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ANALYZING THE EFFECT OF DIFFERENT SOFTWARE ON MATH PERCEPTION OF THE FIRST YEAR HIGH SCHOOL STUDENTS

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ABSTRACT

The main objective of this study was to investigate the effect of different software on first year high school students' math learning in Zabul-Nimrouz. Since the purpose of educational technology is to facilitate and improve learning performance, educational simulations could realize this purpose as a technique. This study addresses the effect of various programs (Mathematica, Maple and Geogebra) on math education in the fields of geometry, polynomials and algebra. The results indicated that Mathematica program was successful in teaching topics such as algebra and polynomial functions and the Maple program was helpful in teaching vectors topics and the Geogebra was effective in teaching geometry.

Keywords: *Mathematical Education, Mathematical Software, Perception, Learning*

INTRODUCTION

Various studies in the countries that have been pioneers in the use of information technology in education have shown that self-learning through computers and other computer-based instructions in the basic skills could improve the performance of students in mathematics and science. There are some evidences about the effectiveness of IT in self learning such as simulation and computer based experiments in science and the research-based guidelines (Amir, 2004).

In educating specialist human resources in IT the priority must be placed on training the software programmers about all curriculums as well as training the curriculum planners who are specialists in IT. Strengthening expertise in these areas is essential for both public and private sectors so that the content of the main courses would be designed and applied based on the IT; so that the application of the IT would be intertwined with the curriculum and the educational technology workshops connected to the global network would be created in primary and high schools and the introduction with the computer and internet would be a part of elementary school curriculum (Ahadian and Ramezani, 2003).

Saffarian *et al.*, (2010) addressed and compared the use of educational software with the traditional method on the learning performance of 4th grade students of Qaemshahr city. In this experimental study among 56 4th grade classes, two classes were randomly selected among Fajr and Sama schools in which the 60 students have been studying as the samples. The sample group was classified into the test and control groups and in order to obtain the result the pre-test post-test quasi-experimental method was applied between the test and control groups. Finally they concluded that: The students trained by the educational software outperformed the students who have been trained in traditional method in mathematics significantly (Saffarian *et al.*, 2010).

Lakdashti and Yousefi (2010) examined the effect of simulation software on learning and memorizing lessons and compared it with the traditional method. For this purpose, the students of technical non-profit universities of the city of Sari were considered as the population. Their research method was quasi-experimental with two experimental and control groups administered based on pre-test and post-test. One group was trained by the simulator program and the other was educated by the traditional method. The results showed that there was a significant difference between the learning and memorizing of simulator software and traditional teaching methods. Hergenahn and Anson (2007) by conducting a study on educational software concluded that the use of educational software can communicate between new and old materials and cause the student to learn the contents meaningfully, therefore the existing knowledge are very important because the new materials are based on them.

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Clements and Sarama (2009) in their study titled “from the exercises and tasks to the role of projects and unique computer problems in creative and innovative mathematics education” addressed the role of electronic content in mathematics. Their research results indicated that the multimedia technologies help the students with rapid feedback, higher independence; part-whole relationship and the emphasis on understanding the problem with computer simulations help the students in thinking about the various solutions and finding the best one.

Based on what have been discussed the main purpose of this study was to investigate the effect of different software on first year high school students’ math learning in Zabul-Nimrouz. This study addresses the effect of various programs (Mathematica, Maple and Geogebra) in teaching and learning mathematics so that all three educational groups were educated based on geometry, polynomial are algebra topics and each group had 10 one hour sessions to learn a specific materials using the software. Then the pre-test and post-tests were given to all three groups in the same condition and results were analyzed and the learning of students in each group, as well as the effect of each software on the intended math topics were compared.

