

The Effectiveness of Teaching Around Wheel Strategy of The Female Students of Fourth Scientific Stage Achievement in Mathematics

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Article Info	Abstract
<p>Article History</p> <p>Received: August 15, 2020</p> <p>Accepted: September 15, 2020</p> <hr/> <p>Keywords Teaching around wheel strategy, Achievement</p> <hr/> <p>DOI: 10.5281/zenodo.4149486</p>	<p><i>The research goal is to know the effectiveness of Teaching around wheel strategy of female students of fourth scientific stage achievement in mathematics, and to achieve That, the experimental method and the design of equivalent groups with the post - test for two groups (experimental and controlled) was adopted. The sample of research was selected randomly and consisted of (70) female students from the female students of fourth scientific class, by (35) female students of the experimental group who studied according to teaching around wheel strategy, and (35) female students of the controlled group who studied according to the ordinary method, and made the balance between the two groups of research in variables (intelligence, previous requirements, age calculated by months, previous achievement in mathematics). Achievement post-test was built consist of (40) items include (25) items of subjective question (multiple choice) and (15) items of essay question. At the end of the experiment the test was applied, and after processing the results statistically their appeared a difference with statistical significance between the average of experimental group degrees which study with teaching around wheel strategy and the average of controlled group degrees which studied according to the normal way, to the benefit of the experimental group.</i></p>

1. Introduction

Teachers of mathematics notice that students suffering in absorbing many mathematical subjects and not mastering the basic skills of this material and subsequently the being weak of mathematics attainment, and there may the most important weakness reasons of understanding the mathematics subjects is the teaching way and how to organize, where there many teachers deal with a teaching techniques that ignore what students have of abilities and preparation and ignore their teaching techniques, in addition to the lake in knowledge of those teachers of how to deal with each technique of teaching techniques which lead to the weakness in students educational attainment. (Alhaedri, 2015:2)

Multiple local studies indicated to the achievement drop of secondary stage student in mathematics like (Al-Sarry, Meeaad&Gofran Jasim,2017) and (Al-Sarry, Meeaad&Jihad Nasser,2018), in general the reason of this drop is belonging to the traditional teaching techniques used in our schools.

Because the teaching around wheel strategy deals with the four thinking and teaching methods introduced by the scientist (Ned Herman)in his theory of brain dominance, so this strategy may meets the educational needs of students.

Based on the above we can identify the research problem by answering the following question:

Is the teaching around wheel strategy has an effect in achieving of female students of fourth scientific grade in mathematics?

Second: the research importance

We can clarify the importance of this research in two sides:

Side1: the theoretical importance

- 1- It benefits the researchers in dealing with new entries relating to strategies adequate to modern educational trends.
- 2- The researchers and teachers can make advantage of the achievement test which will be built, and the scale of thinking patterns according to the Herrmann theory which will be approved.
- 3- The lake of studies that take the subject of teaching around wheel strategy, where found only one Arabic study which is the study of (Al Rashood, 2011) in Saudi Arabia, and it is – according to the researchers- did not made it in mathematics – or any other field- in general education stages in Iraq, which make this study one of the pioneering studies in this field.

Side2: Applied importance:

- 1- Attempting to resolve the problem of low achievement mathematics for secondary stage.

- 2- The opportunity for female students to learn mathematics by different methods suits with their thinking and learning style in addition to their potential and capacity.

Third: the research goal

The current research aims to know the effectiveness of teaching around wheel strategy to achieve mathematics of female students in secondary stage.

Fourth: the research hypotheses

To fulfill the research goal the following null hypotheses will be tested:

There is no statistical significance difference at significant level (0.05) between average degrees of female students of the experimental group (which study mathematics according to teaching around wheel strategy) and the average degrees of controlled group (which study mathematics according to regular method) in achievement test.

Fifth: research limitations

- 1- Female students of fourth scientific grade from secondary stage female students of secondary schools followed to Baghdad educational directorate / Alkarkh Alawla.
- 2- The second semester of the school year (2016-2017).
- 3- Chapter 5 (Vectors), chapter 6 (coordinate geometry), chapter 7 (statistics) of the mathematics textbook for fourth scientific grade.

