



ISSN: 2446-774X

#### Teaching 1st grade functions through gamification with Escape Factory

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#### Abstract

The objective of this work is to verify the contributions of the Escape Factory platform in the systematization and organization of activities, using the content of 1st degree functions through gamification strategies in an activity developed remotely. The methodology adopted for this work is qualitative in nature, being exploratory research, in which the participation of students allowed us to improve ideas or hypotheses about the feasibility of using the platform, providing data for analysis based on their resourcefulness in the activity. The target audience was a group of 1st year high school students from a state public school in the countryside. The results show the acceptance of the platform, the gamification characteristics present at work, the students' performance and their impressions of the experience, the teacher's view on the use of the platform, as well as the weaknesses found in this experience. Finally, it appears that classes with gamification encourage student participation and promote an environment conducive to learning, even with the difficulties encountered in its use. In addition, the fact that there is little research with the Escape Factory platform shows that this work brings a resource to be explored by teachers and scholars in the area, given the potential that gamification has to develop skills and abilities in students.

Keywords: 1st degree functions. Gamification. Teaching of mathematics.

#### Resumo

O objetivo deste trabalho é verificar as contribuições da plataforma Escape Factory na sistematização e organização de atividades, utilizando o conteúdo de funções do 1º grau por meio de estratégias de gamificação em uma atividade desenvolvida de forma remota. A metodologia adotada para este trabalho é de natureza qualitativa, sendo uma pesquisa exploratória, em que a participação dos estudantes nos permitiu aprimorar ideias ou hipóteses sobre a viabilidade no uso da plataforma, fornecendo dados para análise com base em sua desenvoltura na atividade. O público-alvo foi um grupo de estudantes do 1º ano do ensino médio, de uma escola pública estadual do campo. Os resultados mostram a aceitação da plataforma, as características da gamificação presentes no trabalho, o desempenho dos alunos e suas impressões sobre a experiência. Por fim, constata-se que as aulas com gamificação estimulam a participação dos alunos e promovem um ambiente propício à aprendizagem, mesmo com as dificuldades encontradas em seu uso. Além disso, o fato de existirem poucas pesquisas com a plataforma Escape Factory mostra que este trabalho traz um recurso a ser



explorado por professores e estudiosos da área, dado o potencial que a gamificação tem de desenvolver competências e habilidades nos alunos.

Palavras-chave: Função do 1º grau. Gamificação. Ensino de Matemática.

#### Introduction

The pandemic of the New Coronavirus imposed the need for social distancing, which impacted the routine of society globally. The world had to adapt, adapting its work format and the offer of services. And education, like all other areas of activity, was also heavily affected. The pandemic scenario forced an adaptation in the format of classes, adopting emergency remote teaching as a way to continue school activities. And in this context, technology in general has been essential for the progress of the teaching and learning process.

However, it should be noted that the difficulties that permeate the teaching and learning of Mathematics have been more visible with remote teaching, among them, the adaptation of teachers to the use of technologies more frequently. According to Martínez (2021) the use of technologies in education has evolved greatly in recent decades, but mathematics is one of the disciplines that has taken the longest to incorporate the use of technologies to support learning processes. Many teachers continue to use traditional teaching strategies and the implementation of mechanical and decontextualized processes, which do not allow the student to have a global understanding of the subjects covered in the discipline. This has resulted in greater difficulty for students to understand mathematics in the context of emergency remote teaching.

One of the curricular components of the mathematics subject in which students have difficulties is the subject of functions, in general - function of the 1st and 2nd degrees, logarithmic function, exponential function, among others. One possibility to work on this subject in a more dynamic way would be using digital platforms and gamification resources, making the class more attractive and encouraging student interest. According to Sousa, Azevedo and Alves (2020) classroom games, aimed at Mathematics, can reinforce the acquisition of skills and competences, developing logical-mathematical reasoning, the elaboration of strategies to solve problems, in addition to encouraging work in team, public speaking skills and conflict mediation in some cases.

