Human Constructions with Language as a Vehicle

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Abstract
STEAM is the acronym for Science, Technology, Engineering, Arts, and Mathematics. This scenario uses the fundamental principles of STEAM education and guides students in inquiry, dialogue, and critical thinking leveraging interdisciplinary processes. The teaching script combines the 5th-grade's Greek language course with that of mathematics, utilizing the teaching material of the textbooks. At first, students expand the boundaries of their knowledge converting active to passive voice by constructing different types of physical angles. Subsequently, they cultivate their soft skills by creating a digital-analogue clock. On this particular occasion, the script took place during the remote learning period due to Coronavirus disease, and students not only came in contact with the art of architecture but also experimented with science, engineering, and mathematics. Finally, the scenario can be also applied in a physical class.

Keywords: STEAM, interdisciplinary, digital education.

1. Introduction

STEAM is a teaching method for science courses, which underpins the teaching methodology on technology, engineering, arts, and mathematics. Its educational objectives expand beyond one learning subject and frequently combine the acquisition of cognitive skills in different learning subjects. It is the acronym for Science, Technology, Engineering, Arts, and Mathematics (Sousa, & Pilecki, 2015).

Science is a way of thinking. Through science, students observe, experiment, make predictions and logical assumptions or wonder about how something works in practice. In other words, via science, the students cultivate critical thinking competencies (Harris, & Bruin, 2017).

Technology is the application of scientific knowledge for practical purposes. With technology, students not only use physical or digital tools to identify issues but also to solve problematic situations. It refers to the implementation of scientific knowledge for practical purposes (Herro, & Quigley, 2016).

Engineering is the application of science and mathematics to solve real-world problems. The enhancement of the educational process with engineering helps students to resolve problems and utilize innovative practices in designing or creating. In engineering, students make their contribution to the learning procedure as they co-shape their knowledge (Hoisington, & Winokur, 2015).

Art is the aesthetic result of something. Through art, students raise minds and emotions. They express their feelings and simultaneously elaborate on ideas or visions. Also, art assists students in discovering their inner ego and soul. Finally, students break the shackles of logic, heal and free themselves from their torments (Hetland et al., 2013).

By using mathematics students involve number sequencings; they draw shapes such as triangles, squares, and circles. They measure volumes and make comparisons. Through mathematics, students can examine parameters of countable variables like structure and quantity (Jang, 2016).

STEAM prepares students for 21st-century requirements. It assists them in growth competencies both in the learning and innovation fields. In particular, it allows learners to (Sousa, & Pilecki, 2013):

- develop life skills.
- apply their knowledge in real-world problems.
- have active participation in a student-centred environment.
- participate in questions, problem-solving, collaboration, team working, and formulation of hands-on activities.
- discover their talents and interests.
- be responsible, reliable, and legitimate when they work on a task.

As adults, students that have been trained with the STEAM methodology will be capable of (Kropp, 2014):

- designing surveys, collecting data, and making logical assumptions.
- adapting to the concepts and principles of sciences according to the given situation.
- being self-reliant and logical thinkers.
- being technologically literate.

Based on the aforementioned aspects, a crucial question comes to the forefront. Why do students have to cultivate those skills? On one hand, the economy relies on innovation, and on the other hand innovation is based on well-trained employees with STEAM abilities.

Furthermore, STEAM skills are necessary qualifications for most jobs nowadays. Lastly, the STEAM method aims to enhance students' professional careers in the future (Okan, 2003).

However, while it is valid to say that the above ideas reflect the working reality, in fact, they do not emphasize in linguistic communication. The term “language” refers to the way of communication, artificial and non-human point systems. The cultivation of language is the basis on which students build abilities like those mentioned above. This scenario proposes an educational process which expands the STEAM methodology by incorporating the field of language in it and turning it into STEAML. This addition treats the absence of linguistic education in STEAM and adds significant qualifications to students' portfolios such as good communication and instruction comprehension (Shatz, & Gelman, 1973).

