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The Effect of O'Reilly's Strategy in Evaluating the Arguments and Uncovering the Mistakes and Mathematical Errors of the Third Grade Students in Mathematics

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Abstract: ***The purpose of the research is to know the effect of O'Reilly's strategy in evaluating the arguments and uncovering the fallacies and mathematical errors for The third grade students in mathematics. In order to achieve the research objective, the researcher adopted the research methodology of the two groups (experimental and control) with the post-test. Zero hypotheses were developed for research. The research community was selected or determent, which represents the third grade students of the Directorate of Education Rusafa first, The sample was selected randomly (71) students, and the sample was divided into two experimental and control groups .Parity between the two groups was performed in the variables (evaluation of the arguments, the detection of inaccuracies, the chronological age). For the purpose of collecting the data for the experiment, a test was constructed to evaluate the arguments in the final form of (9) the test of the objective type and one question of the type of pans, and the test of the detection of inaccuracies in the final form of (9) experimental paragraphs of the objective type The appropriate statistical analyzes were performed, and the cytometry properties of the two tests were ascertained. The results showed that the experimental group's students who studied according to O'Reilly's strategy succeeded over the students of the control group who studied according to the usual method in the variables of evaluating the arguments and discovering the fallacies and mathematical errors.***

Keywords: Mathematical Errors , O'Reilly's Strategy, Evaluating The Arguments , Mathematics

1. Research Problem

There is no doubt that we are in the era of globalization and in light of the rapid development of all areas, including education, we need to qualify the new generations to be able to keep up with these changes and make the right decisions. The basis of this rapid development is knowledge Which flow in different forms and fast so as not to leave a field of understanding and absorption, so in light of these challenges, the great trends of the education scientists moved from the focus on conservation and indoctrination to new strategies that train students to think and processing information and examination of evidence and discrimination of important information from other information, so that generations can keep pace with developments and continue to progress. It is therefore important to provide an educational environment conducive to discussion, questioning and reflection to encourage critical thinking, and these skills can not grow without the help of the teacher.

The recent trends in the teaching of mathematics have changed from a process in which the role of the student is negative, only the receipt of the information to be stored in the form of small molecules, easy to retrieve after a period of training and frequent mars to take another course in which the student builds mathematical information by itself and by using special way, which gives it the special meaning that makes it modify according to its knowledge (Nassar, 2009,2).

The training of learners to think in general and critical thinking in particular has become an urgent requirement in the field of education because of its role in making the learner able to think independently and objectively in making appropriate decisions, monetary education training the individual to use reason and logic Without rushing to uncover the facts and to distinguish between views, mistakes, defects, weaknesses and power of the problems and issues in daily life (Attia, 2015, p. 168).

Critical thinking is one of the important keys to ensuring an effective cognitive development that allows the individual to use his or her maximum mental potential to react positively to his environment and to cope with the conditions of life and adapt to them (Fekihi, 2006). Critical thinking consists of a set of skillsWhich is based on looking at the information and accuracy and its importance and also includes the ability to think critically in learning how to ask? And when? What questions are asked, and critical thinking skills are acquired only through systematic education strategies for learning critical thinking skills, Including the O'Reilly strategy that trains students to search for and evaluate the evidence, so the research problem can be summed up in the next question

-Does O'Reilly's strategy affect the evaluation of arguments and the discovery of mathematical errors and errors among third-grade students in mathematics?

2. Research Importance

The theoretical importance of this research can be expressed in two aspects: one theoretical and the other practical.

a) The Theoretical Aspect

1) Teaching using the strategy of O'Reilly enables learners to adopt logical solutions in any step of solution, especially that mathematics in their composition and consistency is the basis of logic.

2) The use of critical thinking strategies, including the strategy of O'Reilly enables learners to see any mathematical problem from several directions and away from private views.
3) Teaching using the strategy of O'Reilly contributes to increasing the ability of learners to self-learning by searching and searching for information.
4) That the individual has the ability to question and research and scrutiny of each information means that the individual has an open mind and flexible and the ability to make sound decisions.
5) To direct the attention of the designers of mathematics curricula to the vaccination of the curriculum sports activities to develop higher thinking skills and the formation of positive motives towards mathematics
6) Not to use the strategy of O'Reilly in the teaching of mathematics previously to the knowledge of the researcher, despite the search on the Web sites and research centers and is considered difficult to apply in mathematics to some extent.
7) Critical thinking skills, including the skills to evaluate the arguments and the detection of fallacies like other skills are not inherited and do not acquire only education and training, so it is the duties of teachers urgent development of these skills.
8) The training of learners on the skills of evaluating the arguments and the detection of fallacies contribute to the development of their abilities in higher thinking skills.
9) Training students on the skills of critical thinking in general and the skills of the evaluation of arguments and the detection of inaccuracies, especially contributes to improve their achievement.
10) The skills of evaluating the arguments and the detection of the fallacies of the basic skills of critical thinking of the calendar and highlight its importance in enabling learners to issue judgments about the development of ideas and safety, and training on these skills enables the learner to discover his ability to distinguish between positive and negative ideas when he is required to judge a case or make an assessment on a subject.