From the above and analyzing the scenario of remote teaching and the adversities present in the discipline of Mathematics, it is pointed out as a guiding question: How could the content of functions be dynamically worked with using digital platforms and gamification of teaching? To this end, the objective of this work is to verify the contributions of the Escape Factory platform in the systematization of activities on 1st degree functions, using gamification strategies.

The methodology adopted in this work is qualitative research, of the exploratory type, because according to Gil (2002, p. 41) this type of research has as its scope "the improvement of ideas or the discovery of intuitions", with a flexible planning, which allows consider various aspects about the fact or object studied.

The target audience of this research is a 1st year high school class, which participated in the application of an activity using the resources of the Escape Factory platform, in



a gamified class format, in which it seeks to verify the dynamics of the platform for the teaching of 1st grade functions.

In the following sections there is an explanation of the theoretical framework, covering remote teaching and the discipline of Mathematics, the teaching and learning of functions through digital resources, gamification as a learning strategy, the Escape Factory platform and its resources for gamification, the presentation of the methodology of this work, as well as the authors' final considerations.

## Theoretical framework

In this section, aspects of the discipline of Mathematics in the course of remote teaching will be discussed, the possibilities for teaching and learning functions of the 1st degree through digital resources, presentation of gamification as a learning strategy and, finally, the presentation of the Escape Factory platform as a digital resource for gamification.

# Remote teaching and the discipline of mathematics

In the current pandemic scenario that the world is in, education has had a sudden change in its way of working, where the methodological practices of teachers demanded emerging adaptations, such as the adoption of remote teaching in schools in the country and around the world. In this restructuring of teaching practice, educational technologies, tools, and digital resources offer a range of alternatives to help the continuity of school activities, being essential for the adaptation of the actors involved in the teaching and learning process. Thus, the teacher begins to teach in other ways, learning and reflecting on his practice and the student visualizes alternatives through technology for the apprehension of knowledge.

Remote Learning was an alternative adopted by educational institutions to reduce damage and delay in curricular components. However, it is important to emphasize that many teachers, including those of the mathematics discipline, did not have developed technological skills or received any previous training on this teaching format during their professional career. Some undergraduate courses offer disciplines that involve Distance Learning (EAD) in their curriculum matrices, however, EAD brings learning in a different way than remote learning and it is important that these modalities are not mistakenly confused.

Santos (2020) makes this distinction between remote teaching and distance learning, pointing out that EAD was designed and developed with a view to using a set of applied technologies and techniques, with practical classes, with the objective of student autonomy in their learning, with the flexibility to study in another physical space different from the traditional classroom and time, with regard to the progress of the student's study pace. That way:

Technological preparation with subjects who are aware and prepared to perform their function with a focus on autonomous learning is not characteristic of remote classes, since for the methodology of these classes the teacher was not prepared for the methods with new technologies, do not have didactics exclusively in remote mode in their training. (SANTOS, 2020, p. 48).



In a general panorama, the mathematics teacher has faced difficulties to obtain positive feedback from students in their discipline in the remote modality. Faced with the difficulties of this type of teaching, specifically with regard to the discipline of Mathematics, Martínez (2021) points out that Mathematics is the discipline that has taken the longest to insert technological resources routinely into teaching practice, even adopting traditional teaching mechanisms and the relationship between mechanical and decontextualized procedures, which has possibly reverberated in the current scenario. Thus, the author mentions that "technology as a resource for exploration and visualization, should allow the student to establish relationships between different mathematical objects, becoming familiar with their characteristics, making them tangible and manipulable" (MARTÍNEZ, 2021, p. 389 *apud* VEGA; CÁRDENAS; NIÑO, 2015), which shows us the importance of making the approach to content more perceptible for a better understanding of the student.

The physical distance between teacher and students in remote teaching has hampered the teaching and learning process, being an adversity in students' understanding of Mathematics and, in many cases, has demotivated classes and caused a reduction in engagement in classes, which is harmful to their development in their routine of autonomous/home studies.