Sixth: the terminologies definitions

Teaching around the wheel strategy:

- 1- Defined by (Tuculescu and others):

It is a strategy that require a planning from teacher and producing a series of educational episodes contain all four educational methods, where teacher ensure the fulfilling of all educational needs of students as educational experiment rich with learning techniques, which every student will be in a challenge to master the basic facts (mastering), and using critical thinking and analyzing skills (understand), discovering information and applying it (subjective expression), and connecting what they learn in life and personal experiments (interpersonal) (Tuculescu and others, 2002,164).

- 2- Defined by (Al Rashood)

It is a strategy where there will be planning and producing seminars aims to achieve balance through developing the four educational methods to fulfill the educational needs of students like (mastering the basic facts, understanding, self-expression, and interpersonal knowledge) where the students' knowledge becomes deep and whole and rememberable. (Al Rashood, 2011:194)

Achievement

- 1- Defined by (Abu Jado) as:

It's the sum of what student learns after a period of time, as a degree that student get in achievement test to know how successful the strategy is which made and planed by teacher to achieve his goals, and what student get from knowledge translated as grades. (Abu Jado, 2003:455)

- 2- Defined by (Alhareri, 2010) as:

It's the student achievement of knowledge and school skills in scientific and organized method. (Alhareri, 2010: 200)

Conceptual framework

First: Brain based learning theory:

This theory takes the assumptions that made by neurology researches which indicates that brain learns better if left to its nature, where the teachers will be mistaken if they expect their student will learn according to the method they teach with. (Alsalty,2009:27)

It includes knowing the brain rules that lead to meaningful learning and organize the learning according to these rules. (Caine and Caine, 1997:25), also it's learning theory based on the full understanding of human brain which branches from many science fields like Chemistry, psychology, neurology, ... etc, and by taking advantage of what we know about brain we made a better decisions and impart understanding to biggest number of learners without losing attention of anyone. (Jensen,2000: 77)

Brain based learning theory ensures that every human brain has different and multiple capabilities and skills which are different from individual to another according to physiological maturity of each brain and the brain capabilities affected directly with environmental and biological effects, which lead to distinguish a somebody brain with a better capabilities better than another one at the same age, where the genetic side, social environment and cultural composition have effect in acquiring and refining the skills and capabilities of individuals. (Afanah Yousif, 2009:97)

Also, the Brain based learning theory has twelve principles, can be summarized as following:

- 1- The brain is a vital organ and the brain with the body are one dynamic unit.
- 2- Mind/ social brain.
- 3- Searching of meaning is innate.
- 4- Searching for meaning happened through profiling.

- 5- Emotions is critical in for profiling.
- 6- Every brain/ mind aware and create parts and whole synchronously.
- 7- The learning includes both focused attention and terminal perception.
- 8- The learning always includes a conscious processes and non-conscious processes.
- 9- There will be two ways to organize memory at least.
- 10- Learning is evolutionary concept.
- 11- The complex learning supported with challenge and limits with threats.
- 12- Each brain organized in a unique way. (Mahmood, 2006:288-299)

Second: Herman Theory of Brain Dominance:

This theory started in 1976 when the scientist Herman started to think about how to invest and recruit brain researches to serve human development, understanding human behavior and knowing the mean affect this behavior, in addition to develop means to limit what if there probably preferences for thinking patterns can be identified and measured for different individuals, and Herman succeeded to achieve his goal when he produced another concept to understand the brain functions through the theory of brain dominance or four quadrant model which consider a metaphorical explanation to the preferences of knowledge and thinking patterns human have, that done by dividing brain into four regions, each region represent a dominating pattern of thinking, which work together to form the whole brain but there will be a single region or more which dominate more than others. (Al Rashood, 2010:190-191), (Nawfal and Abu Awaad, 2007:144)

This theory divided the brain according to learning features to upper part (left and right) specialized to conceptual and abstraction, and lower part (left and right) specialized with emotions and interiority, in addition to dividing brain to left upper part specialize with logic and quantity and left lower part specialized with sequencing and organizing, in addition to right upper part specialize with concepts and visuality and right lower part specialize with personality and emotions, in general the right side is not textured while the left side is fully textured. (Rawashdah and Nawafiah and Alomari, 2010:362)

About the describing of the four-thinking pattern, (Mahmood, 2006), (Zaetoon, 2008), and (Nawafiah, 2008) mentioned the following:

1- Left model thinking processes

This side is dividing into two parts:

A- Upper left brain

It called objective thinking pattern and it symbolized with (A), and the person who this part is dominate will specialized with the following features: logical, reasonable (justificatory), truthful, theoretical, analytical, quantitative, mathematically, critically, technical, financially.

