and pivotal thinking and how to study physics for the fifth grade applied science.

The researchers found that:

- 1) (89) teachers use the usual method of teaching, the reason why they do not know the modern methods and the purpose of completing the curriculum on time.
- 2) (80%) of the teachers confirm that there is a low level of achievement among the students, The reason for the security situation and the increase in the number of students in the classroom, as well as the lack of tools and laboratory devices.
- 3) 100 teachers do not have knowledge of pivotal thinking skills.
- 4) (100%) of teachers have no knowledge of the model of active thinking.

These results are consistent with the views of most specialists and the results of previous studies which confirmed that the decrease in achievement was the result of the use of the usual teaching methods in our educational institutions, which was the reason for making the student inactive in the classroom, his role is limited to listening and receiving information only without making an active contribution to the lesson. This is one of the sources of poor student achievement and the difficulties of developing their central thinking, so recent trends in science teaching emphasize the need to use the teacher's use of modern strategies, methods and methods capable of improving students' achievement and developing their interaction with the variables in the social environment by developing their thinking and keeping abreast of the tremendous developments in the field of teaching.

Despite the clarity of this vision, the teaching methods used in our schools still focus on the content more than the student, whose role is mostly negative. Therefore, it is necessary to pay attention to the teaching methods and tools of the physics which it plays, and make it the focus of the educational process, which may contribute to raising the level of achievement and thinking pivotal to him. For the purpose of addressing these effects and empirical confirmation, the researchers considered the use of the active thinking model as a model that may be related to improving achievement and level of achievement, and the level of thinking among students and therefore can formulate the problem of the current research through the following questions –

- 1) What effect of the active thinking model in the achievement of students of the fifth grade applied science of physics?
- 2) What is the effect of the model of active thinking in the pivotal thinking of students in the fifth grade applied science?

2. The Importance of Research

As a result of the great challenges posed by the tremendous scientific and technological development, and the practical and renewable applications of various sciences in every area of our daily lives, and at an accelerated pace. To make those responsible for the educational process appear ready to restore the elements of the educational system and education in order to modernize it in line with this rapid scientific and technological development and the apparent increase in the importance of science. Therefore, their efforts to invent modern teaching methods and methods aimed at making teachers able to communicate knowledge to students in accordance with their mental abilities and the nature of the subject (Fayadh, 2016).

And physics, which plays an important role in the technological development taking place in the world. In view of this importance, increasing interest in the methods of teaching and developing them through the use of strategies and teaching models that make the role of the student a positive role in the educational situation, As well as their contribution to the development of thinking and self-learning. Educational literature refers to the growing views of teaching in order to raise the level of thinking among students and develop their mental abilities more (Salama et al., 2009, 17-18). Because it is the usual method of teaching by understanding and improving the processes of teaching and learning through the studies, research and experiments they have done to be able to build different models of teaching (Zitoun, 2009 237).

To help teachers develop plans, design lessons, select strategies and teaching methods used in classrooms, create an appropriate learning environment for lesson objectives, learn information, ideas, academic and social skills, and help students to good learning and thus raise the level of achievement (aggression, Muhammad, 2011 165). One of the models that can achieve this is the active thinking model, which aims to help develop different life skills, it encourages discussion and dialogue As well as the public participation of thought, in order to address the problems of real life to facilitate the transfer of learning and the future use of problem-solving skills, through his steps, which were prepared based on Vygotsky (1978). In his social-cultural theory, emphasized the importance of social interaction in the development of higher psychological processes, as well as Sternberg (1985) in his three-pronged theory of human intelligence, which assumed that there are three types of human intelligence: Analytic Intelligence, Creative Intelligence, Practical Intelligence, Which together can help to make students able to cope with the problems of life. This model is a flexible model that can be adapted to the needs, preparations and abilities of students in different areas of the curriculum. (Jaber, 2008 293-294). The researchers believe that the use of the model of active thinking in the teaching of

physics may contribute to increase the students' absorption of the material, which is reflected in the level of achievement and the central thinking. It is possible to highlight the importance of the current research in terms of theory and practice with the following points:

- 1) It is a few research and according to the knowledge of researchers at the local and Arab level, which dealt with the model of active thinking in the teaching of physics for students of the fifth grade Applied science and its impact in achievement and pivotal thinking.
- 2) The importance of raising the level of thinking central to students in the secondary stage, which represents an important stage of the life of the student, interspersed with a lot of questions and shows the performance of different types of mental abilities.
- 3) The importance of physics after science, where physics is the basic basis on which the other natural sciences, as well as vital relationship to the life of the student and its role in helping him to face the problems that prevent him from achieving his goals.
- 4) This research constitutes the nucleus of other research in physics and other stages.
- 5) This research may help interested in the educational process to work the various training courses aimed at raising the level of achievement in the physics of students through the use of modern models in teaching.