Schwanz and Felcher (2020) point out that in the current scenario and in the midst of so many difficulties in teaching Mathematics, digital technologies have become essential resources for the progress of the teaching and learning process, given that they provide opportunities to carry out activities synchronously and/or asynchronously, whether through video conferences, use of digital platforms such as Google Classroom, applications, video recorded classes, among other tools.

Based on the above, this work points out the Escape Factory<sup>1</sup> as an auxiliary digital resource, which consists of a platform aimed at boosting learning, not only in Mathematics, but in a multidisciplinary way. This platform consists of several games ready to be used in the classroom, but also allows the teacher of the discipline to make his own production.

According to information available on the platform itself, it allows the teacher to monitor the learning of their students in a different way from a traditional quiz, where there is the possibility of transforming any content into a game using maps, their own avatar, among other possibilities, distributing tips, images, videos, among other media throughout the games or sessions to enhance their way of teaching and learning.

# Teaching 1st grade functions through digital resources

Regarding the creation of the concept of function, according to Boyer (1996) the records of the relationship between values date back to approximately 2000 BC Eves (2007) adds that most of the correspondence tables mention the Babylonian civilization in such materials, in which there are several records relating to knowledge of geometry and algebra.

However, according to Silva and Oliveira (2017), the concept of function has undergone major changes throughout history, since its first manifestation from Oresme in the 14th century, in which the term was used to establish the dependence between

Educitec - Revista de Estudos e Pesquisas sobre Ensino Tecnológico, v.8, e178822, 2022.



<sup>&</sup>lt;sup>1</sup> Official website of the Escape Factory platform: <u>https://escapefactory.me/#/</u>

two magnitudes, until reaching formalized structure known today, which in turn are proposed in basic education textbooks.

The teaching of functions is recurrently a subject in which high school students face difficulties, whether in understanding its formation laws, graphics, or practical applications (CALIL; VEIGA; CARVALHO, 2010). And in the face of the remote teaching scenario, the difficulties have become more accentuated.

Nascimento *et al.* (2019) states that the functions, as curricular components of the mathematics subject, can be applied in different situations and one of the most widespread functions in practical situations is the function of the 1st degree. In this sense, the importance of working on this subject is perceived, given its relevance to the development of high school students.

Also, according to the same authors, specifically the affine function is one of the most important and worked subjects among the various curricular components of the mathematics subject, as it is approached throughout elementary and high school, either through specific chapters or in an interdisciplinary way (NASCIMENTO *et al.*, 2019). However, despite its proven relevance and its numerous possibilities of association with everyday life such as in communication vehicles, advertisements, games, among others, students still have a series of difficulties in their understanding.

The National Curricular Common Base (BNCC, acronym in Portuguese) brings, in relation to the skills and abilities necessary for the student to understand the functions of the 1st degree, which is necessary:

Investigate relationships between numbers expressed in tables to represent them in the Cartesian plane, identifying patterns and creating conjectures to generalize and algebraically express this generalization, recognizing when this representation is a 1st degree polynomial function. (BRASIL, 2018, p. 533).

Regarding the BNCC, we understand that it is of great importance that students reach this understanding through the relationship between the content of affine function and everyday situations. In addition, BNCC points out the importance of using digital technologies as a way of stimulating computational thinking and enabling students to actively participate in the problem-solving process (BRASIL, 2018). Technologies "are alternatives for varied experiences and facilitators of learning that reinforce the ability to reason logically, formulate and test conjectures, assess the validity of reasoning and build arguments" (BRASIL, 2018, p. 528), fact highlighted in several studies.

