



## ESCAPE ROOM: ESCAPE GAMES AS A SCIENCE LEARNING TOOL

**Rubiane Duarte Masulc<sup>1</sup>,**  
**Josias de Paula Oliveira<sup>2</sup>,**  
**Maria de Lourdes Siqueira Confort<sup>3</sup>,**  
**Estaner Claro Romão<sup>4i</sup>**

<sup>1</sup>Mestre em Ciências pela Universidade de São Paulo,  
Pós-Graduação em Projetos Educacionais de Ciências,  
Escola de Engenharia de Lorena,  
Estrada Municipal Chiquito de Aquino, nº 1000,  
Santa Lucrecia, Lorena-SP,  
Brazil

[orcid.org/0000-0003-2715-2592](https://orcid.org/0000-0003-2715-2592)

<sup>2</sup>Mestre em Ciências pela Universidade de São Paulo,  
Pós-Graduação em Projetos Educacionais de Ciências,  
Escola de Engenharia de Lorena,  
Estrada Municipal Chiquito de Aquino, nº 1000,  
Santa Lucrecia, Lorena-SP,  
Brazil

[orcid.org/0000-0002-6335-2658](https://orcid.org/0000-0002-6335-2658)

<sup>3</sup>Mestre em Ciências pela Universidade de São Paulo,  
Pós-Graduação em Projetos Educacionais de Ciências,  
Escola de Engenharia de Lorena,  
Estrada Municipal Chiquito de Aquino, nº 1000,  
Santa Lucrecia, Lorena-SP,  
Brazil

[orcid.org/0000-0002-7668-3819](https://orcid.org/0000-0002-7668-3819)

<sup>4</sup>Livre Docente em Cálculo pela Universidade de São Paulo,  
Pós-Graduação em Projetos Educacionais de Ciências,  
Escola de Engenharia de Lorena,  
Estrada Municipal Chiquito de Aquino, nº 1000,  
Santa Lucrecia, Lorena-SP,  
Brazil

[orcid.org/0000-0003-4316-2029](https://orcid.org/0000-0003-4316-2029)

### Abstract:

This article used the Escape Room game as a tool for teaching science, which was adapted to be carried out in a remote classroom. The objective was to propose the development of this game as a remote learning strategy, contributing to fostering scientific knowledge

---

<sup>i</sup> Correspondence: email [rubianemasulck@usp.br](mailto:rubianemasulck@usp.br), [josiasdepaula@usp.br](mailto:josiasdepaula@usp.br), [maluconfort@usp.br](mailto:maluconfort@usp.br), [estaner23@usp.br](mailto:estaner23@usp.br)

through the playful activity of solving challenges and enigmas. The research methodology used was a case study, having been developed in a private school, with 19 students from a 7th-grade elementary school class. Data collection was carried out using two instruments, with observations made during the application of the game and then a qualitative questionnaire. As a result, it was observed that this game provided students with the necessary conditions for meaningful, dynamic, and innovative learning, motivating them to be the protagonists of new knowledge, face challenges, seeking solutions through an active methodology based on solving problems.

**Keywords:** science teaching, remote teaching, game, escape room

## 1. Introduction

The media revolutionized the means of communication and consequently also the means of teaching and learning, providing new virtual tools among which games emerged as innovative instruments in a playful way, arousing the increasing interest of students.

Educational games attract the interest and attention of children, teenagers, and young people, because it provides quick and easy access to obtain information, changing current educational paradigms (Savi; Ulbricht, 2008).

The Escape Room, the game applied in this activity, was directed to students from a private school in a city in the State of São Paulo, in a 7th grade class of Elementary School, being applied in the discipline of Science, through asynchronous remote class, Due to the situation of social distance caused by the COVID-19 pandemic that suspended face-to-face classes.

The objective of this work was the elaboration of an online Escape Room game as a remote learning strategy, contributing to fostering scientific knowledge in a playful way, encouraging through the game the development of cognitive, emotional, and social skills, in addition to promoting motivation, and incentive to research.

Due to the changes in communication, the insertion of virtual media, and, consequently, the emergence of new demands in education, the need to rethink other educational practices for the new generations is increasingly reinforced.

## 2. Theoretical Foundation

The game is an effective way to arouse interest in learning due to its playfulness, and being considered today as a form of pedagogical intervention. According to Santos (2008), the playfulness seen until then as not very relevant, became fundamental, being studied scientifically in its application.

The interaction in living in groups, in social relationships (sociointeractionism), studies the importance of play, in which playing is a tool for personal promotion, going beyond educational development, making companionship (collaboration) more flexible, personal interactions, respect for rules and initiative as socio-emotional skills (Vygotsky, 1989).

Continuing his studies, Vygotsky (1989) considers that play allows a greater development than the real, creating new possibilities of action in the world. He also says that playing is learning by preparing learners for more elaborate future learning.

According to Brasil (2018), in Socio-Emotional Education, it is important that students develop cognitive, emotional, social, and ethical skills: Cognitive such as solving problems, planning, making decisions, investigating, and acting creatively, among others; Emotional in dealing with gains and losses, developing self-confidence, self-assessment and responsibility; Social such as cooperation, collaboration, respecting the rules, working as a team, dealing with conflicts and developing communication and ethics by developing respect for differences, and attitudes for the collective good. Therefore, these skills can be worked on in collaborative educational activities, such as team games, represented here by the Escape Room.

The Escape Room appeared in Kyoto, Japan, in 2007, and was created with the intention of bringing the adventure of books and video games to the real world through a game (Clarke *et al.*, 2017).