b) The Application Aspect

1) Know if there is an impact of strategy O'Reilly in the evaluation of arguments and the detection of fallacies for students in the third grade in mathematics.
2) This study provides tests for the skills of evaluating the arguments and detecting the fallacies of the middle (third medium) is no longer used. These tests have the appropriate cykometric properties for the sample of the research and this gives confidence in their future use for scientific research purposes.
3) To draw the attention of teachers of mathematics on the use of modern strategies of teaching, including the strategy of O'Reilly, which is one of the critical thinking strategies that are concerned with the search for and evaluation of the guide.
4) To direct the attention of the process of teaching the importance of the integration of critical thinking skills of Evaluating the arguments and revealing the fallacies in particular in the mathematics curriculum.
5) To draw the attention of teachers of mathematics to develop questions that develop students' higher thinking skills to develop their ability to examine the available information and thus develop logical solutions based on abstract thinking.

c) Research Aim

This research aims to calculate the knowledge of the effect of the strategy of O'Reilly in the evaluation of arguments and the detection of fallacies and mathematical errors among students in the third grade in mathematics.

d) Limits of Research

The research is determined by the following:

- The third grade students in the General Directorate for Raasafa Education in Baghdad Governorate
- Chapter 6 (Department) of the content of the book of mathematics for the third grade students I 6, 2016.
- The second semester of the academic year 2016-2017.

e) Research Hypotheses

The hypotheses of the research for the purpose of verification of the research objective The researcher put the following zero hypotheses

1) There is no significant statistical difference at the level of significance (0.05) between the average grades of third-grade students average who studied the article on them according to the strategy of O'Reilly(Experimental group) and students who studied the same subject in the usual way (control group) in the test of the evaluation of arguments.
2) There is no statistically significant difference at the level of significance (0.05) among the average grades of third-grade students who studied the average course of study according to the strategy of O'Reilly (experimental group) and students who studied the same material in the usual way (Control group) in the test of detecting errors and mathematical errors.

3. Identifying the Terms

3.1 O'Reilly's strategy

(Saadah, 2003) defines it as a 'cognitive strategy based on the role-playing style of a particular situation. The teacher makes students skeptical about the information associated with the situation to destroy the search for evidence and then evaluate it under teacher supervision (Saadah, 2003, 120).

The researcher defines the procedure as a set of steps that are based on directing the students to a particular mathematical subject and asking them to give evidence or evidence about it and whether the evidence is direct or not, and whether there is support.

3.2 Evaluate the arguments

Watson and Glaser (1991) have defined the arguments as 'the ability of the individual to distinguish between strong arguments and weak arguments, by being able to analyze them or classify them based on their relevance and relevance to the subject presented or asked.' (Watson, Glaser, 1991).

The researcher defines them as the ability of students to evaluate ideas for acceptance or rejection and to distinguish the strong arguments from the weak and to judge the

information in terms of its importance to the position presented.

-The detection of mathematical inaccuracies and errors
(Udall * Danicls, 1991) is one of the skills of orthodontic thinking, namely the identification and identification of errors and misconceptions, and falls under it to differentiate between facts and opinions, to identify information related to the object, in order to make the identification of subtle mental reasoning or false conclusions' (Udall * Danicls, 1991 68).

The researcher defines the procedure as the ability of students to know mistakes and misconceptions and identify them and distinguish between facts and opinions and distinguish important information from the information overload and identify the wrong conclusions and measured to the degree they get in the test prepared for this purpose.

4. The Theoretical Background

4.1 Thinking

Thinking is one of the mental processes that accompany man in all aspects of his life, that is, when a person thinks when he speaks and listens, and thinks when he works and plans and applies when he is raised and issued judgments or choose or make a decision, then it is a multi-faceted,So it is a multifaceted composite process without thinking of any meaningful learning (Attia, 2015, 37). Thinking in the comprehensive and meaningless sense of meaning in a given situation, or an experience that requires the thinker to meditate and consider the components of that position, can be considered as Bayer believes that thinking is a problem solving. Persis sees it as a complex cognitive process that comes after acquiring knowledge. De Bono is considered a practical skill in which one exercises intelligence based on experience (Abdel Aziz, 2009). So we can say that the disintegration, So we can say that thinking is a complex concept consists of three elements are complex cognitive processes and at the top solving problems, and less complex understanding and application, in addition to knowledge of the content of the article or subject with the availability of personal preparations, Especially trends and tendencies (Saadah, 2003).

4.1.1 The characteristics of thinking
For thinking properties can be summed up by the following:
- Distinguish between truth and opinions.
- Take time when making a decision.
- Objectivity, impartiality and control.
- Find alternatives, and balance each alternative between negatives and positives.
- Dependence on accurate information.
- Flexibility to adjust the situation in the event of new data.
- Pay attention to the search for causes, and the ability to distinguish between causes and consequences. (Jarar, 2015, 44)

4.1.2 The relationship of thinking with mathematics
The relationship of thinking with mathematics that one of the most important functions of education is to develop the ability to think in all students and in all stages and through all the academic studies. Mathematics is considered to be able to bear this responsibility. Teaching thinking by solving mathematical issues and mathematical proof is one of the important criteria advocated by NCTM (Abu Zeina, 2010).

And the nature of its construction and method of treatment of subjects, considered mathematics as one of the pillars of scientific and technological development and this has made them a fertile ground for training in sound thinking methods, because the construction is indicative of the beginning of the introduction of the pretested information. The results are derived from the use of logical rules. This is the basis of sound logical thinking, and its language is characterized by accuracy and concise expression. This is one of the factors that helps to clarify the ideas, so it is one of the most important areas that can contribute to the development of thinking methods. Because of its nature, which is related to extrapolation, reasoning and innovation (Al-Maliki, 2002).
The follower of the trends of learning and learning of thinking notes three methods adopted by theorists in the teaching of thinking, either through separate programs (explicit education and direct), or depends on another team of them on the content of teaching materials to teach thinking by these materials. A third team adopts a middle position based on a compromise between the first and second directions (Nofal, 2010 34).