The research by Cruz and Mont'Alverne (2021), for example, points out that the use of technologies to work with 1st grade functions in the classroom can make the learning process more dynamic, agile, provoking greater interest on the part of the student, if it is compared to the actions practiced by them in the resolution of mathematics questions performed manually. Rêgo (2000, p. 76, apud SÁ; MACHADO, 2017, p. 1) complements these authors, pointing out that:

The main advantages of technological resources, in particular the use of computers, for the development of the concept of functions would be, in addition to the positive impact on students' motivation, its efficiency as a tool for symbolic manipulation, in the tracing of graphics and as a facilitating instrument in tasks problem solving (SÁ; MACHADO, 2017, p. 1).

In the work of Tenório, Tavares and Tenório (2016), the authors bring an investigation about technological resources in the teaching of 1st grade functions, exploring different tools, obtaining a positive result regarding the understanding of the intuitive notion of



function, as well as a greater motivation of students in carrying out this model of activities.

Based on the above, we consider that the use of technologies, whether through software, applications, or digital platforms, has the potential to enable the teaching and learning of 1st grade functions. Thus, this work addresses the use of the Escape Factory platform as a way to facilitate the learning of this curricular component, based on the gamification of the subject.

## Escape Factory as a digital platform for gamification

Gamification uses competition as a differential to attract the attention of students in the classroom. In addition to collaborating and supporting the learning process, it is known as a strategy to encourage engagement in the classroom (TOLOMEI, 2017). In this way, gamification became known from 2010, starting to be used to encourage education, using graphic elements and game design in a context that is not necessarily a game (SILVA; RODRIGUES; LEAL, 2019).

Although its use in the classroom is a recent practice, we can see that the practice of gamified classes tends to provide participation, involvement, and a reduction in students' fear of making mistakes. In this sense, Tolomei (2017), on the use of gamification in the classroom, describes that:

Game elements are related to human wants and needs such as rewards, status, and challenges, among others. Gamification can be used to meet these targeted needs in Education to motivate and engage students to be more participatory and increase their relationship with their peers. (TOLOMEI, 2017, p. 151).

Thus, according to Tolomei (2017), gamification can develop student engagement within the school environment, helping to solve problems, improving learning and motivating students' behaviors and actions in a positive way.

According to Silva, Sales and Castro (2019), to gamify a class it is not necessary to use all the elements in a game, but four of them are essential, which are the objectives, the rules, the feedbacks, and the voluntariness. These elements are present in any type of game and can be combined with others to build a gamification relevant to the school environment.

The authors Barbosa, Pontes and Castro (2020), reinforce that gamification has the potential to assist in the teaching of Mathematics, in view of the elements present in games, such as the creation of goals, adoption of specific rules, feedbacks, scoring, ranking, have a stimulating character, making the learning environment productive through the development of creativity and reasoning, in addition to the competitive stimulus among students, being a motivating factor for mathematical learning.

Based on the above, in this work we point out the possibilities and advantages of a platform that is still not widespread in education, which is the Escape Factory. In recent years, this platform has become a digital gamification instrument to assist in the development of students, being used to involve them in the learning process through virtual games, guided by an avatar, in movements performed by the student, within from a map created by the teacher.

Escape Factory consists of a virtual learning platform based on games with scores, in the form of quizzes, used to check students' knowledge in an interactive way, different



from traditional activity platforms. The platform has free access, however with limited use of its resources. For greater use, there is a subscription to the (paid) plan, with a greater number of monthly access sessions and other features. In the free modality, the Escape Factory platform allows multiple choice tests or open questions in discursive format within the virtual environment (GUARDIA, 2019).

The platform shows student performance in a personalized way, has an attractive layout, and encourages student engagement within the game. In Escape Factory we can create several game models, adapting them to the lesson planning, quickly and dynamically with the creation of interactive maps, encouraging the exploration of resources similar to role-playing games (RPG).

The gamified class has the possibility of immediate feedback, being of great value within the learning process. Escape Factory allows teachers to monitor student learning in a different way than a traditional quiz. In addition, when transforming content into games, there is the possibility of providing tips, images, videos, and other media to enhance the dynamics of the elaborated activity, transforming successes into rewards, instigating students' curiosity, and reproducing a collaborative and competitive dynamic.