It was in the last decade, around 2012, that they became more popular, starting in Asia, and then spreading through Europe, Australia, Canada, and the USA (Nicholson, 2015) reaching, then, as far as Brazil. It is a team game with real activities in which the components of these teams need to unravel enigmas and solve puzzles collaboratively using tips, clues, and strategies to escape from a locked room in a certain period of time (Vörös & Sárközi, 2017; Borrego *et al.*, 2017).

The authors Vörös and Sárközi (2017) highlight in their work that from this game came the idea of using these escape rooms in science centers or even in classroom activities, as long as the necessary adaptations were made.

With the success of this game and the various possibilities it can provide, it has encouraged some of these Escape Games to be tested for educational purposes within some curricular components, such as physics, chemistry, biology, and mathematics, and thus be used at different levels of education as a tool of learning (Vörös & Sárközi, 2017; Cleophas & Cavalcanti, 2020; Alonso & Schroeder, 2020; Charlo, 2020).

Authors also suggest that the use of Educational Escape Rooms can help students retain knowledge, as they can apply what they have learned, involved in an active learning process (Vörös & Sárközi, 2017).

In addition, this use of a challenging and collaborative game can also help in the development of personal skills, such as communication, leadership, and collaboration, and provide several benefits such as student involvement with the objects of knowledge worked, stimulation of curiosity, creativity, tenacity, and problem-solving (Cleophas & Cavalcanti, 2020; Vörös & Sárközi, 2017; Clarke *et al.*, 2017).

Finally, Alonso and Schroeder (2020) reflect on the challenge of enabling students to have an attractive and effective learning experience, despite using remote classes, resulting from the social distancing generated by the COVID-19 pandemic, and then suggest a possible adaptation of the face-to-face Escape Room to an online version. In this same perspective, the present work seeks to propose an online Escape Room to promote science learning in Elementary schools.

### 3. Methodology

The present work was developed in a private school in the State of São Paulo, with 19 students (aged between 12 and 13 years old) from a 7th grade class of Elementary School, being applied in the discipline of Sciences, through a synchronous remote class on the platform used by the school (Microsoft Teams), given the situation of social distance, due to the COVID-19 pandemic that led to the suspension of face-to-face classes from March to November 2020. The application of the work took place over a period of two months.

The research methodology used was a case study, a methodology applied to evaluate or describe dynamic situations in which the human element is present (YIN, 2001).

This research consists of the elaboration, application, and analysis of an "Escape Room" game that was adapted to an online version since the original game was developed in person, and at the time this project was applied to classes that were happening online. The central proposal is to use this game as a tool in science learning, combining learning with playfulness and the development of various skills, essential for the student.

After the elaboration and application of the game, data collection was carried out using as an instrument qualitative questionnaires (online) in Google Forms for further analysis.

For a better understanding of the execution sequence of the project carried out in this work, the stages of elaboration and application of the Escape Room (Table 1) will be shown.

**Table 1:** Escape Room elaboration and application stages

Stages and Description	
1. Define the central theme/subject that will be addressed in the enigmas	13. Apply, test, and if necessary, reformulate some game rules or reformulate some enigmas
2. Set the rules	14. Publicize the activity for students
3. Estimate the average duration of the activity	15. Assemble the teams
4. Define the number of teams	16. Select the leader and timekeeper for each team
5. Determine the number of enigmas	17. Publicize the teams, leaders, and time controllers for their subsequent preparation
6. Create an explanatory guide with the Escape Room rules	18. Pass the Explanatory Guide to students and clarify doubts about the game
7. Elaborate the enigmas	19. Apply the game
8. Check the insertion of technology for the adaptation of the face-to-face game	20. Observe the execution of the game, analyzing the behavior and dynamics between the players, difficulties, and facilities presented by them during the game
9. Research and prepare the creation of the Escape Room virtual space on Google Forms for the creation of the online version of the game	21. Record the completion time of each team to verify which is the winning team who managed to "escape the room" in less time
10. Create an "Escape Test", and apply it to a small sample of people to identify possible errors or problems	22. Participating students must complete the final questionnaire about the game

11. Make adjustments if necessary	23. Announce the winning team
12. Create the official virtual room for the Escape Room	24. Evaluate the entire application procedure, the game experience and the completed questionnaires

Next, the stages of elaboration and application of the Escape Room game will be detailed. The game was created to be a tool to support the teaching and learning of the Science curricular component, and the proposal was not to offer random puzzles, but rather, with a central theme that was chosen, to involve the participants. The theme chosen was "Living Beings" with a focus on the Animal Kingdom (Stage 1), a theme that, besides arousing great attention and curiosity in students, it is a content worked during the first semester of the school year in the 7th year of Elementary School, that is, it would be a review activity.