4.1.3 Levels of Thinking
The researchers in the field of thinking have distinguished between two levels:
1) Thinking from a lower or basic level. Basic thinking includes many skills, including acquisition, remembering, observation, comparison, and classification, which researchers agree is necessary before the transition becomes possible to effectively meet composite thinking levels.
2) Thinking of a higher level or a composite either in terms of thinking of the upper level or composite, which can be called a comprehensive thinking and the majority of references to the existence of five types when talking about thinking at the higher levels fall under the umbrella of the composite thinking which are:Critical thinking, creative thinking, problem solving, decision-making, and meta-cognitive thinking. Each of these species includes a number of thinking skills that distinguish them from others (Jarwan, 1999, 35-36).

4.1.4 Critical Thinking
The critical thinking movement of the modern era began with John Dewey's attitudes toward thinking and inquiry, and then the attitudes of the cognitive school psychologists began to present philosophical views of relevance to Critical thinking and put it in frameworks of educational knowledge (Attia, 2015 153). Libmam (1991) asserts that high-level thinking is only a combination of critical thinking skills and creative thinking. Some psychologists insist that critical thinking is a form of problem solving .The critical thinker can make effective decisions through his ability to handle information and rationalize it. Others also prepare a scientific approach when dealing with information because the scientific method requires practicing some critical thinking skills, for example in determining the problem

solving and put hypotheses and collect and process information for appropriate decision-making (Al-Atoum et al., 2009).

And critical thinking of the vital topics that have been concerned with the education of old and recent because it is very important to enable the learners of basic skills in the process of learning and teaching, and the main goal of learning and teaching critical thinking is to improve the thinking skills of students In order to help them succeed in all aspects of their lives (Abu Jado and Neufel, 2007 225).

4.1.5 Components of Critical Thinking

Three components of critical thinking can be summed up as:

1) Cognitive components that mean thinking independently, the possibility of identifying the problem, identifying the information directly related to it and the information overload, how to process information and activate other types of thinking Such as deductive, deductive and critical thinking, and not being influenced by opinions or views that are not based on evidence and evidence.
2) Emotional components based on factors that may affect the objective thinking, so it is important to present the truth on the personal side and not to focus on the self, but accept the views, although the violation and avoid personal bias.
3) Behavioral components and based on the distinction between opinion and truth , and not to issue any judgments before confirming and supporting evidence and the use of clear and meaningful terms that express the true meaning without distortion. (Abdul Aziz, 2009).

4.1.6 Criteria for Critical Thinking

Researchers agree on a number of criteria and specifications to be met in critical thinking when addressing a particular phenomenon or situation.

1) Clarity is an essential input of critical thinking and is the main criterion for other standards, So it is important that the phrase be clear so that the speaker is understood.
2) Accuracy is a clear statement that does not mean to be correct, so it is important that the statement is true, credible and supportive.
3) Precision means the presentation of the idea or subject without increasing or decreasing.
4) Relevance: The relevance of questions and evidence to the topic of discussion.
5) Depth (Depth) depth of the subject depending on the complexity and size of the problem.
6) Breadth covering the problem in all its aspects.
7) Logical reasoning: it means finds the solution logically (Attia, 2015:162).

Al-Atoum et al., 2009, 76) added the eighth criterion is the significance of the problem and its importance compared to other problems. Characteristics of critical thinking.

4.1.7 Characteristics of Critical Thinking

Saadah in (2003) has identified eight characteristics of critical thinking, which are: asking questions, identifying problems, examining evidence, analyzing hypotheses and biases, avoiding emotional thinking, avoiding excessive simplification of things, taking into account other interpretations of things, and And carries ambiguity (HE, 2003 104). Al-Zu'bi (2009) identified several characteristics of critical thinking. Critical thinking is a learning skill.

- Controversial topics and problems are considered effective sources of education.
- Teaching critical thinking emphasizes the use of content not just gain and this is illustrated by goals, educational methods and calendar.
- Students should be their ideas and justify them in writing and be cooperative for learning and to strengthen their thinking. (Zoubi, 2009 23).

4.1.8 Teaching Critical Thinking

A person does not have the critical thinking of his instinct, but his skill is educated and requires training and training. He is not related to a certain age. Everyone can do it according to his or her mental abilities. Critical thinking needs to use other thinking skills. Such as reasoning, inductive and analytical, and it is difficult to preoccupy the process of critical thinking without supporting other thought processes (Nora and Amoush, 2013 50).

The critical need to learn critical thinking emerged at the University of California in 1980, which determined that the teaching of critical thinking was designed to explain the relationship between language and logic. This relationship should lead to an individual's ability to analyze and critique ideas and extraneous reasons.

The conclusion, or the actual research, or the assessment of the conclusion on the basis of inference, as the individual acquires the impact of cases of knowledge or beliefs and critical thinking currently emphasizes the mental attitudes and the applications of evidence (Abu Jado and Neufel, 2007 245).

Thus it can be said that critical thinking has become one of the most important goals of contemporary education in different educational systems in the world. Maiorana, 2000) points out that the goal or purpose of teaching and learning critical thinking is to gain understanding, evaluate others' views, solve problems, andbecause the three areas involve asking questions, it can be said that critical thinking is a subjective question that we use when we seek to understand, evaluate, and find solutions (Maiorana, 2000 67).

