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The Effectiveness of Navigation Type within Multimedia Software in Teaching Algebra on Preparatory Stage Students' Achievement, Problem Solving and Attitude Towards the Subject

A Dissertation Submitted for the Degree of Doctor of Philosophy in Education, In the Field of Education Technology

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Introduction

The Arab World has witnessed a lot of trends and changes in most fields recently, either on the local level or on the global one. Some local trends call for the necessity of reforming and developing education as a basic step towards developing the society in all fields. Some of those global changes are the wide spread of modern times technology in all fields, the enormous scientific research in teaching and learning field and creating new communal and individual teaching strategies.

Maths has obtained a great deal of development and modernization just the same as the development and changes which happened in all other fields .In addition to its wide spread in the physics branches, maths plays a significant role in the possibilities theory, electronic sciences,calulators ,economy, industry, commerce, medicine, pharmacology and sociology.

The most obvious aspect of maths is that it is a " a research technique " as it depends mainly on logic and mental thinking through using wittiness, imagination expansion, accuracy of observation Besides, it is considered a fertile field of training on the proper thinking techniques because the mathematical issues are basically deprived according to logic rules which are the origins of proper thinking.

Also problem solving is one of the basic aims of teaching maths because teaching maths is no longer limited to memorizing students some rules which they recite when solving mathematical problems. Yet, it has become a technique to help a student thinks scientifically till he realizes a lot of mathematical facts by himself. It enables him to find himself the technique to solve mathematical problems and other problems as well.

Using computers is the best way which helps develop problem solving skills in teaching maths as it gives the students the opportunity to control what they learn and the technique they learn through.

Moreover, learning via computers provides a learner with active educational atmosphere distinguished by interaction, void of any abstraction or distraction which frequently appears during using the other teaching techniques especially those which depend on recitation because presenting the scientific material to the learner is closely related to his reaction to the stimulants presented to him via computers.

With the great progress in the field of computers, especially in teaching, integration between it and another different group of teaching aids has become possible; they affect each other and work together to achieve a set of different educational aims. The above-mentioned group is called the "multimedia software".

Designing multimedia software is one of the basic pillars when producing such a kind of software because a good design leads to a good programme in order to achieve its intended and expected aims. Navigation type within the multimedia software is the corner stone when designing and producing such technology because it gives the learner a great deal of freedom and facility to reach the intended information.

Navigation type moves with the user through all areas in the programme so as to define and gain the intended information. Talking about navigation suggests that the intended information hide behind a certain door that we cannot open without a certain key. Navigation is considered to be that key, the key we use to obtain information. The concept" navigation" can be obvious through this main question; Where am I and where will I go?.

The Research Problem:

This problem represents the weakness of pupils in Algebra. The research tries to answer the following main question:

What is the effect of the navigation type in multi-media software on teaching Algebra for solving problems and developing acquisition in preps stage?

This question is divided into sub- questions:

1- What is the effect of difference of navigation type (Menu – network) on developing achievement in the second year of prep stage ?

2- What is the effect of difference of navigation type (Menu – network) on developing problem solving in the second year of prep stage ?

3- What's the effect of difference of navigation type (Menu – network) on the attitudes towards learning Algebra?

4- What's the effect of acquisition level (high- low) on the developing achievement.

5- What's the effect of achievement level (high- low) on the developing problem solving.

6- What's the effect of this difference on the tend towards learning Algebra?

7- The effect of reactions between the navigation type (network- menu) and the acquisition level.

8- The effect of this reactions on the developing of problem solving.

9- What is the effect of the previous reactions on the tendency of students towards learning Algebra in the second year of prep stage ?

Research Aims:

The aim of the current research is to define the following items:

1- The effectiveness of substitution between navigation styles (menu- network) in the multi- media program in teaching Algebra, on developing the achievement of the second year of prep stage students.

2- The effectiveness of variation between navigation styles (menu- network) in the multi- media program in teaching Algebra, on development of problem solving skills of the second year of prep stage students.

3- The effectiveness of the program on the second year of prep stage students' attitude to learning Algebra.

4- The effectiveness of variation in students' achievement level (low- high) on the development of their problem solving skills.

5- The effectiveness of variation in students' level of achievement (low- high) on their attitude to learning Algebra.