3. The objective of the research

The aim of the current research is

- 1) To identify the effect of the active thinking model in the achievement of the students of the fifth grade applied science of physics.
- 2) Pivotal thinking.

4. The Research Hypothesis

The research hypothesis is to verify the target of the research, the zero hypotheses were formulated as follows:

- 1) There is no statistically significant difference at the level of (0,05) between the average score of students in the experimental group who studied physics using the active thinking model and the average score of students of the control group who studied the same substance in the achievement test.
- 2) There is no statistically significant difference at the level of significance (0.05) between the average score of students in the experimental group who studied physics using the model of active thinking and the average score of students in the control group who studied the same material in the usual way in the pivotal thinking test.

Limits of research

The current research is confined to

- 1) Students of the fifth grade Applied Science in the secondary and middle schools day of the Directorate General of Education Baghdad / Karkh first, for the academic year (2016-2017).
- 2) The second semester of the academic year (2016 - 2017).
- 3) Chapter (fifth, sixth and seventh) of the book of physics, for the fifth grade Applied Science, sixth edition, for the academic year (2016 - 2017) m, (temperature and

temperature, thermal properties of matter, transformations of the state of the material).

5. Terminology

1. The active thinking model Wallace and Adams (1993) defined it as 'an educational model based on the Sternberg and Vygotsky theories, consisting of the following eight steps (gathering information, identifying and discriminating, generating ideas, making decisions, Implementation, assessment, communication, learning from experience), helps students to think effectively in a socially-active environment (Wallace, 1993

Jabir (2008) defined it as 'an educational model in the form of an eight-step course based on the theory of triple intelligence In Sternberg, and Vygotsky's social construct theory is used to help students develop their thinking and develop the ability to solve problems '(Jabir, 2008, pp. 288-295).

The procedural definition consists of eight steps of a sequential process based on Sternberg's theory of intelligence and Vygotsky's social constructs beginning with the collection of fifth-grade scientific students on physical information and its regulation, Thus distinguishing between information, as well as generating relevant ideas for the purpose of decision making, evaluation and dissemination, in an atmosphere of interaction between students, which helps to improve their thinking.

Achievement

Abu Jado (2008) defines it as 'the outcome of what the student learns after a period of time which can be measured by the total score obtained in the achievement test, in order to determine the success of the strategy that the teacher sets to achieve his goals and the student's knowledge translated into Degrees' (Abu Jado, 2008 292). The practical definition of how students of the fifth grade applied scientific information of physical information, which is the degree to which they get in the achievement test prepared for this.

Core Thinking

Was defined by the American Society for Curriculum Development and Education (ASCD, 1995) as 'thinking based on separate cognitive processes that are fundamental

building blocks of thinking and include twenty-one cognitive skills of cognitive thinking has been collected in eight skills' quoting (Moussawi, 2012). • (Beyer, 2003) 'A set of delicate and sensitive mental processes that overlap with each other and represent the basis for effective and influential thinking, in order to reach meaning or knowledge' (Beyer, 2003) A set of delicate and sensitive mental processes that overlap with each other and represent the basis of active and influential thinking, with the aim of reaching meaning or knowledge '(Beyer, 2003). (Abu Jado and Nouvelle, 2007).

(Noufal and Al-Rimawi, 2008) is a mental process that is used uniformly to achieve a specific goal and contains a list of twenty-one core skills of thinking grouped into eight major categories (Nofal, 2008). The researchers agree with this definition. They also defines it procedurally as 'thinking based on the eight main mental processes and the twenty-one sub-lines derived from the main pivotal thinking skills that were adopted in the construction of the test given to the sample of research'.

6. Background Theory and Previous Studies

1. The Active Thinking Model Whereas problem solving is the ultimate goal of the learning process, both Wallace and Harvey Adams have proposed a model of thinking to solve problems in an environment which It has an atmosphere of social interaction and is based on the connection between thinking, problem solving, and thinking (Active Thinking in a Social Context), which is abbreviated (T A S C). And put this model to improve students' ability to think, and The model provides a practical framework that supports problem solving through its various phases, encompassing all the cognitive and cognitive skills used by the individual, including strategic thinking and reflection on what has been learned. The model tools consist of a mix of strategies Which includes logical thinking, innovative and practical tendencies and tendencies are included under the factors of motivation and direction in an atmosphere of communication, and this model is provided for the formation and development of thinking by solving problems (Jaber, 2008 288). Figure 1 illustrates the steps of the model and the thinking tools that can be used for each step. (Wallace & Adam, 1993: 12-16) Figure 1 the steps of the model and the thinking tools

