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Implementation of Gamification and Elements of Augmented Reality During the Binary Lessons in a Secondary School

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Abstract. The *purpose of the research* is to consider the possibilities of gamification and elements of augmented reality in the secondary school during the binary lessons in Physics and English. The *objective of the research* is to give examples of conducting binary lessons by means of gaming and elements of augmented reality. The *object of the research* is the process of teaching Physics and English in a secondary school. The *subject of the research* is the use of gamification and the elements of augmented reality when conducting binary lessons in a secondary school. The article considers the possibility of introducing the elements of augmented reality and gamification in a secondary school during the binary lessons. Examples of binary lessons for the secondary school students using gamification and augmented reality elements are given. The introduction of various types of educational activities during the binary lessons is analyzed. The *results of the research* indicate that gamification and the introduction of the elements of augmented reality in the process of studying in a secondary school contribute to the formation and development of cognitive interest of students in Physics and English; it will promote the application of scientific and technical knowledge in real life.

Keywords: binary lessons, gamification, augmented reality, studying in a secondary school, Physics, cognitive interest, basic school.

1 Introduction

One of the effective means of forming students' cognitive interest in science in general education is the implementation of integrated lessons.

The problem of organizing the educational process on an integration basis was the subject of researches conducted by Iryna M. Kozlovska [8], Yaroslav M. Sobko [15], Vladimir T. Fomenko [7], Tetiana D. Yakymovych [18] and others; the integration of natural science knowledge was analyzed in the works of Iurii I. Dik [6], Vira R. Ilchenko [9], Mykhailo T. Martyniuk [11], Vasilii G. Razumovskii [14], Illia O. Teplytskyi [16] and others. Integral pedagogical technology as a model of learning was developed in the works of Oksana Ya. Marynovska [12].

2 Exposition of Basic Material of Research

Integrated lessons should be conducted periodically so that students could see the correlation between the school subjects and understand that the knowledge gained from studying one subject allows you to understand the processes that are being studied in other subjects better. These lessons are relevant and effective regardless of whether the students are learning new or generalizing already learnt material. During the integrated lessons multidimensional objects are considered, which are subjects of studying for various school disciplines [4, 5].

In the process of studying at a secondary school the integrated technology is implemented in the following ways: conducting lessons using interdisciplinary connections; implementation of integrated lessons; conducting binary lessons [1].

Binary lessons, as a rule, allow you to integrate knowledge from different fields to solve one problem, make it possible to apply your knowledge in practice. Such lessons are often conducted by two teachers.

Our experience shows that in the process of studying in a comprehensive school it is reasonable to have integrated lessons in physics, biology, chemistry, mathematics, foreign languages [17].

The purpose of a binary lesson is to create conditions for the motivated practical application of knowledge, skills and abilities, to give students the opportunity to see the results of their own learning in two different educational disciplines and get positive emotions from the process of gaining knowledge.

Here are some examples of binary lessons that we think is reasonable to have at a secondary school:

1. “Diffusion in Nature and Science” — a binary lesson in Physics and English (Grade 7) [1].
2. “Science and Technical Progress. Light Phenomena in Nature and in Technology” — a binary lesson in Physics and English (Grade 9).

3. "Magnetic Field in Nature and Technology" — a binary lesson in Physics and Biology (Grade 9) [4].
4. "Resistance-moving System" — a binary lesson in Biology and Physics (Grade 9) [5].
5. "Environmental Problems of Nuclear Energy" — a binary lesson in Physics and English language (Grade 9).

In order that pupils work effectively during the binary lessons, it is necessary to implement gamification and elements of augmented reality.

The game for children and young people is a usual form of communication, when they feel themselves most comfortable. Discussions in form of a game avoid obstacles such as insufficient knowledge, inability to argue reasonably for their opinion [2].

During the lesson in the 7th grade ("Diffusion in nature and science"), it is a good idea to work with the interactive whiteboard, such as SMART Board, at the warming-up stage and during the actualization of students' skills and abilities, for example, the task to define the physical phenomena (exercise "Physical Football", Fig. 1).