Regarding the subject of mathematics, the platform allows access to games developed by other teachers/authors, on the most diverse curricular components, which can be copied, edited, and shared.



Figure 1 – Initial interface of the Escape Factory platform.

Source: Escape Factory (2021).

In Figure 1, we have the home page of the Escape Factory platform with tutorials for tips and information about the game, the play button to enter a code and start a new game, the start button for a new user registration on the platform and the login, for access to all available resources, if the user is already registered.

# Methodology

The research methodology adopted in this work is qualitative exploratory research, because according to Gil (2002, p. 41) exploratory research aims to "provide greater familiarity with the problem, in order to make it more explicit or to constitute



hypotheses". Thus, we seek to understand the particularities and individual experiences about the object of study, considering its various aspects in a subjective way.

According to Marconi and Lakatos (2011), the qualitative approach is a study that is based on the analysis and interpretation of deeper aspects, describing the complexity of human behavior, and providing a more detailed analysis of investigations, attitudes, and behavior trends.

Thus, this research sought to analyze the application of a game on the Escape Factory platform aimed at teaching 1st degree functions, aiming to examine the aspects that confer the feasibility and benefits in its use, both as a tool for the development of student learning, and as Mathematics teacher support tool. The target audience consisted of a group of 20 students from the 1st year of high school, from a regular rural school. The selected students participate in tutoring classes, as they have difficulties in Mathematics. In Figure 2 we present the user interface within the platform:



Figure 2 – User interface on the Escape Factory platform.

Source: Escape Factory (2021).

In Figure 2, we visualize some models previously prepared by the teacher on the platform. By clicking on one of the activities, such as the "Performance Assessment 2nd period", we have the platform interface as shown in Figure 3, which shows the previous layout in which the activity to be developed will be located.



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Figure 3 - Escape Factory editing screen interface.

Source: Survey data (2021).

In Figure 3, we can see some commands to organize the game: edit, save map, delete, test, settings, import questions, among others. It is possible to create the game map in block format (add in a vertical or horizontal line). In the settings option, the teacher can insert questions with short (subjective) or multiple-choice answers and share the activity via QR-Code, which is a type of bar code, or a direct access link to the game, in which the student, when access, you must identify yourself with your username.

From this, we highlight the methodological steps used in this gamification on 1st degree functions, which are: (i) class on the concepts of Function of the 1st grade; (ii) elaboration of the list of exercises in a gamified way; (iii) application of the game with the class and data collection.

Game development and data collection took place in two meetings. In the first moment, there was a lecture on the mathematical concepts necessary for the recognition of a 1st grade function. In the second meeting, the game was applied, as a form of learning verification, with interaction between the participating students and the teacher, with some platform commands and technical guidelines on how to proceed within the map of the questions, solving the problems.

The teacher and the class signed the didactic contract, where everyone was aware of their tasks. Students were asked to record the images of each phase by capturing the cell phone screen and interacting in the meetings in order to promote an environment conducive to learning. Students were asked to answer and send their alternatives using the avatar present in the game, directing it to the questions within the map. The guidelines provided to students for carrying out the activity on the platform were:

1. Access the link or QR-code provided and enter your name;



- 2. When viewing the map, note your avatar's starting position. Keyboard arrows help you move around the map. On mobile, drag the avatar using the screen's touchscreen;
- 3. When you reach the keys, tap the key and you will see the question. Read the statement carefully and mark the correct alternative;
- 4. By answering all the questions, your map will be complete, and you will find the game exit, with your total score.

Given the instructions for the game, the activity was started, and data collection was carried out from the information provided by the platform, where a table was exported with the participants' responses and, from this data, the analysis of errors and successes was carried out of each student.

