

Effectiveness of the Method of Mutual Learning in the Outcome in Physics Subjects and the Development of Decision Making among Secondary School Students

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The current research aims at identifying the effectiveness of the method of mutual learning in the outcome in physics subjects and the development of decision making among secondary school students. The research sample consisted of (60) students from Alrabe'e secondary school for boys in the Qalaat Sukkar district. The experimental group consisted of (30) students and the second group represented the control group of (30) students. The researcher balanced between the two groups taking into consideration some variables such as age counted in months, grades of the first semester in the physics subject, intelligence test, and educational level of parents. The researcher prepared a test of (40) items and the scale of decision making to solve the physical problems consists of (13) items. The researcher verified the validity and stability of each of them, and after the end of the experiment the achievement test and the decision making scale were applied to the original research sample, and the results were statistically analysed. The results showed superiority of the experimental group that was studied through the application of the method of mutual learning over the control group that was studied through applying the normal method. The calculated T values were (3.76) and (3.26) for the achievement test and the decision scale, which is greater than the table values (2.21) and (2.00) for both results respectively, and for the benefit of the experimental group when using T-test. In the light of the results of the research, the researcher made a number of recommendations, including: to include the method of mutual learning in the teachers' preparation programs.

Key words: *Teaching methods, structural theory, prediction, questioning, illustration.*



Introduction

The educational process is a multi-faceted process that includes the objectives of education, structure, content, methods, means, management, systems and relationships. Each of these elements can be divided into many dimensions and sub-components. Reforming education, increasing its efficiency and increasing its productivity requires improvements and changes not only in its main factors but on each part of its branching elements because these aspects, dimensions, elements, and parts are all interacting and overlapping and if any part of them is neglected, it will have a negative impact on the other parts.

The educational institutions have paid great attention to the teacher since he is responsible for implementing the curriculum, especially after changing his role from a conveyor of knowledge and information to the students' minds like information stores and his interest in the subject matter and the tests to more profound and comprehensive roles such as his being the facilitator of learning, manager of the class and leader of the class activities and the students' interviewer. (Darwazah, 2005)

In order to achieve the education of the students, the specialists in the field of education have been concerned with the educational achievement because of its great importance in the life of the student and the teacher: it is the result of what happens in the educational institution from the various learning processes and the different skills, knowledge and various sciences that indicate the student's cognitive activity and the outcome is also related to certain factors, including mental, emotional and other personal components, as well as its being affected by the social and cultural variables that are related to the student school environment. (AlJalali, 2011) That increased the challenges faced by students that are characterised by pluralism and diversity, which increased the responsibilities entrusted to them in quantity and quality, and the decision making processes were complicated in the light of alternatives to solve the educational problems they face in light of international quality standards that created the spirit of competition and cooperation to achieve Excellence, imposing a new reality that required more hard work and stimulation of mental abilities and translated them into creative behaviours that contribute in the incensement of the educational outcome and face the new reality (Nowfel, 2004).

"The teaching methods are one of the significant pillars on which the teaching process is based. The teaching method and the prescribed material represent tangible material objects. No part of the material can be delivered to students except through a certain method and the students cannot gain any experience except through a method as both are the complement of the other." Altayar (2013).

Alhasry and Yousif say: "The method is the tool in which the objectives of the subject are achieved in the first step in which the school curriculum is put into practice. It is the tool that enables avoiding the potential imbalance in some elements of the curriculum. Such potentiality depends on the teacher's best choice of the appropriate teaching method" (2000, p.15). "The choice of the appropriate method influences teaching the subject, significantly, in achieving the objectives of the lesson. The methods differ in different subjects, materials and the learning environment. Students should be involved in the teaching process. The more students participate, the better". (Alhariri, 2010).