Thinking tools	steps	No.
Survey by senses	collection and organization of information	1
memory Doubt in available data		
Identify problem		
Find additional information	Identification and discrimination	2
Explore and investigate goals		
Ask questions about the required		
production of ideas	Generating ideas	3
Consider consequences		
Compare alternatives and possible outcomes		
Determine priorities	Decision making	4
Choose a path of action		
Planning the steps and methods of observation		
observation Expecting progress and reviewing the efficiency of the decision	Implementation	5
Planning the steps and methods of Consider alternatives and revise the solution		
Evaluate the extent of achieving the goals		
Evaluate the efficiency of processes and strategies	evaluation	6

Justification of decisions	Communicating	7
Exchange of ideas		
Listening, interpretation and explanation		
Comparison of current performances in the past	Learning from experience	8
Review and revise the overall procedure		
Mainstream learning and its impact		

This model helps to develop the skills of life through discussion, dialogue and public participation in thinking. The following is a detailed description of the aspects of the skills and directional factors promoted by the model

- 1) The directional and motivational factors, including
 - The hypothesis and optimism.
 - Active interaction with the environment.
 - Understand the need for survey, detection and accuracy.
 - Preparing for cooperative action.
- 2) Skills above the cognitive and includes
 - Awareness of the existence of the problem.
 - Choose appropriate formulas to represent and portray the problem.
 - Select appropriate cognitive strategies.
 - Planning. - draw attention.
 - Monitoring the solution.
 - Sensitivity to feedback.
 - Awareness of the individual strengths and aspects of weakness.
 - The balance between pivotal, analytical and innovative thinking.
- 3) Problem solving skills include
 - Distinguish between relevant and irrelevant information.
 - Looking for relationships between things, events and experiences.
 - Analysis of information and problems to parts.
 - Compose and install ideas.
 - Thinking about possibilities and consequences.
 - Using the witness and logical thinking to demonstrate things.
 - Defense of opinions.
- 4) Communicate and include
 - Avoid self-centeredness.
- 5) Select a suitable format for communication.
 - Provide clear instructions.
 - Positive listening. (wallace * adams, 1993 12-14).

The researchers used these steps are when writing instructional plans and implementing them with the experimental group.

2) Thinking and thinking skills

Thinking is the completion of the mind in the knowledge to reach the unknown knowledge also means the completion of the mind in the problem to reach a solution, a series of senses, one of the five senses (Majdi, 2007 101) quoting (Mujahid, 2014 168). Thinking is an important element in the mental composition of man, because it affects and is affected by cognitive processes, such as perception, perception and memory, as well as affect and affect the aspects of personal, emotional and social (Jarwan, 2010). Thinking is seen as as a series of brain-based mental activities that allow the learner to process sensory inputs and

retrieved information to reach meaningful outcomes. Thinking is a mental activity that can be learned or even trained to master his skills, So that the student can be able to data and information and contribute to solving the various problems of life, while the skills of thinking that specific processes are practiced with the aim of processing information, and thinking skills are not acquired through the accumulation of knowledge and information only, not growing maturity and natural development alone. Rather, there must be a structured education that starts with basic skills and extends to higher thinking processes, from thinking skills to problem identification, information gathering and processing, decision making, thinking processes such as observation, comparison, application, analysis and conclusion (Al-Atoum, et al., 2011, p. 43), and (al-Qawasim, Abu-Ghazaleh, 2013, 50). The specialized literature contains many types of thinking according to the theories that have been interpreted.

Pivotal thinking: A pivotal thinking is one of the types of thinking that can be acquired at any stage of schooling and consists of a number of interrelated skills.

- Main and secondary thinking skills are divided into interpersonal skills (8) main skills, including (21) sub-skill,
- Focusing Skills The focus skill helps to take care of collecting small pieces of information available to him and then work to neglect some, including
 - 1) Skill definition of problems Defining (Is to clarify the puzzling or questionable positions of the learner).
 - 2) Setting Goals (aims to identify educational outcomes that the learner is expected to attain after passing through experience and presenting him with a puzzling scientific position) (Marazona et al., 2004) Stargerg (Stargerg, 1996) quoting (Razuki, Nadia, 2013).

Information Gathering Skill: This skill includes two sub-skills:

- 1) Observation means access to information from the environment by employing one or more of the human senses and that human senses are the windows of the world. (Marzano, 112, 1995) (Olive, 2009 102) (HE, 2006, 49).
- 2) Formulating Questions, which include clarifying issues and meanings by means of a survey, good questions draw attention to important information (Stargerg, 1996) and Katami, Al-Arnaki, 2007, 138).

