

The Effect of the Appleton model in the critical thinking of fifth grade students in mathematics

Dr. Ghassan Rasheed AL Sydawy

Hussein Ayfan Hassan

College of Basic Education / Mustansiriya University

Abstract

The research aimed to identify the impact of the Appleton model in the critical thinking of students in the fifth grade in mathematics, and to verify the research objective, the following hypothesis was formulated:

There was no statistically significant difference at the level of (0,05) between the average grade of the students of the experimental group who study according to (Appleton model) and the average score of the students of the control group who study on

(The normal way) in the test of critical thinking.

The sample of the study consisted of 67 students from the fifth grade of scientific / biological in the preparatory school of Qalat Sukkar in the Directorate of Dhi Qar. A (34) students were selected as the experimental group according to the Appleton model and (B) (33) students to be the control group, which is taught according to the usual method after the exclusion of students from the two groups statistically and only one student in the Division (B) and verify their equivalence in the variables (age, time and previous sports knowledge and intelligence and the previous academic achievement of the grades of the course I tested and skilled Critical Thinking)

The last four chapters of the mathematics book for the fifth grade were set to teach the students of the two research groups. The experimental and control groups studied the same subject.

I rely on the research tool: (Critical Thinking Test) which consists of (30) paragraphs divided into (five) areas (knowledge of assumptions, interpretation, arguments, deduction, conclusion) so that each field contains (6) Is the most appropriate choice for the test of critical thinking, and its validity was verified as well as knowledge of the cycometric characteristics in terms of difficulty and discrimination and the effectiveness of the wrong alternatives. The test of two separate independent samples, the difficulty and discrimina

tion coefficients, the effectiveness of the alternatives, and the ETA coefficient for calculating the effect size were adopted (statistical means of research).

In light of these results, the researcher recommended the adoption of Appleton model in the teaching of mathematics for the preparatory stage, as the results of this research showed an improvement in the level of critical thinking among the students of this stage of study.

Keywords: Impact, Model, Appleton, Critical Thinking

El efecto del modelo de Appleton en el pensamiento crítico de los estudiantes de quinto grado en matemáticas

Resumen

La investigación tuvo como objetivo identificar el impacto del modelo de Appleton en el pensamiento crítico de los estudiantes de quinto grado en matemáticas, y para verificar el objetivo de la investigación, se formuló la siguiente hipótesis:

No hubo diferencias estadísticamente significativas en el nivel de (0,05) entre la calificación promedio de los estudiantes del grupo experimental que estudian de acuerdo con (modelo de Appleton) y la puntuación promedio de los estudiantes del grupo de control que estudian en (La forma normal) en la prueba del pensamiento crítico.

La muestra del estudio consistió en 67 estudiantes del quinto grado de ciencias / biología en la escuela preparatoria de Qalat Sukkar en la Dirección de Dhi Qar. A (34) estudiantes fueron seleccionados como grupo experimental de acuerdo con el modelo de Appleton y (B) (33) estudiantes para ser el grupo de control, que se enseña de acuerdo con el método habitual después de la exclusión de los estudiantes de los dos grupos estadísticamente y solo un estudiante en la División (B) y verificar su equivalencia en las variables (edad, tiempo y conocimiento e inteligencia deportiva previa y el logro académico previo de las calificaciones del curso que probé y el pensamiento crítico experto)

Los últimos cuatro capítulos del libro de matemáticas para el quinto grado se establecieron para enseñar a los estudiantes de los dos grupos de investigación. Los grupos experimentales y de control estudiaron el mismo tema.

Confío en la herramienta de investigación: (Prueba de pensamiento crítico) que consta de (30) párrafos divididos en (cinco) áreas (conocimiento de supuestos, interpretación, argumentos, deducción, conclusión) para que cada campo contenga (6) Es el más apropiado elección para la prueba de pensamiento crítico, y se verificó su validez, así como el conocimiento de las características cuantitativas en términos de dificultad y discriminación y la efectividad de las alternativas incorrectas.

Se adoptó la prueba de dos muestras independientes separadas, los coeficientes de dificultad y discriminación, la efectividad de las alternativas y el coeficiente ETA para calcular el tamaño del efecto (medios estadísticos de investigación). A la luz de estos resultados, el investigador recomendó la adopción del modelo de Appleton en la enseñanza de las matemáticas para la etapa preparatoria, ya que los resultados de esta investigación mostraron una mejora en el nivel de pensamiento crítico entre los estudiantes de esta etapa de estudio.