Some rules were pre-established (2), as well as the duration of the activity (3), the number of teams (4), and the number of enigmas (5), as shown below:

- The game is a "virtual room" in which the members of a team must solve 8 enigmas with the theme of the Animal Kingdom. With each enigma unraveled, a "lock" is opened, releasing them to the next padlock, which will present one more enigma, until, upon unraveling the eighth and final riddle, they will be able to "escape" the room;
- Each team will have up to 40 minutes to "escape" the room from the completion of all puzzles;
- Considering the number of students (30 students), the class was divided into two teams;
- For each team, a leader will be chosen (by drawing lots) who will be the spokesperson for the group. He will be responsible for opening the form, sharing the screen so that everyone (teammates and professors/researchers) can see and he will transcribe the answers in the form;
- For each team, a "time controller" will be chosen (by drawing lots) who will monitor the time (together with the teacher/researcher) through an online timer;
- All answers to the enigmas must be written without spelling errors and in lowercase letters, otherwise, students will not be able to "open the lock" and will be prevented (by the form itself) from going to the next enigma;
- The team that manages to open all the locks wins, that is, to unravel all the enigmas and manage to "escape" the room in the shortest time;
- Leaders should not answer the questions alone and should only transcribe the answer on the form when the team has reached a consensus;
- The "timekeeper" must notify colleagues when there is 10 minutes left for the end of the time;
- The teacher/researcher can make, during the game, only small assistance interventions when extremely necessary for the progress of the game;
- Upon completion of the game, the teacher/researcher must release a scoreboard with the completion time of each team and announce the winning Team.

It was prepared and available to students before the start of the game as an Explanatory Guide (stage 6) in the written version and on video (available on YouTube, at the link: <https://www.youtube.com/watch?v=XfV7-RoDSNU>) with all the rules and guidelines necessary for the execution of the same.

The enigmas were designed (stage 7) considering the selected theme in a range of difficulty levels (easy, medium, and difficult). After this stage, preparation was carried out (stages 8 and 9) through research and tutorial search on how to create an Escape Room online by the form in Google Forms. At this stage, tests were carried out on how to add the image of the locks to each enigma (Figure 1) and how to prevent the unlocking of the enigma if the answer is incorrect, and this is possible through Google form tools (Figure 1).

Subsequently, an Escape Test (stage 10) was created to check for possible errors and adjustments to be made. It was applied to a small sample of three of the researchers of this work and no correction was needed (stage 11), allowing the creation of the official virtual room for the game (stage 12).

With the game ready, the application of the following steps was continued (stages 14 - 23) including the dissemination of the activity to the students, preparation of the teams, application of the game, observation and analysis of the execution, completion of the questionnaire and announcement of the team winner. The last stage (stage 24) was the evaluation of the application through observation and questionnaires.



**Figure 1:** Padlock number five with Enigma to be solved in Google Forms quiz and error message (internal text in portuguese)

## 4. Results and Discussion

### 4.1 Collect and data analysis

Regarding the data collection process, we used two related instruments: Direct observation (Instrument 1) and a Questionnaire (Instrument 2). According to Gil (2002)

obtaining data through different procedures is a determining factor in the quality of results. For Yin (2001), the use of “multiple sources” is an important instrument in a case study, attributing more significance to its results.

In this way, during the application of the Escape Room game, the students' attitudes were observed and recorded in order to offer a broader perception, contributing to more efficient analysis of this teaching and learning tool.

These observations were made based on categorizations, based on the objectives outlined at the beginning of the work. Thus, through pre-established criteria, attitudes were categorized and analyzed.

More objectively, Instrument 1 of data collection seeks to measure the effectiveness of the Escape Room game in promoting socialization, playfulness, and learning among students. Thus, for a better view of the criteria used in the categorization and analysis of Instrument 1, as shown in Table 2.

**Table 2:** Categorization of Observations - Collection Instrument 1

<b>Categorization reference</b>	<b>Skills</b>	<b>Description</b>
I	Use of reasoning and memory	Students are expected to be able to use quick thinking, accessing the memory of medium and short term, regarding the content worked during science classes.
II	Interaction and collaboration between team members	It is expected that the members are able to establish interaction between the various team members in order to solve the proposed enigmas. It will be observed if the students were able to use the personal skills of each member in the best way, promoting the progress of the team.
III	Playfulness of the activity	It is expected that the game is able to stimulate in a playful way, creativity, interaction and learning in a fun way.
IV	Use of concepts learned in science classes	Students are expected to be able to use concepts already worked on during science classes.
V	Development of cognitive, emotional and social skills	It will be observed, if during the activity, the students were stimulated to make use of cognitive, emotional and social skills.
VI	Research stimulus	Students are expected to be able, through group research, to solve the proposed enigmas.

Instrument 2 of data collection has as its main objective to measure the effectiveness of the Escape Room game, as well as to evaluate the development of activities by those involved.

This data collection instrument used a questionnaire adopting the Likert scale, in order to capture information regarding the students' perceptions, analyzing attitudes and degree of intensity at the same time (Bermudes *et al.*, 2016). The Likert scale model adopted was with five points, for presenting in a simple way and completing the collected data. Still regarding the questionnaire, its application was through the Google Forms platform, with a link being sent for the students to respond after the game. In order

to better visualize the criteria used in the categorization of the questions of this data collection instrument, the classification will be presented in Table 3.

**Table 3:** Categorization of Questionnaire Questions – Collection Instrument 2

<b>Categorization reference</b>	<b>Criteria</b>	<b>Description</b>
I	Game Applicability	In this criterion, the feasibility of applying the Escape Room game remotely will be evaluated.
II	Student involvement	In this criterion, the degree of involvement of the students in the participation of each stage of the game will be evaluated.
III	Relevance of the game as a teaching and learning tool	In this criterion, we will evaluate if the game Escape Room, presents itself as a teaching and learning tool, in order to be used in other subjects in a current way.
IV	Aspects to be improved	In this criterion, we will evaluate the positive and negative points of the application of the game, in order to make future adjustments in later versions.

## 4.2 Escape Room Game Application

The activity was carried out as an option and after class, in which 19 of the 30 enrolled students participated. The teams were randomly distributed, with Team 1 being formed by 8 students and Team 2 by 11 students.