Remembering Skills

(A set of activities or strategies that learners take to store and retain information in the long-term memory). This skill includes two sub-skills

- 1) Coding skill (Encoding) coding process linking Small pieces of information together to keep them in the long-term memory).

- 2) The skill of retrieval () (know the skill of recall or retrieval as an organized and conscious process to store information so that it can be retrieved).

Organizing Skills

This skill has four sub-skills:

- 1) Skill Comparison (comparison means to identify similarities and differences between the information being searched and investigated) (Jood, 1995) and Abu Jado, 2010 (88).
- 2) Classifying) refers to working on the aggregation of paragraphs and vocabulary on the basis of their critical characteristics, or working on the development of vocabulary in groups according to their common characteristics (Jod, 1995, 228) and Sa'ada, 2006 (49).
- 3) Ordering means the organization of elements or vocabulary according to a certain standard or a sequence of vocabulary according to a predetermined criterion
- 4) Representing The learner changes the form of information received from the external environment by establishing Relations between specific elements (Marazona et al., 2004, 166).

Analyzing Skills

For the skill of analysis Four sub-skills are

- 1) Identifying attributes and components Identifying attributes and components.
- 2) The properties or parts of something can be determined by the knowledge bases stored in it, and then work to clarify the parts that are all.
- 3) Identifying Main Ideas The process of identifying ideas is a case in order to identify patterns and relationships.
- 4) Identification Identifying Errors () This skill is primarily based on error detection during a logical display that includes a collection of Procedures and Information (Marazona et al., 2004, 166).

Generating skills

(Is the ability to generate new ideas that do not already exist, namely the student's ability to adapt information to reach new solutions. This skill includes three sub-skills:

Inferring is defined as a kind of inductive and hypothetical proof. The deductive proof is the ability of the individual to determine an existing principle in a logical manner, while the inductive proof refers to the uncles and the logical statement based on the observation of different situations.

Prediction skill

- 1) This skill appears to the learner by visualizing or anticipating certain results based on certain situations.
- 2) Marzano defines it as a process of anticipating certain outcomes from a given situation, based on the information contained in the student and feedback on the validity of that information. Prediction is a complement to understanding strategies.
- 3) Expanding (the learner's ability to provide more detail, explanation and information related to previous knowledge, in order to improve the understanding of students).

Integrating Skills

This skill has two sub-skills:

- 1) Summarizing is the ability of the learner to extract the basic elements of a text by forming a set of coherent phrases that clearly make sense in the mind of the learner (Abu-Jado and Neufel, 2010).
- 2) Reconstructing (the process of changing the knowledge structures directed towards the integration of new information, the teacher 'as is new' activity aimed at modifying or expanding or reorganization in the article in order to abandon the concepts of the previous recognition).

Evaluation skills:

It consists of two parts:

- 1) Establishing skills: The skills of the construction of standards refers to the development of a set of benchmarks to judge the value and quality of ideas, and describes them (Aldhamen, 1993).
- 2) Verification is defined as the confirmation of the accuracy of the claims made on an issue and is considered one of the highest scientific processes. It includes most of the processes of science, such as the collection of observational information and measurement tools, the development of hypotheses, the control and identification of variables, Then do the experimentation. 'Experimentation is a test of hypothesis validity through the use of materials and tools and the control of variables' (Guarantor, 1993, 8), and these primary and secondary skills were adopted in the teaching and testing provided to students.

7. Previous Studies

a) Studies on the model of active thinking

Abd, 2012 The impact of the model of active thinking and the strategy of the Department of responsibility in the collection of public health and decision-making bioethics and the development of skills above the knowledge of students of the Department of Biology Sciences.

b) Studies on pivotal thinking skills

- 1) Attribution and iron, 2014 Fifth grade students scientific in the pivotal thinking and sports communication.
- 2) Oweid, 2014 Designing a training strategy based on the integration of thinking skills with content and its impact on the development of pivotal thinking skills.
- 3) Fayyad, 2016 Analysis of books on physics according to the skills of central thinking and visual thinking of the secondary stage and acquisition of students.

Fields of benefit from the previous studies as a whole, where the researchers benefited from the previous studies presented in the three axes and other studies in the following areas

- 1) Derivation of the problem of research and identification.
- 2) Determine the research questions and objectives.
- 3) Choose the appropriate method and method of research.
- 4) Identify key and subsidiary thinking skills as well as visual thinking skills.
- 5) Selection of appropriate statistical means.