Palabras clave: impacto, modelo, Appleton, pensamiento crítico

First: The research problem: -

The advancement of knowledge and the tremendous development in all fields that the world is witnessing now, pushes to use the maximum available of this technology, that modern developments affect the pillars of the educational process, especially teaching strategies and teaching methods, and the place that mathematics in the ranks of knowledge is obligatory on all Other sciences would benefit from it so mathematics paid great attention to thinking and its skills (Afane et al., 2007: 23)

Through the personal experiences of researchers in the teaching of mathematics for the preparatory stage during several years noticed that there is a clear negligence in the knowledge of the extent to which students use critical thinking as a scientific method, as the adoption of memorization and memorization as a method of teaching eliminates many types of thinking among students, these are all educational problems led researchers to A special questionnaire consisting of four questions, and distributed to a group of teachers of mathematics numbered (15) teachers and schools in (10) schools of preparatory and secondary schools of the Directorate of Education Dhi Qar and the result as follows:

- 1) 85% of teachers agreed not to use modern methods and methods in teaching mathematics.
- 2) All teachers agreed not to know the (Appleton model)
- 3) lack of knowledge in how to contribute to raising the level of critical thinking among students

There are factors that affect the thinking process and prevent it from

progressing among students while the focus of outstanding teachers on thinking and skills in teaching students where it helps them to overcome academic and life problems often these factors are:

- 1) Many teachers stick to his point of view and do not accept the ideas of students that may conflict with their ideas, which affects the thinking a lot
- 2) Many teachers in the class depend on a certain group of outstanding students and not share their ideas during the lesson.
- 3) Most teachers ask questions based on memorization by students, which leads to the development of their thinking skills
- 4) The largest role during the course of the lesson for the teacher, where he is the decision maker in the class and the role of students is marginal and is not entitled to express opinion in many cases
- 5) Relying on traditional methods of teaching, especially the method of teaching by teachers, as well as the scarcity of teachers who rely on effective teaching methods that develop thinking skills of students (Saadeh, 2006: 72-73).

Some often ask about the need to build special programs to teach critical thinking as long as we teach our students to deal with mathematical and scientific issues through the daily curriculum, but many interested in teaching critical thinking assert that what the teacher does in the classroom involves the provision of academic content (what you think) The correct way to understand and evaluate the scientific material (how to think about the material) It is noted that many teachers are able to transfer the content of knowledge to students, but the majority of teachers fail to teach students how to think of this content. (Atoum et al., 2009: 90).

The training of students in thinking skills is one of the main objectives of education, because every student has the right to logically express himself fully freely, and therefore it became necessary to provide the student with the skills that enable him to analyze the information that reaches him, think objectively and flexibly, and make critical judgments (Khawaldeh, 2002: 4)

Based on the foregoing, the problem of research emerges in the attempt to answer the following question:

"The Effect of Appleton Model on Mathematics Achievement among Fifth Grade Students and Their Critical Thinking"

Second: The Importance of Research:

The importance of the current research can be summarized in the following points:

- 1) This research (according to the researchers' knowledge) is the first local study

of the model of structural analysis with the variable of critical thinking in mathematics

2) that critical thinking is a type of advanced thinking that can not do without students, as it is one of the foundations of cognitive development and intellectual advancement as well as facing new problems.

3) Critical thinking skills enable learners to meet the requirements of the future, which will not focus on acquiring a huge amount of facts that should be taught and learned, but on the acquisition of logical and mental methods in the extraction and extraction of ideas, translation and interpretation. (Ali, 2008: 20)

4) The need to develop critical thinking for different subjects and for the intermediate stage, especially the fifth grade students.

5) Draw the attention of curriculum planners and developers to the importance of preparing the curriculum and mathematics textbooks in accordance with the Appleton model.

6) Appleton model belongs to the school of construction and is to rely on the upgrading of education or the educational learning process of the great role it plays in it.

Third: Research Goal: Goal of Research

Current research aims to identify:

The Effect of Appleton Model on Critical Thinking of Fifth Grade Students in Mathematics

Fourth: Research hypothesis: Hypothes of The Research

In order to achieve the research objective, the following hypothesis was formulated: There is no statistically significant difference at the level of significance (0.05) between the average grades of the experimental group studied according to Appleton model and the average grades of the control group students who studied the traditional method of critical thinking for the fifth grade

Fifth: Research Limits:

Current search is limited to:

1) A sample of the fifth grade students of the Directorate General of Education in Dhi Qar.

2) Topics of Chapter VI, VII, VIII and IX of the textbook of mathematics for the fifth grade of the biological section, the tenth edition of 2018, revision of a specialized committee in the Ministry of Education, General Directorate of Curricula.

3) The second semester of the academic year 2018 - 2019

Sixth: Definition of terms

Model Appleton:

Arafa (Yassin and Zeinab, 2012): An educational model through which Apple

ton tried to create cognitive scaffolding between theoretical and practice, especially between students and teachers and among the students themselves. It consists of four steps: sorting ideas, processing information, exploring information and the societal context. (Yassin and Zeinab, 2012: 152)

Arafa (Saadi, 2016): A model through which Appleton tried to establish the knowledge relations between theoretical and practice, especially between students and teachers and among the students themselves, making this model effective in structural teaching. (Saadi, 2016: 297)

Procedural definition: A teaching model represented by the steps (sorting ideas, information processing, information exploration and societal context) was used in teaching mathematics to students of the experimental group and measuring its impact on critical thinking among fifth grade students.