The Escape Room took place on the Microsoft Teams platform used by the school, and the teams were separated at different times. The application was monitored by three of the researchers of this work (one of them being the teacher of the class in question) responsible for the observations (Data collection Instrument 1).

### 4.2.1 Data collection Instrument 1

Team 1 was attended by eight (8) students. It was observed that they were participative and the game was permeated by laughter and relaxation, however, without losing the aspect of seriousness that the enigmas demanded. They showed anxiety related to "which team would win" or "who would be able to escape in the shortest time" demonstrating some traits of competitiveness with the opposing team, a common aspect in games in general, which may be directly related to greater motivation. In addition, opening the locks also provided intense excitement for the participants, being identified as another motivational factor. Thus, the presence of the "Playfulness of the activity" (criterion III) was evidenced.

It was also noticeable that they developed the skills indicated in criterion II "Interaction and collaboration between team members", since they kept the camera and microphone on during the game using them to communicate with colleagues and the leader, not having demonstrated no problems interacting with team members and no disagreements.

There was strong collaboration and organization between them, as they divided the tasks for each enigma, and while some sought the answers in the handout, others

looked for them on websites, also evidencing the development of skills of criterion VI “research stimulus”.

During the game, the “use of reasoning and memory” (criterion I) was visible, as well as “the use of concepts learned in science classes” (criterion IV), because during the enigmas they remembered the terms and living beings that have been studied, including, citing observations that were made by the teacher during classes, in addition to that, even when they did not remember the exact answer, establishing relevant relationships with the correct answer, as for example, in Enigma 1 in which the answer was “sponges”, a student remembered the cartoon “SpongeBob” before realizing that that was the answer to the enigma in question.

According to all the observations and punctuated analyses, it is clear that the skills referring to criterion V “Development of cognitive, emotional and social skills” are also covered during the game by Team 1.

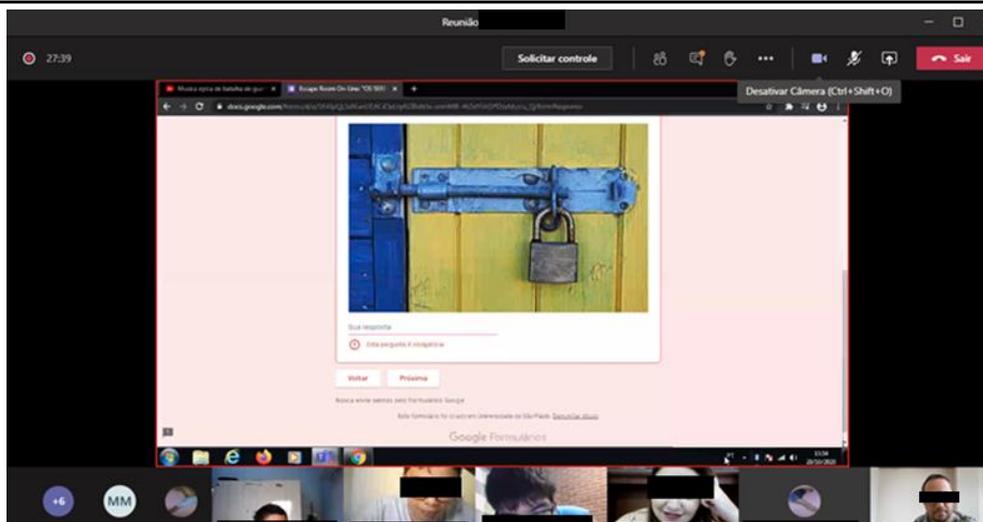
Regarding the difficulties, at the beginning of the game the student selected as “the time controller” was unable to access the online timer via cell phone, so another student voluntarily took his place. It is important to highlight that it took a while to complete Enigmas 2 and 8, requiring a few interventions from the teacher and a greater research effort in other sources.

This team did not need 40 minutes to “escape the room”, they completed the game in 18 minutes and 7 seconds (18:07), being the winning team, since they “escaped” in less time than the competing team.

Meanwhile, Team 2 was attended by eleven (11) students. The application took place in a similar way to that of Team 1, reaching the skills scored in criteria I to VI in a satisfactory way, except for differing in some details.

Regarding criterion II “Interaction and collaboration between team members”, although this skill has been developed, it was noticed that the interaction between them was discreetly lower, since some of them did not want to open the camera, and others did not have a microphone on their devices, expressing themselves only in writing in the chat (however, they still participated and contributed during the game), making the game less dynamic. Even so, the leader performed his role of “spokesperson” for the team satisfactorily, asking colleagues if they were in agreement before writing the answer (an uncommon attitude in Team 1), even looking in the chat to see if any participant had written the suggestion through this other communication channel.

However, when evaluating the criteria “use of reasoning and memory” (criterion I) and “use of concepts learned in science classes” (criterion IV), we noticed that these were also widely explored by team 2, which when not remembered exactly the answer, they received help from the others, who gradually built up the resolution of the enigmas. For example, in Padlock 6 (Figure 2) the correct answer was “frog” (“rã” in Portuguese), and the suggested answers started with “fish” (“peixe” in Portuguese), starting with “amphibians” (“anfíbio” in Portuguese), closer to the answer, until some students suggested “frog”. Others mentioned, “but a frog is not aquatic”, and “which amphibian is aquatic?” until one of them finally remembered the “frog” in which all participants agreed to be the key to opening the padlock in question.