4.1.9 Critical Thinking Strategies

A group of educators and researchers have put forward a number of critical thinking strategies and skills since the 1980s, emphasizing the importance of teaching them to students regardless of the academic content (Afaneh, 1998, 40). Teachers can achieve this by using certain strategies to develop critical thinking, Mahmoud (2006) cited six strategies for critical thinking.

1) Direct teaching strategy and includes the identification of views and strategy words interrelated.
2) Bayer strategy and include the provision of components of the skill and then give enough examples of students to be absorbed with the training and then applied.
3) The strategy of the questions in which students are motivated By asking open-ended questions and upper levels (analysis, composition, calendar).
4) The strategy of dialectical issues and is through the inclusion of students in problems that require research

and investigation and information and hopes to examine, Rai and discussion.
5) Strategy to defend the point of view.
6) Inductive strategy Here the skill is provided to the students and trained on them and knowledge that are available in their minds to use them many times (Mahmood, 2006, 176).

Saadah in (2003) has identified four instructional learning strategies that can be used to directly teach critical thinking skills:
1) Smith Strategy, an educational plan to train students on the skill of evaluating sources of information.
2) O'Reilly Strategy: Students are trained to identify and evaluate the evidence.
3) Byer Strategy and used to train students on skills to be able to use life.
4) McFarland Strategy (McFarland Strategy) is one of the most critical thinking strategies for the teaching of elementary stages.(Saadah, 2003, 122-199).

4.2 O'Reilly Strategy

Kevin O'Reilly put forward this strategy in 1985 and considered that the first step to training students in critical thinking skills is to make students skeptical of everything they read or hear so that their thinking is critical for teaching them the skill of challenge.

This skill requires that the following questions be asked to the students about the subject.
- Is there a document that supports this phrase?
- What is the motive for saying this phrase or incident?
- What is the motive for saying this phrase or incident?

If the answer to any of these three questions is not answered, it can not be considered as a guide but merely as information. After answering the questions, the students are asked to evaluate the evidence, and here they must ask themselves the following four questions.
- Is the manual available primary or secondary?
- Is there a reason why the author of the manual to distort and distort or not?
- Is there other evidence supporting the first manual?
- Is it a general or special guide?(Abu Jado and Nouvelle, 2007 260).

Teachers should keep students constantly discussing topics students think about, and then show weaknesses during the discussion to make them constantly alert and the teacher can teach the skill of identifying the directory and evaluating it constantly to highlight the evidence during the discussion and then evaluate it (Afon and end, 2012 75). He explained (2003) that teaching the skill of determining and evaluating the guide starts playing roles around the subject of the lesson, so this strategy must be implemented under the supervision of the teacher and they have to train on their steps as athlete's train to train them. O'Reilly has developed a guidebook called Critical thinking Guide to help implement this strategy (Saadah, 2003,120).

4.2.1 Critical Thinking Skills

When reviewing educational literature, many opinions and classifications about critical thinking, the critical intellectual possession of these skills, and their training have a profound impact on thinking and information processing.

Thus making decisions on a subject or issue (Attia, 170, 170). Studies and educational research indicate that there are many classifications of critical thinking skills according to the number of definitions and theoretical methods explained to him. Including Watson and Glaser (1980) who divides it in to following skills:
1) Identify assumptions and indicate the ability to distinguish the truthfulness of the information from its sincerity, and distinguish between truth and opinion, the objective of the information given.
2) Interpretation means identifying the problem and determining whether the generalizations and the results are acceptable or not.
3) Induction refers to the ability of the individual to determine some of the consequences of introductions, or previous information.
4) Conclusion refers to the ability of the individual to derive a result from certain facts, and has the ability to realize the validity of the result or error in light of the facts given. 5. Strengthen Evaluate the arguments of the individual's ability to evaluate the idea, accept or reject it, distinguish between primary and secondary sources, strong and weak arguments, and judge the adequacy of information. (Watson & Glasser,1980: 13-14)

Based on what was reached at a meeting of the Delphi Commission in 1992, Peter Fashion in the United States of America identified a list of key and secondary skills of critical thinking:
- Interpretation skills and includes sub-skills (skill classification, skill to draw meaning or significance, and skill to clarify the meaning).
- The skill of analysis includes sub-skills (examination of ideas, identification of arguments, analysis of arguments).
- Assessment skills include (assessment of claims, assessment of arguments).
- The skill of conclusion comprises (examining the evidence, guessing the alternatives, and reaching conclusions).
- Explanation skills include sub-skills (skill of advertising results, justification of results, presentation of arguments).

4.2.2 Critical Thinking Skills
- Identify the facts that can be proved from the allegations. -Identify the relevant information from the linked person.
- Determine the accuracy of the information.
- The credibility of the source.
- Identify arguments and ambiguous information.
- Familiarity with the period.

Recognition of undeclared assumptions. -Is there bias. -
- Familiarize yourself with the fallacies.
- Identify the irrational paths of thinking.
- Determine the strength of the directory.

- Establish a solid basis for a practical decision to be taken on the subject.
- Predicting the outcome of the resolution.(Jarwan, 1999, 66).

O'Dall and Daniels (1991) describe critical thinking skills in three categories:

First, inductive reasoning skills are a process of reasoning, aimed at reaching conclusions or generalizations that go beyond the limits of available evidence.

Second, the skills of deductive thinkingA logical reasoning process, designed to arrive at a conclusion or new knowledge based on hypotheses or introductions and information available

Third, the skills of the thinking of the calendar means mental activity, which aims to rule on the value of the ideas or things, safety and quality(Udall * Daniels, 1991 67-68).