Research Procedures

The research methodology will be presented in terms of the choice of experimental design, identification of the research community and its design, equivalence between the research

groups (experimental and control), preparation of its requirements and tools, and applying the experiment and selecting the appropriate statistical means, As the following :

The experimental design of the research

Since the current research has an independent variable (the active thinking model) and the two dependent variables

(achievement and pivotal thinking), the researchers adopted the experimental design with partial control in two groups (experimental and control) The post-test of collection and pivotal thinking can be expressed as the experimental design of the research as in the Figure (2).

Figure 2: Experimental Design for research

Independent variable	Dependent variable	qualification	group
pivotal thinking achievement	Active thinking	<ul style="list-style-type: none"> • IQ • Test previous information • Test the pivotal thinking 	experimental
	Normal way		control

The research community and its design

The research community was identified by the students of the fifth grade applied science in the preparatory and secondary schools in the Baghdad / Al-Karkh first education. Al-Mansour junior high school was chosen by Al-Qasim, which includes seven academic grade students. For the fifth grade scientific. The research sample consists of students of the fifth grade applied in two divisions, randomly selected (A) to be the experimental group studied according to (active thinking model). The number of students was (39) students and Division (B) to be the control group Which was studied (in the usual way) and the number of students (38) students, as shown in table (1).

Table 1: Sample of research

Number of students after exclusion	Number of excluded students	Number of students before exclusion	group	No.
31	8	39	a	1.
31	7	38	b	2.
62	15	77	total	

Thus, the number of members of the research sample (62) students distributed between the two groups. The students who were rejected were statistically excluded.

8. Setting Procedures

The researcher insists to set which effects on the variables which in turn will effect on the validation of the research results of the research as following:

1) Make verification for the internal experimental design:

Equivalence of the Sample Although the experimental and control groups were chosen from the same school, age and random placement, the probability of inequality of groups was obtained, which necessitated some equivalence measures, some of which may be due to sample characteristics, the two research groups were rewarded with the following:

- Intelligence variables using the Raven matrix.
- The previous information using a test prepared for this purpose consists of twenty paragraphs. Objectivity of the type of multiple choice of four alternatives and verified its validity and stability.
- Pivotal thinking using a test prepared for this purpose. Table (2) contains the arithmetic mean and variance of the equivalence variables for the students of the two groups (experimental and control), which showed that there were no significant differences between them at the level of significance 0,05 through the use of T-test for two independent samples, Which means that the two groups are statistically equal in equivalence variables.

Table 2: Arithmetic mean, variance, T calculated and tabular value of the equivalence variable for students of both groups (experimental and control)

Statistically significance	T value		differences	Arithmetic mean	No.	group	
	tabular	calculated					
Not significant	2	0,580	17,842	21,387	31	Experimental	intelligence
			9,859	21,935	31	control	
Not significant	2	0,477	188,348	11,322	31	Experimental	Previous degree
			99,301	12,774	31	control	
Not significant	2	0,473	9.461	28.064	31	Experimental	pivotal thinking

- Control the conditions of the experiment and prevent accidents Accident intended all accidents and circumstances that can occur and exposed to students during the duration of the experiment. The preparation and pre-planning of the lesson and the cooperation provided to researchers by the school reduced the importance of this factor. The experiment was not accompanied by an incident affecting its application or results.
- The third researcher taught the experimental and control research groups throughout the duration of the experiment

because he is a teacher of the school owners and thus the impact of the teaching experience was neutralized.

- Course material The study material itself was determined by the two groups of research which were represented in chapters (5,6,7) of the books of the year 2014-2015. Measurement of Measurement Tools The researchers adopted tools to measure the variables of the two research groups (achievement test and pivotal thinking test).
- Waste: The researchers did not lose any of the sample during the experiment.

- The duration of the experiment was equal to the experimental and control groups, the second semester of the year (2016-2017).
- The duration of the experiment was equal to the experimental and control groups, the second semester of the year (2016-2017).
- Physical conditions: The teaching site was chosen for the two research groups in the classroom, and they were similar in terms of physical conditions such as capacitance, Lighting, ventilation, seats and blackboard.
- Teaching hours: The experimental group and the control group were taught according to the schedule prepared by the school administration.
- Daily tests and duties The students of the two research groups were tested by the tests themselves and assigned to the daily duties themselves.

2) Ensure external safety of experimental design.

The external safety conditions of the experimental design were provided and the research experience was made as remote as possible in the course of the following procedures.

- Interaction of Experimental Attitudes The two research groups did not experience more than one experiment during the research period and the experimental procedures were followed by the researchers themselves teaching. The interaction of the choice with the experiment The effect of this variable was limited. The sample was selected as a trial group and a control group randomly.
- Interacting the test with the experience The adoption of the researchers tribal test may lead to the identification of these groups on the nature of the experiment before the application and to reduce the impact of this variable applied a test of pivotal thinking before the experiment for the purpose of tribal equivalence by the teacher article and tell students that this test is from the school administration for scientific research purposes.
- The interaction of the experimental conditions was limited to the effect of this variable. The two groups studied natural and non-artificial situations. Experimental attitudes included confirmation of one empirical variable, the teaching method.

