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FROM FACE TO FACE TO REMOTE LEARNING: A PRIMARY EDUCATION TEACHING SCENARIO IN DIGITAL CLASS

Aikaterini Goltsiou[1], & Chrysa Sofianopoulou[2]
[1]PhD candidate
[2]Associate professor
Harokopio University, Department of Informatics and Telematics (Greece)

Abstract

Environmental protection and its utilization, taking account of sustainable development, becomes a necessity in today's rapidly changing era. In the schools' surrounding environment there are resources which could be integrated in the students' everyday life, within the frameworks of sustainability and with respect to their existence and their characteristics. Students take up an active role by implementing STEM methodology in remote learning, with a combination of synchronous and asynchronous learning.
The aim of the paper is to present the design of a teaching scenario about mathematics, in the field of geometry, and specifically the teaching of angles, via STEM methodology and utilization of e-me digital classroom. Students are asked to solve the problem of designing paths in the school garden and also to recognize the angles in their home and at the work of arts. If and how a math teaching scenario using the digital environment of e-me and Web 2.0 applications and applying modern and asynchronous distance learning with STEM methodology, could lead to understanding and knowledge acquisition. The estimated duration of the teaching scenario was three teaching hours in synchronous and asynchronous learning. It was designed and implemented in 5th grade students of a primary school in Athens. Students worked individually or in groups, depending on the task assigned to them in the digital learning environment, cultivating their critical thinking and problem solving.
The involvement of students in synchronous and asynchronous learning and the results of their activity, showed that the students cultivated their critical thinking and problem-solving skills. They took pleasure through creativity. Their critical thinking was encouraged via STEM methodology, where the e-me environment favored students' navigation and the co-construction of knowledge.

Keywords: *E-Me, STEM, remote learning, mathematics, scenario.*

1. Introduction

The learning approach, according to the curriculum of primary schools, needs to be exploratory- inquiry based, interdisciplinary, active, combining Information Communications Technology (ICT), implementing team-cooperative teaching, so as to cultivate students' social and cognitive skills (Αλαχιώτης, 2002). The syllabus of Primary Education is based on the theories of constructivism, inquiry learning, the implementation of cooperative teaching (ΔΕΠΠΣ, 2003), being oriented towards the 21st century skills and sustainability (Brundiers et al. 2020).

In recent years there has been noticed a strong interest in designing teaching scenarios via STEM methodology which contributes to the development of programming, observation, critical thinking and problem solving skills (Komis & Misirli, 2016). STEM education refers to Science, Technology, Engineering and Maths. The main goal is to solve problems through student participation, through experimentation and questioning, in conjunction with everyday life and based on pre-existing knowledge and experiences of the student in an appropriate educational environment (Hwang &Taylor, 2016).

Cooperative teaching combined with new technologies is implemented in Primary Education in the framework of STEM methodology and it requires an appropriate digital environment for cooperation, communication and outcome presentation (Fragou et.al., 2019). An educational teaching scenario is an activity plan that deals with the content, the course flow, the roles of the participants, the learning theory on which it is based, the digital resources that are used in the teaching practice in order to achieve the students' interaction (Σπυράτου & Γουμενάκης, 2008).

1.1. e-me and digital educational applications

The utilization of ICT in the context of collaborative activities with the use of appropriate digital applications offers to the student immediate results. The intervention of each student is immediately

visible and mobilizes all members of the group. By utilizing the digital environment students organize their prior knowledge and contribute to a common project. The results are immediately visible to everyone.

A variety of digital environments is available for use by the teacher as the digital environment of e-me and Web 2.0 applications. e-me (https://auth.e-me.edu.gr/) is a Greek digital educational environment for students and teachers in primary and secondary education and the connection of its members is done through the Panhellenic School Network. Provides a secure learning place for students and teachers in which they communicate, collaborate, create and share content. e-me aims the students to have active involvement in a secure environment where members have the opportunity to utilize common files and applications in the area of the Hive, as is called each digital classroom.

e-me has the Wall, which functions as a forum for interaction, collaboration and feedback between students and teachers. The e-me Wall allows and enhances the interaction of the members of the Hive and it is a space for collaborative learning and innovation in a Web 2.0 environment (Megalou et.al., 2015). On the Wall it is possible to share links and integrate Web 2.0 applications, such as the mindmeister mind maps (https://www.mindmeister.com/) and a synchronous communication application link, such as the Cisco WebEx digital classroom (https://www.webex.com/).

Digital mind map is especially utilized in every educational grade as it offers a visualization of the subject of negotiation, collaboration and the possibility to intervene at any time (Arulselvi, 2017). Coggle mind map was used by Arulchelvan et.al. (2019) in an English language class, with students of Primary and Secondary education, for the improvement of the English language and the enhancement of participative learning, with positive results.