Critical thinking:

Gun (Gunn, 1993) points out that critical thinking is a mental process for evaluating thinking products that rely on the validity of evidence, assessing the causes, and developing logical arguments.

Arafa (Jarwan, 2010): Sensitive thinking about the situation by its potential for self-corrective controls and by relying on criteria for reaching judgments (Jarwan, 2010: 61)

Procedural Definition: It is a measure of the student's ability to respond correctly to the situations contained in the test prepared by the researcher and includes five sub-tests (conclusion, assumptions or axioms, deduction or interpretation and evaluation of arguments), which are expressed by the grades obtained by the student in the final test of critical thinking

Theoretical framework:

Theme 1: Appleton Model:

Ken Ableton is a professor at the Central University of Queensland - School of Education in Rockha Mpton, Australia. This theorist gave a paper at a conference on the effects of using constructive theory-based models in science education in Santa Cruz, California, in 1997. How Piaget's ideas, Claxton and Howard's views, and Vygotsky's views can be used in social learning through his model. (Appletone, 1997: 302)

This model was developed by Ken Appleton (1997), based on the constructivist theory, especially Piaget's vision of alignment and unbalance, and the views of (Claxton) and (Howard) on how adaptation between previous and later experiences within the student's knowledge system, especially school experiences within The societal context emphasized by Vygotsky. (Attia, 2015: 345)

Through the model, he tried to show and identify the overlapping factors, and to show these factors and find the scaffolding between theoretical and practice, especially between the teacher and students and among the students themselves, which makes this model effective in structural teaching (Asadi and Mohammed, 2015: 141).

Ableton Model Steps:

This model, when used in teaching, goes through the following steps:

1. Sorting out the ideas held by the student:

This stage is the starting point in constructive learning, which believes that the new learning builds on the previous learning, by diagnosing and sorting the ideas that students have before starting to view the content, as it uses different methods such as concept maps, interview or exploratory questions to sort the ideas of students. In the light of students' responses, experiences are organized into images of ideas and knowledge systems that can be consulted when interpreting new events and experiences that are presented to them.

2. Information Processing

At this stage, the student tries to determine the best appropriate explanation in which he or she can use to construct a sense about the new information. This state of cognitive conflict and incompatibility between what is in the student's cognitive system and new learning leads to a state of cognitive conflict that causes the student to become active in the search for what he finds from this cognitive wrestling situation.

3. Information exploration:

At this stage, students who are unable to provide complete answers to the situation need what are called scaffolds, which are hints or plucking information that will help them in reaching the full answers through research and exploration. This exploration process, as seen by the model designer, is done in many ways, including the ideas of the teacher and the teaching materials available in the learning environment, including those of other students and colleagues. Out the social context of teaching and learning that you see structural.

4 - Community Context: This stage is based on the scaffolding provided by the teacher and received by students, which represents the societal context of the lesson, which takes several forms, including verbal or non-verbal hints, or the use of similar ideas in memory or by observing manifestations of the educational situation.

(Zeitoun and Kamal, 2003: 210) (Calik & Pasayas, 2006: 5) (Zeyer et al., 2014: 419)

Past experience plays a pivotal role in determining the parameters of the student's perception of the learning situation as well as in determining the curriculum used by the student in his study with his own perception of the learning situation (Prosser & Keith, 1999: 5).

In this model, the student uses his / her prejudices to understand new experiences and information. Learning takes place when the students' prejudices are changed by providing the student with new ideas. (Appleton, 1997: 303)

Advantages of Ableton Model:

The Ableton model has several advantages, including:

- 1) The student makes the center of the educational process by activating his role, the student is looking for information.
- 2) gives the student an opportunity to develop a positive trend towards science, and towards the society with its various issues and problems.
- 3) allows the student the opportunity to discuss and dialogue with fellow students or with the teacher, which helps to grow the sound language of dialogue and make him active.
- 4) Provides students with the opportunity to reflect on as many solutions as possible to one problem, which encourages the use of critical thinking and then develops them.
- 5) Learning is contextual. The student learns through the relationship between what he knows and what he thinks, what he agrees with and what he rejects. (Ahmad, 2014: 36)

The second axis: critical thinking

Those who think critically in their lives are those who think in a rational, just and balanced way, and such people learn to discover the non-mental processes of thinking, and to think beyond. In the same vein, a number of researches have indicated that the distinctive personality traits of critical-minded individuals are ego strength, emotional stability, independence, self-confidence, personal harmony, self-sufficiency and social relations (Mahmoud, 1988).

