Maria Mion POP
Mihaela GIURGIULESCU
University of Bucharest, Faculty of Psychology and Educational Sciences, Romania

LEARNING GEOMETRY THROUGH MIMESIS AND DIGITAL CONSTRUCT

Methodological Articles

Keywords
Performance
Geometry
Encoding-decoding
Teacher advisor
Digital learning

JEL Classification
I20, O33

Abstract

The theme proposed by us is useful to teachers and students for mathematics in the compulsory school cycle. The issues faced by school teachers/parents are the difficulty with which students read and understand the lessons/examples/synthesis in order to assimilate technical terms. The echoic and iconic memory facilitates the learning of the specific curriculum of linear, spatial and analytical geometry by the students using digital platform designed by us; it facilitates the acquiring of the theoretical elements of applied geometry by encoding-decoding, so that the teacher's role becomes the one of the advisor and not only a person who transmits the information. The utility of the program extends from mainstream schools to special schools.

"Tell me and I will forget,
Show me and maybe I will remember,
Involve me and I'll understand!"
Confucius

Theoretical Fundamentals
For many years, the modern school tries to eliminate the restrictive education system based on teaching - playback, pleading for a school open to the practice: *deduce* by *doing*.

Such learning requires a very large investment or even very small because it depends on where the curiosity of the subject interested to learn through habit without specific information extends-i.e., only through mimesis ("representation", "imitation", "create", "copy", "create", "emulation", "simulation") (Woodruff, P., 1992).

Considering, however, that the theory of Confucius refers to understanding, it concludes that the purpose of the student is *to understand* and thus confirms "Tell me and I forget" (Confucius) because there is very much theoretical information submitted by teachers to the classroom in recent decades that is in relation to specific school curriculum of every school year.

Students' requirements are reduced to: "show me and maybe I will remember" (Confucius) thus requiring the teacher to involve iconic and echoic memory, tactile and sensory, in order to educate through direct participation and awareness at its formative process. Basically, the student asks the teacher to move from the theoretical stage to the practitioner and counsellor.

Using "Show me", the student is requesting theoretical and practical information already existing in the memory of the teacher; he should be involved in the demonstrative process with theoretical explanation so that the students pass the phase: "maybe I will remember" (Confucius). The training process itself is based on "I will remember" (Confucius), on the long-term memory that is absolutely necessary for the long-term habit.

Certainly the human progress is based on mimesis, too, notion engaged in Plato's Republic Books (1969-1970). The habit itself is also based on this concept, defined as the art of dialogue as platonian literary style. Plato explains the usefulness of mimic art in education.

The science of all times, but especially the modern one remains faithful to the Plato's idea and asks each teacher (in the context of formative - educational) to have (in bearer form) a behaviour / a morality and an information database specific to the matter they teach, information adjusted at any time and any context, depending on the student / students the teacher prepares. The amount of information received from the teachers in the school, from specialists, via the internet, etc. involves the student in a chaotic race of knowledge without limits. The information itself is a continuous challenge; it should be found and then selected, classified according to the interests of each user. Precisely because of the quantity of information, the student needs a support to facilitate its work of assimilation of curricular specific terms for each matter, to put order into the short and long-lasting mental chaos.

The massive volume of information and terms of the school textbook do not contribute to their full assimilation during the school formative period. Iucu, R. (2007) highlights the "The lack of responsibility toward their own training" and is demonstrated by the lack of reading lessons, examples and auxiliary materials in order to deepen his own school training in particular.

It's about an informational-theoretical type of formulation from class of students. It always seeks "effective learning methods and techniques" (Neacsu, 1990) and benchmarks to generate teaching strategies (Ciolan L., 2008).

An ingenious method of applicability of technology in the classroom is told in an interview published in the newspaper Il Gazzettino di Venezia "La matematica in ...cuffia" (Mathematics in ... headphones), a method proposed and developed by Pop Mion, M . in 1989, in the high school and middle school. Here is an example of the results achieved by teaching students the algebra through an individual audio system customized on the level of knowledge of the student. The teacher's role becomes that of an adviser and evaluator of the levels of study acquired by each student individually, component of the effective communication (Pânişoară, 2003) for raising students ' performance.

Experiment
The author of the method applied in Venice authorized its implementation with the purpose of a re-evaluation of the applicability of the method this year for a class of students in Romania, at middle and high school for learning geometry concepts.

At the experiment there is a participation of four classes of students, respectively 89 students in which 48 middle school students from 7th and 8th study years, i.e. 54% from total and 41 high school students, i.e. 46% from total (see Figure 1). From middle school attended: 22 boys meaning 46%, and respectively, 26 girls meaning 54% (see Figure 2); from high school attended: 19 boys, meaning 46%, respectively 22 girls meaning 54% (see Figure 3).

The experiment included:
- The sound system - involves echoic memory; this system permits listening of the explanations guided using headphones (in Venice model).
- A printed support - involves iconic memory; allows the viewing of figures / information transmitted through images.

