



Cairo University  
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**The Effect of Interaction between the Advanced  
Organizer Style used in Multimedia Programs  
and Teaching Style on the Development of  
Geometric Thinking of Prep Stage Pupils**

A Dissertation Submitted for the Degree of Doctor of  
Philosophy in Education ,in the Field of  
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## **Introduction:**

One of the major components of mathematics is geometry which provides its learners with life-long basic skills as it includes cognitive learning aspects that are necessary for the comprehension and explanation of the cognitive learning aspects of other mathematics branches. It also helps in the expansion of students' mental abilities and develops their logical deductive thinking and reasoning when problem solving and situations analysis are concerned. It assists the development of students' imagination when they are involved in the preparation of geometrical constructions, measurement, geometric shapes transformation and comparison, comprehension of terms, symbols and abstractions, in addition to the geometrical shaping of natural objects.

Accordingly, it is clear that geometry could not be learned in a negative learning atmosphere or through recitation as it requires a positive active endeavor on part of both learners and educators. Unfortunately, the reality of geometry teaching and learning in our schools does not provide for the realization of its educational aims. Thus, new techniques are needed for enhancing geometry introduction especially the ones depending on the use of interactive advanced technological devices that would support learners throughout the process of knowledge achievement and educational needs' satisfaction.

Information technology and computers use are among the recently introduced means of teaching and knowledge provision that characterize our modern world. Using them in education is highly provided for as computers nowadays are widely spread among variant societies and all the social classes. Like all the other fields, computers have variant and numerous uses that might help in the achievement of higher educational aims such as increasing its effectiveness or making it more attractive. Therefore, computers became one of the leading technological devices in the field of education and a highly competitive tool that could not be ignored or done without.

Multimedia on the other hand is one of the potentials provided by computers as they could very simply and clearly

introduce the educational content using the typed form, graphs, audible representations, static and dynamic images in addition to animations. In this way, concepts, rules, laws could be comprehended, problems could be solved, values and attitudes could be acquired in addition to the achievement of all possible types of cognitive, affective and psychometric educational aims.

The computer program production is mainly based on designing. It could be simply stated that good designing leads to the creation of a beneficial program that could achieve its aims. Thus, designing good effective screens requires the presence of highly qualified proficient designers who master the tools of their profession and put in mind the educational variables to be considered and utilized. Among the most developed and advanced techniques is the advanced organizers .

The concept of advanced organizers was initially introduced as one of the Ausubel theory basic concepts. It is mainly used in the creation of effective computer-based learning environments as it helps in connecting the learners' prior or stored knowledge to the newly introduced pieces of information. In other words, it functions as a cognitive bridge that assists learners to connect what is new to what is well comprehended and learned previously thus giving meaning to new knowledge.

The nature of mathematics as a subject depends on the creation of links between the unfamiliar and the familiar pieces of information. Thus, the advanced organizers could be highly effective in mathematics introduction and solid geometry specifically as it provides for the development of the pupils' ability to differentiate, analyze, re-formulate the body of knowledge possessed. Thus, it is evident that advanced organizers can play a major role in mathematics especially when using its variances that match the nature of the subject matter, the teaching situation, the learners' educational standard and their abilities to be able to correspond to the learners' individual differences.

The consideration of students' individual differences urge educationists to use Style Treatment Interaction (STI) approach as it pays special attention to the introduction of educational materials

and connecting them to individual and group learning situations. The approach suggests the matching of the special properties of a certain educational pattern with a certain method of application to achieve better results, depending on the fact that there are no perfect methods of teaching but there are ways that are suitable for certain teaching situations and yield better results.

### **Problem of the Study:**

The study problem is represented in the deterioration of the second year prep pupils level in geometry and their geometric thinking as well . In addition to the fact that there is an urgent need for research works that put into consideration the characteristics of multimedia programs and pays attention to learning styles and its relationship with other variables in light of the interaction between the processing and style approach .

The recent study attempted to answer the following questions :

- (1) What is the effect of the advanced organizer style (written and audible – audible, written and animated) used in the multimedia programs introduced to second year prep students on the development of their geometric thinking?
- (2) What is the effect of the teaching style (individual – small groups) used with second year prep students on the development of their geometric thinking?
- (3) What is the effect of the interaction between the advanced organizer style (written and audible – audible, written and animated) used in the multimedia programs and teaching style (individual – small groups) introduced to second year prep students on the development of their geometric thinking?