Preparation of research requirements

The current research requires the preparation of a set of inputs for the purpose of carrying out the research procedures and these requirements:

- Determining the scientific material The last three chapters of the book of physics for the fifth grade applied science, These classes are taught during the second semester of the academic year (2016 - 2017) from the end of the spring break until the final examinations of the academic year, according to the annual plan that was

developed and according to the guidance of educational specialists.

- Formulation of behavioral objectives: Behavioral objectives were formulated based on the content of the educational material covered during the trial period, and reached (113) behavioral objects (121) cognitive purposes according to Bloom's knowledge classification at its six levels, 26 for technical purposes and 6 for emotional purposes.
- Behavioral objects were presented with a copy of the book of physics for the fifth grade Applied Science to a group of experts in the field of education, psychology and methods of teaching science. To express their views on the accuracy of the formulation and the extent of coverage of educational content and suitability to the level that measure by paragraphs. In the light of the opinions and observations of the experts, some of them were reworded, and the proposed amendments were made to others, thus the final number (133) became a behavioral object that was valid, having obtained the approval of (80) or more of the arbitrators' opinions.
- Preparation of teaching plans (27) a teaching plan for the experimental group and the same for the control group in order to achieve the teaching of the article planned for the last three chapters of the book of physics for the fifth grade applied science. Models of these plans were presented to a group of the author and the experts in the field of education and psychology and methods of teaching science to express their views on the appropriateness of the method of teaching and the content of the article and behavioral purposes, and based on the comments offered were modified some plans and set the rate of (80) and more for the consensus and in light of this ratio was modified in order to take its final form.

Research Tools

This research requires the preparation of two tools to measure the dependent variables: achievement, and pivotal thinking. These tools were prepared as follows:

- a) The main objective of the test is to measure the achievement of students of the fifth grade applied in the scientific content of the chapters of the book for physics, for the academic year 2016 - 2017 and according to the behavioral objectives for that educational content.
- b) Determining the number of test paragraphs were identified in 40 test paragraphs only

3) The preparation of the test map (table of specifications)

The weights of the study content were determined in light of the number of pages for each of the chapters covered by the research. The weights of the behavioral objectives were determined according to the three levels (38%) with a minimum level, (42%) with the absorption level and (20%) at the application level, as shown in Table (3).

Table 3: Test map of the test collection

total 100%	مستوى الاهداف			percentage	Page no.	chapter
	applying 20%	Comprehension 42%	38% remembering			
Paragraphs number						
13	3	5	$4.8 \cong 5$	32%	11	5
11	2	5	4	27%	9	6
16	3	7	6	41%	14	7
40	8	17	15	100%	34	total

4) Formulation of the paragraphs

The clauses of the collection test were formulated in its preliminary form according to its indicators in the specification table, and adopted the formula (multiple choice) of 30 paragraphs and 10 paragraphs of the article. The test scores were divided between the six cognitive levels.

5) Preparing the instructions for answering and correcting the test

The instructions for how to answer the test scores were provided to help the students in the accuracy of the answer and not the confusion.

Correction of the achievement test The researchers set a standard for correcting the answers to the achievement test according to the correct answers, and the overall score for the test ranged from zero to a maximum of 40).

6) Validation of the test

The authenticity of the content and the validity of the content were verified by presenting the collection test accompanied by the content of the material and the behavioral objectives and the specifications table on a group of specialists in physics and methods of teaching physics. Some of the test paragraphs were reviewed based on their observations and opinions, and the test paragraphs, which received 80 or more, were kept as a percentage of agreement between the views of the specialists and the Cooper equation.

7) The survey application was applied in two stages:

A) Application of the test on the first survey sample:

The test was applied to a sample of the students of the fifth grade applied scientific (30) students in Al-Mansour junior high school, Without the research sample for the purpose of ascertaining the calculation of the time required to answer, the clarity of the paragraphs and the extent to which students understand them. The student was given the answer sheet after 35 minutes and the last student handed the answer after 45 and the average time was 40 minutes.

(a) Application of the test on the second survey sample: The test was applied to a sample of 100 students from the fifth grade applied in Al-Mansour junior high school without a sample.