It has pursued in this experiment the learning-student centred, each student having his own

headphone and being encouraged to listen in headphones lesson, explanations, concepts, at peace, isolated from others around him. Simultaneously with the sound in the headphones, the student follows the teacher printed support and attempts to understand the information and make the necessary connections with the sound heard. After that, the professor applies tests to students to see any issues which are not understood, he gives them immediate response and shows them what they have solved incorrectly, indicating how the work load should have been resolved. Then, the teacher motivates students and encourages them to resume learning concepts that were in error, continue to apply for each student custom tests, guiding them to navigate and to understand the matter further.

The results of the experiment
The first week: 80% of middle school students of 7th and 8th study years have learned 100% the specific terms; another 15% have learned about 90% and only 5% have learned from 70-80% (as shown in Figure 4). In high school, 100% of students have consolidated terms of geometry studied in recent years; 90% of students have learned 95% of specific analytic geometry concepts.
At the end of the third week: 90% of participating students correctly placed, indicated or removed items as appropriate or inappropriate as they are asked to.
The results lead us to believe in the usefulness of the method widely.

The extension method in digital
The era we are experiencing now is called "information age", "computer era" or "digital age". The people of this world are passionate of technology, absorbed in a sea of information, sounds and pictures, blogs and social networks. The information era is undoubtedly created due to the evolution of new technologies. The main products of the information age are so-called "information society" where the use of technology is vital.
During the massive technological development in recent decades, the advent of personal computers (PC) marked the beginning of the birth of a new generation that learns to develop, evolve and socialize in a new medium, the digital environment. This new generation was called in 1998 by D. Tapscott "Net Generation", followed a little later, in 2001, to be named by Prensky "digital native". Digital natives defined by Prensky are part of the generation born after 1980; they are "native speakers" of the digital language of computers, mobile phones, video games and the Internet.
There are common characteristics and similar experiences that define, namely how it interacts with technology, with information, how they communicate with each other, with other people or institutions, as interrelated networks. In his discussion about digital natives, M. Prensky describes digital natives as those who grow up surrounded by technology, feel comfortable with the multitasking activities, are addicted to graphics for communication, and like thanks and frequent rewards.
Doing a quick comparison with the current generation, we see that this falls clearly into the typology of "digital native". They grow up in an environment in which computers, smart phones, tablets, etc., are at their disposal. We often meet young people that at the same time listen to music, write, communicate online, without any effort, communicate easily online (WhatsApp, Skype, instant messaging, etc) using abbreviations and signs, graphs, icons, often to the detriment of direct communication, interpersonal and last but not least, expect rewards for anything they do, the intrinsic motivation remaining in background.
Technological developments that surround us, continue to expose new types of stimuli and increased attention to sensory input of activities in the digital environment (virtual world), and led in time to the cognitive changes over the current generation.
This requires the need for different approaches to learning for the next generation. The idea that digital natives have new styles of learning was supported by C. Dede (2005). These new styles of learning "in progress," as C. Dede says, are characterized by a greater use and fluency in multimedia and virtual environments based on simulation, and are an expression of a variety of common knowledge individual or distributed in a community or in a context; a balance between experiential learning, mentoring and collective reflection; non-linearity of expression, association representing a network, and co-design learning experiences to meet the needs and preferences of the individual.
„The cognitive differences of the Digital Natives cry out for new approaches to education with a better "fit"." (Prensky, 2001).
If from the students clearly it appears the need of new methods and approaches in education, the same necessity arises from persons who educate them. Through a recent study on a sample of 153 students, future teachers, it was obtained that the lack of appropriate tools in educational process is one of the important factors that may affect the performance, with the highest percentage of 23% among respondents (Mion & Giurgiulescu, 2015).
In the light of students' needs and in order to underline the current teachers' needs and to have a solid foundation of key elements of construct geometry, we expand the classical method of learning applied to Venice and experienced in

Romania, to a method including a digital platform "Learn theoretical constructive geometry". The scope of this platform is to involve the learner in the process of skill-specific terms from geometry to construct a coherent language useful in reading and full understanding of problems that it faces along its formation, through digital, keeping the features of traditional method and coming through the technology to meet the needs of the present generation. Due to the conceptual specific of the platform, this can be used by students with special needs, too.