### **The Study Aims:**

The current study helped in clarifying:

- (1) the effect of the advanced organizer style (written and audible – audible, written and animated) used in the multimedia programs introduced to second year prep students on the development of their geometric thinking.

- (2) the effect of the teaching style (individual – small groups) used with second year prep students on the development of their geometric thinking.
- (3) the effect of the interaction between the advanced organizer style (written and audible – audible, written and animated) used in the multimedia programs and teaching style (individual – small groups) introduced to second year prep students on the development of their geometric thinking.

### **The Study Importance:**

The study might help in:

- (1) Directing the multimedia programs designers' attention to the consideration of advanced organizer style " audible, written and animated " .
- (2) Directing the attention of the experts supervising the education process to the importance of considering the learning style in small groups in the multimedia programs .
- (3) Providing a multimedia programs model that could be used as a basis for developing similar projects.
- (4) Introducing a test for measuring geometric thinking levels of second year prep pupils .

### **The Study Limitations:**

The study is limited to:

- (1) A sample of second year prep pupils in some prep stage schools at Fayoum governorate.
- (2) The area unit of the geometry syllabus introduced to second year prep.
- (3) Two of the advanced organizer style; namely the written and audible organizer and the audible, written and animated one.
- (4) Two of the teaching styles: individual and small groups.
- (5) The four levels of geometric thinking: Imagining, analysis, figurative deduction and non-figurative deduction.

### **The Study Hypotheses:**

The study attempted to test the following hypotheses:

- (1) There is a statistically significant difference between means of scores of the experimental group in the post geometric thinking test that could be attributed to the difference in the advanced organizer style (written and audible – audible, written and animated) used.
- (2) There is a statistically significant difference between means of scores of the experimental group in the post geometric thinking test that could be attributed to the difference in the teaching style (individual – small groups) used.
- (3) There is a statistically significant difference between means of scores of the experimental group in the post geometric thinking test that could be attributed to the interaction between the advanced organizer style (written and audible – audible, written and animated) and the teaching style (individual – small groups) used.

### **The Study Variables:**

- (1) The independent variables:

The study included two independent variables:

- The first independent variable: The advanced organizer style used including two levels:
    - The written and audible organizer style
    - The audible, written and animated organizer style.
  - The second independent variable: The teaching style used including two levels:
    - The individual teaching.
    - The small groups teaching.
- (2) The dependent variable: The geometric thinking levels.

### **The Study Design:**

In light of the previous variables, the researcher selected the experimental design known as the factor design 2x2 requiring the following table:

The advanced organizer style	written and audible	audible, written and animated
The teaching style		
Individual	Group (1)	Group (2)
Small group	Group (3)	Group (4)

### **The Study Tools:**

- **The experimental study material:**

The current experimental study included the use of four multimedia computer programs containing the same content (the area unit included in the geometry syllabus introduced to the second year prep pupils) but different in their design using the two specified independent variables.

- **The Measuring Tools:**

The Measuring tool is mainly the geometric thinking test dealing with the area unit included in the geometry syllabus introduced to the second year prep pupils

### **The Study Procedure:**

The study followed the following procedure:

- (1) Surveying the literature and previous studies related to the current research work so as to design the study outline and specify the needed procedure in designing and implementing the study tools in addition to the designing of the test.
- (2) Designing and producing four multimedia computer programs according to the two specified independent variables and judging it suitability by the jury members and specialists in the field of education technology. Then, preparing the study program in its final form according to the suggested alterations.

- (3) Designing the geometric thinking test, judging it and changing its items according to the jury members' point of view, then calculating its validity and reliability.
- (4) Selecting the study sample from among the pupils of second year prep stage in Fayoum governorate and dividing them among the study groups.
- (5) The pre-implementation of the geometric thinking test to all the study groups.
- (6) Introducing the multimedia computer programs to the study groups according to the experimental design of the study.
- (7) The post-implementation of the geometric thinking test to all the study groups.
- (8) Specifying the study results and analyzing them statistically.
- (9) The study recommendations and suggestions.

### **The Study Results:**

The study proved the following:

- There is a statistically significant difference at (0.01) between means of scores of the experimental group in the post geometric thinking test that could be attributed to the difference in the advanced organizer style used (written and audible – audible, written and animated) in favor of the ones using the audible, written and animated style.
- There is a statistically significant difference at (0.01) between means of scores of the experimental group in the post geometric thinking test concerning the (imagining – analysis – non-figurative deduction) that could be attributed to the difference in the advanced organizer style used (written and audible – audible, written and animated) in favor of the ones using the audible, written and animated style.

