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The Effect of Using Buxton Model in the Acquisition of Mathematical Concepts among Fifth Grade Students and their Attitudes towards Mathematics in Jordan

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Abstract

The purpose of this study was to investigate the effect of using Buxton model in the acquisition of mathematical concepts among fifth grade students and their attitudes towards mathematics. The researcher selected fifth grade students at Khalid Bin Al-Waleed and Ruqaya Bint Al-Rasoul schools in Irbid city and randomly selected an experimental group of (40) students from both schools, and a control group (44) students. The Buxton model was applied to the experimental group in the integers chapter. Teaching plans were developed for both groups, building a test in the acquisition of mathematical concepts and a scale of the trend towards mathematics. It was presented to a group of experts and specialists in the methods of teaching mathematics to find its reliability and to find also the ease, difficulty and discrimination factors. After applying the test and scale on both groups, the results showed that there were statistically significant differences between the two groups in the test of acquiring mathematical concepts for the benefit of the experimental group, and the absence of statistically significant differences between the students of the experimental group and the absence of statistically significant differences between the two groups in the scale of the trend towards mathematics, and the presence of statistically significant differences between the students of the experimental group and for the benefit of students, the researchers concluded that the Buxton model has an important role in the acquisition of mathematical concepts for students, and recommended the use of Buxton model in secondary schools.

Keywords: Buxton model, mathematical concepts, attitudes towards mathematics, Ease factor, Difficulty factor, Discrimination factor

Introduction

Buxton model

Buxton proposed a model of understanding in four ways. Call it levels of understanding, which is:

1. First Level (Automatic) Instrumental (Rote):

It is that understanding that depends on automatic conservation, as the information is printed on the memory and strengthens and enhance by the exercise to save by repetition, for example, when the student keeps the definition of the French Revolution (Kastberg, 2002: 13).

This kind of understanding is similar to automated receptive learning for meaningful learning for Ozil, at this level of learning the material is presented to the learner in its final form and he must preserve them by heart without attempting to link them or integrate them into his cognitive structure. In this mode, the student acts as a computer mind, storing a range of methods in his memory and when he asked to perform a particular operation, he routinely remembers the way that leads to the solution, it means blind application without awareness or understanding of what is going on around him of relationships and concepts (Zaghloul and Imad, 2007: 120).

2. Second Level (Observation):

At this level (style) of understanding is based on recognizing and distinguishing patterns and observing regularity any observation and awareness of relationships and patterns that act as a reminder and thinker of the rules and positions previously understood and working to come up with a solution and more general rules for similar situations and this method of understanding is deeper than automatic understanding, but it is not entirely relationally that it works as a transition from automatic to relational. (Kastberg, 2002:13).

Observation is a skill of scientific thinking, and this skill occupies the first place in the acquisition of knowledge of the learner and delight using the five senses. (Beyer, 1987:2). Observation is the most important development of thinking and it means taking impressions of an object or things, as it requires the individual to pay great attention and include the variables that occur during the presentation of a situation about a new knowledge or issue and this means that the teacher has a major role in the development of observation process for students. By encouraging them to use their senses effectively, thus, Buxton agrees with bandura,1977 view that the process of attention is influenced by the cognitive and sensory system of the learner.(Absi, 2009, 19).

3. Third level insightful understanding:

It is a relational understanding, ie, an understanding of the relationships between primary and secondary concepts and conceptual structures to form an integrated structure of concepts. The student knows not only the facts and concepts but also the reasons for their use (Buxton, 1978:36).

In this method of learning (visual) the student learns plans, methods and general methods of dealing by linking the relationships involved in the different stages, to solve a problem to be solved as he can deduce and draw a rule or a general way to deal with this particular problem. (Al-Sharif, 1996, 290)

4. Fourth level (Abstract, formal):

This method is concerned with the theoretical proofs and expressions of mathematical concepts and ideas and this method is usually followed when the teacher wants to convince his pupils of the public health when applying a rule, law or method, such as the method needed when understanding the proofs of engineering theories, rules and general laws, Buxton suggests that this method of understanding is appropriate only after the student has acquired or learned through the method of relational understanding(Buxton, 1978:36).

Problem of the Study

Careful consideration of the impact of strategies on learning concepts is recent as it began in the last three decades; some of this attention is based on the assumption that the strategy has an impact on the acquisition of the concept and hence related concepts.

Given the importance of strategies in the teaching of mathematical concepts, several studies have been conducted, to search for the most effective one. (Abu Zeina, 2010).

Educational theorists rely on the formulation and development of appropriate teaching models because knowledge of learning theories and principles do not care for the teacher as it is concerned with the adoption of one of the teaching models while conducting teaching procedures (Zayer et al, 2013).