Jarbo'o states that: "The way to improve the level of students in the learning process is to develop their ability to draw appropriate strategies for learning, learn how to activate previous knowledge, just to employ them in current learning situations, to focus attention on points and elements of content, and to practise assessment techniques criticising ideas and meanings, and monitoring intellectual, cognitive and linguistic activities used to verify understanding." (2014, p.10)

Palincsar and Brown, 1986, believe that: "Intercultural learning emerged from three theories related to learning: Vigotsky's zone of proximal development, proleptic teaching, and expert scaffolding. Vigotsky noted that children grow up in two levels – the reality development level at which they can handle tasks autonomously, and the other level is the potential development or the level at which they can solve a problem with the help of the teacher or with the help of teamwork with their colleagues. There is another growth zone that comes between the current students' growth and the expected growth level, and the students can push themselves from the first to the second or learn beyond their real growth level with the help of social interaction, as that they can grasp the strategies." Ostovar and Shahhosseini (2011) believe that mutual learning helps teachers monitor the progress of their students, enable them to take responsibility for their learning, and become self-resident to the learning. Mutual learning has demonstrated certain benefits, including:

- 1 - Teaching students of different levels and materials regardless of their abilities and skills.
- 2 - Helping the students to learn new terms, ideas and knowledge.
- 3 - Improving the level of students in tests.
- 4 - Developing higher thinking skills.

Al-Kubaisi, (2011) explained that the results of educational research and psychological theories pointed out the significance of the method of mutual learning according to the following basic aspects:

- 1 - Teaching through the mutual learning method. Through such theory students with learning difficulties can be dealt with to teach them how they can learn well.

2 - It is a supportive education for students, through which they are provided with things and ideas that support their learning in an interactive learning environment, and social negotiation, scientific and logical discussion all about the content to be learned.

3 - The more the students progress during their studies in different grades, the more the curriculum becomes dependent on the absorptive skills available in each of them.

4 - If not addressed, the difficulties of assimilation shall negatively affect the progress of learning in students in almost all areas of learning.

5 - If any skill is not taught in the classroom, through the curriculum or the teacher, there is a high probability that some students do not acquire them by themselves, so it is necessary for the teacher to learn about the so-called mutual learning method. Through this method, the process of discussion and dialogue between the teacher and student groups is based on following the four steps that are central to the continuity and incensement of the active involvement of students in learning the content to be understood, and these are as follows:

- Summarising the content so that the most significant information and data are summarised from the part to the whole.

- Generating, formulating and raising questions about the content and reinforcing the previously summarised key ideas.

- Clarifying and discussing difficult and new examples, terms and concepts.

- Predicting the future contents and setting its next hypothesis, in order to activate the knowledge element and create the ground for new learning.

Al-Shanqeeti and Falak (2014) pointed out that: "mutual learning is one of the most effective teaching methods in the development of cognitive processes in students. It includes organisational procedures that enable them to choose the planning strategies, monitor and evaluate their progress and the basis for interactive learning, which makes the students responsible for their roles in the learning process and allows them to support each other."

Allen, (2003) stated there are: "Three basic principles of cross-teaching that must be emphasised in order to develop the competencies of students to reactivate their prior knowledge and apply them in current educational situations (Abdel Bari, 2010); (Abdel Salam, 2006) (Strange, 2016). They focus on the fundamental factors in educational content, and monitoring of mental activities in the teaching of learning processes, and these foundations are as follows:

1. Acquiring sub-strategies in mutual learning is the shared responsibility of students and teachers.

2. Although the application of reciprocal learning and strategies is the responsibility of teachers, this responsibility gradually shifts from teacher to student.

3. The teacher makes sure that all the students have taken part in the activities, supports them, provides them with feedback, and selects for them the activities that fit their personalities and levels.