In view of the multiple characteristic characteristics of the critical thinker, the researcher extrapolated some of these characteristics, as follows. (Jarwan, 2002; Bakheet, 2000, Radwan, 2000)

- 1) Emotional thinking about logical thinking
- 2) Do not argue about something when nothing is known about him.
- 3) Know when it needs more information on a topic.
- 4) The ability to distinguish between prejudice and reality.
- 5) Looking for reasons and alternatives.
- 6) Distinguish between hypotheses and generalizations and facts and claims.

organization (Kuznetsov, 2014). Another Empirical study shows that an 7) Takes all aspects of the position as important.

Health doubt about existing assumptions.

9) Independence in decision-making.

10) mental openness and mental flexibility.

The role of the teacher in the teaching of critical thinking: It is common among researchers in the field of education that the teacher has an important and distinct role in teaching critical thinking and stimulating students to activity and creative creative thinking instead of stagnation and stagnation, by placing the student in educational situations - distinctive learning lead to Increase on imagination, interpretation, explanation and decision-making.

The desire of teachers to achieve a love of learning and to help students understand and apply their potential creates a favorable climate in the classroom based on mutual respect, and thus realizes the meaningful learning that Ozil has long advocated.

Teachers can support critical thinking through multiple school subjects by:

1) Use the same critical thinking vocabulary, for example asking questions such as: What do you conclude, or what do you expect to have effects?

2) Work to involve students in role-playing or interpretation of phenomena where differing views.

3) Organizing counter-arguments or debates involving the participation of students in competitions and confrontations that endure more than one opinion on a particular topic.

4) Invite students to solve normal life problems where there is a possibility of more than a solution and at the same time requires the solution more than a source and a way to collect the required information.

5) Ask students questions more than one answer.

6) Assigning students to defend their point of view on an issue and explaining the reasons behind it.

Previous studies:

First: Previous studies related to the structural analysis model

1- Study (Al-Ahdal, 2012):

This study was conducted in the Kingdom of Saudi Arabia. The researcher adopted a partially controlled experimental design (experimental group and control group) with post-test experimental design for this research, the researcher prepared an objective achievement test consisting of (52) test items, as well as a test for thinking Creatively, the researcher adopted the appropriate statistical methods where the results of the research proved the superiority of

the experimental group that applied the structural analysis model to the control group in the collection and creative thinking. (Al-Ahdal, 2012, p. 1091)

Al-Jubouri Study (2016)

This study was conducted in Iraq and aimed at (knowledge of the effectiveness of teaching the structural analysis model in the innovative physical tendencies of first graders average). The experimental design was partially controlled for two equal groups. According to this design, it was chosen as the medium of the unique contract for boys. It consisted of four divisions (A, B, C, D). Two divisions were selected by random assignment to represent the research sample. They studied the traditional way.

The experiment was applied in the second semester of the academic year (2015-2016) and lasted for (8) weeks with two lessons per week. Statistical portfolio of social sciences program and data processor Microsoft Office Excel 2007, the results of the research showed the superiority of the experimental group studied according to the structural analysis model than the control group studied by the traditional method in the scale of innovative physical tendencies.

Second: Studies related to critical thinking

1- Mines Study (1980): This study was conducted in the United States of America and aimed at developing the standards of critical thinking in mathematics. The research sample consisted of (140) male and female students from Boston University distributed as follows: (60) secondary students, (40) undergraduate students - primary studies and (40) students from the master stage. Two of them to measure the ability to think critically. .

2 - Study (Obeidi, 2005): The study was conducted in Iraq, and aimed to learn the skills of critical thinking in mathematics among students of the gifted school by grade levels.

The research sample consisted of 53 students of the gifted school. Each paragraph has three alternatives.

The test was applied to a sample of (80) students from the distinguished / green high school students in the Directorate General of Education in Karkh, and the psychometric characteristics were extracted.

The test was applied to gifted school students, and the results were analyzed using Anova variance analysis and the Scheffé and Tukey tests. Research results showed that gifted school students, except for first graders, possess critical thinking skills in mathematics. (Obeidi, 2005)

(Research Methodology and Procedures):

Table 2 depicts the AVE value> 0.5. Cronbach Alpha> 0.6 and composite First: Research Methodology and Experimental Design: The experimental approach was adopted, through which the researcher can know the effect of the cause (independent variable) on the result (dependent variable). (Assaf, 2010: 277) The experimental design of post-test and partial control was used in two equivalent groups (experimental and control), which partially adjusted each other to test critical thinking. As in Table (1).
Table (1) Experimental design adopted in research