To help students acquire mathematical concepts, the researchers decided to do a study in the application of the Buxton model by answering the hypothesis of the research.

Hypotheses of the Research

The first hypothesis: There are no statistically significant differences at the level of significance (0.05) between the average grades of the mathematical concepts acquisition test for the fifth grade students in the experimental group who were taught according to the Buxton model, and the average grades of the mathematical concepts acquisition test for the control group students who were taught by the ordinary method.

The second hypothesis: There are no statistically significant differences at the level of significance (0.050) in the test scores to acquire mathematical concepts among the students of the fifth grade of the experimental group.

The third hypothesis: There are no statistically significant differences at the level of (0.05) between the scores of the trend toward mathematics' scale for the experimental group who were taught according to Buxton model and the control group grades that were taught in the normal way.

The fourth hypothesis: There are no statistically significant differences at the level of significance (0.05) between the average scores of the trend towards mathematics test for the students of the experimental group.

Research limits

The current research is limited to the following limitations:

- Students of the fifth grade in public schools in Irbid city.

- Chapter 3 of the fifth grade textbook, Ministry of Education, Jordan.
- First semester of the academic year 2015/2016

Previous studies

Saadi study (2011), the study was conducted in Iraq and aimed to identify "the effect of using the Buxton model in the acquisition of mathematical concepts and the trend towards mathematics. For second grade students, the sample of the study consisted of (22) students, by (52) students for both groups (experimental and control), the researcher prepared a test to measure the acquisition of mathematical concepts consisting of (24) paragraph and a measure of direction from (01) paragraph by using T-test for two independent samples, the results showed that there were no statistically significant differences between the students of both groups (experimental and control). In the mathematical concepts acquisition test, the experimental group outperformed the control group, in the trend scale of matter also, the experimental group in the scales of the distance trend scale exceeds the scores of the tribal trend scale, in this light, the researcher recommended a number of recommendations and suggestions (Saadi, 2011, 9).

Study of (Muhammad, 2013), the study was conducted in Iraq and aimed at identifying the effect of the Skman model on the acquisition of historical concepts, the study sample consisted of (21) students, (30) and (30) students respectively for both groups (experimental and control). The researcher prepared a test of the acquisition of historical concepts consisting of (24) Objective paragraph and using T-test for two independent samples, the results showed that the experimental group was superior to the control group in the concept acquisition test and in light of the research results, the researcher recommended a number of recommendations and suggestions (Muhammad, 2013,9-11).

Study of (Munis, 2015), The study was conducted in Iraq and aimed to identify the impact of the Buxton model on the acquisition and retention of geographical concepts. The study sample consisted of (22) students, (33) (34) students respectively for both groups (experimental and control), the researcher prepared a test of the acquisition of geographical concepts consisting of 50 substantive paragraphs using the T-test of two independent samples, the results showed that the experimental group outperformed the control group in the conceptual acquisition test as well as in retention, in light of the research results, the researcher recommended a number of recommendations and suggestions (Munes 2015-209).

Methodology o the Study

Research Procedures

First: Experimental Design:

For the purposes of the research, the researcher used the experimental design of partial control consisting of experimental and control groups, as it is suitable for the nature of her research (David, 1990).

Experimental design of the research

Group	Independent variable	Dependent variable
Experimental	Buxton model	Acquire mathematical concepts
Control	Traditional way	The trend towards mathematics

The population of the study and its sample

Population of the Study

The research population consists of all fifth grade students in Irbid schools for the academic year 2015/ 2016

Sample of the Study

The sample comprised of fifth grade students from Khaled bin Al Waleed school for boys and Ruqayya bint At Rasoul school for girls in irbid, they were (50) males, and (34) females.

Table (1): Distribution of students of the experimental and control groups

Group	Male students	Female students	Total
Experimental	20	20	40
Control	30	14	44
Total	50	34	84

Equality of the two groups

The researchers investigated the equivalence of the experimental and control groups in the previous achievement in mathematics, chronological age and the trend towards mathematics. As shown in the table (2)

Table (2): Data of the equivalence of the experimental and control groups in the pretest, age and the trend towards mathematics

Variables	Group	N	Mean	Variance	Calculated "t"	Tabulated "t"	Df	Sig
Previous achievement	**Experimental**	40	56.2	245.272	0.644	2.021	40	Not significant
	Control	44	58.7	78.856				
Age	**Experimental**	40	13	1.368	1.714	2.021	40	Not significant
	Control	44	13.6	1.196				
Trend towards mathematics	**Experimental**	40	53.1	54.2	0.291	2.021	40	Not significant
	Control	44	35.5	34.929				

As well as in the collection of the father and in order (primary and below, intermediate, junior and higher was coded by numbers (1,2,3) and in order and as shown in the table (3)

Table (3): equality of the experimental and control groups in the achievement

Group	1	2	3	Total	Calculated K^2	Tabulated K^2	Df	Sig
Experimental	16	14	10	40				Not significant
Control	18	14	12	44	0.042	5.99	2	
Total	34	28	22	84				

Search Requirements

1. Scientific material

The unit of integers was selected for the third semester of the fifth grade math book scheduled for the academic year 2015/ 2016.