2. Application Details

Table 1. Identification of the script

Educational level	5th
Date of application	08/04/2021
Duration of application	1 hour
Sample	16 students
Sample characteristics	multicultural environment, economically depressed area

3. Objectives - Pursuits

At the cognitive level, after the completion of the course, students are expected to:

- remember the conversion from active to passive voice and the opposite.
- recall the different types of lines (straight, ray, segment).
- discuss the differences and similarities in specifically selected pictures.
- enrich their vocabulary.
- learn the different types of angles (acute, right, obtuse).
- learn about protractor and how to use it.
- select the suitable tools to build an object at Scratch.

Simultaneously, at a skill level, students are expected to:

- analyze the structure of some words to define their meaning.
- discover the communicative difference between passive and active voice.
- manage instructions.
- draw geometric items.
- handle geometric instruments.
- construct an architectural object at Scratch.
- communicate their thoughts.
- measure angles.

Finally, at an attitude level, students are expected to:

- complete a task.
- practice the new knowledge creatively.
- appreciate the values of team working and collaboration to complete a project.
- accept that individual work helps them to learn to handle tools.
- organize their apprenticeship.
- realize the role of communication in the success of a project.

4. Methodology Of The Script

The educational scenario took place during the period of Coronavirus disease, in which the services of the school were adjourned. It was applied using the method of distance education synchronously and asynchronously. However, the material produced can also be used in a physical class with or without modifications by the responsible teacher (Coultas, 2016). Moreover, the teaching script not only follows the principles of the STEAM method but also expands the specific methodology to linguistics. Through step-by-step instructions, students raise their curiosity and combine elements from science, engineering, technology, art, mathematics as well as language to complete their tasks (Skallerup, 2016).

5. Teaching Material

The teaching material leverages both printable and digital sources. As far as the first mentioned above, it relies on the school's textbooks for the Greek language and Mathematics for 5th-grade students. As for the second one, it leverages digital presentations which are used either synchronously or asynchronously. The presentations include step- by step educational instructions to help students to work autonomy. They also provide them with more information in case they cannot complete their assignment.

6. Presentation Of The Activities

At the beginning of the script, students participate in cultural activities or games in order to relax. They also take part in a set of breathing exercises to get rid of their stress. Then, the teacher reminds them the lesson´s code of conduct and presents to them the educational contract of the process. Subsequently, students partake in an exercise to revise the previous lesson´s material. After that, the schooling of the new subject initiates.

At first, students have to open both the mathematics and the Greek language´s textbooks. They also have to compare and contrast two pictures in order to find differences and similarities between them. Afterwards, they focus on the manual of the Greek Language. At that point, they follow the presentation´s steps to address the first exercise and improve their answers by observing the examples or the presentation's slides. Then students recall different types of lines like straight, ray and segment. They discuss and try to break the word: "Ορθογώνιο" (rectangular) to find its meaning. They also make considerations on why we use a square to construct right angles.

In the next stage, students use squares to draw a right parallelogram and make logical assumptions about the length of the sides. After a short break, students focus their attention on grammar. They discuss and convert the active voice into passive and the opposite. Simultaneously, they learn to use a protractor to draw angles. They also name the different types of them, and they construct a side rectangle. Finally, students observe the central picture of the mathematics textbook. They measure and categorize the angles of different clocks.

At that point, the educator gives time to the students to express their queries and enhance them to answer a self-assessment questionnaire. Moreover, the teacher provides them with extra material and assigns them the homework exercise. At home, students have to first make a revision and then leverage Scratch software to construct a virtual analogue clock by following orders. Last but not least, the teacher explains to the students the content of the following lesson, and the teaching procedure ends.

7. Teaching Steps

The lesson starts with the teacher's welcome. The process includes games and improvisations on art. Then, the teacher reminds the lesson´s internet safety rules to students. Subsequently, the educator presents the teaching material and links the content of the current lesson with that of the previous one. At the next step of the process, students juxtapose two pictures and discuss their thoughts about them. The following step refers to the development of the educational procedure and includes all the needed activities for the completion of the script. Afterwards, the students have to put into practice their new knowledge. For that purpose, they join in experiential exercises and conversations about their newly acquired knowledge.