Group	Equivalence of the two groups	Independent variable	Dependent variable	Post-test
Experimental	-Tribal critical thinking test -The chronological age of months previous knowledge - Intelligence - Collecting parents	Model Appleton	• Tribal critical thinking test	• Tribal critical thinking test
Control		Usual method		

Second: The research community and its sample:
The research community consisted of all students of the fifth grade of science / biology in the preparatory and secondary government schools of the Directorate of Education in Dhi Qar for the academic year (2018 - 2019), the researcher found that the students of the fifth grade of science / biology in the prep of sugar castle for boys only two divisions and by holding lots Division (A) became the experimental group and Division (B) is the control group and the students who failed (1) were excluded from the control group.
Third: Equity of the two research groups:
He was keen to make parity between the two research groups in some of the variables that may affect the experience, namely: chronological age in months and the first course in mathematics for the academic year (2018-2019) and test scores of intelligence and previous knowledge.
Fourth: Adjusting non-experimental variables (extraneous)
In order to preserve the integrity of the experiment, some non-experimental variables that were considered to affect the safety of the experiment were seized, namely:

1. Conditions of the experiment and the associated accidents: The experiment has not been subjected to any incident that impedes its progress and affects the dependent variable besides the effect of the independent variable.
 2. Experimental extinction: The present research has not been exposed to such cases, except for cases of individual absences that occur in schools normally.
 3. Maturity factor: These variables did not affect the current research, because the duration of the experiment was short and unified for the experimental and control groups, as the experiment began on Monday, 18 February 2016, and ended on Sunday, 6 May 2016.
 4. Measurement Tool: A unified tool was used to measure the variable of the students of the two research groups. They prepared the critical thinking test for the purposes of the current research and applied it to the experimental and control groups at the same time.
 5. Impact of experimental procedures: In order to protect the experiment from some factors that may have an impact on the dependent variable, some procedures have worked to reduce the impact of these factors in the conduct of the experiment.
- A - Confidentiality of the research: The fact that one of the researchers was originally a former teacher in junior high.
- B - Subject: The two groups studied the same subject, namely Chapter VI (derivative), Chapter VII (Engineering), Chapter VIII (principle of counting and permutations and combinations), Chapter VIII (matrices)
- Distribution of classes: The two research groups studied 4 classes per week based on the distribution of weekly lessons prepared by the school.
- E - Duration: The duration of the experiment was equal to the two groups of research (12) weeks.
- Classroom Environment: The experiment was applied in one school with two classes similar in terms of environmental and physical conditions.
- V. Research Requirements The Research Requirements
- (1) Determination of scientific material: Before starting the application of the experiment was determined the scientific material taught in the second semester of the academic year (2018-2019) and the distribution of the curriculum vocabulary to the weekly classes.
 - (2) the formulation of behavioral purposes: The behavioral objectives in the cognitive field were formulated based on the content of the educational material included in the duration of the experiment and amounted to (145) behavioral purposes according to the classification (Bloom) cognitive levels of six (namely, remember, comprehension, application, analysis, composition,

evaluation It was presented to a number of arbitrators specialized in the field of education, psychology and teaching methods, and was amended in the light of their observations and suggestions. Thus, the agreed purposes became distributed among the four chapters.

(3) Preparation of daily teaching plans: prepared a daily study plan for both research groups (experimental group according to Appleton model) and (control group according to the usual way of teaching) and two models of these plans were presented to a group of experts and specialists The judges, after taking into account the observations favored by professors competent, the plans became more accurate and objective in its final form.

Sixth: Search Tool:

Critical Thinking Test

The objective of the test is to measure critical thinking skills of fifth grade students. The researcher built the test according to the following steps:

1) Determine the objective of the test: The test aims to measure the critical thinking skills of fifth grade students.

2) Access to critical thinking tests: The literature and studies conducted with the aim of measuring critical thinking skills were found. It was found that the tests were numerous and this may be due to the multiple concepts and skills of critical thinking and the theoretical basis on which it was based. On two common tests:

Watson & Glasser Test for Critical Thinking and Cornell for Critical Thinking, abbreviated to CCTT.

He reviewed several local, Arab, and foreign studies and decided that the critical thinking test should be built in the light of the skills he identified (Watson & Glasser, 1991):

(Knowledge of assumptions, interpretation, evaluation of arguments, extrapolation, conclusion). (Watson & Gasser, 1991: 120)

3) Prepare the initial version of the test

The critical component of critical thinking was identified in the light of the theoretical and procedural concept adopted. Mathematical problems and life situations that could provide an opportunity to push the respondent to the practice of critical thinking were surveyed and controversial and controversial situations requiring critical thinking were identified. The critic and the adoption of appropriate positions, while modifying and modifying some positions to conform to the objectives of the current study.