The researcher will explain the skills of evaluating the arguments and uncovering the fallacies as they are the dependent variables in the research.

Argument Watson and Glaser (1980) explained that individuals can evaluate, accept or reject the idea, distinguish between primary and secondary sources, strong and weak arguments, and judge the adequacy of information (Watson * Glaser ,1980).
This skill has been included in the skills of orthodontic thinking in Udall's (Danicls, 1991) 67). Daniel Anderson explains that the skill of evaluating arguments shows the ability of individuals to distinguish between strengths and shortcomings, which is important for the students, because by using these skills, the students can:

- Their participation in ongoing discussions strengthens their beliefs.
- There are some issues that are very complex and lack of confidence in the sources of information.
- Continuous research and analysis of all information and non-repetition. Anderson Students should participate in the critical discussions and search for a solution that includes all aspects of the subject in question / accurately determine where the problem lies / prepare for change when the situation requires evidence to be found / choose the best solutions / emphasizing that the best is not the best for each individual points out that it is important to encourage the that it is important to encourage the / Openness to others / inquiry and comparison of interpretations. (Alsaeed, 1995,. 65).

This skill means analyzing and tabulating available information on a topic or problem, and ranking it according to its importance and priority (Watson * Glaser 1991). The strong argument is directly related to the subject and is important either the weak argument is weak or indirect link. And consider them some of the mental characteristics that depend on the rationality of the individual and its maturity and its ability to analyze and tabulate information and can improve these characteristics as the age and maturity, and show the ability of individuals through the identification and identification of important and useful and basic and interpretation and appropriateness (Atom, 2000, 313).

The skill of evaluating arguments is one of the sub-skills identified by Facione (1998), which includes key critical thinking skills and sub-skills that fall into each skill. These skills are interpretation, analysis, evaluation, conclusion, explanation, The skill of evaluating the arguments and the skill of evaluating the claims has been incorporated into the main calendar skill (Facione, 1998, 67).

4.3 Detect Fallacies

The ability to think is very important for understanding mathematics by developing ideas, exploring phenomena, interpreting results and using mathematical conjectures, and logical thinking can not be taught, but must be part of the mental habits of students so there must be educational programs that enable students to recognize the importance of building mathematical speculation and the ability to verify them, and detect logical errors (Abu Zeina, 2010 100).

The skill of detecting the fallacies is one of the skills of orthodontic thinking, through which students can identify errors and misconceptions logically and identify them, and can distinguish between facts and opinions, and identify information directly related to the subject, and identify the weak mental reasoning (Udall * Danicls, 1991 68) .

There are three types of mathematical exaggerations:
1) Mathematical Errors, which are processes of thinking aimed at generating new knowledge by induction and conclusion by the adoption of certain rules and strategies, and the contrary , The aim of exploring rules and laws and then identifying the fallacies to find new solutions to old problems or develop new hypotheses.is a fallacy and must be identified by the student.
2) Reasoning errors ()Put the information and facts in an organized manner and address them in a logical way to reach a resolution or solve a particular problem.
3) Inductive Errors, which are mental inferences aimed at reaching generalizations beyond the limits of evidence sometimes, or information available, and the objective,The aim of exploring rules and laws and then identifying the fallacies to find new solutions to old problems or develop new hypotheses (Abu Shabban.,2010, 98) .

Al-Mayouf, 2011, believes that this skill allows the learner the ability to verify and evaluate information based on specific criteria after careful examination of the information available in accordance with the rules of logic and gradually to detect errors and logical errors and Leading to sound and accurate results. (Almaeoof, 2011, 7)

5. Previous Studies

The researcher tried to obtain some previous studies that fit the nature of the independent variables and to be used in the research procedures and comparison with the results reached, and despite the research on the Internet and research centers. However, the use of dependent variables directly, few and limited to the Iraqi studies dealt with the

skills of evaluating the arguments and the detection of inaccuracies in particular, and did not find any researcher studies of Arab or foreign independent variable did not find any study in mathematics dealt with this strategy anda summary of these studies is presented below:

no	Researcher	Education level	Students gender	Sample number	subject	Type of subject	Independent variable	Dependent variable	Results
1	Almaeeof, 2010	6th secondary grade	Male	93	Mathematics	Experimental two sets of experimental and adjustment	High thinking level questions	Collection - evaluation of arguments - the detection of mathematical fallacies	The results showed that there were statistically significant differences at significance level of 0.05 and for experimental group tests in the achievement test, the evaluation of the arguments and the detection of mathematical inaccuracies and for the experimental group
2	Saho, 2011	4th faculty grade	Male 45 Female 96		Mathematics	descriptive			The results showed that there were no statistically significant differences at significance level of 0.05, but there were statistically significant differences at significance level of 0.05 and for arguments - the detection of mathematical fallacies
3	Maolood, 2013	8th primary	Male		Mathematics	Experimental three sets of 2experimental and 1 adjustment	Thinking above cognitive-mind maps	evaluation of arguments - the detection of mathematical fallacies	The results showed that there were statistically significant differences at significance level of 0.05, for the experimental groups 1 and 2 and the experimental groups 1 and 2 exceed the adjustment group in all experiments
4	Mohamed, 2013	4th faculty grade	Male 21 Female 35		Mathematics	descriptive			The results showed there were statistically significant differences at significance level of 0.05 and for arguments - the detection of mathematical fallacies

5.1 Research Methodology and Procedures

5.1.1 Research Methodology

The researcher chose the experimental research method, from which the appropriate experimental design, which is a two-phase trial and control group, which is one of the real experimental designs,, Which represents the strategy of O'Reilly (independent variable) and the skills of the evaluation of arguments and the detection of mathematical fallacies (dependent variables).