Al-Hamdani and Anwar, (2013), state that: "the process of mutual learning is important in the development of many different educational outputs and increases the educational achievement and decision making; it is applied at an important stage is the intermediate stage, which is a significant stage because it is a real transition, in which the student moves from primary to secondary school." From the above-mentioned facts, the significance of the research is as follows:

- 1 - The importance of physics and its role in building the human personality, scientifically and practically.
- 2 - The study may provide information about the method of mutual learning in the development of achievement and decision making, which may benefit those who are teaching programs and teaching physics in schools about the need to pay attention to modern methods and strategies in teaching.
- 3 - The significance of the intermediate stage as it is the link between the primary and preparatory stages. It is an important stage for the growth of the student's mental abilities.
- 4 - Teachers may be helpful in encouraging students to interact, express their needs and participate in planning activities so that meaningful learning occurs.
- 5 - This study may help to review the content of topics of physics and their preparation as they develop the independence of the student in his thinking and thus make the right decisions in the process of learning.

Research Problem

As a result of the evolution of educational systems, as methods and content, the views on the teaching of physics have shifted from focussing on the preservation of facts and scientific laws to the application and employment of science in practical life (Shankiti and Volk, 2014). Perhaps the reason that many students in secondary education suffer various difficulties in understanding a lot of principles and concepts, laws, and terminology is that many of the teaching methods have become inadequate to keep up with the revolution of knowledge and the great philosophy of modern education, which emphasises the structure of the educational material and its fundamentals, principles, and concepts to be used in the understanding of partial facts and will affect the decision making process (Pilot, 2013); (Return, 2017).

In addition, there is the emergence of unfamiliar habits in recent times and that is the problems of lack of seriousness of students and interest in studying, and the increase of private tutoring and the decrease of achievement, including physics lessons that need not only to be studied but require more focus and thinking, as well as the ongoing complaint by parents and teachers and students themselves, where the teacher accuses the students of being unable to understand and master the fundamentals of physics in the previous stages. Physics is a cumulative subject that depends on subsequent learning. If the student does not master the previous learning, he will have difficulties understanding what is being built on it. The knowledge of the basics of

mathematical physics and their applications are an essential requirement for every member of society, as well as its being an intellectual material contributing to the development of a variety of ways of thinking and precision of expression, and the ability to prepare and use planning methods in solving the problems by taking appropriate physical decisions (Nabil, 2011); (Nofal, 2004).

Therefore, attention has been focussed not so long ago on learning and acquiring the concepts in different stages of the study. Research and studies were conducted on the nature of these concepts and methods of learning, and all stressed the significance of acquiring new knowledge, and the matter goes further to reach the significance of reorganizing all subjects of the subject of the learning materials on a gradual basis at levels... from more general and comprehensive concepts to more specialised ones, whether for the material or for the one subject (Gamal, 2000) (Jerobo'a, 2014).

In view of the role of physics in the preparation of the student scientifically by providing him with a set of information, laws, and concepts that relate to the scientific and logical explanation and interpretation of the phenomena and intellectual skills to develop the ability to make decisions about physics and help him to solve educational problems in general and physical problems in particular, the researcher noted the need to raise the level of achievement of students in this subject, as well as the teachers' awareness of the significance of preparation of information and concepts in education, outcome, and methods of composition and absorption, in addition to the emphasis of many educators on the significance of the positive connection between the effectiveness of the teachers and the students' gaining of information (Asadi, 2011); (Asadi, 2009).

The current research aims at identifying the following:

The effectiveness of the method of mutual learning in the outcome of physics subjects and the development of decision making among intermediate school students (Al-Tian, 2014).

Research Hypothesis

To achieve the objective of the research, the following two hypotheses were developed:

1 - There are no statistically significant differences in the level (0.05) between the average score of achievement in physics subjects in the post-test between the experimental group, which is taught by applying the method of mutual learning, and the control group that was taught by applying the normal method (Al-Tai, 2012).

2 There are no statistically significant differences in the level (0.05) between the average decision making in physics in the post-test between the experimental group that is taught using the method of mutual learning, and the control group studied using the normal method.

