

Dynamic Teaching

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Abstract:

Characteristics of trained teachers with Geogebra in the classroom without using digital tools are described in this article. This will open a new vision of study for future research.

Introduction:

The wave of information technology goes ahead fast and changes our life in all aspects, especially in teaching-learning interactions. The presence of various technologic tools in educational environments, homes and students' room has influenced education strongly and educational tools play an important role in this field.

In an appropriate separation, we can divide educational tools into two groups:

- 1) Digital tools like computer and graphic calculator;
- 2) Non-Digital tools like pencil, ruler, compass and blackboard.

Among the digital tools, educational softwares have used more in learning environments. Simulation softwares have used especially in learning process as virtual laboratory for learning some subject matters in depth.

The necessity of utilizing simulation softwares in mathematics education, leads so many companies to design dynamic geometry softwares.

Dynamic geometry softwares create flexible, multi functional and rich environment as a virtual laboratory to explore, understand and represent mathematical concepts and also create a connection between concrete and abstract concepts.

Kaput & Thompson, 1994

Teacher- Pupils Matrix:

The physical environment of classrooms is divided as following types:

- 1- Equipped class with digital tools;
- 2- Non-equipped class with digital tools.

Many articles and case studies have been repeatedly conducted to study the first type, whereas there is still more opportunities in this field of study. In this article I will focus on the second one.

Non-equipped classrooms can be divided in four categories based on teachers and students' ability of using dynamic geometry softwares, especially Geogebra as below:

Teachers pupils	Familiar	Not familiar
Familiar	A	B
Not familiar	C	D

Four categories of non-equipped classrooms

- A. The teacher may know the students' prior experiences of the software and hints them as a reminder, to continue making sense of concepts. These hints can be about some tools or special features of the software. For example, for investigating different statuses of intersections two circles on the blackboard, teachers can remind the slider tool as below:

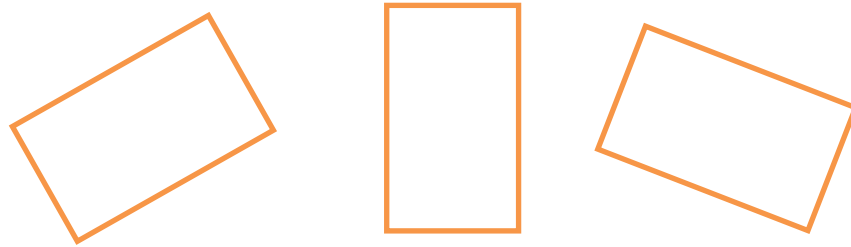
"We change the distance between centers of circles with a slider. Find all statuses of intersections two circles".

- B. In this case teachers may face different types of students in the classroom. For example, non-stereotyped questions may be asked by students, that these questions may be made by rotating, resizing, or moving the shapes in the students' minds based on their experiences of Geogebra.

Or students who are familiar with dynamic softwares may sketch abnormal shapes on the notebooks. For example students normally draw a rectangle like this:



But this type of student, may sketch rectangle as below because he/she has experience of shapes in dynamic environment.



Some abnormal shapes that have been drawn in students' notebooks

C. In this case, teacher has been trained properly to manipulate software and knows appropriate method for using it. Some classroom observations and interview teachers about their method of teaching showed that their teaching trend has been changed, although they managed their class without using digital tools. It seems that teachers' experience of dynamic geometry software environment caused this change.

In this paper, I am going to focus on this case.

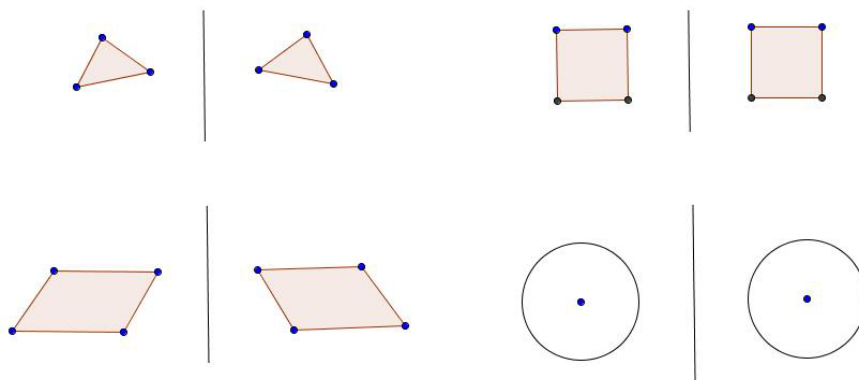
D. In this case, no effects of dynamic thought are seen in class because teacher and students are not familiar with dynamic environment.

A trained teacher in a class without any digital tools

Teachers, who participated in the Geogebra workshop, stated that they can simulate the atmosphere of software in the class and show continuous movement of geometric shapes on the paper or blackboard disconnectedly.