5.1.2 Research Community

The research community is composed of all third-grade students.

5.1.3 The Sample

The researcher chose the rational medium for girls from the Directorate General for the Education of Rusafa the first to conduct the experiment for several reasons, including the cooperation of the school and its proximity to the work and housing researcher, contains three study groups and randomly selected Division B to be the group experimentation And (c) to be the control group, the experimental group consisted of (38) students, and was excluded (2) two students and the control group of (36) students and was excluded (1 One student is a supervisor to be the final preparation as in Table (2)

Table 2: Number of students in both experimental and adjustment groups

Total number of students	Excluded students	Students number	Division	Group
36	2	38	B	Experimental
38	1	36	C	Adjustment
71	3	74		Group

5.1.4 Control procedures Internal safety:

The two research groups were paralleled in a number of variables (age of time, evaluation of arguments, detection of fallacies). Five paragraphs of the tests (born, 2013) were adopted for correcting arguments and detecting fallacies for purposes of parity and table (6).

Table 6: The equivalence of the two groups of research in the age of time and the evaluation of arguments and the detection of inaccuracies

Significance Level	T value		Standard deviation	Arithmetic mean	Number of students	group	variable
	tabular	calculates					
Not significant at level 0.05	2	1.051	4.32	395.11	36	experiment	age
			4.02	394.01	35	adjustment	
Not significant at level 0.05	2	1.122	1.01	2.5	36	experiment	evaluation of arguments
			0.91	2.5	35	adjustment	
Not significant at level 0.05	2	0.972	0.89	2.5	36	experiment	detection of inaccuracies
			0.81	2.5	35	adjustment	

5.2 External safety of the design

The article teacher, The researcher trained the material school in the school on the strategy of O'Reilly and provide it with the study plans and tests of the groups (experimental and control).

- The study content studied the same course subject for the two groups.
- Experimental period The duration of the experiment was 20 study hours for the two groups of the second semester of 2016-2017.
- Distribution of Quotas The number of mathematics courses per week (5).
- Research tools The research tools were applied, namely, the evaluation of arguments and the examination of the detection of inaccuracies on the groups.
- Physical conditions The classrooms of the two research groups are equal in terms of physical properties.
- Experimental abstraction is the effect that results from leaving a number of students in the sample of the research or the interruption during the experiment. No student leaves the study or discontinues the study.

Tools of the study a - the evaluation of the evaluation of the arguments

1) Determination of the concept of evaluating the arguments After the researcher learned a number of literature that dealt with the skills of critical thinking, the researcher adopted areas (Saho, 2011) to build the test of the evaluation of arguments and areas are:
   - Ability of the ability of learner to evaluate the ideas and expect or reject it.-
   - The ability of the learner to distinguish between primary and secondary sources.
   - The ability of the learner to distinguish between strong and weak arguments.
   - Learner's ability to judge the adequacy of information. -
2) Preparation of the paragraphs in the preliminary form, depending on the previous areas The test was built and based on the general mathematical information of the students because the mathematics curriculum of the cumulative type and serialized and the first form of (10) paragraphs of the type of substantive question 9 which was explanation question.
3) Preparation of the test instructions The test instructions were put in place. The students were asked to read the paragraphs well and to pay attention to the examples if any, and to answer all the paragraphs.If a paragraph is left unanswered, the error is calculated for the purpose of scientific research.
4) Presentation of the test to the arbitrators The test was presented to a group of arbitrators in the field of mathematics and methods of teaching to ensure the validity of the paragraphs of the test, rejected one paragraph and re-wording of some paragraphs and in light of the views of the arbitrators amended paragraphs were agreed by (80%) and are ready to apply for the exploratory application.
5) The application of the survey and to know the clarity of the test paragraphs and understanding and clarity of instructions for the answer and to calculate the time taken to answer, the test was applied to a sample of (80) students from the middle of the Zahraa for girls of the research community and non-sample study and the paragraphs are clear for the students, the time taken to answer was calculated by calculating the weighted average between the first and last three students who performed the test and it turned out that (50) minutes were sufficient.
6) Correcting the test The test was corrected with one score for the correct answer and 0 for the wrong answer.
7) Statistical analysis of paragraphs

To obtain statistical indicators to test the evaluation of the evaluation of the arguments followed the following steps

- After correction, determine the total score of each student on the test.
- Ratings were ranked in descending order from the highest score (12) to the lowest grade (3).
- Size of the survey sample was (80) students, and identified what represents (50%) from the lowest degrees.

After calculating the correct answers for the upper and lower groups, the following statistical analyzes were performed:

a) Calculate the coefficient of discrimination for each of the test paragraphs by using their equation and find that their value ranges between 0.27- 0.75, and these indicators are a good indicator of the acceptance of the paragraphs.
b) Calculation of the difficulty coefficients of the paragraphs by type (pans and objective) and the results areranged between (0.33-0.69). These results are acceptable. The sources indicate that any paragraph in the distribution of difficulty coefficients ranges from 0.20 to 0.80 with a mean value of 0.50 and is recommended to be retained.
c) The effectiveness of the incorrect substitutions for the substantive paragraphs was calculated for the test scores by finding the difference between the number of students who chose the alternative from the upper group and the number of students who chose the same alternative from the lower group divided by the number of students in one group.

