

THE EFFECTIVENESS OF USING INTERACTIVE INFOGRAPHIC AT TEACHING MATHEMATICS IN ELEMENTARY SCHOOL

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ABSTRACT: *The study aimed to explore the effectiveness of using interactive infographics in the teaching of mathematics at the second grade of elementary school, the study has used a semi-experimental approach through pre and post tests for two groups; experimental and control group where the study sample consisted of 32 students from the second grade in the first semester of the academic year (1435-1436h). the sample were randomly selected and divided into two groups, one is a control group consist of (17) students (studying with traditional method); the other one is experimental (pilot) group consist of (15) students (studying with interactive infographics method). The researcher developed an instructional design model for teaching mathematics using interactive infographics; the results indicated that there are statistically significant differences at level (0.05) between the means of students' scores of experimental group and control group in post achievement test in favor of experimental group in which concluded that the interactive infographics is an effective tool in teaching and learning mathematics at elementary school*

KEYWORDS: Infographics, Mathematics Teaching, Elementary School

INTRODUCTION

All realize that mathematics is the backbone of progress in various sciences, where it considered to be one of the most important science at present, and most modern sciences became dependant upon mathematics since it is the basis which the progress of modern science and applications based on, and we can see that in various sciences such as astronomy, space sceinces, computer science and engineering, and in medical and pharmaceutical applications of various specialties, and its contribution in the formation of clear knowledge that contribute to the building of human civilization throughout the ages.

The continous development of teaching and learning of mathematics has become so important in recent decades, with the inetervention of mathematics as a key factor in various spheres of life, and constitute an essential element in learning many of the basic skills that serves as the basis for many other courses, so students' success in learning mathematics and its fundamentals, and understanding of the basic processes in the elementary schools would be a success factor to understand its applications in other courses. Despite the importance of this stage and its role in the formation of mathematics at the level of students in the following stages of education, but many results of different studies (Coffey, 2011; Alexander 2011; McDevitt and Ormrod 2010) stresses the need to improve students learning at the elementary level in mathematics to ensure the positive impact of the transition from learning to subsequent stages of education. Little (Little, 2009) refers that there are challenges in the students 'learning of mathematics at the elementary school where it was clearly evident in the follow-up student scores, which confirm the existence of deficiencies in students' understanding of the concepts

of basic mathematical operations and therefore reflect their impact on the possession of students mathematical skills in the future.

Also Madar and Buntat (Madar and Buntat, 2011) confirms that the visual images through the interactive multimedia enhance the students' learning of mathematics, where it increased interaction in two ways; between teacher and student, as well as between the student and the student with respect to elements of the visual graphics, and the study concluded that interactive multimedia can enhance the effectiveness of teaching and learning in mathematics, the study pointed out in its literature that one of the reasons for the decrease in the level of learning mathematics may be due to the majority of teachers who use traditional ways in the teaching of mathematics in spite of proven multimedia effectiveness (including pictures, drawings) in improving mathematics learning outcomes. Several studies have indicated (Baharuddin, 2005; Alfinio, 2007; Tengku Zawawi, 2008) to obvious improvement of students learning outcomes as a result of reliance on graphics and pictures as an effective tools for learning mathematics, where the increase of students' interest in learning the subject, and increase the students' motivation to continue learning and improve understanding, in addition, an increased focus on the progress of knowledge and information, and make mathematical skills meaningful for students in which giving the students chance to retaining the learning. These were confirmed by Carruthers and Worthington (2006), that the continous teaching of mathematics with traditional methods will affect students learning and will probably be the reason for the decline in the enthusiasm of learning mathematics and repelled them, and that has apeared at students low grades in mathematics, and led to increased voices calling for the urgently needed to create an exciting learning environment that supports the learning of mathematics using different tools and techniques that enhence learning process and induce students' motivation to learn. As noted by Rapp (2009) that mathematics is often taught using an audio sequent methods, and the problem of these methods is limited to be ineffective when used with visual learners, moreover, it consedered to be harmful to them at the academic and emotional levels, then Rapp study recommends to refrain from these strategies to more effective teaching strategies, which agreed with Swanson study and others (Swanson et al., 2008) which confirmed that the students who have a severe failure in solving arithmetic problems characterized as slowly in the cognitive aspects of visual component, which confirms that the use of the visual aspects in the educational process will helps in development of some aspects of the learner educational process and improve achievement.