Photodentro is the National Accumulator of Educational Content (http://photodentro.edu.gr/aggregator/) in Greece for Primary and Secondary Education, part of the central e-service of the Ministry of Education for the free distribution of digital educational content for any interested.

The blog is used for students' activity to publish their opinion, comments and upload their work. Students interact through the posts and work collaboratively to complete the assignments have assigned to them (Montagud-Romero et.al., 2020; Alsubaie & Madini, 2018).

The digital environment of RunMarco! (https://runmarco.allcancode.com/) utilized by the students to learn the programming language through experimentation with immediately visible results and to connect the tool with the STEM methodology (Giannakoulas & Xinogalos, 2019; Meftah et.al., 2019).

The aim of the paper is to present the design of a teaching scenario about mathematics, in the field of geometry, and specifically the teaching of angles, via STEM methodology and utilization of e-me digital classroom. The basic question is:

- If and how a math teaching scenario using the digital environment of e-me and Web 2.0 applications and applying modern and asynchronous distance learning with STEM methodology, could lead to understanding and knowledge acquisition.

2. Methodology

This action of designing the digital teaching scenario was applied to 25 students, 12 boys and 13 girls, aged 10 years old, of a 5th grade Greek school, who had knowledge of collaborative learning from the beginning of the school year. The scenario was implemented in remote learning, synchronous and asynchronous learning, through the WebEx meetings and e-me digital platform respectively during the pandemic. During the action in the digital environment of e-me were implemented:

A. Student's prior knowledge investigation.

B. Implementation of the teaching scenario and consolidation of the angles and planning, to solve a problem of school everyday life, ie the design of paths in the school garden

C. Qualitative analysis of individual and group student assignments.

D. Recording by students in Poll of e-me of the satisfaction they got from the in the digital environment.

E. Observation by the teacher.

The implementation was carried out in 3 lessons exclusively in remote learning, lessons synchronous -1 lesson asynchronous (30 minutes each lesson and 40 minutes each lesson respectively). Students were involved individually and in groups in asynchronous distance learning. Also they worked in groups of 5 people or in plenary in synchronous learning.

The initial exploration of the students' prior knowledge which constituted the initial assessment was achieved by the Wall of the e-me utilizing digital classroom and introducing a conceptual mapping link. The activity of the students during the implementation of the scenario and the e-me content questions constituted the formative evaluation. The final evaluation consisted of the individual and group assignments of the students in the e-me applications. The evaluation of the educational scenario was

carried out throughout its implementation, through the students' activity, their cooperation and participation, as well as the e-me Poll in which students expressed their satisfaction by using all these digital environments.

2.1. Design - Implementation of a teaching scenario

The activities were designed and implemented to achieve the aims of STEM. In order to decide the students how they will design the school garden's paths, after their return to school, they should have been taught the angles.

The activities of the scenario were related to:

- Activity of psychological and cognitive preparation: evaluation of existing knowledge and detection of representations and cognitive difficulties.
- Teaching activities of the angles (oral speech development, exploration, cooperation, challenge-conclusions in groups and in plenary).
- Implementation-expansion activity (work submission, creation of posts on the Hives' e-me blog)
- Cognition activity (RunMarco! - programming)
- Scenario evaluation activity

The students had worked again in the specific e me environment and they had an account in the Hive. They also knew how to browse the internet safely, to use some Web 2.0 tools and they knew basic programming commands.

The following capabilities of synchronous learning in WebEx meetings were utilized:

- Break out sessions
- annotate
- student presenter
- chat
- The following capabilities of e-me asynchronous learning were utilized:
- Wall (course information / links for safe navigation / exploration /comments)
- e me content (flash cards, Drag Text), e me assignments (submission of assignments)
- e-me Blog of the Hive (collaborative writing)
- Poll (scenario evaluation by the students)
- Other digital tools that had links on the Wall of e-me:
- Mindmeister mind map (collaborative writing / prior knowledge)
- e-book of 5th Grade Maths (visualization / students' book)
- Photodentro (Geogebra/experimentation)
- YouTube (teaching of the angles)
- RunMarco! (metacognition / code / gamification)

The flow of the scenario follows.:

In the 1st lesson in synchronous learning via WebEx (30΄) were implemented:

- Activation, collaboration and communication of students through the mind map Mindmeister, as a pre-organizer, where students recorded where they located angles in their home. The teacher watched the recordings and then shared the result in plenary.