The statistical analysis of the test paragraphs: The following procedures were arranged by the students' answers papers (100). By the final grades, 27 of the highest scores were chosen, representing the top group, and 27 answers were selected. Of the responses with the lowest scores

representing the lowest group. The following statistical analyzes were performed:

(b) Calculating the level of difficulty, and the researchers applied the difficulty equation of the objective and transitional paragraphs on the test paragraphs, and found that the difficulty coefficients ranged from 0.20-0.85 This is a criterion for acceptance of the paragraph.

B) The coefficient of paragraph discrimination .

The coefficient of discrimination for each of the objective and group achievement test paragraphs was calculated according to their own equivalence and was found to be between (259.0 - 815.0). Brown (1981) points out that the test paragraphs are good If the discriminatory power of paragraphs (20.0) and above (Brown, 1981, 104). Since the strength of the test scores was more than 20.0, the researchers kept all the test paragraphs.

C) Effectiveness of the wrong alternatives to the objective questions The effectiveness of the wrong alternatives was calculated. The researchers found that the wrong alternatives are all negative, ie, they attracted a number of lower group students than the students of the upper group. 1. Stability of the test The Alpha-Cronbach equation was used to calculate the stability coefficient (0.84). It is a high coefficient and a good indicator of the stability of the test. The consistency coefficient of the test paragraphs is good, as (Awdah, 1999). Accordingly, the finalization of the test is ready for implementation.

Pivotal Thinking

The researchers adopted the pivotal thinking test prepared by Fayyad (2016), which was designed to measure the central thinking of students of the scientific sixth, and was implemented during the academic year (2015-2016). And the test consists of (21) article. They were formulated according to the eight main pivotal thinking skills and twenty-one sub-skills, as in Table (4).

Table 4: Main pivotal thinking skills and the number of test paragraphs and the total score

Total marks for each skill	Mark for each paragraph	No. of paragraphs	Pivotal thinking skills
12	6	2	1 - focus
12	6	2	2 - information collection
12	6	2	3 - memory
12	3	4	4 - organization
12	3	4	5 - analysis
12	4	3	6 - generation
14	7	2	7 - integration
14	7	2	8 - evaluation
100	42	21	Total

The researchers relied on virtual honesty to verify the validity of the scale, which is one of the basic characteristics that must be available in the psychological and educational standards. To achieve the validity of the scale, the scales were presented to a group of experts in teaching methods, Psychology and measurement and evaluation, to judge the validity of the measurement of what is intended to measure, and adopted the proportion of the agreement 80. All paragraphs received acceptance because it was not more than a year to prepare and apply as well as the similarity of the target group in mental age and time and thus was verified.

Procedures to apply the experiment

To maintain the integrity of the design, and to reach accurate results and to answer the research questions were adopted the following steps and procedures:

The researcher tries to teach the course material for the experiment. -

- The IQ test and the information test are applied information on Sunday (19/2/2017)
- The pivotal thinking test was applied on Monday (20/1/2017).
- The two groups taught the same subject, and were given the same amount of requirements.
- The experimental group was studied according to the active thinking model while the control group according to the usual method and according to the plans.
- After the completion of the teaching of the scientific material, the test was applied on Wednesday (19-4-2017) of the two groups.
- Test positive thinking and the pivotal thinking test on Thursday (20/4-2017) and for both groups.
- The experiment lasted 9 weeks starting from 19/2/2017 until 20/4/2017.

Presenting and Interpreting the results

The findings of the researchers will be presented according to the research objectives by verifying their zero hypothesis.

9. Presentation of results

For the purpose of verifying the first hypothesis, which states that there is no statistically significant difference at the level of significance (0.05) between the average score for students who study according to the active thinking model and average grades of students who study according to the usual method. Group Number of Students Mean Account Standard Deviation T Calculated T-Test 3134,1933,223,115 Control 3123,8715,69 The results obtained from the application of the collection test after its preparation as explained in Chapter 3 on the experimental and control groups as shown in Table (5).

Table 5: Arithmetic mean, standard deviation and calculated T value of the students' experimental and control group scores in the test

T value calculated	Standard deviation	Calculated mean	Students no.	group
3,115	3,22	34,193	31	experimental
	5,69	23,871	31	control

The mean scores of the experimental group (34,193) and the standard deviation (3.22), while the average of the students of the control group (23,871) and the standard deviation (5,69) and the use of the test for two independent samples showed that the T value (3,115), which is greater than the value of (2) at the level of significance (0,05) and the degree of freedom (60). This indicates the superiority of the experimental group students who studied during the duration of the experiment using the active thinking model on the students of the control group who studied In the normal way in the achievement test.

Impact size

The difference between the mean of each of the experimental and control groups in the collection variable is calculated by dividing the standard deviation of the control group. The size of the effect helps us determine the relative effect of a particular educational process and to determine the level of impact, because;

- Less than 0.2 Weak
- Between 0.2 - 0.8 Average
- 0.8 or greater (LF, 40, 2005).