Limitations of the research:

The current search is limited to:

- 1 - Students in the first grade in Alrabe'e secondary school for boys / Qalaat Sukkar district.
- 2 - The second semester of the academic year (2015-2016).
- 3 - Topics of the book of physics for the first-grade intermediate level that is prepared by the Iraqi Ministry of Education (Version 6) for 2014, including (Chapters V,VI, and VII) (temperature, thermal properties of matter, and transformations of material cases), respectively (Al-Husri and Yousef, 2000).

Research Methodology

The researcher adopted the experimental method, which is one of the most accurate and efficient scientific research methods. Melhem (2002) believes that "experimental research is one of the earliest researches to solve educational problems in a scientific way, and the most valid approach (Al-Bawi, 2012)."

Since the current research is one of educational experimental research, the researcher chose an experimental design with a partial control with a post-test for two equal groups, one of which is experimental, and was taught by applying the mutual learning method; and the other is taught by applying the normal method manner, as it is shown in the following Table (1).

Table 1

Group	Independent variable	Variable dimension
Experimental	Mutual learning	Outcome test
Control	Normal method	Decision making

Research community and design

By the 'research community', Abbas, (2011) means: "all individuals, objects and persons who constitute the subject of the research problem, which is one of the elements related to the problem of the study that the researcher seeks to generalise its results through his study." The research community included all the first-grade students of the Intermediate schools and the secondary school for boys/morning studies in Qalaat Sukkar district / Dhi Qar Governorate for the academic year (2015-2016). The researcher chose the sample of the research (Alrabe'e

secondary school for boys) to carry out the experiment, and the reasons that led the researcher to choose this school were:

- 1 - The school management expressed the desire to cooperate with the researcher in conducting his experiment.
- 2 - It is easy to move to and from school.
- 3 - The teacher who applies the experience is a staff member of the same school

The researcher applied the method of random drawing in the selection of the two research groups. The B group represented the experimental group, which is taught according to the method of mutual learning when teaching physics, and the D group represented the control group, which is taught according to the usual method.

The number of students in the two groups (experimental and control) was 65:, 30 students in each of the two groups after the exclusion from the results of the research the students who failed last year. The experiment was not contaminated with these students, staying inside the classroom in order to maintain the teaching system as it is detailed below.

Table 2: Number of students of the sample before and after exclusion of the students who failed last year:

Group	Before	Failed students	After
Experiment	33	3	30
Control	32	2	30
Total	65	5	60

Equal Research Groups

Although the students (sample of the study) are from the same residential area and same sex (males), and studying in one school, the researcher however conducted the equivalence in the research groups (experimental and control) in some variables: (age calculated in months, intelligence and educational attainment of parents), as follows:

- 1 - The age of the students calculated in months: through the information form that was given to the students, in addition to the school card for each student to verify the authenticity of the given information.
- 2 - Marks of the first chapter in the physics subject: they were obtained for the first semester of the academic year (2015-2016) from the records of the school administration.
- 3 - IQ test: the researcher used the Raven test, (used in the Iraqi environment) and the level of the school stage.

4 - Educational level (degree obtained) of parents: the researcher was able to collect information on the educational level of parents through the information form that was given to the students. Tables (3 and 4) illustrate the process of equivalence:

Table 3: Arithmetical mean, standard deviation and T value of the three variables

Group	Experiment (30) students		Control (30) students		T value	
	Arithmetical mean	standard deviation	Arithmetical mean	Standard deviation	Calculate	Table
age calculated in months	151.1	10.846	151.6	11.460	0.1619	2.001
Marks of the first chapter in physics subject	78.833	14.982	82.266	11.319	1.1001	
Intelligence	34.9	10.58	31.1	8.82	1.37	

Table (3) shows that all calculated values (0.1619) (1,1001) and (1.37) are below the table values (2,001) and (2,021), respectively, at the level of (0.05) and the degree of freedom of (58) that is statistically significant, so the two groups are equal in the above-mentioned variables.