B- Lower left brain

It called operant cerebration pattern and symbolize with (B) and the person who this part is dominate will specialized with the following features:

Serial, organized, detailed, planed, operant, ruled, guided, conservative, structural determinant, not risky, temporal.

2- Right model thinking processes

This side divided into two parts:

A- Lower right brain

It called the emotional thinking pattern and symbolize with (C) and the person who this part is dominate will specialized with the following features:

Interpersonal, emotional, sensory kinetic, symbolized, technical, spiritual, expressive, emotional, supportive, verbal, reader, writer.

B- Upper right brain

It called creative thinking pattern and symbolized with (D) and the person who this part is dominate will specialized with the following features:

Visual, thoroughness, creative, imaginary, wholeness, conceptual, synthetic, synchronous, intuitive, self-explorer, initiative, innovative, risky.

Third: teaching around the wheel strategy

(Silver & Hanson) produced teaching around the wheel strategy as a strategy benefits leaning school subject deeply, because learning deeply achieved by learning the school subject with every style of four learning styles (mastering, understanding, self-expression, interpersonal), mastering style used to learn facts and procedures, understanding style used to learn concepts and critical analysis, expression style used to learn personal concepts and expressing emotions and values, at last the interpersonal style used to learn creation and genuine applications of school subjects, in other word dealing student with what he learn. (Silver & Hanson, 1998:153)

Not that the four learning styles (mastering, understanding, self-expression, interpersonal), where produced by (Silver & Hanson) as a base to discover how gathering the four basic functions to form the learning process and directed education, and two styles of these four styles consist of perceptual preference (sense or intuition), and

the other two consist of judgmental preference (thinking or feeling), and result of that four probable groups of students, as shown in the figure (4), as following:

- 1- Thinkers – sensual (mastery learners): they will be realistic, practical, care about truth, the called mastery learners because they seek to master skills and content.
- 2- Thinkers – intuitionals (understanding learners) they will be theoretical, reasonable, oriented towards knowledge, they called understanding learners because they take thoughts thoroughly and inclusively to reach understanding.
- 3- The subconscious – intuitive (self-expression learners): they will be curious, insightful, imaginative, and they called self-expression learners because they always seek for a creative and unique ways to express themselves.
- 4- The subconscious- sensual (interpersonal learners): they will be socialists, friendly, and they called interpersonal learners because they seek continuously for the relation between what they learn and their own personal experiences. (Silver & Strong & Brainie, 2006:29-33)

To achieve the balance in the four thinking and learning patterns according to Herrmann theory of brain dominance in accordance with learning principles based to brain, Dr. (Jawahir Bint Sawood Al Rashood) – Prof of curriculum and methodology of science teaching in university of Alamerah Norah Bint Abdulrahman in Alriadh- developed teaching around the wheel strategy which produced by (Silver & Hanson) and produced it with new stages derivative from The Conative Instructional Model and adding two stages to fit the four thinking patterns, and this strategy will be the experimental factor in current research, and before telling the details of this strategy stages, we should clarify the Conative Instructional Model which this strategy was derivates.