- There is a statistically significant difference at (0.05) between means of scores of the experimental group in the post geometric thinking test concerning the (figurative deduction) that could be attributed to the difference in the advanced organizer style used (written and audible – audible, written and animated) in favor of the ones using the audible, written and animated style.
- There is a statistically significant difference at (0.05) between means of scores of the experimental group in the post geometric thinking test that could be attributed to the difference in the teaching style (individual – small groups) used in favor of those using the small group style.
- There is a statistically significant difference at (0.01) between means of scores of the experimental group in the post geometric thinking test concerning the imagination level that could be attributed to the difference in the teaching style (individual – small groups) used in favor of those using the small group style.
- There is a statistically significant difference at (0.05) between means of scores of the experimental group in the post geometric thinking test concerning the (analysis – non-figurative deduction – figurative deduction) levels that could be attributed to the difference in the teaching style (individual – small groups) used in favor of those using the small group style.
- There is no statistically significant difference at (0.05) between means of scores of the experimental group in the post geometric thinking test that could be attributed to the interaction between the advanced organizer style

(written and audible – audible, written and animated) and the teaching style (individual – small groups) used.

- There is a statistically significant difference between means of scores of the experimental group in the post geometric thinking test concerning the (imagination - analysis – non-figurative deduction – figurative deduction) levels that could be attributed to the interaction between the advanced organizer style (written and audible – audible, written and animated) and the teaching style (individual – small groups) used.

### **The Study Recommendations:**

In light of the current study results, the researcher recommends the following:

- (1) Using the multimedia technology potentials in introducing different subjects as they provide learners with an interactive comprehensive learning environment that assists the teaching and learning of variant educational experiences according to the individual needs of the learners.
- (2) Paying more attention to the designing and production of multimedia programs that handle the variant topics of the geometry syllabus at the secondary stage as they play a fundamental role in the introduction and clarification of the geometric concepts and generalization.
- (3) Making use of the current study computer program in teaching geometry at the prep stage especially to the second year pupils.
- (4) Benefiting from the teaching and learning theories results when designing and producing multimedia programs especially those related to the presentation of the educational content.

- (5) Using advanced organizers when designing and producing multimedia programs including visual and audible materials as well.
- (6) Considering the use of the advanced organizer style (audible, written and animated) when designing multimedia programs as it was proved to surpass the other style in effectiveness when the development of geometric thinking is concerned.
- (7) Considering the use of the advanced organizer style in all the mathematics branches as it was proved to have a clear positive effect on the development of differentiation, analysis and construction of information which might lead to a more meaningful way of mathematics learning.
- (8) Utilizing the small groups teaching style when using multimedia computer programs to enlarge the learners' opportunities for interaction and forming positive attitudes towards the use of computers in learning. It might diminish the anxiety accompanying the learning experience leading to better learning and more achievement.
- (9) Teachers should be concerned with encouraging their students to work cooperatively.
- (10) Being concerned mainly with the development of learners' thinking ability to replace memorization and recitation.

#### **The Study Suggestions:**

The researcher would suggest the following further studies:

- (1) Carrying out similar studies in other subjects.
- (2) Carrying out a similar study in another stage as new results might be gained due to difference in age and level of experience.
- (3) Carrying out similar studies using different variables such as learning time, its retention, creative thinking and problem solving.

- (4) Carrying out a similar study using another advanced organizer style.
- (5) Carrying out a similar study using variant teaching styles such as teaching in small groups vs. large groups.
- (6) Studying the relation between the advanced organizer style used in the multimedia computer programs and the learners' variant achievement levels (high – medium – low).
- (7) Studying the relation between the advanced organizer style used in the multimedia computer programs and some cognitive styles such as reflection vs. rashness, dependence vs. independence.
- (8) Carrying out a similar study to clarify the effect of interaction between learning styles and surfing styles used in multimedia programs.
- (9) Carrying out a similar research to study the relationship between learning styles and the other variables related to the designing and production of multimedia programs such as interaction styles and the feedback type used in the program.
- (10) There could be future possibilities for using the current study independent variables using other types of programs with different properties such as video and multimedia programs.