Table 4: shows the equality of the two groups in the educational education level of the parents variable

Group	Experiment (30) students				Control (30) students				chi-squared test value	
	Reads and writes	Primary School	Secondary	Diploma and above	Reads and writes	Primary School	Secondary	Diploma and above	Calculated	Table
Fathers' education level	4	12	7	7	6	9	8	7	2.03	7.82
Mothers' education level	10	7	7	6	9	8	7	6	5.08	

Table (4) shows that all calculated values (2.03) and (5.08) are below the table values (7.82) at the level of (0.05) and the degree of freedom of (58) that is statistically significant, so the two groups are equal in the above-mentioned variables.

Experiment Application Requirements

Scientific Material

The researcher identified the scientific material to be taught based on the existing physics book (version 6 for 2014) and is scheduled to be taught to the first-grade students in the Iraqi intermediate schools for the academic year (2015-2016) chapters V, VI and VII, as follows:

Temperature, Thermometers and Their Types, Temperature Gradients

Heat transfer, conductivity, types of materials in terms of heat delivery, water, heat conductivity, different materials in heat conductivity, load method, generate convection currents in the water when heated, radiation method, land and sea breeze, absorption, heat emission, heat insulation, thermos bottle, glasshouses.

- Chapter VII: melting, melting point, melting of snow, increasing volume of water during inundation, temperature changes, latent heat of evaporation, evaporation, condensation, alcohol faster evaporation of water, evaporation cooling process, boiling, sublimation, latent heat of evaporation, applications).

Behavioural Objectives

Allaqani et al. (1999) state that: behavioural goals are "carefully written phrases that explain to students what they can do after completing a particular subject." The researcher analysed the content of the subject. After defining the principles, (88) behavioural goals were formed after presenting them to a group of experts and specialists in education, psychology, measurement and teaching methods, according to Bloom's knowledge classification of the first three levels (knowledge, understanding, and application).

Teaching Plans

Jamil, (2000), defines teaching plans as: "planning the teaching of a systematic approach, method and organized way of work, and is a deliberate and purposeful process that leads to effective and capable goals that are effectively set." Therefore, the researcher prepared two model plans for subjects that were studied over the course of the experiment. The first was the experimental group according to the method of mutual learning, and the second is for the control group according to the usual method, after it was submitted to a group of experts and

specialists in the field of education, psychology and teaching methods, who made some adjustments in the light of their observations that were taken into consideration by the researcher.

Research Tools

Abbas (2011) states that the research tool: "is a means used by the researcher to obtain the required information from the relevant sources in his research." The nature of the current research and its objectives require the availability of two tools:

- 1 - The achievement test.
- 2 - The decision making scale.

The procedures for building and applying these tools are as follows:

The Achievement (Outcomes) Test

The objective of this research is to prepare an objective test by the researcher in an objective manner (four-choice) with four alternatives in the light of the behavioural objectives of the three levels of cognitive knowledge (knowledge , understanding, and application) and the content of the scientific material. (Qatami, 2003) defines the achievement tests as: "a structured procedure to measure the changes that occur in the students after passing through specific learning experiences", in order to identify the effect of the method of mutual learning in the achievement of the students of the first grade (the research sample) in the physics subject after the end of the experiment, relying on the test map that is prepared for this purpose, As the test of (40) questions in its final form after being submitted to a group of experts in the field of education, psychology, teaching methods, and measurement and evaluation, as there were several steps to be taken to build it in the final form , as follows:

Preparation of the Specifications Table

Abo Allam (1987) explains that: "the test is built on a set of specifications that determine the area that the test measures as a representative sample of the learning outcomes, and the preparation of the specification table is one of the most significant methods to achieve this purpose." The researcher determined the significance of the topics in light of the number of pages of each subject. The significance of the levels of objectives was determined in light of the number of behavioural objectives in each level to the total number of goals.