The Conative Instructional Model

(Alnajdi and Saudi Alrashid) mentioned this model was created by (Daniel Neale) and (Charles Anderson) and a group of their colleagues in (1987), and they make advantage in clarifying the model from ideas from (Learning cycle) and (advance organizer) and (direct instruction) and (concept map). (Alnajdi and Saudi and Rashid, 2005:445)

Zaitoon defined it as one of the blended teaching based on theoretical thesis derivative from multiple intellectual orientations which is:

Behaviorism theory, constructivism theory, meaningful learning theory of (Ausubel) also it reflects (Jean Piaget) thought. (Zaitoon, 2003:211)

The model contains 9 stages: direct learning/ producing, check, review/ the overall outlook, surveys/ activities, clarification/ expressions/ recording/ representing, dialogue and discussion, organizing the knowledge constructive, applying, summarize and closure). (Alnajdi and Saudi and Rashid, 2005:446-447)

(Al Rashood, 2011) add to these stages another two which are fellings expression and awareness construction to form teaching around wheel strategy based on Herrmann theory of brain dominance and brain-based learning, the following are the detailed stages of this strategy:

Teaching around wheel strategy stages

Teaching around wheel strategy was designed according to the following stages: (Al Rashood, 2011:197-199), Al Najdi and Saudi and Rashid, 2005:446-447)

First stage: presentation stage: in this stage the students supplied with an introduction comprise the title and the lesson goals in specific points, and the purpose from this presentation is to focus the student attention on what need to be done in lesson and push them to participate in lesson.

Second stage: review stage: in this stage some questions will be asked to review the previous experiences and attempt to link them with the new ones, in addition to preparing students to absorb the novelties in current lesson.

Third stage: the overall outlook stage: here will be review to the lesson content in general like forming it in organized and advanced shape presented by teacher.

Fourth stage: investigation and activities stage: the students solve activities according to information presented in the previous.

Fifth stage: recording and representation: the student record all results and solves been reached and represent them as graphics, maps of concepts, tables or reports.

Sixth stage: dialogue and discussion stage: here will discuss the results recorded by students in the previous stage and detect any misunderstanding about some concepts, where teacher ask some questions like: What did you find? What have you done? What's your conclusion?

Seventh stage: Organized cognitive Structure: here ideas and conclusions made in the previous stage will be formed and organized by guiding students to draw mind map or concepts map.

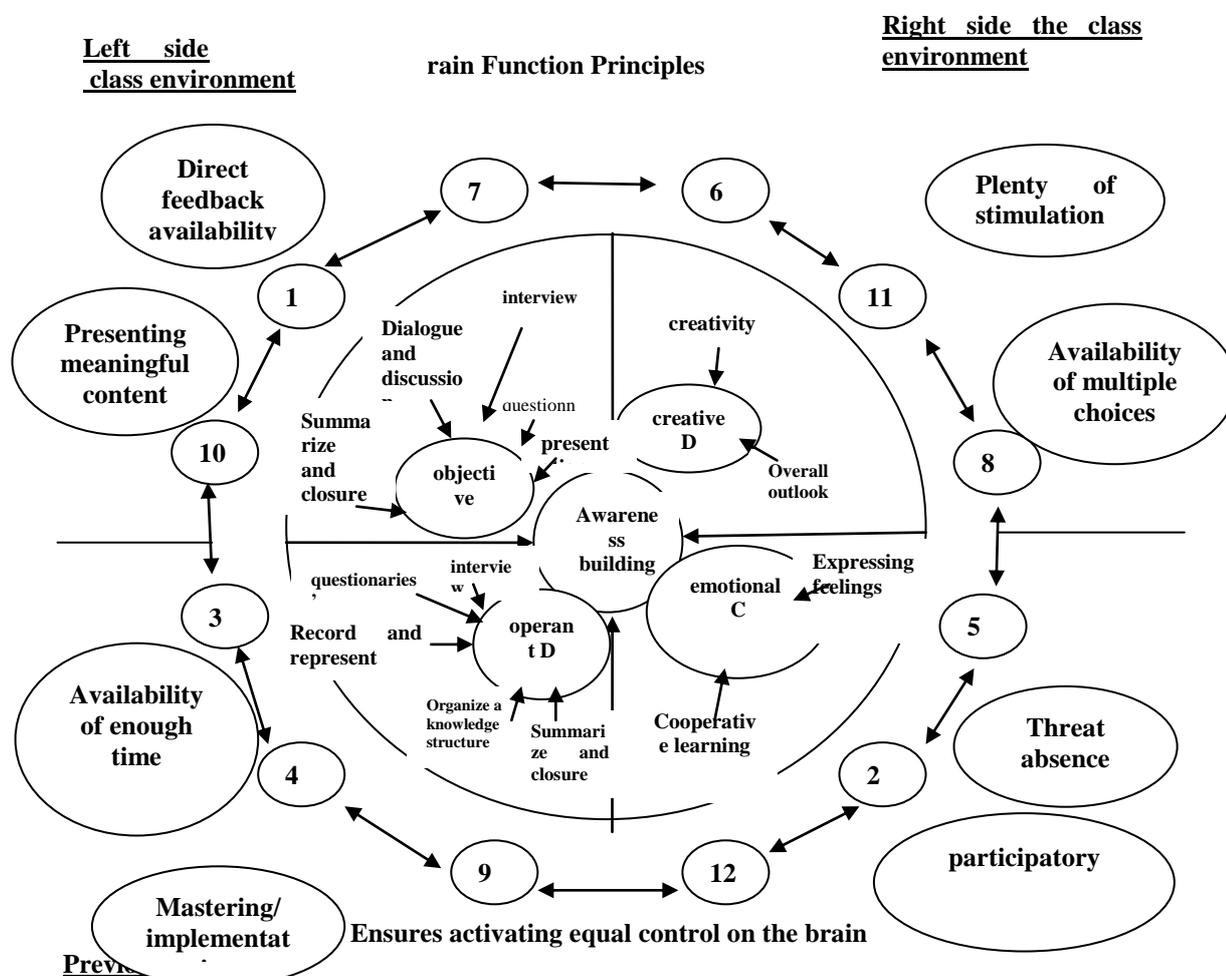
Eighth stage: creativity: is this stage the thinking guided towards creativity or towards non reasonable thinking Where there will be suggestions of creative Solutions or asking question with creative and renewal field.