MATERIALS AND METHODS

Research Method

Methodology

The research method used in this research is applied and in terms of data collection method it was a semi-experimental research which has used the training and testing plan. Figure 1 is a conceptual Figure of the present study which is planned as follows:

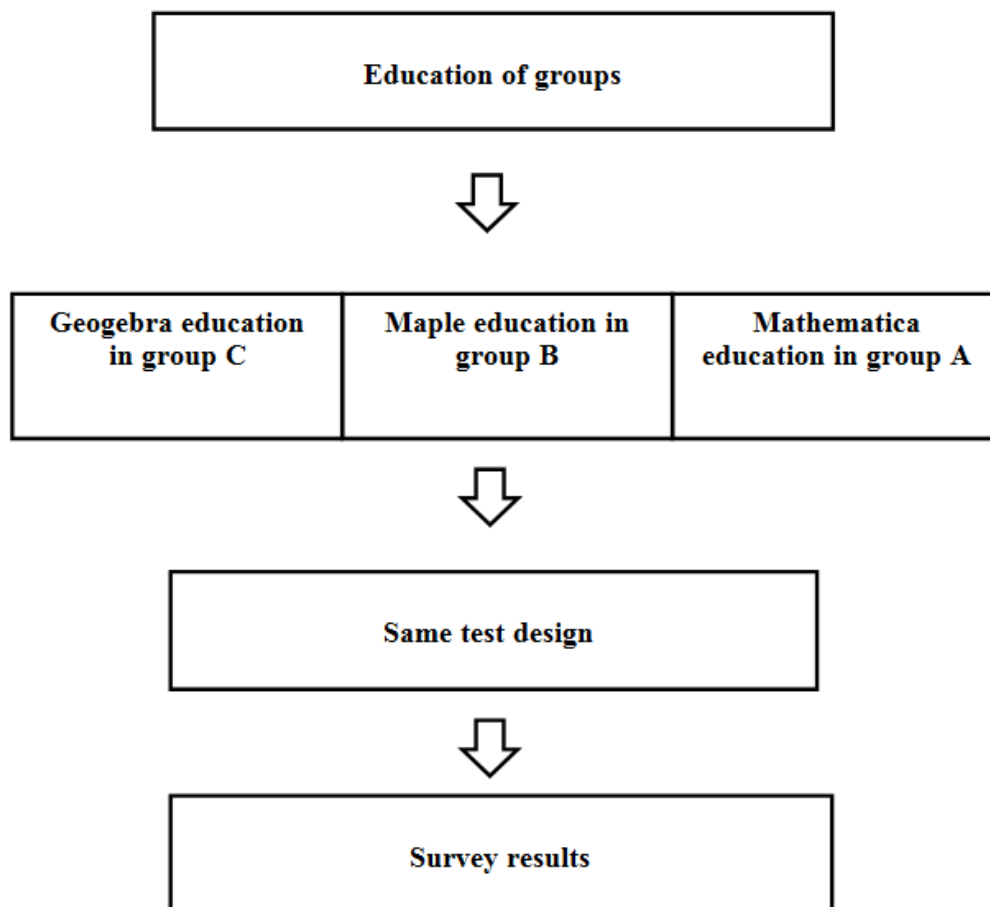


Figure 1: The research plan diagram

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Population

The research population included all students that have been studying in 2013 -2014 in Nimrouz city which included 5 high schools with 5 first year high school classes in each containing a total number of 450 students.

Sampling

There were three first year high school classes with 30 students in each class in Nimrouz city in 2013 - 2014. Three classes were randomly selected from Rezvan high school in which 90 students attended and again based on random sampling 60 students were selected and classified into three groups of 20 students known as A, B and C.

Methods and Tools for Data Collection

In order to measure student learning in the context of polynomial functions, algebra, vectors and geometry zero to twenty scored tests were used. First a pre-test was given to all three groups of students and the homogeneity of students' learning was examined then the students of all groups took part in 10 one hour sessions to learn geometry, polynomial and algebra –vectors topics through specific software for each group.

Implementation

After obtaining the necessary permits from the Department of Education and performing the coordination with school math teachers and administrators involved in the research project, a pre-test was given to all groups and their knowledge was examined. Next all groups were trained to use the software programs in 10 one hour sessions. Then a post-test was given to all students under the same conditions. The test had no negative score. After the announcement of the results we analyzed students answer to the questions and compared learning outcomes of students in each group and the effect of each software program on mathematical concepts.

After the following the above procedures we had a training workshop for teachers and educational professionals and presented the research process in detail. In order to study the research process after the acknowledgement of the teachers and education experts from the research process we gave them a survey form with 15 questions with 5 point Likert scale and 20 teachers and experts completed this form.