The effect of the active thinking model on achievement is therefore significant.

Table 6: Value of the effect size (d) and the effect of the active thinking model on achievement.

Impact size	D value	Independent variable	Dependent variable
high	0,804	Achievement	Active thinking model

- To verify the second hypothesis that there is no statistically significant difference at the level of (0,05) between the average score of pivotal thinking for students who study according to the model of active thinking and the average grades of students who study according to the usual method.
- The results obtained from the application of the pivotal thinking test on the experimental and control groups presented in Table (7) showed a statistically significant difference at the level of (0,05) between the average scores of the two groups. The average scores of the experimental group (72,354) and the average of the control group (56,000) and after the use of the test for two independent samples. It was found that the calculated T value is greater than the tabular value, and it is equal to (4,959) and the degree of freedom (60).

This indicates a statistically significant difference between the average scores of the experimental group and the average score of the control group students in the pivotal thinking test and for the benefit of the experimental group, thus rejecting the second zero hypothesis.

Table 7: Arithmetic Mean and standard deviation and the calculated T value of the scores of the experimental and control groups in the pivotal thinking test

T value	Standard deviation	Arithmetic mean	Students no.	group
4,959	3,656	72,354	31	experimental
	6,126	56,000	31	control

The magnitude of the effect of the pivotal thinking variable was 1.26. Therefore, the magnitude of the effect in the active

thinking model on the pivotal thinking is as high as in Table (8).

Table 8: Value of the effect size (d) and the magnitude of the effect of the active thinking model in the pivotal thinking

Size impact	D value	dependent variable	Independent variable
high	1,26	pivotal thinking	Active thinking model

10. Explanation of the Results

It is clear through the results of the researchers that the use of the model of active thinking positive effect in increasing the achievement of students in the research sample, due to the following reasons:

- 1) Teaching according to the model of active thinking gives students the opportunity to build knowledge through positive interaction with the teacher of the material, as well as the interaction between the students themselves to communicate among themselves through the exchange of views and dialogue, which may raise the interest of students and the advancement of their scientific level to the maximum allowed by their abilities and potentialities and capabilities.
- 2) It was possible to observe the interaction that prevailed in educational attitudes as the active thinking model contributes to helping students to participate positively, which enhanced self-confidence and the ability to conclude.
- 3) Teaching according to the model of active thinking helped to transfer students from the state of direct reception of the information to make students the center of the educational process and this is contrary to the usual way in which the teacher is the focus of the educational process and the student is the recipient of information and its role is limited to the preservation and implementation of information only.
- 4) The role of the teacher in directing students to other sources of information outside the curriculum contributed effectively by the arrival of students to new information was not present, which made them solutions easily and choose the alternatives sound and achievable.

Furthermore, The use of the model of active thinking has a positive impact on the development of central thinking among students of the research sample, due to the following reasons:

- 1) The use of the active thinking model provided a 'safe' environment that allowed for social interaction and soft interaction among students, and this reflected on increased central thinking.
- 2) The active role of students in the course of teaching, and their interaction in the presentation and presentation of the lesson, has given them self-confidence, and how to deal with different positions and this in turn led to increasing the desire of students to search for facts and inquiry about the outstanding information through the multitude of questions and inquiries and then the use of the model of active thinking led to the development of the central thinking of students.

11. Conclusions

In light of obtained results, the main conclusions which obtained are:

- 1) The active thinking model has a great effect on the achievement of the 5th grade for applied scientific branch students in physics.
- 2) The active thinking model has a great effect on the pivotal thinking for the sample students.

12. Recommendations

- 1) Depending on the active thinking in Physic teaching method , because it has a direct effect in improving the achievement of the students and enhancing the pivotal thinking.
- 2) Held a workshop to make training for the teachers in order to teach them how to use active thinking strategy in teaching and not constrains on the old teaching methods of reading, keeping and teaching.
- 3) Reducing the traditional styles of physics teaching , which includes the old methods of concentration on comprehension and applying the activities that give a permission to the student in keeping the information for a long time instead of remembering the information and real events.
- 4) Provide a classroom Which enable the students from interaction and participation in all activities and enhance their achievement and enhance the pivotal thinking of them.
- 5) Guide the managers of the subjects and the authors of the books in order from benefit from the thinking model in writing the books and displaying the scientific content of the book

13. Suggestions

- 1) Make another study with another variables like(Gender, Virtual thinking, pivotal thinking).
- 2) Make a comparison study between the active thinking and another strategies to find which has the greatest impact on the pivotal thinking.

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