6- The effectiveness of interaction between navigation style (menu- network) and students' level of achievement (low- high) on the development of third year prep students' achievement.

7- The effectiveness of interaction between navigation style and students' level of achievement on the development of students' problem- solving skills.

8- The effectiveness of interaction between navigation style and students' level of achievement on students' attitude to learning Algebra.

Research Limitations:

The current research was limited to:

1- Two navigation style, namely; menu- network navigation styles.

2- A sample of low- high level third year prep students in some schools in Fayoum.

3- " Division of Algebraaic Amounts and Analysis " unit in the second year of prep stage curriculum.

4- Measuring the effectiveness of variation in navigation style in the multi-media program on the following item:

(1) Achievement.

(2) Development of problem.

(3) Development of students' attitude to learning Algebra.

Research Importance:

The current research was useful in:

1- Directing the attention of designers and programmers of multi- media programs to the effectiveness of changing the design style on the achievement and problem- solving skills of the second year of prep students.

2- Offering a model of a multi- media program that can help to design other simulated programs to achieve other aims in other school subjects.

Research Hypotheses:

1- There is no statistically significant difference, relevant to the basic impact of variation in the navigation type, between means of scores of the research sample in the application of the achievement post- test in the " Division of Algebraaic Amounts and Analysis " unit.

2- There is no statistically significant difference between the means of scores of the research sample in the post application of the problem- solving test in the selected unit.

3- There is no statistically significant difference between the means of scores of the research sample in the post application of the scale of students' attitude to learning Algebra.

4- There is no statistically significant difference related to the basic impact of variation in students' level of achievement (low- high), between the means of achievement post test in the selected unit.

5- There is no statistically significant difference related to the basic impact of variation in students' level of achievement (low- high), between the means of scores of the research sample in the post application of the problem- solving test in the selected unit.

6- There is no statistically significant differences, related to the basic impact of variation in students' level of achievement, between the means of scores of

the research sample in the post application of the scale of students' attitude to learning Algebra.

7- There is no statistically significant difference related to the basic impact of interaction between navigation type and students' level of achievement, between the means of scores of the research sample in the post application of the achievement test in the selected unit.

8- There is no statistically significant difference, related the above mentioned reason, between the means of scores of the research sample in the post application of the problem- solving test in the selected unit.

9- There is no statistically significant difference, related to the same reason, between the means of scores of the research sample in the post application of the scale of students' attitude to learning Algebra.

Research Method:

According to the nature of the research, the researcher used the experimental method for investigating the effectiveness of variation in the navigation style in multi- media program on the achievement, mathematical problem- solving skills, and students' attitude to learning Algebra.

Experimental Design of the research:

1- Independent variables:

The research includes two independent variables that are:

(A) Navigation style: It will be designed in two ways:

* Network navigation type * Menu navigation type

(B) Achievement level: It will include two levels:

* Low achievement level * High achievement level

2- Dependent variables:

The research includes three independent variables:

(A) Achievement (B) Problem- solving

(C) Attitude to learning Algebra.

Type of Experimental Design:

Because the research design includes two independent variables, the researcher selected the experimental design know as "factorial design 2 * 2"

Navigation type / Level of achievement	Network	Menu
High	Group (1)	Group (3)
Low	Group (2)	Group (4)

Table (3) Experimental Design of the Research

Research Groups:

Group 1: High level students who study the program using network navigation type.

Group 2: Low level students who study the program using network navigation type.

Group 3: High level students who study the program using menu navigation type.

Group 4: Low level students who study the program using menu navigation type.

Research Instruments:

1- Two multi- media program that are built upon menu navigation type and network navigation type to teach "Algebric formulas" unit to the student of second year of prep stage . (Prepared by the researcher)

2- Achievement test in the selected unit. (Prepared by the researcher)

3- Mathematical problem- solving test in the selected unit. (Prepared by the researcher)

4- A scale for measuring students' attitudes to learning Alegbra. (Prepared by the researcher)

Research Procedures:

The research was done according to the following steps:

1- Reviewing literature and previous studies related to the current research, to formulate the theoretical frame of the research.

2- Preparing two multi- media programs dependent on menu and network navigation styles, and showing the two programs to experts and specialists in the field of teaching technology.

3- Selecting a random sample of second year of prep stage students in Fayoum.