Reliability and Validity

According to 20 experts the content validity of the questionnaire with research purpose was 90%. Then after conducting the pre-test the questionnaire was completed by 20 education specialists and the reliability was calculated as 0.874 based on Cronbach Alpha using the SPSS which is presented in the Appendix which is a desirable rate of reliability.

RESULTS AND DISCUSSION

Data Analysis

The data were entered into the SPSS software program and analyzed using appropriate statistical tests. Finally the effectiveness factors Figures of each software program in the specified sectors was produced and finally we obtained the ability of each program in rendering the defined contents.

Based on the subject and its purpose this is a quasi-experimental study. The population of this study included all students that have been studying in 2013 -2014 in Nimrouz city.

Three groups were randomly selected among the schools in Nimrouz city and after conducting the pre-test, training courses and exercising Mathematica, Maple and Geogebra programs a 20 item post- test was performed. In the group A the education was based on Mathematica program and solving the problems was performed in this software. In class B the education was based on Maple program and solving the problems was performed in this software. In the group C the education was based on Geogebra program and solving the problems was performed in this software.

In order to achieve the desired results the quasi-experimental design with the same test design was applied on three groups and they were compared and their answers were examined. Questions designed to test the concept of geometry, vectors, polynomial functions are based on the sample questions of first year high school book which is published by Ministry of Education, Research and Planning. Since the sample

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questions were presented to several experienced teachers and experts in the field of education to ensure the validity and they approved them, it can be concluded that questions have content and face validity. In this study to evaluate the reliability of test the retest method was used in which the questions were entered into the SPSS software program and the reliability of 0.89 was obtained which was a desirable result. In Figure 2 the pre-test given to the students is presented.

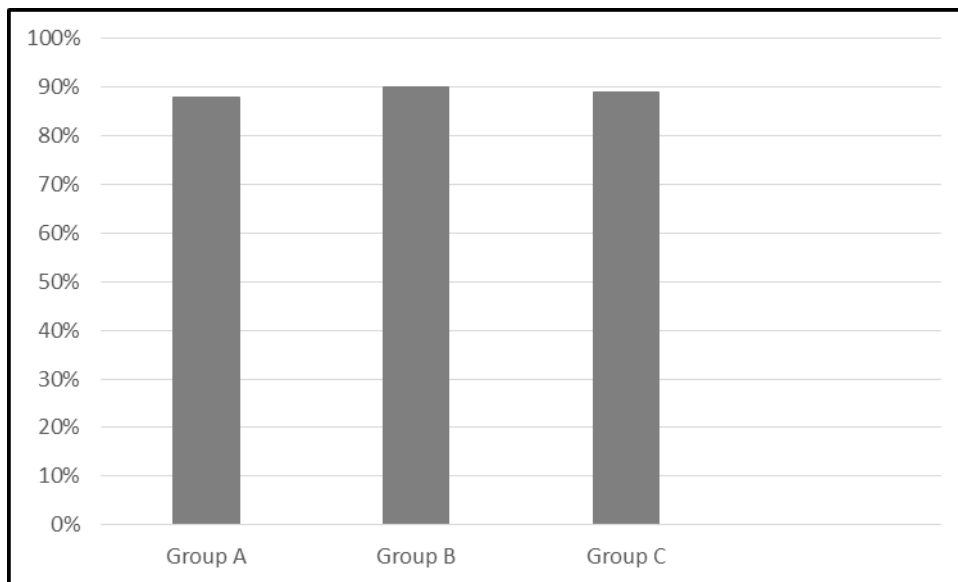


Figure 2: The results of the pre-test

Based on the above Figure of the pre-test results, it can be observed that all students have the same IQ level, approximately.

Table 1 presents the average high school math score of the pre-test.

Table 1: Average of math score

	Group	Questions	average
Algebra	A	7	18/88
	B	7	15.93
	C	6	16.63
Vectors	A	7	16.95
	B	7	18.90
	C	6	16.75
Geometry	A	7	16.23
	B	7	15.18
	C	6	19.88

In Table 1 group A has the highest score in the topic of algebra and the students in group B obtained the weakest results in this area. The students of group C had the average score in this content.

Group A in the vectors content obtained the average score and group B had the highest response to the questions. The students in group C had the lowest scores.

Group A in the geometry content obtained the average score among the groups B and C. The students of group B among the groups A and B obtained the lowest scores in this area and the students in group C obtained the highest scores in this content.

