TREASURE HUNT – DEVELOPMENT OF 21ST CENTURY SKILLS IN INTERNATIONAL TEAMS THROUGH ERASMUS + PROJECTS

Dragana Sekulić Pilipović

Mladen Šljivović

Grammar School Zaječar, Zaječar, Serbia

The need for development of competencies is becoming more emphasized. This means that the reformation of the current system of working with students is necessary, in order to enable their development of "hard" skills, but also the "soft" skills such as communication, problem-solving and cooperation. In this paper, we will demonstrate an example of practice of Gimnazija Zaječar, organized during long-distance teaching. The activity was realized during the time period between January and March 2021, in which five schools from Turkey, Bulgaria, Poland, Spain and Serbia participated, all partners in the Erasmus project *From game to STEM*. First of all, every school chose their students, who were later on, by the random selection method, divided into twenty international teams, each one of them having five members. Google classroom was created for each group, but it was up to them to choose the way of mutual communication. The students were given the first task, and after successful completion, they were given next one. During this problem solving, we observed the communication that students achieved, troubles with solving the problems and success percentage. All the results are stated in the report and can be found on the project's site http://fromgametostem.com/. The conclusion is that, even if students find this activity entertaining and would like it to be done more often, unfortunately, there are clear indications that sometimes all the work is done by an individual team member (lack of cooperation), some students take an inactive role (lack of teamwork), and that there are problems with communication that have to be worked on.

Keywords: mathematics, 21st century skills, game, Erasmus

INTRODUCTION

Long-distance teaching has brought many challenges to the teachers. Majority of these challenges is related to the students' motivation in the classroom. Several authors (Faridah et al, 2020) find that the use of digital tools accelerates the students' motivation to work. Susilawati and Supriyatno (2020) came to a similar conclusion, observing how using the WhatsApp groups accelerated learning among students and high school students. Although these two papers look encouraging, we must take into account that the research of the group of authors (Butnaru et al, 2021), who conclude that these effects are individual and depend on the ability of an individual to use certain digital tools (digital competence).

The research of the domestic authors are not very benevolent. One of the problems that domestic authors highlighted is that: "students are separated from their peers and it's crucial to provide their well-being and protect their mental health" (Stepanović, 2020). It can be concluded that with a large

number of students from the inclusive education digital tools aren't applied sufficiently (Medar & Ratković, 2021). The conclusion of some authors (Vasojević et al, 2021) is that insufficient preparation of teachers in Serbia for the work in the digital environment also had negative impact.

The Zaječar Grammar School stepped into 2020/2021 school year with two goals: the development of competence among students (defined by standards) and the implementation of Erasmus+ project From game to STEM. In working conditions where the class was divided into groups and classes shortened to 30 minutes, teachers have faced entirely new challenges. It was clear that the project itself needed modification for a successful start.

Method

The project From game to STEM is financed by Erasmus+ invitation in which five schools from Poland, Spain, Bulgaria, Turkey and Serbia, which is also a coordinator, participate.

The primary goals of this project are:

1. Introduction of innovations to the STEM subjects through the usage of ICT (Arduino and video games)
2. Improvement of key competencies of students through STEM subjects
3. Strengthening competence of the teachers of STEM subjects through new methods

Each one of the schools is an expert in one of the STEM fields (Poland – biology, Spain – chemistry, Bulgaria – programming, Turkey - Arduino platforms, Serbia – mathematics and physics). The original plan was expected that, during the mobility and preparation for them, participants would share their experiences and at the same time work on creating a video game through which STEM subjects would be taught. More about the project can be found on the site http://fromgametostem.com/

Since traveling and participating in mobility wasn't possible due to uncertain situation regarding the pandemic, it was decided to hold the majority of the activities online. Mathematics was chosen as the first subject that students worked on.

Each school chose 20 students. The students were divided into international teams, using the random selection method, and then enrolled in Google classrooms to achieve communication with teachers. It was up to students to decide on a way of mutual communication. This was done to test their digital skills. The majority of students chose social media for communication (Instagram DM, rarely Facebook Messenger groups…), while they used Zoom or Google meet for meetings.

Right at the beginning, during the first week, the students were given an initial test in mathematics, that contained logical questions intended for all ages.

An example of the task in the initial test:

How many different sums of dice numbers can we get by throwing 3 standard dice for play at the same time?

Solution: There are 6 different point numbers (1, 2, 3, 4, 5, 6). The minimum sum is 3 (1+1+1), and the maximum is 18 (6+6+6). There are 16 different sums from 3 to 18.

The average grade on this test was 58/100 points.

The students were given the task to organize the meeting, get to know each other, choose the leader of their team and also decide on the name of the team. This was done to help students develop communication in a foreign language but also the cooperation, two competencies defined by the standards of interdisciplinary competence, but also by the European skills framework. Further communication between the teacher and the team was done through the leader.

Team leaders were given the instructions for the next step. Now we started working on "The treasure hunt", a mathematical game in which groups are given the problems, solving them and when they have all the correct answers, they progress to the next level. The winner is the group that first solves the tasks.

Example of the first level task

Find the number that is missing:
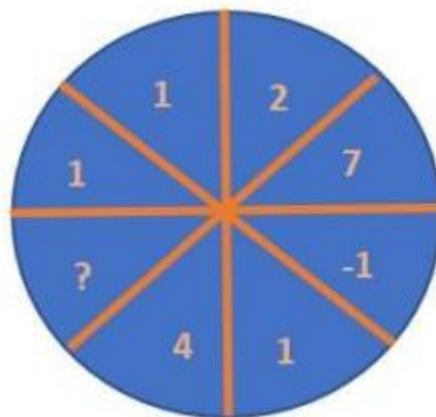
Picture 1. Illustration of the first level task.