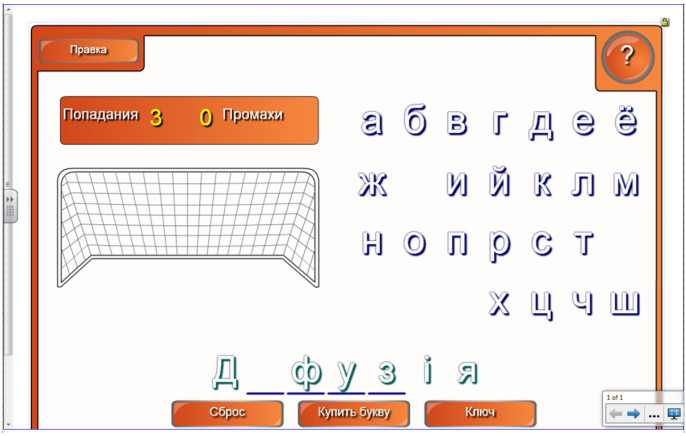

Fig. 1. Exercise "Physical football"

After the announcing of the theme of the lesson students are encouraged to explain the task encoded using QR codes and thus split them into teams (Fig. 2).

QR codes can be used in game quests to offer game tasks at one or more stages of the corresponding activities, in educational crossword puzzles [3].

Fig. 2. QR codes for dividing students into teams

During the main part of the lesson students carry out experimental tasks: one group of students carries out experimental tasks with the help of devices, and the other group of students is encouraged to watch the video after scanning the QR-code [1].

Students of the 7th grade are encouraged to read the task in English, carry out the experiment, and then explain the results in English as well. An example of the task "Wilful Potato".

Experiment # 2. "Wilful Potato"

Purpose: to observe the phenomenon of osmosis.

Equipment: potato cubes, a glass of weak salt solution, a glass of clean water, a glass of concentrated salt solution, a knife, sugar, a board, a saucer.

1. You have three glasses with different liquids, they contain almost identical cubes of potato.
2. One or two hours later, we can see that the cubes began to differ: the first of them (the one that was in weak salt solution) remained the same size, the second (it was in strong salt solution) shrank and became much smaller, and the third, on the contrary, plumped up.

At the beginning of the lesson "Science and Technical Progress. Light Phenomena in Nature and in Technology", the teacher of English and the teacher of Physics announced the theme and the objectives of the lesson. The aim of this lesson in Physics is to test and consolidate students'

knowledge on the topic "Light Phenomena", the purpose of the English lesson is to activate and test students' skills in different types of language activities in English.

During the warming-up activities students were offered some tasks in both English and Ukrainian. There were tasks using Kahoot [10], SMART Board. With great interest students solve puzzles (Fig. 3); guess riddles in English concerning light phenomena in Physics (Fig. 4).