5.3 Extraction of cykometric properties to test the evaluation of the arguments

Honesty Validity Coefficient as three types of honesty were extracted
A - The truthfulness of the face virtual Validity The test on a number of arbitrators in the disciplines of mathematics and methods of teaching and view their views one paragraph to make sure that each field there is more than one paragraph to measure and got the paragraphs on the proportion of the agreement more than (80) and thus be honest test content.
C) Construction validation using the Pearson correlation coefficient to measure the internal consistency of the test by linking each paragraph to the test as a whole and the ratios were deleted and the other paragraphs got the acceptance of (80%) so that all the paragraphs of the scale became accepted.

B - Content Validation Although the test paragraphs were presented to a group of arbitrators who showed that the test was ostensibly honest, the researcher wanted to verify the authenticity of the content because the apparent honesty is not enough. So she presented the test construction areas with the paragraphs on a group of expertsbetween (0.368 - 0.689), all of which were at the significance level (0.05) except for two points that were at the level of (0.01) and Table (3)

Table 3: Shows the correlation coefficients of each paragraph in the total summation

قيمة معامل الارتباط	الفقرات
0.401(**)	1
0.368(*)	2
0.431(**)	3
.0.501(**)	4
..374 0(*)	5
0.392 (**)	6
0.659(**)	7
0.385(**)	8
0.495(**)	9

(**) means a function at the level (0.05)
(*) means a function at the level (0.01)

The Reliability The stability was obtained by using the Alpha Kronbach equation, which is valid for both the objective and the transitional paragraphs, and the stability was (0.77). Thus, the test of the evaluation of the arguments has the truth and the acceptable stability and its paragraphs acceptable in terms of difficulty and discrimination. This is ready to be applied to the research sample as final.

5.4 The test of detecting the fallacies and mathematical errors

5.4.1 Determination of the concept of the skill of detecting the fallacies and mathematical errors
The researcher relied on the background of the theoretical research that was presented in determining the skill of detecting the fallacies, and adopted areas of the study (Saho, 2011):

- Ability to differentiate between facts and opinions.
- Ability to identify relevant information.
- Ability to recognize wrong conclusions.

5.4.2 Preparation of the test paragraphs
In the initial form The test paragraphs were composed of (9) paragraphs of the objective type, which were developed depending on the previous areas and was based on the cumulative mathematical information of the students to put these paragraphs.

5.4.3 Preparation of the test instructions
To complete the initial test, the instructions were prepared to ensure that the results of the test are for the purposes of scientific research only, and asked the sample members not to leave any paragraph without an answer.

5.4.4 Getting the opinions of the experts
After the completion of the test and its instructions was presented to a group of arbitrators in the methods of teaching mathematics to express their opinions and observations and in light of which some modifications were made to some of them.

5.4.5 The survey sample
In order to ascertain the clarity of the test paragraphs and their understanding by the survey sample and the clear instructions to answer it, and to calculate the appropriate time for the answer, the test was applied to a sample of (80)female students. Of the requests of third grade intermediate and non-research sample (medium Zahra for girls) were asked to read the instructions first and then attention to the paragraphs of the test and inquire about any ambiguity, and it became clear that the instructions are clear as well as the paragraphs of the test is understandable for all students.

The time taken to answer was calculated by calculating the weighted average between the first and last three students who performed the test and was (45) minutes sufficient.

5.4.6 Correcting the test
The correction key (0,1) is adopted as the paragraph is either correct or false.

5.4.7 Statistical analysis of the test paragraphs
The difficulty coefficients were extracted and the ratios ranged from 0.32 to 0.81. these percentage are considered acceptable percentages but the percentage of discrimination was between (0.27-0.69) and these values are also an acceptable value.

5.5 Validation of Coefficient

5.5.1 Face validity
The test was presented to a number of arbitrators from mathematics disciplines and teaching methods who supported the fact that the test clauses were appropriate for the purpose for which they were developed. Thus, the test is ostensibly honest.

5.5.2 Honest content
The areas of the skill of detecting inaccuracies were presented with the test paragraphs on a group of arbitrators to ensure that each field had one or more paragraphs to measure and the test obtained the proportion of the arbitrators agreement (80%).So the test became honest.

5.5.3 Constrict Validity

Using the Pearson correlation coefficient, the correlation coefficient for each paragraph was calculated with the total number of tests. The results ranged between 0.410-0.763. This indicates the internal consistency of the test paragraphs. These results are effective at the significance level (0.05) and Table (4).

Table 4: Correlation coefficients of each paragraph in the grand total

الفقرات	قيمة معامل الارتباط
1	0.428(**)
2	0.537(**)
3	0.439(**) 9
4	0.601(**)
5	0.410(**)
6	0.582(**)
7	0.429(**)
8	0.736(**)
9	0.480(**)

(**)means a function at the level (0.05)

5.5.4 The Reliability

Was extracted by using the Kyoder-Richardon 20 equation because it was suitable for the paragraphs to be answered (0,1), and the stability (0.85) was acceptable stability. Thus, the error detection test is ready in its final form for application to the sample.

5.5.5 The results

The results were analyzed in order to achieve the objectives of the research and to answer its hypotheses. The data were analyzed for the significance of the statistical differences between the computational domains using the statistical file (SPSS). The results related to the research hypotheses will be presented and explained in the light of what is reached.