The ninth stage: closure or summarizing: here what have taught in lesson of results and explains and full explanations will be summarized.

Tenth stage: expression feelings: the positive human effects are found, where teacher guides students to write about their feelings and express them in different ways.

Eleventh stage: consciousness: students' self-awareness is developed in this stage, and the importance of these concepts in their life and how to use them in a functional way and guide students to make what called awareness treasure where after most stages' students guided to think in how to make use of this information in their life and keeping that in awareness treasure.

The following is a scheme shows the relationship between strategy stages and four thinking patterns according to Herrmann theory (Objective (A), Operant (B), Emotional (C), Creative (D)), and the twelfth principles of learning based to brain, as following: (Al Rashood, 2011:200)



Previous

There is no studies made about teaching around wheel strategy except one study (Al Rashood, 2011) which done in Saudi Arabia, and aimed to know the effectiveness of teaching around wheel strategy based on Herrmann theory and learning based on brain in developing conceptual absorbing in Chemistry and thinking patterns which female students in secondary school have in Alreadh city, where the sample consists of (56) female students of first secondary class (fourth scientific) and distributed into two groups, controlled group contain (28) student and experimental group contain (28) student.

To achieve the research goal, the researcher prepared two tools, the first one is conceptual assimilation test, and the second tool is a sample of Herrmann measures for thinking pattern.

The two tests implemented before study on the female student of the study sample, and after the experimental group subject to the experiment and finish it, the test repeated on same students, and after processing the results statistically, the results shows that teaching according to teaching around wheel strategy has effectiveness in developing conceptual assimilation in Chemistry and thinking patterns for female students of secondary school in Alreadh city.

Research method and procedures:

First: research method and design:

To achieve research goal, the experimental method was adopted, also adopt equivalent groups with posttest for the two groups (experimental and controlled), as shown in the following table:

Teaching around wheel strategy scheme

Groups	Equivalence the two Groups	Independent Variable	Dependent Variable	Post Test
Experimental group	1) Intelligence 2) Previous information	Teaching around the wheel strategy	Achievement	Achievement test
Control group	3) Age calculated in months 4) Previous achievement in mathematics			

Second: research community and sample:

A- Research community: the current research community were specified with female students of fourth scientific of Baghdad general directorate of education/ Alkarkh Alola, school year 2016-2017.