The test, in its initial form (36) positions, including (108) paragraphs (3) paragraphs for each position and these positions were distributed equally to the

five skills of critical thinking so that each covered seven positions of skills in addition to the test included instructions that show students how to answer paragraphs Test with an illustration of each test skill.

A preliminary criterion for correcting the test is given in which one score is given for each correct answer and zero for the wrong or abandoned answer.

1) Sincerity test:

It is the test that measures what is prepared to measure, which is what achieves what is not ignorant.

(Creswell, 2012: 303)

He used two types of honesty:

- Apparent honesty: According to this type of honesty, the honest test is what seems to the examiner to be honest and sometimes called honesty formal or formal because his sincerity seems to depend on the examiner that the paragraphs of this test related to the subject to which the test. (Kavah, 2003: 104)

The critical thinking test was presented to a group of arbitrators and experts and the paragraphs that received the agreement of 80% were accepted.

Exploratory experience

- Application of the test to the first exploratory sample:

Work on the application of the test on a survey sample of (30) students of the fifth grade students in (preparatory master Balagh boys) on (Monday) corresponding to (6/5/2019) m, to reveal the clarity of the test instructions and paragraphs and how difficult and formulated and time In cooperation with the teacher of the subject and during the supervision of the researchers on the application note that the instructions of the answer and test paragraphs were clear except for some words that were not understood and clarified and the time taken to answer was (35) minutes and was calculated using the following equation (the time of the first student + time The second student Qassoum on the total number of students).

- The second exploratory experiment

After confirming the clarity of the test clauses and instructions and the time taken to answer the test was applied again to a sample of (100) students of the fifth grade scientific / biology students, were selected in the junior high and aspiration secondary and Dar Alnadwa secondary school on (Tuesday) 5/2019), the students were informed of the test date a week before the application has been supervised by the researchers themselves.

3. Statistical analysis of test items:

- Difficulty coefficient: The process of measuring the ease or difficulty of the question, especially important in assessing the question and judging all the paragraphs of the test, is a necessary process is important. (Abdul Hadi, 2001:

405). After calculating the difficulty level for each test item, it was found to be between (0.31 - 0.56), which means that all test items are acceptable and applicable, and test items are acceptable if their difficulty coefficient is between (0.20 - 0.80). 2007: 170)

- Distinction coefficient: Distinction of paragraphs means the ability of the paragraph to distinguish between excellent individuals in the quality measured by the test, and individuals who are weak in that capacity, that is, the distinction between the upper and lower levels of individuals in relation to the attribute it measures (Al-Hashemi, 2013: 114). Each paragraph can not be answered by students at all levels are worthless and must be abolished, and can not be counted by which we judge the achievement of students accurately, and the strength of paragraph recognition is good if the strength distinguish (0.20) and more. (Abdul Hadi: 2002, 156) The coefficient of distinguishing test items ranged between (0.26 - 0.67), so all test paragraphs are distinctive.

Test stability:

Means the ability of the test to give the same score if it is reapplied next time to the students themselves. (Al-Azzawi, 2008: 192) The test is stable when it gives almost the same results every time it is applied to a group of students. We have almost said that the scores of students may rise or fall a little the second time, but the rank or position of the student in his group may remain constant, In this case, the stability of the test is complete (Abu Jadu, 2005: 402).

The stability of the test was confirmed by (Elfa-Crow-Nebach equation): This equation calculates the stability of the test called the alpha coefficient and this formula applies to calculate the stability whether the test parts are two halves or the test parts are multiple until all the test items are)) . (Imam, 2011: 126) The coefficient of stability in this way was (0.77) and is a very good stability index.

VII / Statistical Methods: The Statistical Portfolio of Social Sciences (SPSS) and Excel program were used to analyze and statistically analyze data and results.

Presentation and discussion of findings, conclusions, recommendations and proposals

First: Presentation of the results: (There is no statistically significant difference at the level of (0.05) between the average scores of the experimental group studied according to Appleton model and the average score of the control group students studied according to the usual method of testing critical thinking).

After applying the critical thinking test to the two research groups (e

xperimental and control) and the answers were corrected and the average scores for each group were calculated as shown in Table (12), the statistical results showed that there is a difference between the average scores of students of the experimental group (20.79) and the average The t-test was used for two independent samples that were not equal in number. The t-tab value of (1,999) at freedom degree (65), which confirms that this difference is statistically significant, Thus rejects the second hypothesis and accept the alternative hypothesis that is, (there is a difference between the mean scores of the two groups of research students (experimental and control) to test critical thinking and that this difference is for the benefit of the experimental group students), and as shown in the table (2).