The experimental group studied the teaching material according to the Buxton model and the control group studied the same subject in the usual way.

2. Mathematical concepts

The researchers chose ten major mathematical concepts from the unit of integers Chapter II of the book of mathematics fifth row Representing integers on the line of numbers, absolute integer, adding integers, subtracting integers, multiplying integers, dividing integers, approximation and approximation of integers, analysis of integers to its prime factors, the square root of the positive integer, the cubic root of the integer, the researchers presented these concepts to a group of experts, arbitrators and specialists in teaching methods to ensure its reliability, the percentage of agreement was (95%).

Tools of the Study

First: Acquisition test of mathematical concepts

The researchers have built a test in the acquisition of mathematical concepts to measure the extent of the acquisition of the research sample of mathematical concepts has reached the number of paragraphs (30) questions, Of these (20) multiple choice questions and (10) essay questions are distributed across the three Bloom levels (knowledge, comprehension, application) as shown in the specification table (4)

Table (4): specification table of mathematical concepts acquisition test

Levels	Sequence of paragraphs	Total	The percentage in the paragraphs of the test
Knowledge	1,2,4,5,7, 10,14,16,17,20	10	33.3%
comprehension	3,6,8,9,11,12,13,15,18,19	10	33.3%
application	21,22,23,24,25,26,27,28,29,30	10	33.4%
Total		30	100%

To ensure the validity of the test, the researchers presented the paragraphs to a group of experts, arbitrators and specialists in teaching methods on the validity of the tool and the rate of agreement (97%). In order to ensure the stability of the test paragraphs, the researchers applied the test to a reconnaissance group consisting of (25) students from the fifth grade in Khalid Bin Al Waleed School, after the correction of the answer sheets, the split-half method was applied to find the coefficient of reliability (scores of individual and even questions) using the Pearson correlation coefficient (90%).

The half-stability coefficient was corrected using the Spearman-Brown correlation coefficient (95%), the difficulty coefficient was found where the best ratio was (20% -80%) (Odeh, 1998), the coefficient of discrimination for test paragraphs where the best ratio is 40% and above (Odeh, 1998) as shown in Table 5.

Table 5: Ease, difficulty and discrimination coefficient to test the acquisition of mathematical concepts

Items	Ease factor	Difficulty factor	Discrimination factor	Items	Ease factor	Difficulty factor	Discrimination factor
2	٪12	٪72	٪29	22	٪29	٪41	٪41
1	٪72	٪12	٪20	27	٪12	٪72	٪41
3	٪29	٪41	٪41	29	٪41	٪29	٪ 20
4	٪29	٪41	٪29	22	٪41	٪29	٪27
2	٪42	٪24	٪41	10	٪72	٪12	٪41
2	٪39	٪21	٪20	12	٪12	٪72	٪41
7	٪12	٪72	٪41	11	٪33	٪27	٪20
9	٪27	٪33	٪27	13	٪20	٪20	٪20
2	٪24	٪42	٪72	14	٪42	٪24	٪41
20	٪29	٪41	٪93	12	٪29	٪41	٪41
22	٪41	٪29	٪20	12	٪42	٪24	٪27
21	٪12	٪72	٪41	17	٪31	٪29	٪20
23	٪33	٪27	٪20	19	٪33	٪27	٪72
24	٪21	٪39	٪41	12	٪12	٪72	٪29
22	٪12	٪72	٪41	30	٪12	٪72	٪41

Thus, the test of acquiring mathematical concepts is ready for final application

Second: The scale of the trend towards mathematics

The researchers constructed a scale of the trend towards mathematics based on the previous studies and educational sources and the items of the scale (20) items according to the Likert scale of the triple gradient (agree, neutral, disagree) with the grades of (3,2,1) if the paragraph is positive, and the grades (1,2,3) if the paragraph is negative and in order.