4- Dividing the sample students according to their achievement level into four groups .5- Pre- application of the research instruments on the four sample groups.

6- Application of experimental treatment materials on the four sample groups according to the experimental design .

7- Post application of the research instruments on the four sample groups.

8- Statistical analysis of the research results to test the hypotheses.

9- Elaborating and introducing results in relevance to the theoretical frame of the research and the previous studies.

10- Formulating research recommendations and suggestions.

Summary of Results

1-There are statistically significant differences at the level of 0.01 between the means of scores of the experimental groups in the post application of achievement test of the selected unit ," Division of Algebraaic Amounts and Analysis .this can be referred to the main effect of variation in the navigation type (network- menu).

2- There are statistically significant differences at the level of 0.01 between the means of scores of the experimental groups in the post application of problem solving test of the selected unit ," Division of Algebraaic Amounts and Analysis .this can be referred to the main effect of variation in the navigation type (network- menu).

3- There are statistically significant differences at the level of 0.01 between the means of scores of the experimental groups in the post application of the attitudes towards Algebra scale .this can be referred to the main effect of variation in the navigation type (network- menu).

4- There are statistically significant differences at the level of 0.01 between the means of scores of the experimental groups in the post application of achievement test of the selected unit ," Division of Algebraaic Amounts and Analysis .this can be referred to the main effect of variation in the students' level of achievement (high- low).

5- There are statistically significant differences at the level of 0.01 between the means of scores of the experimental groups in the post application of problem solving test of the selected unit ," Division of Algebraaic Amounts and Analysis .this can be referred to the main effect of variation in the students' level of achievement (high- low).

6- There are statistically significant differences at the level of 0.01 between the means of scores of the experimental groups in the post application of attitudes towards Algebra scale due to the main effect of variation in the students level of achievement (high- low).

7-There is no statistically significant interactive relationship at the level of 0.05 between the navigation type (network- menu) used in the study and students' achievement level (high- low) revealed by means of scores of the experimental groups in the post application of achievement test of the selected unit.

8- There is no statistically significant interactive relationship at the level of 0.05 between the navigation type (network- menu) used in the study and students' achievement level (high- low) revealed by means of scores of the experimental groups in the post application of problem solving test of the selected unit.

9- There is no statistically significant interactive relationship at the level of 0.05 between the navigation type (network- menu) used in the study and students

achievement level (high- low) revealed by means of scores of the experimental groups in the post application of the attitudes towards Algebra scale .

Recommendations of the study:

In the light of the study results , the researcher gives the following recommendations:

1- As results of the study proved the effectiveness of using the network navigation type in desining multimedia programs in improving students achievement level, problem solving abilities ,and attitudes towards Algebra , the researcher recommends using this style when desining and producing multimedia programs for general educational purposes, especially for improving students' achievement level , problem solving abilities ,and attitudes towards Algebra.

2- Agreater deal of attention should be directed to the application of navigation style that engage students in attaining the intended educational goals , especially when thes goals are related to achievement, problem solving abilities ,and attitudes towards Algebra.

3- It is necessary to make use of multimedia technology in introducing different syllubi ,either practical or theoretical. This is because these types of programs provide an integrative environment of multimedia which is required for facilitating the acquisition of concerete and abstract educational experiences with regard to students' individual abilities.

4- It is important to manipulate the currently used teaching methods ,and use new ones to cope with differences.

5- It is useful to produce multimedia programs using navigation types other than the menu and network ones and to measure their effect on dependent variables other than those used in the current study.

Suggestions for further Research:

1- The current reseach was limited to measuing the effect of its independent variabeles on the pefomance of prep stage students .so, future research

can be conducted for measuring the effect of these variables on the performance of students at other stages ,for it is possible that results one affected by students' age and experience.

2- Investigating the effect of variation in the navigation type (menu-netwok) in designing multimedia programs on developing students' mathematical ,creative ,and critical thinking skills.
3- Investigating the effect other navigation types in designing multimedia programs on developing other sides of the educational process.
4- Studying the relationship between different types of navigation in designing multimedia programs and different learning styles of students.
5- Investigating the relationship between different types of navigation in designing multimedia programs and some variables such as impulsive and reflation behaviors, dependence and independence in the perceptual domain.
6- Investigating the relationship between links of different types and sizes and different levels of achievement.