Ouda (1985) pointed out that the process of "calculating the significance of content, target levels, and the number of items per cell is as follows:

1 - Percentage of the significance of the content of subjects = number of pages of one subject
 ----- ×100

Total number of pages

2 - Ratio of the significance of levels of behavioural goals = number of behaviour goal of one level
 ----- ×100

Total number of behaviour goals

3. Number of items per cell = total number of paragraphs × percentage of significance of content × proportion of importance of objectives.

Thus, **Table (5)** demonstrates the experimental map of behavioural goals and achievement test items as follows:

Table 5:

Chapter	Number of pages per chapter	Percentage significance	Goals			Total of goals	Test items			Total items of test
			Knowledge 25%	Understanding 47%	Application 28%		Knowledge	Understanding	Application	
V	12	33%	10	24	17	51	6	6	3	15
VI	10	28%	2	5	0	7	4	6	0	10
VII	14	39%	10	12	8	30	5	6	4	15
Total	36	100%	22	41	25	88	15	18	7	40

The Validity of the Test

Melhem, (2009) pointed out that: "honest testing is the one that measures the function that it allegedly measures and does not measure anything else in place of or in addition to it." In order to verify the truth, the researcher adopted the following types to know the veracity of the test: Virtual Honesty

The apparent honesty indicates the general appearance of the test as a means of measurement, that is, it indicates the appropriateness of the test for learners and the clarity of its vertebrae. (Ebel, 1979, p.566) states that: "the best way to ascertain the apparent honesty is that a number of arbitrators assess the extent to which the vertebrae are achieved for the measure to be measured", thus, the 50 item test along with the behaviour goals, according to the previously mentioned table of characteristics, was submitted to a group of specialists and experts, and the

researcher depended on a percentage of (80%) and more on the validity of the test items. In the light of the specialists' and experts' observations, some of the items were deleted and modified to reach the final form of (40) items, so that all the items of the test are true and acceptable (Abu Jado and Muhammad, 2007).

Content Validity

Based on the procedures followed by the researcher in terms of (preparation of the specification table, presentation of test items, behavioural objectives, and content of scientific material), it can be said that this kind of honesty has been achieved.

Exploration Application

Al dulaimi and Adnan (2005) noted that: "the purpose of the test application is to determine the appropriateness of the test in terms of clarity of the terms and the length of time to answer, as well as the clarity of the instructions for the test." Therefore, on (12/4/2016) a test was applied to a random sample of (100) students of the first-grade intermediate school (Alnaba'a Aladhim Intermediate school for boys / Qalaat Sukkar district), who studied the same scientific subjects of physics, which is from the research community and is not the same sample. During the process of application, the test recorded the completion time of the first (10) students and another (10) students who had completed the test on average of 50 minutes. It has been shown that most of the instructions and items are clear, and a simple adjustment was done to some of them according to a student's questions about them, and the difficulty of the questions, and the ease and force discriminatory of each item, coefficient, and the effectiveness of the wrong alternatives, have been calculated as follows:

Level of difficulty of items

Adulaimi and Adnan (p. 64), indicated that the coefficient of difficulty "indicates the proportion of students who gave a wrong answer to the items to the total number of students (upper and lower group)". After calculating the difficulty factor for each item of the test, it was found as (0.37 - 0.70), which means that all test items are acceptable. Bloom (1971, p. 66) considers that tests are "good and valid" if their coefficient of difficulty is between 0.20 - 0.80.

The discriminatory power of Items

The differential power of each of the test items was calculated to be between 0.37 and 0.49. Aziz (1989) notes that "the item is distinguished if it is 0.30 or greater and are weak and unacceptable if they get less than that, "i.e., they are deleted from the test and thus all items are acceptable.

Effectiveness of Wrong Alternatives

The responses of the exploratory sample to the test were analysed using the equation of the effectiveness of the wrong alternatives between the groups that are extreme in the total score, and it appeared to be between (0.70 - 0.370). Ouda (1985, p.140) states that: "the wrong alternative is effective when it attracts a large number of students in the lower group that is greater than the number of students of the upper group", and accordingly all the wrong alternatives for testing are considered effective.

