Escape Room – Teachers Approved!

Marina Stojanovska[1], Vesna Milanović[2], Dragica Trivić[2]
[1] Ss. Cyril and Methodius University, Faculty of Natural Sciences and Mathematics, Skopje, Macedonia
[2] University of Belgrade – Faculty of Chemistry, Belgrade, Serbia
e-mail: mmonkovic@yahoo.com

Abstract

Escape room is novel and innovative method that can be used in teaching in general. Its popularity grows every day. The benefits of applying this approach in chemistry teaching are numerous, concerning both the cognitive and affective side of teaching. Thus, it can be used to develop conceptual knowledge, critical and creative thinking, problem-solving, but also skills needed in everyday life. It trains students to communicate and collaborate, to express and defend their opinions, to make compromises and decisions. Several escape room activities were conducted with chemistry teachers during seminars for professional development in Macedonia and Serbia. The goal was to actively involve teachers in the activity and to get insight into their opinions about the applicability of this approach in chemistry teaching. In this paper five escape room simple paper-and-pencil activities are presented which can be implemented in chemistry teaching.

Introduction

Escape room is a relatively novel concept and it has been used in education in recent years (Dietrich, 2018; Peleg et al., 2019). It is based on game-based learning (Admiraal et al., 2011; Antunes e al., 2014; Burguillo, 2010; Orlik et al., 2005; Russell, 1999; Stojanovska, & Velevska, 2018), and goes beyond that. It involves learning activities aimed to introduce or revise concepts in more attractive and engaging way. This approach fosters creativity and logical thinking. Students are put in a position to solve problems, discuss, defend their arguments, make compromises, and finally make a decision. Escape room puzzles are designed to be carry out by a group, thus increasing students' communication skills, but also other skills needed for their future life, such as collaboration, empathy, teamwork, self-confidence etc. These activities provoke higher-order thinking skills and development of conceptual knowledge and sometimes they can fill the gaps in knowledge or confront some misconceptions. It is understandable that students communicate more freely with their classmates rather than with the teacher. Involving games into the lesson insures both learning and having fun.

Games can be used as a pedagogical tool, which means that they must have some educational content and not be used only as an entertainment. They should be well-prepared and the preparation process is crucial for successful implementation. Preparation time is usually longer than the actual realization of the game, but once prepared games can be used many times with slight modifications. Teachers should also be aware of the lesson time limit and all escape room activities must end before the bell rings, and also leave some time for overall-class discussion.

Carefully prepared game-based activities will surely enable greater students' participation and mental involvement, which will then lead to increased students' motivation and interest of the subject and development of positive attitudes toward chemistry. Hence, educational games and escape room activities can be very beneficial in the classroom providing both mastery of the curriculum and an inspiring lesson.

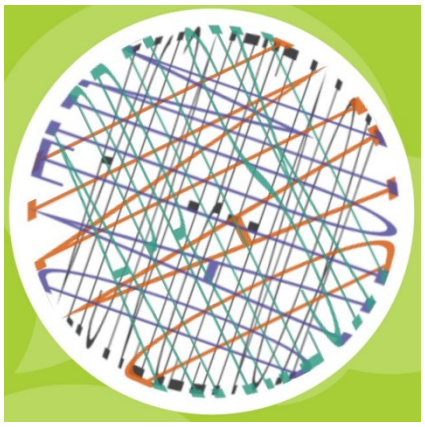
Having all this in mind, it is important to educate pre-service and in-service teachers and illustrate the applicability of this approach in chemistry teaching. This goal was set for seminars for professional development of chemistry teachers in Macedonia and Serbia during 2019 (Stojanovska, 2019a; Stojanovska, 2019b). The idea was to introduce the escape room approach to teachers by truly involving them into the activity (Figure 1). In this way, they could understand the escape room approach based on their own experience and feel the excitement while playing with their colleagues. Furthermore, this approach is appropriate for any topic, any school subject and any age level. Therefore, it can be integrated into the professional development program of teachers regardless of the teaching subject.

Figure 1. Working atmosphere during the seminars

Escape room puzzles

In a typical escape room activity, the participants are locked (or "locked") in a room trying to solve the puzzles in order to escape. The presented puzzles are developed for primary and secondary school students, so it is more appropriate to use the award 'locked in the box' instead of actually locking the students inside the classroom! One thing that can be significant for teachers is the cost for these activities, which in this case is minimal and, additionally, materials can be reused.

During the seminar workshops, teachers were given a handout for each puzzle, either to help them to solve the puzzle or to motivate and encourage them in their work. Puzzles presented at the seminars, together with a brief explanation, teachers' handout, and the final code to the puzzle are given below (Figures 2–6).



a

This puzzle can be easily made using the snote application (https://snotes.com). Four words are overlayed in a way they are unreadable. If this puzzle is printed on a piece of paper and rotated at a certain angle, the words are easy to understand. In this particular case, the words are: konferencija (conference), datum (date), aprilski (April), dani (days). This puzzle was used in a game during the conference in Belgrade and these words gave a clear association to participant teachers about the code (the conference was held on 24th April 2019).

b

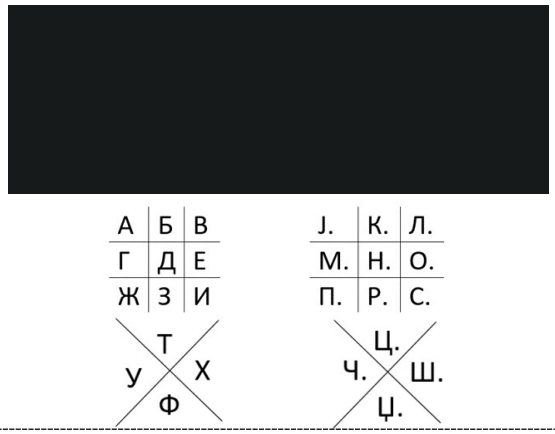
Seminars are an important part of teacher professional development, which is a continuous process – beginning on the first day and ending on the last day of a teacher's working career. It is a lifelong learning process in which the teacher is constantly improving.