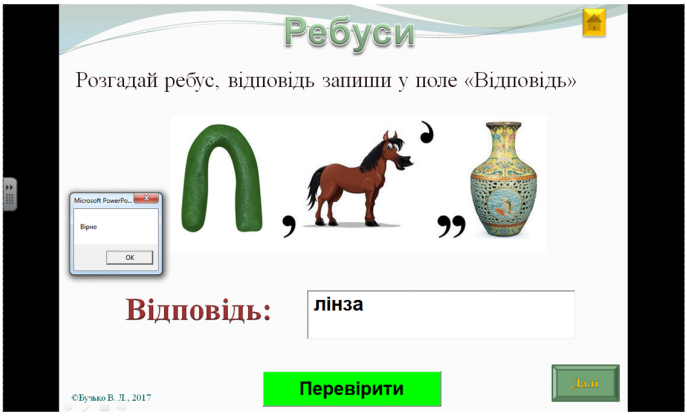

Fig. 3. An example of a puzzle

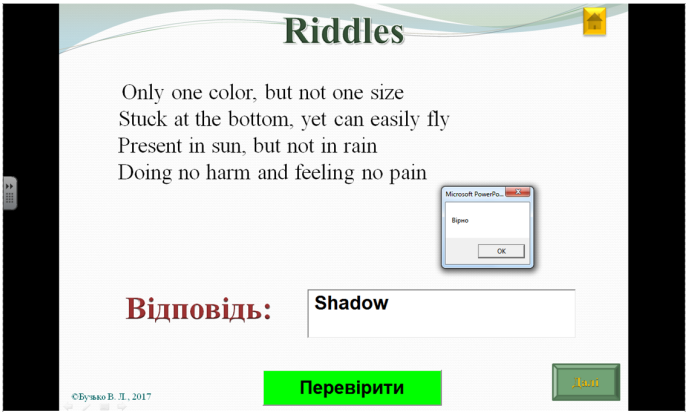

Fig. 4. An example of a riddle

The main part of the lesson was dedicated to performing experimental tasks in Physics. Students were divided into four groups beforehand, performing laboratory work they studied the laws of Physics and light phenomena, for this purpose, the method of active learning was introduced: the experimental task is given to the students, having read the task students work out the possible results of the experiment, and subsequently check it during the experiment.

Fig. 5. The work with a marker

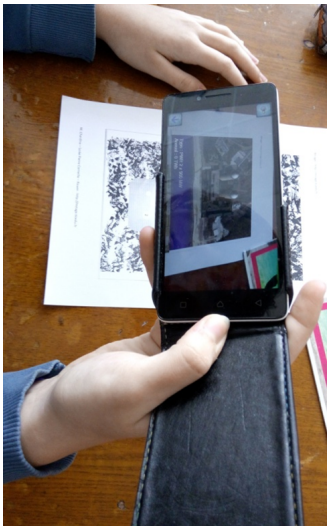

Fig. 6. The elements of the augmented reality at the lesson of Physics

During the course of this lesson, the students are encouraged to ascertain experimentally the validity of the following laws:

- The law of refraction (Snell's law of refraction) — the law of refraction of light (the law of Snelius),
- Dispersion of light,
- The law of reflection,
- The law of rectilinear spread of light.

During the lesson "Environmental Problems of Nuclear Energy" (Grade 9) it is reasonable to use the elements of the augmented reality [13] (Fig. 5). To do this, before the lesson, the students are encouraged to download the "Augmented Nuclear plants" free application (Fig. 6). The markers printed on paper are distributed to the students.

We offer the following tasks to the ninth-graders:

1. Describe the nuclear power plants on each card, explain how the nuclear power plant works.
2. Try to find out on what conditions you can build a nuclear power plant.
3. Two power plants are not atomic power plants, find them. Explain how they affect the environment.

3 Conclusion

Our experience of conducting binary lessons gives grounds to draw the following conclusions. Binary lessons are an effective means of increasing the motivation of studying natural sciences as they create conditions for the practical application of knowledge; develop students' skills in self-education, since a significant part of the training is carried out by students on their own and after classes; develop analytical abilities and ingenuity; form convergent thinking; at binary lessons we transfer skills in new spheres, which helps to find a solution to the problem under the new conditions; have significant educational potential; the positive atmosphere of such a lesson allows us to solve communicative tasks and contributes to the formation of a fully-developed student's personality. The realization of integration between subjects is possible only under the condition of a positive climate in the team of teachers, their fruitful cooperation on the basis of mutual understanding and respect and the knowledge of the programs of other natural sciences.

It is important to integrate English with other subjects in high school for the career-guidance purposes. It is important to note that the introduction of gamification and augmented reality in education in the secondary school allows the participants of the game to go beyond the content and the forms of the presentation of educational material introduced by the teacher; in the process of performing such tasks students develop their communicative skills; gamification and elements of augmented reality contribute to the formation and development of students' cognitive interest, motivate their self-educational activities.

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