B- Research sample: research sample was chosen randomly, which contain (70) student of fourth scientific, by (35) student for the experimental group who studied according to teaching around wheel strategy and (35) student for the controlled group who studied according the normal method.

Third: the equivalent of the research groups

Research groups ensured to be equivalent in the valuables (intelligent, previous requirements, age, previous achievement in Mathematics, and the results were as shown in following table:

Table of equivalence the two groups

Variables	Groups	N	Mean	Std. Deviation	df	t-test calculate	t-test tabular	$\alpha = 0.05$
Intelligence	Experimental	35	25.714	7.7481	68	0.313	2	Non-statistically significance
	Control	35	25.086	9.0241				
Previous information	Experimental	35	10.343	4.0289	68	0.236	2	Non-statistically significance
	Control	35	10.6	5.0246				
Age calculated in months	Experimental	35	189.057	7.9296	68	0.275	2	Non-statistically significance
	Control	35	189.686	10.9538				
Previous achievement in mathematics	Experimental	35	71.2	16.6906	68	0.157	2	Non-statistically significance
	Control	35	70.514	19.8159				

Fourth: the research requirements:

1- specify the scientific material: the scientific material which studied to the research groups specified in (fifth unit / vectors, sixth unit/ coordinate geometry, seventh unit/ statistics).

2- Formulating behavioral goals: (165) behavioral goal was formulating and for the school content according to the six levels of Bloom taxonomy (knowledge, comprehension, application, analysis, construction, correction)

3- Preparing the teaching plans: teaching plans were prepared for both experimental and controlled groups and shown to experts to correct them.

4- Research tools:

A- the scale of thinking and learning patterns: a scale was adopted for thinking and learning patterns according to Herrmann theory of brain dominance prepared by (Nawafiah,2008) to specify the thinking patterns of the experimental group female students and divide them into groups with diverse thinking patterns.

B- Build an achievement posttest: the achievement test build according to test map.

The test consist of (40) items including (25) items objective questions type of multiple choices and (15) item type essay questions and the test was ensured to be truthful by shown it to experts and the needed time for test were calculated by applying it over a first survey sample and vitrificated to be honest by applying it over a second sample contain (100) student (statistical analyzed sample), and the difficulty factor was between (0.33-0.76) and discrimination coefficient was between (0.38-0.76) and all values of the false alternative effectiveness factors were negative.

5-The experiment implementation procedures:

The experiment implementation started in the beginning of second term of school year 2016-2017 and finished on Thursday in 11-5-2017, by five lessons a week and prepared teaching plans for each experimental group according to teaching around wheel strategy and the controlled group according the regular method.

6- Statistical aids:

a- using spss program to find results.

b- T- test for two independent samples have the same number.

c- Effect side equation.

A- View and explain results

First: view results:

After applying achievement posttest, and marking students answers papers and get the whole mark for each student in both experimental and controlled groups and after calculating arithmetic mean and deviation, results in the following table were found:

Results of t-test

Groups	Sample number	Mean	Std. Deviation	df	t-test calculate	t-test tabular	$\alpha = 0.05$
Experimental group	35	78.743	14.409	68	3.911	2	statistically significance
Control group	35	63.886	17.245				

The students average grades of the experimental group were (78.743) with a standard deviation number (14.409), while the average grades of controlled group students were (63.886) with a standard deviation number (17.245), and by using the T-test for two independent equal samples, it turns out that calculated T value which is (3.911) was bigger of the table T value which is (2) with free degree (68), and that indicates the existence of statistically significant difference at function level (0.05) to the benefit of experimental group, so the null hypotheses is rejected.

B- effect size:

This table was adopted to show the effectiveness size of teaching around wheel strategy over Mathematics achievement: (Hasan, 2011:283)

Table of the effect volume

(η^2) Value	0.01	0.06	0.14	0.20
Value d)(0.2	0.5	0.8	1.10
The effect volume	Small	Middle	Big	Very big

The extraction of the value (η^2) for achievement and compensate it in effect size law shows in size value equal to (0.95), which refer to that teaching around wheel strategy has a big effect over achievement, as shown in the following table:

Table of the effect volume for a Teaching around the wheel strategy in the achievement

Independent Variable	Dependent Variable	(η^2) Value	d)(Value	The effect volume
Teaching around the wheel strategy	Achievement	0.184	0.95	Big

Above table results show that teaching around wheel strategy has a big effectiveness over achievement of fourth scientific class in Mathematics and by that the research goal is fulfilment.