In the next step, the students expand their knowledge and cultivate further their skills. In the step that follows, students provide feedback to the teacher, who assesses the whole educational process. Then, the self-assessment of the students takes place. In the following part, the students have to work on a metacognitive level in order to construct the final product of the script. Then, the teacher connects the content of the current lesson with that of the next one. Finally, the teacher thanks the students for their participation and the teaching process is completed.

8. Evaluation

According to the results, the educational process was considered successful. The achievement of the scenario’s objectives and the satisfaction of the students are the strengths of this

educational process. Based on a holistic strategy, the script unites six seemingly unrelated areas (Turner, 2013). Mathematics, art, engineering, science, technology and language are integrated into the final product (digital - analogue clock). Additional strengths of the script are (Kropp, 2014):

- the technological literacy of the participants upon its completion
- the process's innovation
- the positive change in the students' attitude
- the learning outcomes

On the other hand, the technical issues that the students had to face and the restricted time of the educational procedure are the drawbacks of the script (LaJevic, 2013). Concerning the external environment, the following apply (Dewey, 1997):

- The plan provides opportunities for students to improve their performance and brings them in contact with new educational approaches.
- The anxiety regarding the use of new technologies that many students face can prevent the implementation of the scenario.

The element that facilitated the achievement of the objectives of this specific plan is that the effort focused more on qualitative methods (observation - interview) and less on quantitative such as questionnaires. At the same time, the whole process focused on the possibility of giving more and more opportunities for participation to the trainees, as well as measuring their responses (Dewey, 1990).

Bibliographical references

Coultas, V. (2006). *Constructive Talk in Challenging Classrooms Strategies for Behaviour Management and Talk-Based Tasks*. London: Routledge.

Dewey, J. (1990). *The School and Society: The Child and the Curriculum.* Chicago, IL: University of Chicago Press.

Dewey, J. (1997) *Experience and education*. Simon & a Touchstone Book Schuster.

Harris, A., & de Bruin, L. R. (2017). Secondary school creativity, teacher practice and STEAM education: An international study. *Journal of Educational Change*, 1- 27.

Herro, D., & Quigley, C. (2016). Innovating with STEAM in middle school classrooms: Remixing education. *On the Horizon, 24*(3), 190-204.

Hetland, L., Winner, E., Veenema, S., & Sheridan, K. M. (2013). *Studio thinking 2: The real benefits of visual arts education* (2nd ed.). New York: Teachers College Press.

Hoisington, C., & Winokur, J. (2015). Seven strategies for supporting the "E" in young children's STEM learning. *Science and Children, 53*(1), 44-51.

Jang, H. (2016). Identifying 21st century STEM competencies using workplace data. *Journal of Science Education and Technology, 25*(2), 284-301.

Kropp, C. (2014). *Kropp 2014 Sustainability transformation through social innovation.*

LaJevic, L. (2013). Arts integration: What is really happening in the elementary classroom? *Journal for Learning Through the Arts, 9*(1), 1–28.

Okan, Z. (2003). Edutainment: Is Learning At Risk?, *British Journal of Educational Technology,* pp. 255–264.

Shatz, M., & Gelman, R. (1973). The development of communications skills: modifications in the speech of young children as a function of listener (No. 152). *Monographs of the Society for Research in Child Development, 28*(5).

Skallerup, L. (2016). *"Digital Pedagogy | The Center for the Enhancement of Learning and Teaching."* 2013. Web. 2 May 2016.

Sousa, D. A., & Pilecki, T. (2013). *From STEM to STEAM: Using brain-compatible strategies to integrate the arts*. NY: Corwin Press.

Sousa, D., & Pilecki, T. (2015). *From STEM to STEAM: Integrating the Arts*. California: Corwin, a SAGE company.

Turner, K. (2013). *Northeast Tennessee educators' perception of STEM education implementation.*