5.6 Results depending on the evaluation of the arguments

The experimental mean of the experimental group scores was 9.38 and the standard deviation was 1.97. The arithmetic average of the control group scores was 6.31 and the standard deviation was 3.35. By comparing the sensitivity means, It is clear that the strategy of imagination has an impact on educational attainment and for the benefit of the experimental group. Further confirmation In order to support the above results, the validity of the first zero hypothesis was tested by applying the T-test for two independent samples.
The results, as shown in Table (5)

Table 5: t-test of two independent samples of the two groups on the evaluation of the arguments

group	significance level		T value	Standard deviation	Arithmetic mean	Number of students	group
	tabular	calculated					
Significant at level0.05	2	5.65	1.97	3.88	9.38	36	experimental
			3.35	6.60	6.31	35	adjustemtal

By notifying the above table , the calculated t test value is(5.65) which is considered higher than the tabular value (2) in significant value of 0.05 and freedom degree of 69 which refers to the statistically difference in the arguments evaluation test, so that the zero suggestion theorem has rejected and the alternative theorem is accepted.

5.7 Effect Size

The size of effect refers to the importance of the results which gets by the researcher, and it interests is measure the size of the effect which happened by the independent variable in the dependant variables and in this field the researcher had depended on the Kohen equation which is considered as a direct way which finds the differences between the means of the two groups (experimental, and adjustment) divided by the standard deviation for the control group, and Kohen had suggested classification to determine the levels of the effect size, and he considered that the size of effect is about (0.2) is a low value and if the value is 0.5 it will be considered as a medium value, nut if the value is about 0.8 this value is considered as a high value (Almunaizel, 2000, 321) as the following:

Effect size = the mean of the experimental group – mean of the adjustment group/ standard deviation for the control group

Effect size= 9.38-6.31/3.35= 0.91
This value is considered a very high value which obtained by the researcher as described by (Kiess, 1996) and table 6 has shown that as the following:

Effect value	Value of effect size
less	0.2-0.4
medium	0.5-0.7
high	0.8 and above

5.8 Results for the detection of Mathematical errors

The mean of the experimental group scores was 6.33 and the standard deviation was 1.92. The arithmetic average of the control group scores was 4.34 and the standard deviation was 2.15.By comparing the arithmetical averages of the two groups, it is clear that O'Reilly's strategy has an impact on the detection of mathematical errors and errors among the third grade students in the average and in favor of the experimental group.

In order to support the above results, the validity of the second zero hypothesis was tested by applying the T-test for two independent independent samples. The results as shown in Table (7)

Table 7: t-test for two independent unequal samples for the research group for the test of errors detection

significance level	T value		Standard deviation	differences	Arithmetic mean	Number of students	group
	tabuler	calculated					
Significant at level0.05	2	4.15	1.92	3.68	6.33	36	experimental
			2.15	4.62	4.34	35	الضابطة

From the observation of the table above, it is clear that the calculated t-test value (4.15) is higher than the scale (2) at the significance level (0.05) and the degree of freedom (69), indicating that there are statistically significant differences in the test of detecting the fallacies. The alternative hypothesis is accepted.

Effect size = the mean of the experimental group – mean of the adjustment group/ standard deviation for the control group

Effect size= 6.33-4.34/2.15= 0.92
By comparing the results with the table (6) we can notice that the level of effect size is so high.

6. Results Explanation

Many authors assist that the critical thinking is considered one of the high thinking criteria and the criteria of the mathematical thinking defined as9 un traditional criteria because it participates the student to gain the thinking styles which enable them to solve the problems in different ways and not only remembering the equations and theorems of mathematics , so the exceeding of the experimental group in the tests of the arguments evaluation and detection of the errors is considered the real using ofusing the O' relly strategy Which depends on the work of a problem or position and then search for the cause and evidence available and whether there is evidence supporting all this has contributed greatly to the development of the capabilities of students in the search and scrutiny of evidence, especially that the engineering requires logic and support the steps of the solution because proof in engineering requires a manual or mathematical proof for each step and asking Is there more than a mathematical support for any step in the solution and if there is more than a bond requires evaluation by choosing the best and to serve the solution, and the use of the method of collective discussion of the steps of the solution in a logical manner or to evaluate the solutions offered mathematically contributed significantly to the development of female studentsOn the detection of mathematical fallacies and where lies within the solutions put forward, especially if the solutions at the outset and at first glance seem logical and acceptable.

7. Conclusions

1) Teaching according to O'Reilly's strategy has developed the skill of searching for mathematical evidence and evidence for each step in the solution.
2) The students increased boldness in the classroom discussions and express their views on sports topics.
3) Focus on logical arguments to support the steps of the solution and Thus deepening the understanding of mathematical material.
4) Made the lessons of engineering more fun because it is based on understanding and examination and investigation of information and provide logical reasons away from the deaf conservation of theories and axioms.

8. Recommendations

In the light of the current research results, the researcher recommends the following:
1) Instruct teachers and teachers to modern strategies that encourage students to think and develop mental abilities, including the O'Reilly Strategy.
2) Emphasize the importance of training students in critical thinking skills, in general, the skills of evaluating the arguments and revealing the fallacies in particular because of their great importance in helping them to make sound decisions and reflect on their daily lives.
3) To approach the curriculum designers at the Ministry of Education to review the mathematics curriculum in general and the engineering curriculum in particular to present it in a way that motivates the students to think, research and research and not to turn them into theories of conservation only.
4) Holding training courses for teachers to use these strategies, o includes O'Reilly.
5) To enrich mathematics curricula with mental activities that stimulate students to think, research, identify information and identify arguments and evidence.

9. Suggestions

Suggestions and updates to the current research The following researcher proposes to ;
1) Conducting a similar study for students and for the same stage to know the results and compare by sex variable.
2) Conducting a similar study for junior high school students
3) Conducting a study using the strategy of O'Reilly and knowledge of their effect on collection.

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