Second: Results explanation:

After seeing the results related to school achievement which show that there is statistically significant difference between the experimental and controlled groups for the benefit of experimental group which learnt by using teaching around wheel strategy and the results can be explained with the following indicators:

1- Teaching around wheel strategy fit with the modern data where it care about teaching diversity by using four thinking pattern and what this strategy include from logical sensual steps distributed over the twelfth stage that contain presentation procedures, review, overall outlook, which showed in advanced and organized way, and questionaries that include work sheets, in addition to recording, discussion, knowledge organizing as a mine map, and creativity that led students to non-logic thinking and suggest to have a new alternative solutions, summarizing, feelings expression, consciousness building, all that helped to provide learning environment rich with triggers that push experimental group students to interaction and focus in lesson which lead to modify and organize their experiences and information and knowledge combination, subsequently being surpassed over the controlled group in achievement, (Kojik and others, 2008) ensure that lesson diversity in classroom make the participation of all students in educational position an actual participation which lead to raise their focus and attention, and subsequently raise their experiences and information, and that appear in in raising the expected educational production expected from students. (Kojik and others, 2008:113-146)

2- Students of the experimental group supplied with an introduction include the title and behavior goals and show them before them in each lesson to gain their attention to the lesson goal and subject and this has an important role in their superior over controlled group students in achievement, where (Alzaglol and Albakor, 2001) study showed the pre know for the behavioral goals has an importance to improve and raise the educational process efficiency because it helps learner to recover the previous experiences and push student to make more effort to gain experiences of these goals which lead to raise their scholastic achievement. (Alzaglol and Albakor, 2001:168-169)

3-The review of lesson content in an advance and organized way helped students learning to be meaningful through connecting concepts and generalizations and laws together and aware the relation among them and connect them with what learnt previously, which helped them to recover information easily and being superior in achievement test.

4- Teaching around wheel strategy was built on the basis of dividing students to groups conditioned the diversity of all four thinking patterns in single group, and distribute tasks among single group students in questionaries stage and every student has a special role suits her thinking pattern to avoid group depending on single student to do all tasks, and that helped to give opportunity to all students in the group to exchange thoughts and make discussions among them and increase their scientific experiences and then increasing achievement, that was ensured by each (Aubaidat and Abu Alsmeed, 2009) where they sees working in organized groups and each individual in the group has a certain job that serve the assigned mission, is benefit students to enrich their experience as individuals through experiences circulation and exchange which they have, and group work has benefits in increasing students achievement and improving their act and acquire different life skills. (Aubaidat and Abu Alsameed, 2009:96-97)

Third: Conclusions: in light of the research results, the following is concluded:

1- Teaching around wheel strategy has a great effect in improving fourth scientific students' achievement in Mathematics compared with regular method.

2- Secondary stage students need educational environment where they have an active and effective role in reaching facts and provide them chances to propose their ideas and discuss them without fear or hesitation.

3- the use of teaching around wheel strategy in teaching mathematics helped to achieve behavioral goals that needed to achieved in lesson better than regular way.

Fourth: Recommendations: in light of current research results, the following recommendations were formed:

1- The use of teaching around wheel strategy in teaching mathematics shows noticed improvement in students' achievement of Mathematics compared with regular method.

2- the Mathematic teachers should be guided to use modern patterns and strategies to teach and broke routine of traditional ways and methods which no longer fit the current generation who opened on the real and virtual word

in every detail of technological and knowledge developments, and being informed through social media tools about new learning and teaching styles used in advanced states.

Fifth: Suggestions: The following was suggested to complete the research:

- 1- Studies should be made about the teaching around wheel strategy effectiveness on other variables (complex thinking, understanding levels, processing information, directing towards Mathematics, Mathematical communication).
- 2- Making another study similar to the current applied on intermediate stage.

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