The Figures obtained from the first year high school math test are presented below. Figure 3, presents the average score obtained by the groups A, B and C in the algebra and polynomial functions.

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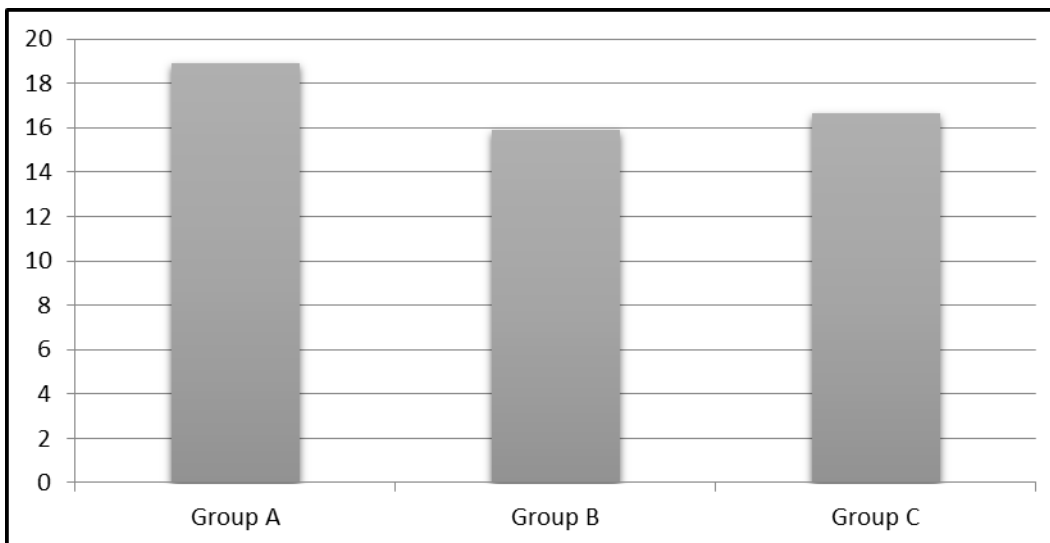


Figure 3: Results obtained from the average score of the groups A, B, C in the context of algebra and polynomial functions

According to Figure 3 the answer to the first question of this research is that the Mathematica software program has a better ability to communicate the algebra of polynomial functions content.

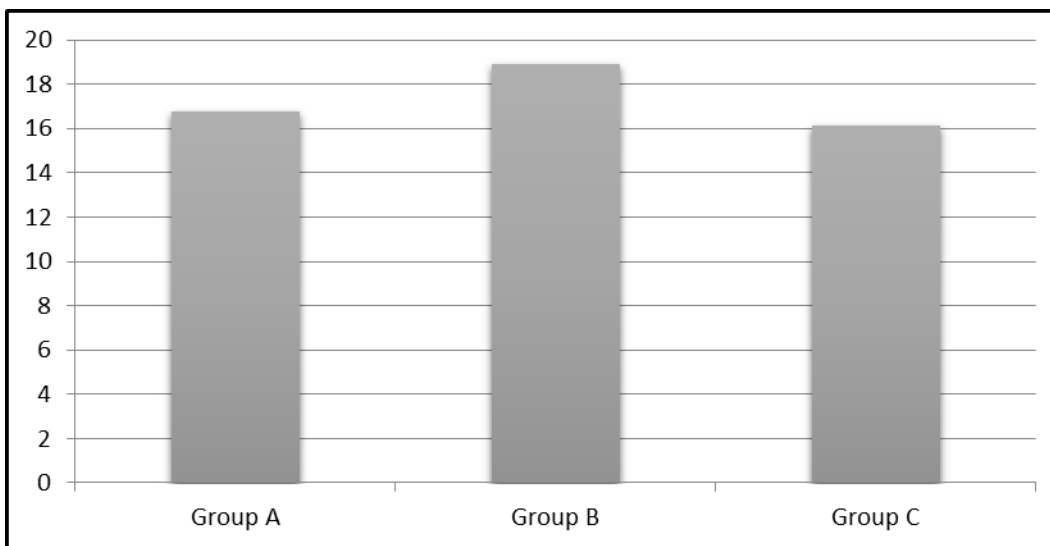


Figure 4: Results obtained from the average score of the groups A, B, C in the context of vectors

According to Figure 4 the answer to the second question of this research is that the Maple software program has a better ability to communicate the vectors content.