- In the initial presentation of the topic the issues were raised and the students made hypotheses. «*How to design paths in the school garden?*». «*We need to know the angles*.». So the teacher was connected to e-me and used the link of the math e-book (Είδη γωνιών (ebooks.edu.gr) which concerned the angles lesson and shared his screen for teaching. This was followed by the presentation of a video regarding the design of the angles (https://youtu.be/sxdZi-4A7v8). The students drew angles on the Webex board. The formative assessment was made with e-me content/flash cards and Drag Text, which are .H5P files and the students shared the results in plenary. The students came to conclusions through group activity and exploration, with experimentation and hypotheses, in Break out sessions utilizing Geogebra (Μέτρηση και σύγκριση γωνιών | ΦΩΤΟΔΕΝΤΡΟ (photodentro.edu.gr)

In the 2nd lesson in asynchronous learning via e-me:

- Individual and group consolidation of knowledge / cultivation of critical thinking / extension of concepts in everyday life. The students submitted individual work from the e-book to e me assignments. They worked as a team with the links that led to painters' works Χατζηκυριάκος Γκίκας, PabloPicasso. Robert Delaunay. The students had to find angles in the paintings, paint with the influence of painters and create articles in the Hive's e-me blog by sharing their work. The instructions were posted on the Wall.

In the 3rd lesson in WebEx:

- Evaluation, feedback, metacognition, individual and group activation through gamification. Mutual evaluation of the articles of the blog. Individual assessment of students with e-me content which

concerned the knowledge that students gained about the angles. Scenario evaluation by students with the e-me Poll. Metacognition and gamification via the game RunMarco! and sharing of students' results in plenary.

3. Conclusions

This paper presents the design of a teaching scenario about mathematics, in the field of geometry, and specifically the teaching of angles, via STEM methodology and utilization of e-me digital classroom. The basic question is how a mathematic teaching scenario was designed using the digital environment of e-me and Web 2.0 applications, applying synchronous and asynchronous remote learning with STEM methodology.

A. The investigation of the students' prior knowledge in the mind map showed that the students perceived where there were angles in their home.

B. Through the e-me content questions as formative assessment it was seen that most students acquired the knowledge during the implementation. Also the activity of the students during the synchronous education, their communication and cooperation, the content that was sharing by the students has constituted the formative evaluation. The results of the implementation were shared during the synchronous communication through the digital classroom where the students could comment on content and experiment with digital applications in synchronous teaching. In addition, the results were shared by the students on the Wall of e-me and at the e-me blog.

C. Qualitative content analysis of students' individual and group work during synchronous and asynchronous learning has showed that students understood the meaning of the angles and realized how to use this knowledge in their immediate environment in everyday life. Through the programming activity they gained ideas for completing their STEM work.

D. All the students said in the e-me poll that they felt satisfied while they were working in the digital environments.

E. The observation by the teacher was an important point of the qualitative analysis because in this case the researchers became observers as well. The teacher discreetly noticed the students' spontaneous activity during the lessons (Richards, 2001).

The digital environments of synchronous and asynchronous learning offered to students the possibility to build their knowledge remotely. The synchronous and asynchronous learning environments as safe educational environments favored the interaction of students enabling the continuation of teaching under adverse conditions such as those of the pandemic. In conclusion, remote learning has proven to be useful in enhancing students' critical thinking and problem-solving skills.

4. Discussion-limitations

The combination of synchronous and asynchronous education favored the design and implementation of the mathematics teaching scenario via STEM methodology with utilization of other digital applications. The students have understood the connection of science, mathematics and technology with everyday life and a pleasant atmosphere of cooperation and communication was created between them. They cultivated their critical thinking and problem solving skills. Digital environments had enhanced their interest and increased their active participation. The paper supports studies on the use of of the above learning environments in Primary education (Brundiers et al. 2020; Fragou et.al., 2019; Σπυράτου & Γουμενάκης, 2008; Megalou et.al., 2015; Arulselvi, 2017; Arulchelvan et.al., 2019; Montagud-Romero et.al., 2020; Alsubaie & Madini, 2018; Giannakoulas & Xinogalos, 2019; Meftah et.al., 2019) contributing to learning through a pleasant atmosphere of student creation and collaboration.

In this research, students were familiar with technology and the internet, but not with the implementation of educational scenarios in remote learning. The students were more restrained at first, but then they felt more creative as they got involved in the scenario and became more active. There was concern from the teacher about the adequacy of the time of completion, but there was a response from the students and the scenario completed. In addition the students had not posted again on the blog and there was relative difficulty in posting. The problem was overcome in synchronous teaching with a presentation by the teacher. This teaching scenario was designed to support the students' distance learning in situations such as the one we are experiencing due to the pandemic. The students were familiar with computers and had the necessary infrastructure. It would be interesting to investigate the involvement of the students in a blended-learning scenario or in experiential learning scenario in order to draw comparative conclusions.

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