Saha et al. (Saha et al., 2010) indicated that using computer design in drawing charts and forms in the teaching of mathematics provides the opportunity for students to explore the relationships between mathematical concepts and the formation of visual images of these mathematical theoretical knowledge, and makes it easier and less frustrating, also allows the student to read formats and charts as a high skill facilitate students' learning, especially in mathematics.

Visual learning is to get the information through illustrations, photos, graphics, icons and other visual expression (Shafie et al., 2009), and given the importance of visual communication as one of the most important and most exciting learning tools, which are based on the pictures and drawings in access to the student's mind and in the integration of text with what constitutes a new term called "Infographic", which allows the transfer of facts, ideas, knowledge, and skills on a wider scale and usually leads to a deeper understanding, and reduces the cognitive burden as a result of a focus on just a text, hence, Infographic considered to be one of the most important means of visual communication, which gained great popularity in recent times, as one of the most effective in the delivery of the information content in the digital age means

(Smiciklas, 2012). The use of infographic has spread to the teaching and learning processes as a key means of learning, and has become an essential tool in many newspapers, magazines, traditional and digital media, which is comparable to social media such as Twitter and YouTube in the educational significance of the dependence on visual communication rather than just text (Kharbach, 2012). Smiciklas (2012) has defined Infographic as the provision of information and ideas in a visual form which is trying to transfer this information to students in an easier manner to understand and faster than traditional text methods, in addition, Kharbach (2012) illustrated that Infographic is an abbreviation of two terms, the information and graphs, and can be reached and designed through the integration of many variables such as text, pictures, flowcharts, graphs, geometric shapes, and other tools that relies on visual discernment.

Interactive Infographic Features:

There are many features for interactive infographic introduced by researchers (Balliet, 2011; Smiciklas, 2012; Lankow et. Al. 2012; Dick, 2004; Dwyer, 2008; Kenner, 2014; Davis & Quinn, 2013) as the following:

1. Give more visual attention for important information, so that they are more noticeable among the information represented graphically.
2. Organize information in a logical way, make student's eye flow in tracking information in the correct order, making it easier to understand and find relationships between them.
3. A combination of signs, graphs, images, texts and colors help for better understanding of the content instead of text only based. So, infographic is an easy and natural way to reach out students with diverse learning styles.
4. Infographic depends on visual interactive activities and extensive use of multimedia, which raise students' motivation to learn and make learning activities more dynamic and realistic.
5. Visual imaging of information supports the teacher's position in the simplification of mathematics and link it to everyday life and make learning meaningful and useful for students.
6. Interactive Infographic provides an opportunity for students to understand the facts and concepts just by looking, and link it to his visual memory in which he could retrieve it easily to build a new experiences.
7. Infographic works to match the visual representation of information, thus achieving the principles of the teaching of mathematics, especially the principles of communication connections.

To consider Infographic to be an effective tool in teaching mathematics and improve learning outcomes for students, then it must be prepared graphs in a way to link between mathematical concepts, processes, and between daily life and society, hence the learning become interesting and meaningful education. That happens because of Infographic focuses on the excitement and display the information in a simplified and fascinate manner to facilitate understanding of the information and lead to the satisfaction of the learner, and researchers believe that Infographics are important tools for learning mathematics as a result of mathematics' nature as an abstract field viewed by students as a difficult to understand, and that could be a result of learning it with traditional text methods, and that would increase the abstraction of mathematics and lead to a reluctance of students, especially in the early stages of teaching mathematics, and this is what led researchers to conduct the current study to explore the effective use of interactive Infographic in teaching mathematics at the elementary level.

The Study Problem:

Despite the increasing importance of mathematics at present time, and its diversity of uses and applications in all areas of life, but it is still considered to be an obstacle to the students; where are spreaded among students negative attitudes towards mathematics resulting from a cultural heritage, which is also spread among a wide category of students at all levels of education, as they look at mathematics as a complex and difficult subject and seen as boring academic subject. This is a big challenge for teachers and educators, especially in elementary and middle schools, where they should introduces and provide mathematics in a good and interesting way so the students can understand basic mathematical principles and concepts in which to enhance their long run achievements. Thus the importance of this study emerged from benefiting from the advantages of visual learning, data conversion, to convert mathematical text information to graphical and visual representation, to be easily organized and retrieved in students' memory through the use of Infographic interactive. Hence, the problem statement of the current study would be in th following questions:

1. What instructional design for the teaching of mathematics for elementary school using interactive Infographic?
2. What effective use of interactive Infographic in the teaching of mathematics in elementary school?