Pilot project
The digital platform construct has built:
- An audio system: involve echoic memory; enables the listening of guided explanation (according to the model applied in Venice). In order for the platform to be perfectly mapped on the method applied in Venice and to be revalidated in Romania with at least the same, students should work individually, each one on a computer, having sound put in headphones.
- A video system: involves iconic memory; allows the students to view the information submitted through the figures/pictures, which are included in the platform and that can be accessed whenever it is needed.
- Interactive multimedia interactive exercises to assess learning, for practice and consolidation.
Using the mouse and keyboard, the student can solve the activities introduced through interactive multimedia system. In case that he manages to give the answer, then immediately he will receive feedback and will be encouraged by a voice (e.g.: Bravo! You did it!). The assessments will be varied and random, not bored. But if he needs help, the help will be given as they get the problem solved until the work is done. During the results verification the student receives an immediate feedback. It will also be displayed the correct answer where there are errors in solving the problem in order to facilitate auto-learning. Messages are motivating, even in case of error. All activities have several variants of content, every browsing of the exercise shows a different content to the student and he could practice and be able to enhance their learning. This favours the game's re-playability.
Examples of activities:
1. Appears on the screen isosceles triangle. What is the opposite angle of triangle base?
Action: Click on the opposite angle.
2. Appears on the screen isosceles triangle. Select this angle bisector.
Action: Display several lines. Click bisecting.
3. Draw two concentric circles.
Action: Drag and drop two circles from the side of the screen so that they are concentric.

4. Look the drawing. It is a ... (right triangle). Shows its elements: large side and small side, hypotenuse
Action: Select one by one.
The user enjoys learning platform theoretical terms, associating the image with the notion that gives it life, plus enjoy the experience of working in digital.

Conclusions
To make the process of learning to have better results, the classical methods must be completed in the classroom with new methods of digital learning. This is required by the profile of the new generation, and the education system should go through this change and methodological enrichment in order to support a good level of motivation of students suitable for a good assimilation. It should also be stimulated the intrinsic motivation of students, the self-learning should not be imposed, but desired.

References
[1] Ciolan, L., (2008), Învățarea integrată. Fundamente pentru un curri
culum transdisciplinar, Ed. Polirom, Iași
[2] Confucius, accesed on http://www.citate.ro/747/intelegere, oct.2015
[3] Dede, C. (2005). Planning for neomillennial learning styles: implications for investments in faculty and technology. In D. Oblinger, & J. Oblinger (Eds.), Educating the net generation (pp. 15.1–15.22). Boulder, CO: EDUCAUSE.
[4] Il Gazzettino di Venezia, 8 noiembrie 1989
[5] Iucu, R., (2007), Formarea cadrelor didactice: sisteme, politici, strategii, Humanitas Educațional, București
[6] Mion Pop, M., Giurgiulescu M. (2015) - Educational Sciences between Information Technology and Communications and Quality Assurance Techniques, International conference "Education, Reflection, Development", ERD 2015, 3-4 July 2015, Cluj-Napoca, Romania
[7] Neacșu, I., (1990), Metode și tehnici de învățare eficientă, Ed. Militară, București
[8] Pânișoară, I. O., (2003), Comunicare eficientă. Metode de interacțiune educațională, Ed. Polirom, Iași
[9] Plato, (1969-1970), The Republic. 2 vol. Trad. Paul Shorey, Cambridge: Harvard University Press
[10] Prensky M. (2001). Digital Natives, Digital Immigrants On the Horizon (NCB University Press, Vol. 9 No. 5, October 2001
[11] Tapscott, D. (1998). Growing up digital: the rise of the Net generation. New York: McGraw-Hill
[12] Woodruff, P., (1992), Aristotle on mimesis. În A. O. Rorty (ed), *Essays on Aristotle's Poetics*, Princeton, NJ: Princeton UP, 73-95, p. 73.
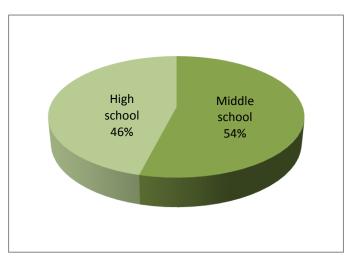
Figures

Figure 1. Distribution of students participating in the pilot project by level of education
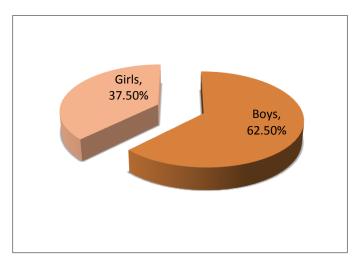

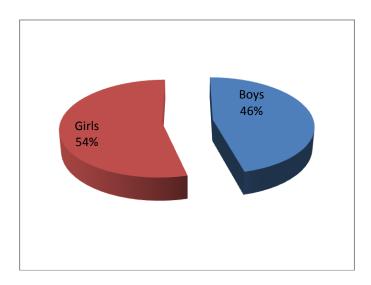*Figure 2.* Distribution by gender of middle school students participating in the pilot project

Figure 3. The distribution by gender high school students participating in the pilot project
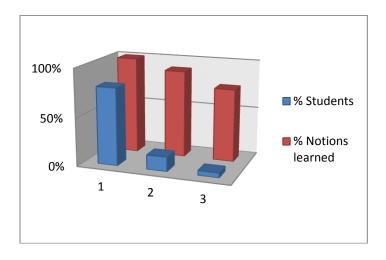
Figure 4. The illustration of quantity of notions learned by middle school students in the first week