**Figure 2:** Team 2 trying to open padlock 6 in the Escape Room game

Now analyzing the difficulties, we highlight that the students took a little longer to open the locks because the leader was waiting for a consensus regarding the answer (including those who wrote the suggestions in the chat). They took a while to complete Enigmas 2, 3, and 8, needing some intervention from the teacher and a greater effort from research.

Another problem with the game is that one of the team members solved the enigmas faster than the others, and gave the answer without first consulting the partners. This fact seemed to cause discouragement in colleagues, who asked him not to give an answer so quickly and wait for the opinions of others. Assertively, the team leader did not fill in the answer immediately when the student spoke, waiting for the others to do their respective research and everyone to come to a joint answer. Although Team 2 showed some more challenges than Team 1, it was noticed that the leader managed to reverse them in order to maintain the smooth running of the game.

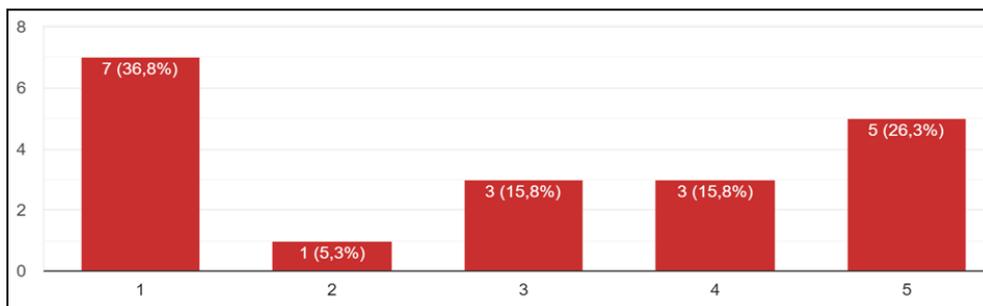
During the execution of the game, Team 2 showed no concern about the team that would win, only at the end they want to know about the winner. It was noticed that they focused on solving the enigmas and not on competitiveness, maybe that's why they performed with greater tranquility and without haste. This team also didn't need 40 minutes to "escape the room", they completed the game in 26 minutes and 53 seconds (26:53).

#### 4.2.2 Data collection Instrument 2

In order to evaluate the effectiveness of the Escape Room game, through the students' perception, below we present graphs that one by one present their analyses.

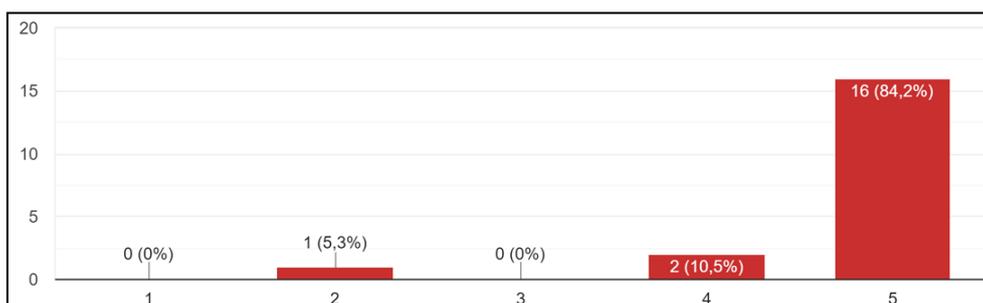
It should be noted that all students participating in the game (19) answered the questionnaire (9 questions) that will use a scale analyzed as follows:

*“Classify each question by assigning a value from zero to five, with the number zero representing “little” and the number five representing “a lot”.”*



**Figure 3 - 1:** Did you already know the Escape Room game?

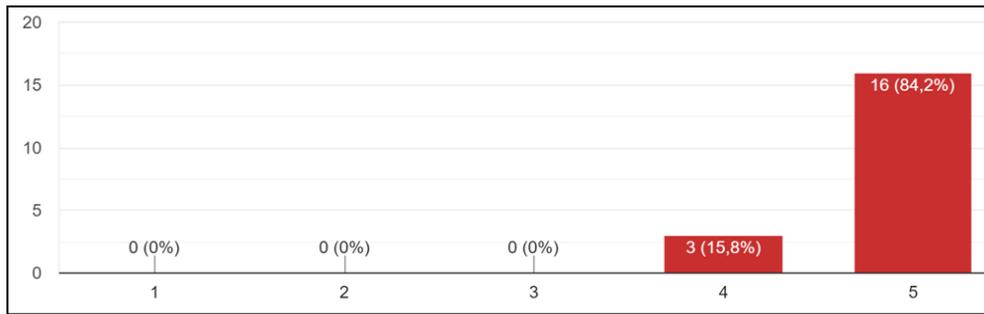
Analyzing Figure 3, we noticed that part of the class already knew the Escape Room game, which facilitated the application of the project. It should be noted, however, that the students did not imagine the possibility of carrying out this game in a virtual and remote way, so this new version aroused interest and participation. We noticed here that criterion I of data collection instrument 2 was reached.