Test Stability

Abdulrahman, (1985) stated that: "the test is reliable and trusted in giving the same results when applied more than once under the same conditions." Therefore, the researcher applied the test to the survey sample and divided these into two groups, one representing the individual items and the other one the double. The stability is calculated by the Pearson correlation coefficient which is (0.78), which was corrected using the Spearman-Brown correlation equation that was (0.84), which is a good stability coefficient. Thus, the collection test is ready to be applied to the original sample of the research.

Decision making Scale

The researcher built a decision making scale for students of the first grade of the intermediate school after reading the literature and previous studies directly related to the subject of research, taking the following steps:

A - Objective Of The Scale

The measure aims to measure the decision making process to solve the physical problems faced by students in the first grade of the intermediate school before and after studying physics subjects.

B - Formulation of the Items of the Scale in its Initial Form

The scale is of 13 items and each one of them contains a physical problem related to the study subject (physics) that the students studied in the first grade. These problems are derived from the daily life of the students. The students are given four grades for the alternative or the correct answer and one for the alternative that is far from the conditions that have been set, namely:

- 1 - Easy to achieve the desired goal (solve the problem).
- 2 - Low cost (time, effort, money).

3 - It does not cause other problems when applied.

The maximum score was 52 and the minimum was 13.

C - Reliability and Stability of the Scale

The researcher used the "sincerity of the content", as he submitted the meter to certain specialists to express their views and observations concerning the validity of the items of the scale for the purpose of the research, and the match of the items with the alternatives set for them. The specialists agreed that all are easy and clear in meaning and measure what they were developed for –(to extract the stability by re-testing with a two-week interval.) The result of the correlation between the first and second tests was (0.84). AlGharib, (1981), stressed that: "the scale is objective because the degree of stability obtained by the researcher is high."

Seventh - Procedures for Applying the Experiment

The researcher followed the following steps during the experiment:

- 1 - Completing the research requirements for equivalence, preparation of teaching plans, preparation of research tools, in addition to determining the scientific material and organizing the weekly lesson schedule for the physics subject – (two lectures per week for each of the two experimental groups taught according to the method of mutual learning and control, which are taught according to the usual method.)
- 2 - The teacher began applying the experiment to the sample members on Sunday (21/2/2016) until Sunday (24/4/2016).
- 3 - After the application of the experiment, the researcher, with the help of the concerned teacher of the subject, applied the research tools (achievement test and decision scale) to the students in the experimental and control groups on Sunday (24/4/2016) on one hour difference between the application of the two tools. The sample members were notified a week before the procedure was applied.
4. Scoring of the results of the test: the researcher scored the students' (the research sample) answers according to the method of correcting the objective tests (0,1), that is to give one mark for the correct answer and zero for the wrong answer, and the unanswered item was considered a wrong answer, and thus the final score of the test was (40) marks.

The researcher processed the research tools statistically using the statistical program for the social sciences (SPSS) version (19) in scoring the results.

Results

For the purpose of verifying the objective of the research, which assures the (effectiveness of the method of mutual learning in the outcome of the physics subject and decision making development among Intermediate school students), which emerged from the following two zero hypotheses:

1. There are no statistically significant differences in the level of (0.05) between the average score of achievement in the physics subject in the post-test between the experimental group, which is taught using the method of mutual learning, and the control group that studied according to the normal method.

To verify the validity of the hypothesis, the researcher processed the student data statistically in the achievement test of the physics subject of the two groups (experimental and control). The mean of the experimental group scores in the test was (32.60) and a standard deviation of (6.16), while the mean of the scores of the control group students was (21.00), with a standard deviation of (5.33). Using the T-test for two independent samples, the calculated T value was (3.76) at the level of significance (0.05) and the degree of freedom (58) which is greater than the table value of (2.21). This means that there is a statistically significant difference between the two averages and for the students of the experimental group, who were taught physics by using the method of mutual learning over the students of the control group, who studied the material according to the traditional method in the achievement test, thus rejecting the first zero hypothesis and table (6) shows that.