The Study Objectives:

The present study aims to:

1. Develop an instructional design model to teach mathematics at elemantry schools using interactive Infographic.
2. Explore the effectiveness of teaching mathematics in elementary school using the interactive Infographic.

The Study Importance:

1. The Infographic considered to be a modern learning tools that the researchers and educator did not invistagate it widely, even though, they realize its significance in improving learning outcomes.
2. The study may contribute to provide a new framework for the provision of educational content of mathematics through instructional design model to teach mathematics using interactive Infographic to benefit both teachers and students.
3. This study may contributes to find solutions of many of the teaching problems by revealing the effectiveness of the use of interactive Infographic.

THE STUDY METHODOLOGY

This is a semi-experimental study, and was designed to compare the effectiveness of using interactive infographics in the teaching of mathematics at elementary school through conrolled pretest and post test to test the effects of the current model

The study population and sample:

Population was comprised of all students of the second-grade in elementary schools in the city of Najran, southern Saudi Arabia. Two groups consisting of 32 students were selected randomly. One group was called experimental group and consist of 15 students (studying with interactive infographic method), while other was called control group and consist of 17 students (studying with traditional method),.

Tools:

In the light of the of Mathematics course syllabus, educational objectives and course content, the researchers prepared an achievement test with multiple choices statements for two chapters (Time - Fractions); the test will be made up of (20) clauses. The researcher presented the test to a group of experts in the field of teaching maths in order to determine the validity of the tool; the percentage of agreement among experts on the validity of the test clauses was (87%), which refers to the verification of the manifested validity of the test. The researcher performed a pilot study on a group of (10) students in order to measure the reliability of the test and determine the test time and the coefficients of difficulty and discrimination. The Cronbach's Alpha coefficient for the test was (0.853) which indicates the reliability of the test and that it is ready for application.

Pretest measurement:

The researchers were eager to start the research experiment in order to ensure groups evenness (experimental and control) in mathematics achievement test in two chapters (Time - Fractions), as the results of pre-test showed that there are no statistically significant differences between research groups which is illustrated in the following table:

Table (1): results of pre- achievement test for equality of experimental and control groups

Group	N	mean	Std deviation	df	t	Sig.
Experimental	15	5.87	2.356	29.1	Calculated	0.850
Control	17	6.06	3.211		Tabular	
					0.191	2.093

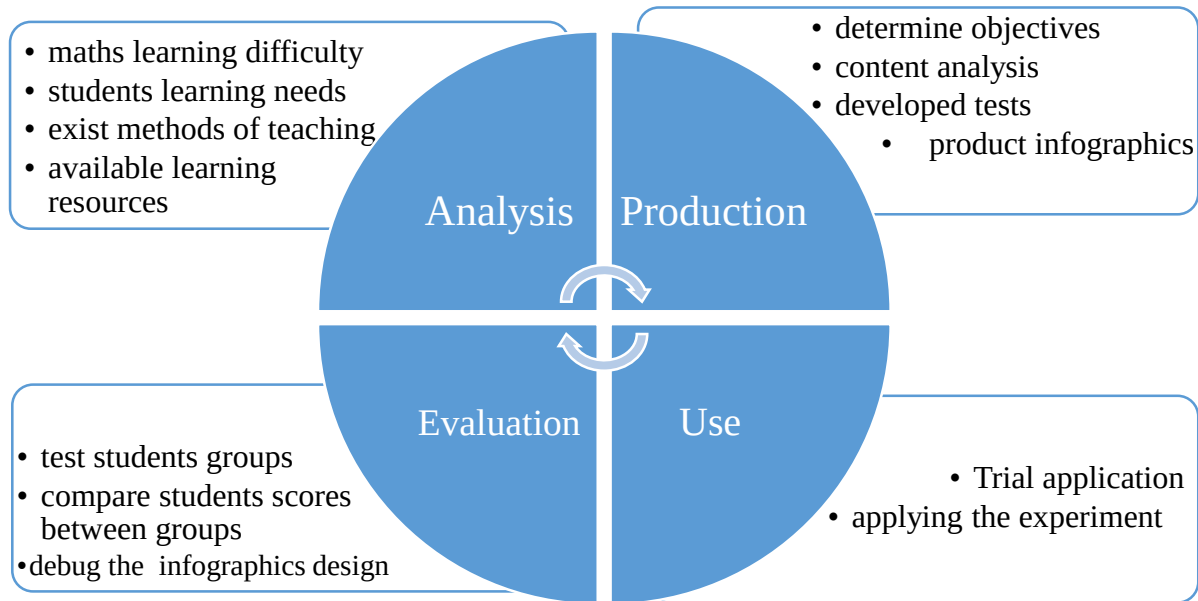
Table (1) shows the value of calculated t is (0.191) which is less than the value of tabular t (2.093) at the significant level of (0.05), which means that there are no statistically significant differences between research groups in the achievement pre-test; this can explain the evenness of experimental and control groups for the dependent variable (achievement test).