**Figure 4 - 2:** Since the beginning of the game, were you interested in participating?

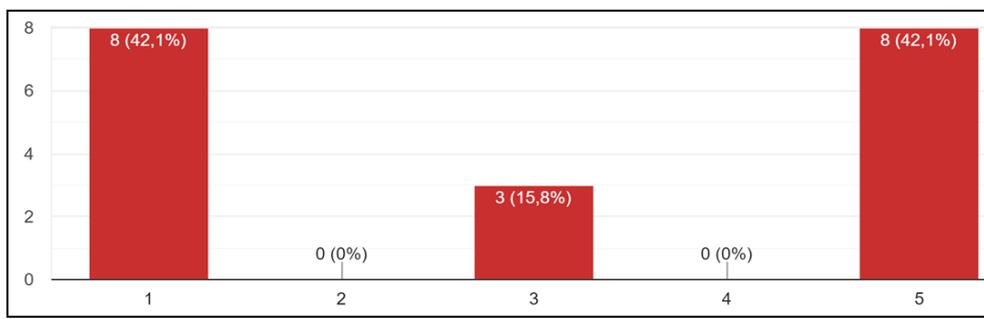
Now regarding question 2 (Figure 4), when we analyze the students' answers in this regard, we realize that, as it is a differentiated activity, practically every class felt challenged and motivated to participate in the game. In view of this finding, we can infer that student involvement proved to be significant, presenting itself as an activity that arouses the interest and active participation of students, reaching criterion II of the data collection instrument 2.

We are led to believe that the Escape Room, as a teaching and learning tool, encourages the active involvement of students in the construction of their own knowledge, being within criteria II and III of the data collection instrument 2.



**Figure 5 - 3:** Was the science content worked through the game relevant to your interests?

It can be seen in Figure 5 that all students evaluated the game as relevant to work on the contents of science classes, having reached criterion III of the data collection instrument 2. Thus, we can recognize the viability of the virtual version of the Escape Room game as a teaching and learning tool.



**Figure 6 - 4:** Was it difficult to understand the game and its rules?

It can be seen when analyzing the answers to question 4 (Figure 6), that a significant number of students found it difficult to understand the rules of the game, thus, it is necessary that these be rethought in future activities. We conclude that new ways of presenting the rules of the game must be thought of, in order to favor the understanding of the students, facilitating the use of this tool in the teaching and learning process. This note is present in criterion IV of the data collection instrument 2.

Altogether, 84.2% of the students, highlighted in items four and five, rated the game as challenging, so we can conclude that this factor contributed to the students' involvement throughout the activity. Thus, it can be seen that criterion II of data collection instrument 2 was reached. It should be noted that 15.8% of the students did not feel challenged, which points to the need for possible changes in the enigmas, in order to arouse the interest of the largest possible number of students.

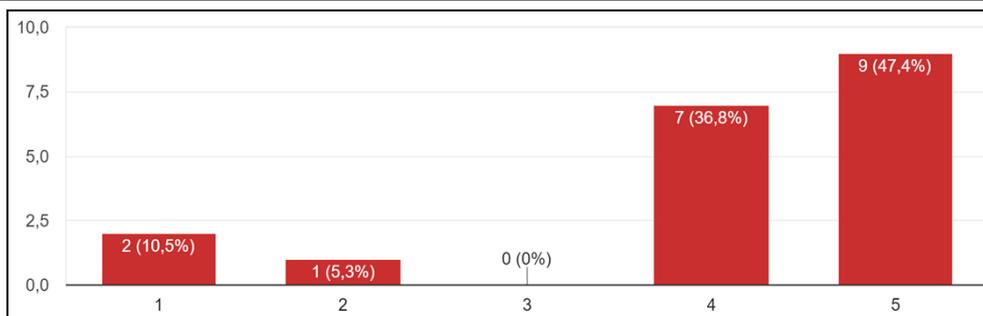


Figure 7 – 5: Did you feel challenged by the game?

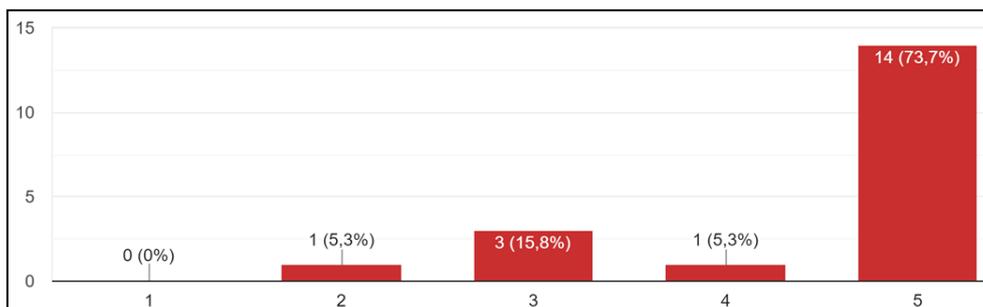


Figure 8 – 6: Was there active participation of the team during the game?

When analyzing Figure 8 regarding question 6, it is noted that 79% of the students evaluated that the participation of the teams was active, which leads us to infer, compared with Figure 7, that even those who did not feel challenged by the game, contributed to solving the enigmas. Based on these data, we evaluated the Escape Room game as a tool that enables collaborative teamwork, even in the context of remote classes, reinforcing criterion II of data collection instrument 2.