Table (2)

Arithmetic mean, standard deviation and T value (calculated and tabular) of the scores of the two research groups (experimental and control) in the critical thinking test

Group	Sample	Arithmetic mean	Standard deviation	Freedom degree	T- value		Statistical significance at level 0.05(
					Calculated	Table	
Experimental	34	20,79	2,858	65	12,166	1,999	Statistical significance
Control	33	12,48	2,728				

xperimental and control) and the answers were corrected and the average scores for each group were calculated as shown in Table (12), the statistical results showed that there is a difference between the average scores of students of the experimental group (20.79) and the average The t-test was used for two independent samples that were not equal in number. The t-tab value of (1,999) at freedom degree (65), which confirms that this difference is statistically significant, Thus rejects the second hypothesis and accept the alternative hypothesis that is, (there is a difference between the mean scores of the two groups of research students (experimental and control) to test critical thinking and that this difference is for the benefit of the experimental group students), and as shown in the table (2).

Table (2)

Arithmetic mean, standard deviation and T value (calculated and tabular) of the scores of the two research groups (experimental and control) in the critical thinking test

Independent variable	Dependent variable	Calculate T-value	η^2 Value	d Value	The amount of effect size
Model Appleton	-Tribal critical thinking test	12.166	0.705	2.092	Very big

The table above shows that the Appleton model has been instrumental in increasing critical thinking among fifth grade students.

Second: Interpretation of Results:

The results of this hypothesis indicate that the students of the experimental group studied according to the (Appleton model) than the control group students who studied according to (the normal method) with a statistically significant difference in the test of critical thinking, that is, the (Appleton model) had an effect in improving critical thinking. For fifth grade students, this may be attributed to:

- 1) Instructional steps according to (Appleton model) helped students to form a scientific way of thinking in order to solve the problems they encounter by clearly identifying the problem and imposing hypotheses in order to find the most appropriate ones and to test the validity of the chosen hypothesis and interpret the consequences To apply it and thus generalize it to similar positions or find solutions to different other positions according to the scientific way of thinking.
- 2) The use of the (Appleton model) of thinking maps implicitly in his steps helped to increase the percentage of critical thinking among students, as (Hyerle, 1996) and (Smith, 2003) that using students (thinking maps) can develop their basic thinking skills, By organizing their ideas on paper, they can then improve their reading and writing comprehension and facilitate students' understanding of the material and their ability to build clear structures that encourage high levels of learning (Smith, 2003: 2), (Hyerle, 1996: 85). Teaching in accordance with the model steps was compatible with the steps of critical thinking, making students adopt the scientific way of thinking This was evident in the high scores of the experimental group students in critical thinking compared to those of the control group.
- 3) The model (Appleton) encouraged students to think because the stimulating classroom environment helped to demonstrate the thinking abilities of

students, because fear and a sense of tension hinder the process of thinking in general, including critical thinking.

4) Through the model (Appleton) varied methods of cognitive processing of information among students, where the student has the ability to evaluate the discussions and interpretation and evaluation of arguments, deduction and conclusion in the treatment of topics and thus increase the ability to think critically

5) Third: Conclusions

6) Teaching using the (Appleton model) has had an impact in improving the level of critical thinking among students of the fifth grade scientific / biological in mathematics and the size of a very large impact.

7) The use of (Appleton model) led to raise the level of scientific and critical thinking

1 Among students.

Fourth: Recommendations

In the light of the findings, interpretations and conclusions of the research, it is recommended that:

1) Adoption (Appleton model) in the teaching of mathematics for the preparatory stage because the results of this research proved the improvement in the level of critical thinking among students of this stage.

2) Training staff in the field of teaching on the use of models emanating from the constructive theory, including (Appleton model) in the teaching of students because of its clear impact in increasing and raising levels of thinking in general and critical thinking in particular for the secondary stage.

3) Urge learners to use the scientific method of thinking, especially in scientific subjects such as (chemistry and physics) as a method of solving problems with critical thinking.

4) To benefit from the results of this research in the development of the curriculum, especially scientific materials so as to adopt the scientific way of thinking.

Fifth: Proposals

To complement the current research, it is proposed to conduct studies of the (Appleton model) on:

1) Students of the educational stages (elementary, intermediate and preparatory) and for all grades in these stages to identify its impact in different study materials, whether scientific or literary and various specializations.

2) Students of the three grades according to gender.

3) Research in different dependent variables such as (acquiring concepts and thinking of all types that are not currently studied).

4) Conducting comparative studies with other independent variables of different educational models and strategies.