RESULTS

The results are displayed according to the sequence of the research queations as follow:

First question: What is the aproprate instructional design for teaching mathematics at elemantry schools using interactive infographics?"

To answer this question, the researcher developed an instructional design model for teaching mathematics at elemantry school using interactive infographics as follow:



Second question: What is effectiveness of using interactive infographics in teaching mathematics at elementary schools?"

To answer this question, the researcher used t-test for two independent samples in order to examine the significance difference between the mean of student scores in the experimental and control groups on the achievement test in the post test, as in table (2):

Table (2) t-test results of post achievement test of study groups

Group	N	mean	Std deviation	df	t	Sig.
Experimental	15	13.73	4.131	29.1	Calculated	0.019
Control	17	10.18	3.972		Tabular	
					2.481	2.093

Table (2) shows that the arithmetic mean of the experimental group students in the post test was (13.73) which is greater than the arithmetic mean of the control group which was (10.18), in addition, the value of t-calculated equals to (2.481) which is greater than value of t-tabular which equals (2.093) at significance level (0.05), that means there are statistically significant differences at level (0.05) between the experimental group and control group in post achievement test in favor to experimental group.

Effect Size:

The concept of statistical significance of the results reflects the confidence that we grant for the results of differences or relationships regardless the size of the difference or the correlation; while the definition of (effect size) focuses on the difference or correlation size regardless of the degree of confidence we grant for results (Fam, 1997:59). Therefore, the researcher calculated the effect size by calculating the ETA square (η^2) for the independent variable (using interactive infographics) on the dependent variable (achievement test), table (3) display this:

Table (3) effect size (η^2) (ETA square) of using interactive infographics in achievement test.

Independent variable		Dependent variable	(η^2)	Effect size
using infographics	interactive	Maths Achievement	0.17	high

DISCUSSION

The study results shows the superiority of experimental group (using interactive infographics) from the control group (learned using traditional method) in mathematics achievement test in elementary schools in Najran; clearly, interactive infographics is more effective than teaching mathematics with traditional methods. The effective of using interactive Infographic in the current study is consistent with previous studies which confirmed effectiveness in improving learning outcomes and increase the motivation to learn, including the Kanner study (Kanner, 2014), and the study (Davis & Quinn, 2013), and the study of Semsichaelas (Smiciklas, 2012), and a study of Inco and others (Lankow et. Al. 2012), and the study of Belet (Balliette, 2011), and the study of Dwyer (Dwyer, 2008), and the study of Dick (Dick, 2004). The infographic should be organized in a way that makes sense to the viewer, while accurately portraying the information, and using visual graphics via multimedia activities promised a high efficient learning outcome as it implicated a dynamic, realistic, tellingly, and conductive learning environment, moreover, visual graphics will help teachers ease up elaboration of lessons to students (Dick, H. 2004; Dwyer, F.M., 2008).

RECOMMENDATIONS

Based on the results reached by this study, the researcher recommend the following:

1. The necessity to train teachers at schools and pre-service teachers on designing and teaching with interactive infographics.
2. Support learning resource centers at schools, and maths textbooks with the educational design patterns and templates for interactive infographics to facilitate the production of courses and lessons based on interactive infographics.
3. Suggest further research to explore the effectiveness of using interactive infographics in teaching different grades.
4. suggests further studies on the effectiveness of Infographic in improving the learner's memory while receiving educational lessons or performance of the learning activities.

ACKNOWLEDGMENT

This research is funded by Najran University, Saudi Arabia The researchers are greatly indebted to Najran University for funding this study and the provision of any required help

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