Solution: It is number 49 since all the elements on the left side are the squares of their diagonal numbers on the right.

The final level wasn't the problem-solving task, as in the previous three levels. In this phase, the students were required to, for the given solution, come up with their own task. The idea was to develop their creativity and to see that composing tasks is not at all easy.

Example of the final level task:

1. In the city Amigos, there are 2 taxi companies – Sun and Star. Travellers that were using services of the cheaper company expressed dissatisfaction. They said that the taxi was always late and it needed more time than the more expensive company's taxi to get to the destination. Sun's vehicles took on average 1 minute and 28 seconds to get from school to the park (distance 1,4 km), Star's vehicles took on average 2 minutes and 32 seconds to pass from factory to school. Which company would you choose based on their price, and which one if you want a faster ride?

2. A businessman from Serbia went to Amigos for a business project. He'll stay there for 5 days, and every day he will have to drive from the hotel to the office, and from the office to the hotel. He wants to save up money for the taxi ride, so he requested bids from taxi services to see which one would pay off more.

The "Star" company offered that every ride costs 7 Amigo dollars per kilometer, and every fifth ride 5 USD per kilometer.

"Sun" was offering that every ride costs 7 Amigo dollars per kilometer, but for every third ride he would get a price of 6 Amigo dollars per kilometer. Which company should he choose if the distance between the hotel and the office is 1 km?

3. Marla will go to her best friend in an hour. Both of them live in New York, but in different locations. She sees two taxis: "Star" and "Sun". "Star" is famous for its comfortable vehicles and fast rides and the price is 5 USD per kilometer. On the other hand, "Sun" offers the price of 3 dollars per kilometer and is much safer. Which choice is better for Marla? Explain.

4. There is one land called The Land of wonders. In that small territory, there are only two taxi companies, the Sun and the Star. The Star company is cheaper than the Sun company but has many shortcomings. The Star is cheaper because it only has 10 vehicles, while the Sun has 50 vehicles. If you call the Star company's taxi, you'll have to wait very long, sometimes even hours to get your turn, but you'll pay 5 USD less than you would pay the Sun's taxi. What do you think, which one would you choose?

There are 4 task levels in total given to the students.

All the tasks with solutions are available in the report that you can download at the project's site. http://fromgametostem.com/download/report1.pdf

Results

The teachers noticed that students were, at first, solving the tasks very quickly, but with time became slower, especially when solving tasks without classic solutions, but requiring an explanation. A number of students didn't participate in the team's work, even though they were selected through public invitation. The winning team consisted of four students (Serbia, Poland, Spain, Bulgaria). It was planned to do another final test after the mobility and compare the results with the first one.

Discussion

Teamwork remains the problem. There is a noticeable tendency of some students to take all the work on themselves.

Communication went mostly smoothly.

The majority of students have enough knowledge to use digital tools, yet, there are noticeable shortcomings, such as incorrect mail writing, handling Zoom application, and the like.

Students have trouble when it comes to explaining their opinions. This affects the problem-solving competencies that still need to be addressed.

Conclusion

The majority of students find this way of work interesting. In a survey after completion, some of the opinions were:

"I'm pleased with the project, mainly because I can develop my language skills and talk to people. To be honest, the tasks are a bit challenging, but I'm not giving up. We had a few meetings. At first, everyone was shy, but it got better." Kinga Domanska

"First of all, I want to say that I enjoyed everything about the game, and it was really useful to me to communicate with other students that I didn't even know before this project. Everyone was super kind and smart, and I think we didn't have a lot of problems with tasks. Their serious attitude towards the game made me feel pleasant in this team. These are my impressions of my teammates. I hope they are enough. Once again I want to say that I'm really happy that I'm part of the team "Amigos" and working with such great teammates." Plamena Penkova

"For me, this was a really interesting experience because I'm getting to know new people from all parts of Europe. The tasks are fun and interesting and a way to connect." Katarina Stefanović

Still, it remains noted that it's necessary to devise a more dynamic method in the future, which would ensure that students complete their obligations more regularly. One of the suggestions is the introduction of deadlines, giving more smaller tasks, or tasks that would have to be solved exclusively during the team meetings.

References

Faridah, I., Sari, F. R., Wahyuningsih, T., Oganda, F. P., & Rahardja, U. (2020, October). Effect Digital Learning on Student Motivation during Covid-19. In 2020 8th International Conference on Cyber and IT Service Management (CITSM) (pp. 1-5). IEEE.

Susilawati, S., & Supriyatno, T. (2020). Online learning through WhatsApp group in improving learning motivation in the era and post pandemic COVID-19. Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan, 5(6), 852-859.

Butnaru, G. I., Niță, V., Anichiti, A., & Brînză, G. (2021). The Effectiveness of Online Education during Covid 19 Pandemic—A Comparative Analysis between the Perceptions of Academic Students and High School Students from Romania. Sustainability, 13(9), 5311.

Stepanović, S. (2020). Uticaj pandemije virusa korona na obrazovanje. Nastava i vaspitanje, 69(2), 183-196.

Medar, J., & Ratković, M. (2021). Primena informaciono-komunikacionih tehnologija u inkluzivnom obrazovnom kontekstu–iskustva nastavnika tokom pandemije COVID-19. *Vaspitanje i obrazovanje u digitalnom okruženju*, 109-113.

A Vasojević, N., Kirin, S., & Vučetić, I. (2021). Kako učenici srednjih škola u srbiji doživljavaju učenje na daljinu. *Kvalitativna istraživanja kroz discipline i kontekste: osmišljavanje sličnosti i razlika*, 54-57.