According to Figure 5 the answer to the third question of this research is that the Geogebra software program has a better ability to communicate the geometry content.

Therefore the findings of the application of software programs in math education and solving the related problems confirm the main hypothesis of this research. So the students trained by the Mathematica program have solved the problems using this program and have a better performance in the context of algebra and polynomial functions and the Maple and Geogebra programs have a better capability in the related contents. The results obtained related to the research hypothesis indicate that the educational and electronic programs help first year high school students to learn the math contents.

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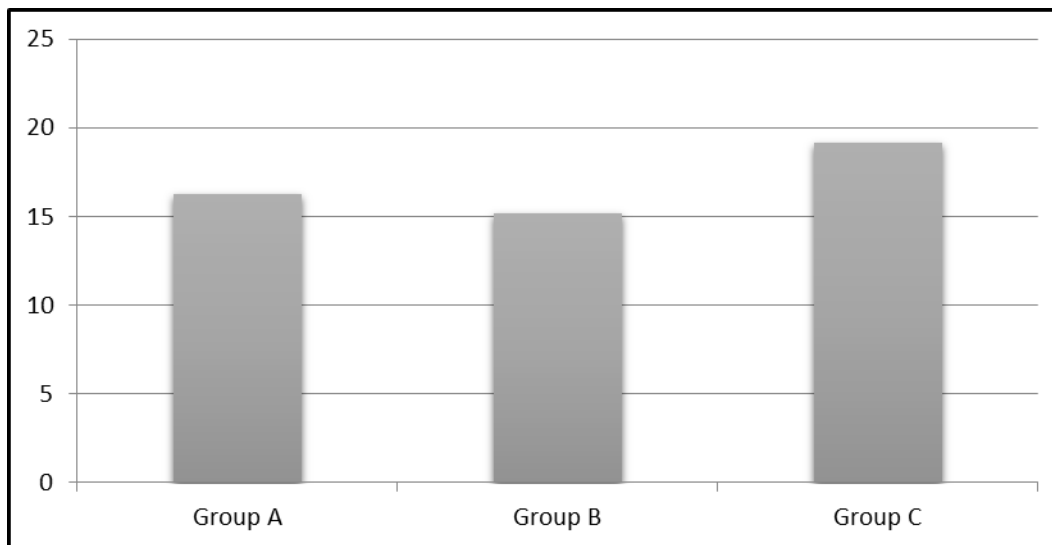


Figure 5: Results obtained from the average score of the groups A, B, C in the context of geometry

Discussion and Conclusion

After collecting and analyzing data using appropriate statistical tests the hypothesis were confirmed using various and direct relations. The results of each hypothesis are summarized below. The first hypothesis analyzes the significant relationship between the ability of the Mathematica software to learn the algebra and polynomial functions, vectors and geometry contents. The results of testing this hypothesis among first year high school students in 2013-2014 indicate that based on the Figure 2 there is a significant relationship at 95% level between the ability of Mathematica software and students' learning of the algebra and polynomial functions contents and this relationship is at 84% level in vectors content and 81% in geometry contents.

The second hypothesis analyzes the significant relationship between the ability of the Maple software to learn the algebra and polynomial functions, vectors and geometry contents. The results of testing this hypothesis among first year high school students in 2013-2014 indicate that based on the Figure 3 there is a significant relationship at 95% level between the ability of Maple and students' learning of the vectors contents and this relationship is at 79% level in algebra and polynomial functions contents and 75% in geometry contents. The third hypothesis analyzes the significant relationship between the ability of the Geogebra software to learn the algebra and polynomial functions, vectors and geometry contents. The results of testing this hypothesis among first year high school students in 2013-2014 indicate that based on the Figure 4 there is a significant relationship at 99% level between the ability of Geogebra software and students' learning of the geometry contents and this relationship is at 83.15% level in algebra and polynomial functions contents and 83.75% level in vectors content. The results of testing the main hypothesis of this research indicate that there is a significant relationship between students' learning of mathematics and using computer software to improve math education.

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