The researchers presented the paragraphs of the scale to a group of experts, arbitrators and specialists in teaching methods to ensure the validity of its paragraphs, the ratio of the agreement (96%) and the scale was applied to a survey group consisting of (25) students from the fifth grade in Khalid Bin Al Waleed School to calculate the stability of its paragraphs, and the split-half method (10) positive and negative items for each part) was applied and the Pearson correlation coefficient was used and was (83%), the correlation coefficient was corrected using the Spearman Brown correlation coefficient (91%), the difficulty coefficient was found (0.25-0.70), and the discrimination factor was (0.30-0.80), thus, the scale is ready for application.

Apply the experiment

The teacher taught the experimental groups according to the Buxton model, and the control according to the usual method. After that, the test of acquiring mathematical concepts was applied to the experimental and control groups and the test of the mathematical direction test on the experimental and control groups, after correcting the answers and arranging the data to test the acquisition of mathematical concepts and measure the trend towards mathematics, statistical analyzes were conducted using the following statistical methods:

1. T - Test for two independent samples to find the value of T calculated between the experimental and control groups (Al-Bayati et al, 1977).
2. Pearson correlation coefficient equation to find the stability of the test of the acquisition of mathematical concepts and the stability of the paragraphs of the trend towards mathematics (Salah and Amin, 2012).
3. Spearman Brown correlation coefficient for correlation coefficient (Salah and Amin, 2012).
4. Cooper equation to find ratios validity of the agreement of experts - Cooper, 1974.
5. Equation of the coefficient of discrimination to find the discriminatory power (Badawi, 2003)

Results of the Study

After correcting the answers of the sample to test the acquisition of mathematical concepts and then analyzed - statistically in the light of the research hypotheses and after the application of the law (t-test) on the experimental and control groups found that there are statistically significant differences at the level of significance (0.05) in the average scores of students of the experimental and control groups in the test of acquire mathematical concepts for the benefit of the experimental group while there are no statistically significant differences between the average scores of male and female students of the experimental group in the test of acquiring mathematical concepts and table (2) shows that.

After correcting the answers of both the experimental and control groups to test the scale - the trend towards mathematics and the analysis of statistical data and the application of the law (t-test) on the experimental and control groups showed that there is no significant differences between the average responses of students of the experimental group and the control on the trend scale towards mathematics. However, it was found that there are statistically significant differences between the average responses of students to the experimental group on the scale of the trend towards mathematics and for the benefit of students. Table (2) shows this

Table 6: Test data acquisition of mathematical concepts and the trend towards mathematics between the experimental and control groups and between the students of the experimental group

Test	Group	N	Mean	Variation	Calculated "T"	Tabulated "T"	Df	Sig
Acquisition of concepts	**Experimental**	40	51.7	189.274	4.287	2.21	40	Sig
	Control	44	34.7	128.181				
Acquisition of concepts	**Experimental**	20	56.6	128.267	1.667	2.101	18	Not significant
	Control	20	46.8	217.956				
A trend towards mathematics	**Experimental**	40	49.3	94.832	0.156	2.21	40	Not significant
	Control	44	48.9	46.448				
A trend towards mathematics	**Experimental**	20	54	80.667	2.479	2.101	18	Sig
	Control	20	44.5	66.056				

Interpretation of results

The results showed that there are statistically significant differences in the test of acquiring mathematical concepts between the experimental and control groups in favor of the experimental group, attributed to the Buxton model with four levels in which the experimental group was taught where the results proved the effectiveness of this model in the acquisition of mathematical concepts, this is because the first step (automated understanding) has an effect on stimulating students' motivation to learn and invoke the lesson, and the second step (observation) draws the attention of the students and the visionary understanding linking the previous information to the new lesson helps students to distinguish new facts and concepts, and the mere understanding is to deepen the relations reached. As for the students of the experimental group, the results showed that there are no statistically significant differences between the male and female students in the test of acquiring mathematical concepts. This indicates that this method had an effect on both male and female students in understanding the lessons.

The results showed that there were no statistically significant differences between the experimental and control groups towards the mathematics; this indicates that the Buxton model did not change the attitude of the experimental group towards mathematics, while the results showed that there are statistically significant differences between the students of the experimental group in the direction towards mathematics and for the benefit of students due to the influence of the steps of the Buxton model and this indicates that the students were more integrated with the steps of this model, which affected their attitude towards mathematics.

Conclusions

The researchers reached the following results: The Buxton model: -

1. Has an important role in the acquisition of the first grade students of the mathematical concepts.
2. Contributes to motivate students in the acquisition of mathematical concepts.
3. Develops students' desire towards mathematics.

Recommendations

The researchers recommended the following:

1. The use of the Buxton model in teaching mathematics in high schools.
2. Teacher training on the Buxton model.

Suggestions

The researchers suggested what follows:

1. Conducting a similar study in other classes
2. Conducting a similar study in other subjects

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