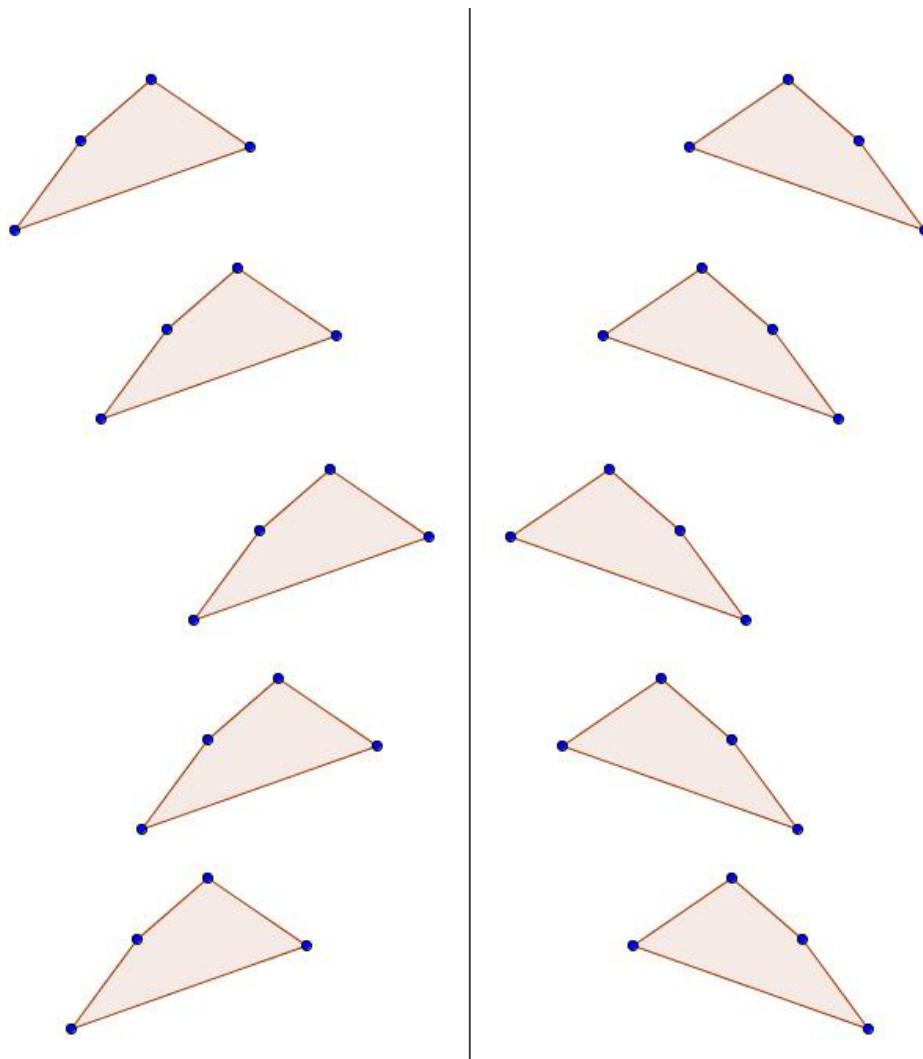
For example, for teaching the symmetry, a teacher moved a shape in some different distance of symmetry axis and asked students to draw the symmetry of that shape. Teacher by drawing a shape and repeat it in different positions, try to induce a connectivity and an animation in the students' mind.

Whereas this teacher used some static shapes as below, for teaching the concept of symmetry before attending geogebra workshop:



Homework presented by teacher before attending the geogebra workshop

This type of education has no movement or continuous changes and just repeats the same exercise for different shapes.



Homework presented by teacher after attending Geogebra workshop

Also this teacher asked these questions in her class:

When does the shape meet its symmetry?

When does the shape situated on its symmetry?

As she stated, she never asked questions like these, when she had static viewpoint and couldn't see the movement of shapes.

In other sample, the trace tool and laying a point on a line, showed its effect on the teacher's method. She found the intersection point of heights in a triangle and named it O, and asked the question as below:

By moving the top vertex on a parallel line to the base, how would the point O move?

The most students answered that it moves on a parallel line to the base.

The teacher drew a parallel line to the base containing the top vertex, and by moving this vertex on the line, created some triangles on the board and found the intersection point of heights for each triangle.

Then she connected the intersection points of heights together sequentially, and showed that point O moves on a curve, not on a parallel line to the base. Indeed she inspired the trace tool from the software.

And also she believed that *laying the top vertex on a parallel line to the base and tracing O in some cases* are necessary for discovering the pattern of this point, that it seems this idea is coming from drawing attention on independent and dependent objects and trace tool in software environment.

Also she stated that before being educated with software, she concerned to finding the intersection point of heights merely and did not move any elements of triangle.

In the other sample, the question of teacher is that what is the shape made by intersection of bisectors of inner angles of a parallelogram? And its answer is a rectangle. Then the teacher continued this question and asked more below questions:

- In what case, the produced shape can be a square?
- Can lay two vertices of rectangle on the side of main parallelogram?
- Is there any status in which, all vertices of rectangle, lie on the sides of parallelogram?
- What shape has been made by intersection of bisectors of outer angles?

In the interview, teacher said that before attending the Geogebra workshop the curiosity situation in the class is restricted because she had no enriched environment which the shapes can move freely and be dynamically and she could not follow her inquisitiveness.

She also stated that she was not worried about doing mistakes in the software environment and messing the shape when exploring the problems. This feature of software that she could easily hide, show, add or omit objects, helped her to save time and see the various aspects of the shape.

Conclusion

It seems that well-educated teachers in the Geogebra workshop have a different mentality. This mentality distinguishes them from other teachers even in the non-equipped class.

Shapes are dynamic and movable for teachers and they can rotate, resize and move easily if necessary for solving a problem. Teachers also try to transfer this viewpoint to their students.

Also it seems that they are prepared for finding patterns and geometric locus and familiar with this method.

Teachers feel free for posing new problems and can work with geometric shapes without any fear and investigate strategies that may lead them to solve the problem.

These are the results of having some interview and observation of teachers' class who participated in the Geogebra workshop in Geogebra institute of Tehran.

For investigating or proving above claims, we are going to conduct a research in the Geogebra institute of Tehran. We hope that the results of this research affect on workshops program for teachers or students positively.