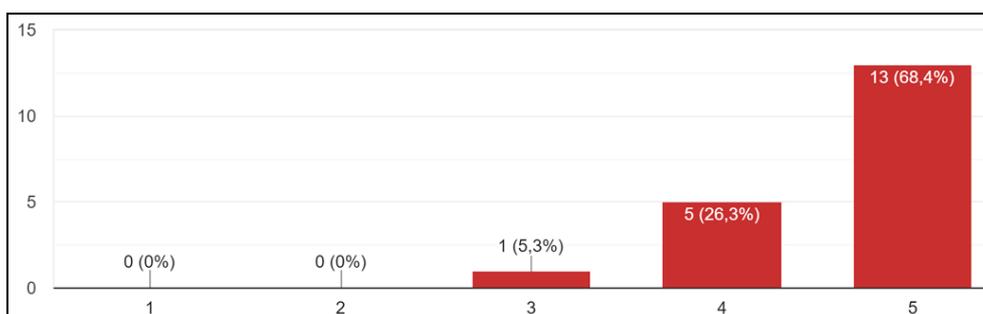
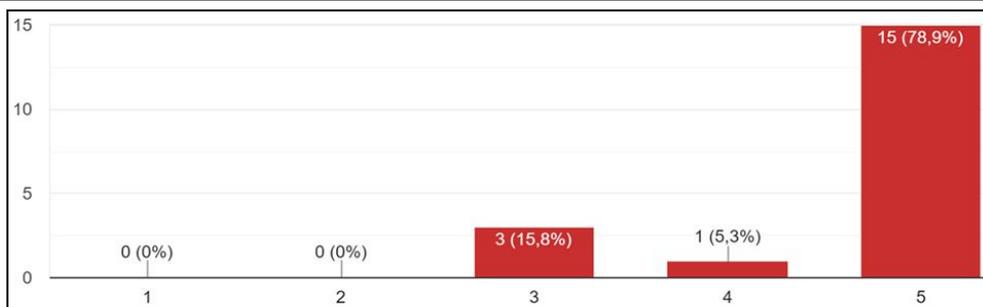


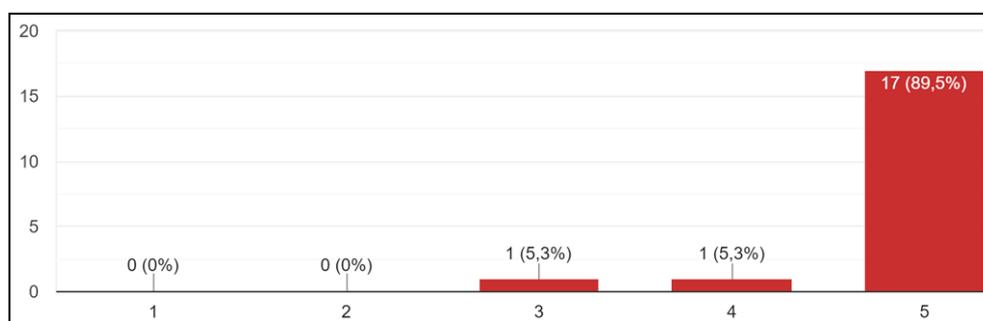
Figure 9 – 7: Did the collaboration of your colleagues during the game help your learning?

Considering the answers presented in Figure 9, we noticed that 94.7% of the students recognized the importance of colleagues in solving the enigmas. This reinforces the finding presented in Figure 8, recognizing the great potential that the virtual version of the Escape Room game presents, as a teaching and learning tool and facilitator of collaborative team activities.



**Figure 10 – 8:** Was competing with another group motivating?

Another important point to highlight is the great potential that the virtual version of the Escape Room game has to stimulate competition between teams (Figure 10). This factor is fundamental in promoting student involvement in the proposed activities, with 84.2% of students rated competition as an important motivating factor.



**Figure 11 – 9:** Would you play this type of game again?

Analyzing Figure 11, we noticed that 94.8% of the students say they would play the game again, which leads us to conclude that the virtual version of the Escape Room has the potential to be used at various times in the teaching and learning process, and can be adapted to other contents and the most diverse areas of knowledge.

Results similar to those found in this research were evidenced by authors such as Vörös and Sárközi (2017); Cleophas and Cavalcanti (2020); Charlo (2020) in their respective works, corroborating that the Escape Room Game contributes positively and effectively to learning, by stimulating creativity, collaboration, problem-solving, as well as presents an essential role in the mobilization and construction of knowledge in an active way by the students.

Vörös and Sárközi (2017) consider that the preparation and elaboration of this type of game, mainly for educational purposes, is complex and takes time, but the author pertinently points out that after finishing, it can be reused whenever necessary in other didactic moments.

The researchers Cleophas and Cavalcanti (2020) point out the scarcity of works in the Brazilian literature on the Escape Room in teaching, thus, it is noteworthy that no works were found involving the Escape Room in Science teaching in Brazilian literature, which demonstrates the need to advance studies on this topic.

## 5. Conclusion

The Escape Room Game, adapted for virtual use, due to the distance imposed by the COVID-19 pandemic, presented effective results in the search for solutions to the proposed enigmas, promoting playfulness and arousing interest and learning in a significant way.

The teams acted in a creative way, where the participants were the protagonists in the acquisition of new knowledge, through an active methodology, based on problem-solving, according to the objectives initially proposed in this work.

We noticed that the socio-emotional skills developed by the students were evidenced in the collaboration and interaction between the team members, in addition to demonstrating the motivation and competitive spirit between teams, during the stages, which occurred in a playful and interesting way.

The time spent by the groups was less than initially estimated, which leads us to reflect, in future works, on a more rigorous analysis regarding this item.

We conclude from the results presented that the use of the Escape Room game as a teaching and learning tool proved to be significant for most students, arousing: interest, motivation, a collaboration between members, competitiveness, and promoting challenging teaching. However, there was a need to make adjustments regarding clarity in the elaboration and transmission of the rules.

It is clear the promising character of future studies, which delve into this theme, given the few publications that relate science teaching and the Escape Room games. In this way, the relevance of the present work is perceived in the contribution of future research.