Sources

- 1- Ahmed, Wafa Mahmoud (2014), the impact of the Ableton model on the achievement of sociology and critical thinking in the fourth grade literary students, unpublished master thesis, College of Education for Humanities (Ibn Rushd), University of Baghdad.
- 2- Al-Asadi, Said Jassim and Mohammed Humaid Al-Masoudi (2015): Modern Teaching Strategies and Methods in Geography, 1st Floor, Safaa Publishing House, Amman, Jordan.
3. Imam, Mohammad Mustafa and others (1990), Evaluation and Measurement, University of Baghdad, Ministry of Higher Education and Scientific Research.
- 4- Al-Ahdal, Asmaa Zain Sadiq (2012): The Effect of Using Ableton Model in Structural Analysis on the Development of Creative Thinking and Achievement in Geography for Second Grade Students in Jeddah Province, Journal of King Saud University for Educational Sciences and Islamic Studies, No. 4, Volume 24.
- 5- Jarwan, Fathi Abdul Rahman (2002): Teaching thinking concepts and applications, I 1, Dar Al-Fikr, Amman.
- 6 - _____ (2010), teaching thinking concepts and applications, the fifth edition, Dar thought, Amman.
- 7- Al-Khawaldeh, Mohammad Mahmoud (2013): Philosophies of Traditional, Modern and Contemporary Education, Dar Al-Masira, Amman.
- 8.Zayer, Saad Ali et al. (2014): Contemporary Educational Encyclopedia, Vol. 2, Noor Al-Hassan Library, Baghdad.
- 9- Zeitoun, Hassan Hussein and Zeitoun, Kamal Abdel Hamid, (2003), learning and teaching from the perspective of constructivism.
- 10- Al-Saadi, Hassan (2016): Effective Teacher and Teaching Strategies and Models, Al-Yamamah Office, Baghdad.
- 11- Sa'adah, Jawdat Ahmad (2006): Teaching Thinking Skills - with hundreds of applied examples, Al Shorouk, Oman.
- 12- Obeidi, Hani Ibrahim, and others (2006): modern strategies in teaching and evaluation, I 1, Wall of the World Book, Amman.
- 13- Al-Atoum, Adnan Yousef and others (2009): Development of Thinking Skills, 2nd Floor, Al-Masirah Publishing and Distribution House, Amman.
- 14- Al-Azzawi, Rahim Younis (2002): The impact of a training program for mathematics teachers in the strategy of asking questions on the critical thinking skills of their students, unpublished doctoral thesis, College of Education / Ibn Al-Haytham, University of Baghdad.
- (2008): Introduction to the methodology of scientific research, I 1, Dar Tigris for Publishing and Distribution, Amman.

- 16- Al-Assaf, Saleh Bin Hamad (2010), Introduction to Research in Behavioral Sciences, 5th edition, Dar Al-Zahraa for Publishing and Distribution, Riyadh.
- 17- Attia, Mohsen Ali (2015): Constructivism and its Applications: Modern Strategies, I 1, Dar Safaa for Publishing and Distribution, Amman, Jordan.
- 18- Ali, Mohammed Al-Sayyed (2011): Modern Trends and Applications in Curricula and Teaching Methods, 1st Floor, Dar Al-Masira, Amman.
- 19- Olayan, Shafer Rebhi (2010): Curricula and Methods of Teaching Natural Sciences, 1st Floor, Dar Al-Masira, Amman.
- 20- Al-Kubaisi, Abdul Wahid Hameed (2008): Developing Thinking with Interesting Methods.
- 21- Kafani, Alaeddin (1983): Obstacles of Critical Thinking The Relationship between Critical Thinking and Psychological Variables, College of Education, Qatar University, Year (2), Issue (2).
- 22- Mahmoud, Aman (1988): Study of the relationship between the ability to think critically and the level of aspiration and self-concept, educational studies, Vol. 4, part 15, 236-260.
- 23- Al-Najjar, Nabil Juma Saleh (2010): Measurement and Evaluation: An Applied Approach with Applications, 1st Floor, Dar Al-Hamed, Amman.
- 24- Appleton, K, (1997): (Analysis and Description Students Learning During Science Classes Using A Constructivist Based Model), Journal of Research in Science Teaching, Australia.
- 25- CALik, Muammer & Ali Pasayas (2006): Aconstructivist- based model for the teaching of dissolution of gas in liquid, Asia-pacific foreman Science learning and teaching volume, Issue1, Article 4, p.7, June.
- Gunn, Bruce (1993): Management systems and personnel evaluation. Management Decision, Issn: 0025 - 1747, publication date 1 April, 1993.
- 27- Hyerle, David, (1996), Thinking Maps Seeing is Understanoling, Educational Leadership, Vol. (53), No. (4).
- 28- Prosser, Michael and Keith Trigwell, (1999): Understanding learning and Teaching the Experience in Higher Education. The society for Research in to Higher Education & open University press, 325 chestnut street, Philadelphia, USA.
- 29- Watson, G.B. and Glasser, E.M (1991): Watson-GlasserCritical Thinking, Appraisal form, Harcourt Brace, Jovonovich publisher, London.
- 30- Smith, Nancy. C, (2003): Thinking Maps & Write From The Beginning Theory & Empirical Evidence, Thinking Maps, Inc. (Formerly Innovative Learning Group, Inc).