Table 6:

Group	Number	Mean	Standard deviation	Freedom	T value		Significance at (0.05)
					Calculated	Table	
Experimental	30	32.60	6.16	58	3.76	2.21	Statistical function
Control	30	21.00	5.33				

2. There are no statistically significant differences in the level of (0.05) between the average decision making in the physics subject in the post-test between the experimental and the control groups.

To verify the validity of the hypothesis, the researcher processed the student data statistically in the decision making scale of the two groups (experimental and control). The mean of the experimental group scores in the scale was 41.50 and a standard deviation of 2.272 while it

was (22.25) for the control group with a standard deviation of (3.376). Using the T test for two independent samples, it was found that the calculated T value was (3.26) at the level of significance of (0.05) and the freedom level of (58) ,which is greater than the table value of (2.00). This means that there is a statistically significant difference between the two averages for the benefit of the students of the experimental group over the control students, thus the zero hypothesis was redetected and the second table (7) shows that.

Table 7: Arithmetical mean, standard deviation, and T value of students' scores in the decision making scale

Group	Number	Arithmetical mean,	Standard Deviation	Freedom	T value		Significance
					Calculated	Table	
Experimental	30	41.50	2.272	58			Statistical function At (0.05)
Control	30	22.25	3.376		3.26	2.00	

- Interpretation and discussion of the results

In the light of the findings of the current study, it can be said that the method of mutual learning has achieved a good level of achievement and decision making to solve the physical problems, and this can be attributed to the superiority of the experimental group over the control group, for the following reasons:

- 1 - The method of mutual learning contributed to the organisation of the ideas of students of the experimental group through the use of the steps of the sequential method (prediction, clarification, questioning, and summary).
- 2 - The method of mutual learning has enabled the capacity of students of the experimental group to grow and increased their motivation to manage dialogue and discussion through questions and exchange of views.
- 3 - The method of mutual learning helped the teacher to take the role of mentor and supervisor of the educational process as a whole, rather than the role of telegram, resulting in a positive impact on the achievement of students.
- 4 - The method of mutual learning worked to help the student to summarise the material and codification of information and facts and principle ideas, which made it easy to understand.
- 5 - The method of mutual learning is effective in increasing the achievement of students and proved their contribution to the processes of remembering and retention of learning for a longer period.



6 - The method of mutual learning presented the physical information in the form of problems related to the life of the students, who have improved their thinking and makes them look for as many as possible of the right alternatives and choose the best.

7 - The method of mutual learning trained the students to generate a set of new ideas used in solving educational problems by the development of a large number of alternatives that lead to solving the problem under study.

8 - The method of mutual learning raised the spirit of discussion and thinking through its strategies, which generated an opportunity to solve the problem and thinking of unreasonable suggestions, and thus helped the student to make the right decision.

9. The method helped the students to analyse the negatives and positives of the proposed solutions to the problem and contributed to thinking and balancing between the best solution and the low-level solution.

This result was agreed upon with the study of (AlSaadi, 2009), (Alsadi, 2009) and (Almuhtasib and Raja, 2010).

Recommendations

In light of the results of the current study, a set of recommendations can be made, as follows:

- 1 - Urging the teaching staff members to engage in training courses to learn more about the latest strategies, including the method of mutual learning.
- 2 - Encouraging the teachers of physics in all educational stages to use the method of mutual learning.
- 3 - Requesting the faculties of education and basic education to establish courses of teaching methods and modern strategies in teaching through the continuing education unit.
- 4 - Including the method of mutual learning in the preparation of teachers to identify the steps and the method of application in practice.



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