Thus, in the face of the challenges that present themselves today, the Escape Room game proved to be a possibility to be used in the promotion of teaching that provides opportunities for protagonism and reflection through collaboration between students, skills that are so necessary for the exercise of citizenship in the present century.

### Conflict of Interest Statement

The authors declare no conflicts of interest.

### About the Author(s)

**Rubiane Duarte Masulck** has a master's degree in Science from USP - University of São Paulo – SP Brazil, a postgraduate degree in clinical analysis and currently works as a science and biology teacher in basic education schools. He is interested in the areas of science education, active teaching methodologies and educational innovation, in addition to conducting environmental, sustainability and citizenship projects and developing research on teaching based on skills and abilities and learning assessment processes.

**Josias de Paula Oliveira** is a teacher of History, Philosophy and Geography in basic education schools, he is a Master's student in Science, in the Postgraduate Program in Educational Projects at USP - University of São Paulo – SP Brazil, postgraduate in Teaching Philosophy and in didactic-pedagogical processes. He has worked as

coordinator, educational advisor and teacher at the Paula Souza State Center for Technological Education and the private education network and has experience in the area of education, with an emphasis on teaching and educational guidance, development of research in Public Educational Policies and development of projects focused on socio-emotional education.

**Maria de Lourdes Siqueira Confort** has a master's degree in Science from USP – University of São Paulo - SP Brazil, postgraduate degree in Neuropsychology of Learning, postgraduate degree in Higher Education, Clinical Psychologist and currently works as a professor of University Education in Psychology and Supervisor of Humanistic Clinical Psychology. Develops research on preventive work on child development through “sensitive listening as an integrative proposal between school, students and community”, under the supervision of students and psychologists.

**Estaner Claro Romão** holds a degree in Mathematics from the Universidade Estadual Paulista Júlio de Mesquita Filho (UNESP-2001), a master's degree in Mechanical Engineering from the Universidade Estadual Paulista Júlio de Mesquita Filho (UNESP-2004), a PhD in Mechanical Engineering from the State University of Campinas (UNICAMP-2011), Post-Doctorate carried out at the State University of Campinas (UNICAMP-2013) and Professorship at the University of São Paulo (USP-2015). Active in two research areas: 1 - in the area of Mechanical Engineering, with an emphasis on Fluid Mechanics and Heat and Mass Transfer, working mainly in the area of Variational Principles and Numerical Methods for Transport Phenomena, and 2 - in the area of teaching, with an emphasis on improving teaching in basic education, with special emphasis on the subject of Mathematics.

## References

- Alonso, G.; Schroeder, K. T. Applying active learning in a virtual classroom such as a molecular biology escape room. *Biochem Mol Biol Educ.*, n.48, p. 514-515, 2020.
- Bermudes, Wanderson Lyrio. *et al.* Tipos de escalas utilizadas em pesquisas e suas aplicações. *Revista Vértices. Campos do Goytacazes*, v.18, nº02, p.7-20, 2016.
- Borrego, C.; Fernández, C.; Blanes, I.; e Robles, S. Room escape at class: escape games activities to facilitate the motivation and learning in computer science. *Journal of Technology and Science Education*, v. 7, n. 2, p. 162–171, 2017.
- Brasil. Ministério da Educação. Base Nacional Comum Curricular. 2018. Disponível em: <http://basenacionalcomum.mec.gov.br/> Acesso em: 01 set. 2020.
- Charlo, J. C. P. Educational Escape Rooms as a tool for Horizontal Mathematization: Learning Process Evidence. *Education Sciences*, v.10, n. 213, p. 1-17, 2020.
- Clarke, S. J.; Peel, D. J.; Arnab, S.; Morini, L.; Keegan, H.; Wood, O. EscapED: A Framework for Creating Educational Escape Rooms and Interactive Games to For Higher/Further Education. *International Journal of Serious Games*, v. 4, n. 3, 2017.
- Cleophas, M. G.; Cavalcanti, E. L. D. *Escape Room* no ensino de química. *Química nova Escola*, v. 42, n.1, p. 45-55, 2020.

- Gil, Antonio C. Como elaborar projetos de pesquisa. 4<sup>a</sup>.ed. São Paulo: Atlas, 2002.
- Nicholson, S. Peeking behind the locked door: A survey of escape room facilities, 2015.  
Disponível em: <http://scottnicholson.com/pubs/erfacwhite.pdf>, Acesso em: 28 out. 2020.
- Santos, S. M. P. Brinquedoteca, a criança, o adulto e o lúdico. 6<sup>a</sup> ed. Petrópolis: Vozes, 2008.
- Savi, R.; Ulbricht, V. R. Jogos Digitais Educacionais: Benefícios e Desafios. RENOTE, Porto Alegre, v. 6, n. 1, 2008.
- Vörös, A. I. V.; Sárközi, Z. Physics escape room as an educational tool. AIP Conference Proceedings, p. 1916, 050002, 2017, Disponível em: <https://aip.scitation.org/doi/pdf/10.1063/1.5017455>, Acesso em: 28 out. 2020.
- Vygotsky, L. A formação social da mente. São Paulo: Martins Fontes, 1989.
- Yin, R. K. Estudo de Caso, planejamento e métodos. 2.ed. São Paulo: Bookman, 2001.

Creative Commons licensing terms

Authors will retain the copyright of their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s). Open Access Publishing Group and European Journal of Special Education Research shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflict of interests, copyright violations and inappropriate or inaccurate use of any kind content related or integrated on the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/).