c

244

d

Figure 2. Hidden words – the puzzle (a), explanation (b), teachers' note (c), and the code (d)



a

Students are given a coded message and a legend to be used to crack the code. They should reveal the mysterious text, and then answer the question.

b

Dear educators,
Use the encrypted message to discover the three-digit code. Think creatively and share creativity. You can't spend creativity. The more you use, the more you have!

c

680

d

Figure 3. Coded message – the puzzle (a), explanation (b), teachers' note (c), and the code (d)


THE BEST TEACHERS WORK TOGETHER

CCC - COOL CHEMISTRY COFFEE
ARHIMEDOVA 5
SKOPJE
MAKEDONIJA
1000

CASHIER: MARINA STOJANOVSKA
CUSTOMER: VREDNI NASTAVNICI

PURCHASE:

CEZIUM €325.00
AZOT €68.00
VODOROD €114.00

DDV +90.45% TAX: €454.06

TOTAL: €956.06

PAYMENT METHOD: CREDIT CARD
TRANSACTION #1546810111 -001
DATE:16/02/2019 11:37:43 PM

NO RETURNS WITHOUT RECEIPT

THANK YOU

a

A fake receipt is created inserting some chemical information among dates, item purchases, names, taxes etc. Students are searching for clues by calculating the atomic or the mass number, the group or the period of the elements, the number of protons, neutrons, electrons, valence electrons etc.

b

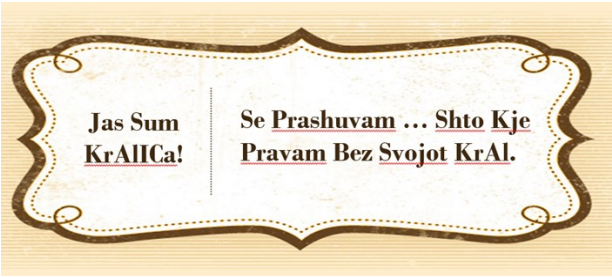
Dear educators,
Welcome to our CCC cafe bar. This is the receipt for your order. No, no, no … don't worry, we're not asking for money! Use your receipt to discover your three-digit code. Be guided by the rule of cooperation: "Working together increases the chance of winning."

c

151

d

Figure 4. Cool Chemistry Coffee Receipt – the puzzle (a), explanation (b), teachers' note (c), and the code (d)



a

Two statements are written on a piece of paper: "I'm a Queen (KrAlICa)" and "I Wonder … What Would I Do Without My King (KrAl)". The text is written in Macedonian, so it is language specific puzzle, but one can use other word-combination to attain the similar effect. Students are expected to use the keyword *without*, thus performing the subtraction operation (*KrAlICa* minus *KrAl* equals *ICa*). Finally, they should use the atomic numbers of iodine and calcium to break the code.

b

In 1869, the Russian chemist Mendeleev wrote the known elements (then 63) on the cards and then ordered them into columns and rows according to their chemical and physical characteristics. To celebrate the 150th anniversary of this important moment in science, 2019 was proclaimed the International Year of the Periodic Table of the Elements (IYPT2019).

c

5320

d

Figure 5. The Queen and the King – the puzzle (a), explanation (b), teachers' note (c), and the code (d)

1. Which of the following pairs **do not** have the same number of neutrons in the nucleus?
A. K and Ca B. Na and Mg C. F and Ne D. Li and Be

2. Two atoms, X and Y, have a total of 12 protons, 14 neutrons, and 12 electrons. The atomic number of Y is three times larger than that of X. In which group (G) and in which period (P) is the element X?
A. G-1, P-2 B. G-2, P-1 C. G-17, P-2 D. G-2, P-7

3. In the third electron shell of one atom there are twice as low electrons than in the first shell. What is the atomic number of the element?
A. 14 B. 11 C. 9 D. 3

	A	B	C	D
Q1	@	☼	♫	♥
Q2	♫	♥	@	☼
Q3	♥	@	☼	♫

@ = 1 ☼ = 2 ♫ = 3 ♥ = 4

a

Three multiple-choice questions are given. Each answer reveals one digit of the code which can be identified using the multiple-choice grid and symbols which are associated with numbers from the legend.

b

Dear educators, *At this chemistry competition you only need to answer three questions. Copying from other groups is not allowed, but you can freely consult the members of your group. After answering the questions correctly, try to discover the three-digit code using the legend. This will allow you to win first prize.* *Good luck!*	431

c d

Figure 6. Municipal Chemistry Competition – the puzzle (a), explanation (b), teachers' note (c), and the code (d)

Conclusion

The escape room approach is suitable to be used for developing activities for students so they can encounter the chemistry content in a different way than in the traditional classroom. This will lead to increased interest for the subject, but it would be an intellectual challenge for students as well. Furthermore, students will develop essential skills for life, such as collaboration, communication, problem-solving, critical and creative thinking, decision-making etc.

Therefore, the escape room activities can be used to create a positive learning atmosphere in the classroom and "revival" the lessons. Our experiences so far showed that this approach is of great interest to teachers and, of course, to students. Teachers during the seminars were amazed what they could do in their classrooms with just a little effort and almost no money and computers. It is an additional motivation for creating new activities of this kind that will benefit both teachers and students.

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