The game was structured in the form of a quiz, consisting of ten questions, each with five response options and an estimated response time between 4 to 6 minutes per question, depending on the level of complexity of each situation presented. In Table 1, the questions inserted in the platform and applied to the students during the game are presented:

| Questions   | Answer alternatives  |  |  |
|---|--|--|--|
| 01. The function f: $R \rightarrow R$ defined by $y = f(x) = ax + b$ has the graph sketched. The linear coefficient and the zero of the function are, respectively:   | A) 3 e 3<br>B) 5 e 3<br>C) 3 e 5<br>D) 5 e 5<br>E) 5/3 e 3/5   |  |  |
| 02. The calculation of the amount paid for an Uber ride includes a fixed amount, called the flag, and influenced by the time of day the passenger requests the ride, and a variable amount, which is dependent on the mileage traveled. So, if the fixed flag costs R\$ 3.44 during the day and each kilometer traveled costs R\$ 0.86, what is the distance covered by someone who paid a total of R\$ 21.50 for the race?   | A) 10 km<br>B) 16 km<br>C) 21 km<br>D) 25 km<br>E) 19 km   |  |  |
| 03. A company has a commercial representative and several salespeople. The sales representative receives R $1200.00$ per week. Sellers work daily. Each of them receives R $270.00$ and works 2 days a week. It is possible to establish a mathematical relationship between the number of employees in the company and the weekly expenditure, where $f(x)$ is the amount spent on employees per week and x is the number of employees in the company, the function is expressed by: | A) $f(x) = 270 X + 930$<br>B) $f(x) = 270 X + 1200$<br>C) $f(x) = 270 X + 1470$<br>D) $f(x) = 540 X + 1200$<br>E) $f(x) = 540 X + 660$ |  |  |
| 04. The monthly salary of a newsboy is composed of a fixed amount of R\$20.00 plus R\$0.10 per newspaper sold. Consider y the monthly salary of this newsboy and x the number of newspapers sold. What is the function that represents the monthly salary of this newsboy?  | A) y = 20,1x<br>B) y = 19,9x<br>C) y = x + 20<br>D) y = x + 20,1<br>E) y = 0,1x + 20   |  |  |

| Table 1 - | Questions | and answe | ers of the | dame. |
|-----------|-----------|-----------|------------|-------|
|           | Quodadno  | and anone |            | game. |



| 05. A salesperson receives a monthly salary composed of two parts: a fixed part, in the amount of R\$ 900.00 and a variable part, which corresponds to a commission of 6% of the total sales he made during the month. Considering ( <b>S</b> ) the salary amount and ( <b>v</b> ) the amount acquired with sales during the month. What is the value of this salesperson's salary when he gets 2300 reais with sales? | A) R\$ 1.015,00<br>B) R\$ 1.018,00<br>C) R\$ 1.028,00<br>D) R\$ 1.038,00<br>E) R\$ 1.048,00   |
|--|---|
| 06. The functions of the 1st degree are present in various day-to-day situations. An appliance store hires salespeople with the following salary conditions: a fixed amount of BRL 200.00 plus 5% on sales made (x). Find a formula that gives the salary at the end (y) of each month.  | A) y = 200 + 5x<br>B) y = 205x<br>C) y = 200 + 10x<br>D) y = 200 + 0,05x<br>E) y = 2,05x  |
| 07. The ideal height for a child aged 3 to 12 years is given by the formula H = $5n + 80$ , where <b>H</b> is height in centimeters and <b>n</b> is age in years. Determine the age of a child who is 115 cm tall.   | <ul> <li>A) 5 years old.</li> <li>B) 6 years old.</li> <li>C) 7 years old.</li> <li>D) 8 years old.</li> <li>E) 9 years old.</li> </ul> |
| 08. An electronics technician charges R\$50.00 per visit and R\$30.00 per working hour. If he worked <b>x</b> hours and received <b>p</b> reais, then:   | A) p = 150x<br>B) p = 50x +30<br>C) p = 30x +50<br>D) p = 80x<br>E) p = 50x + 80  |
| 09. A 1st degree function is of the type $y = ax + b$ . Determine the function represented by the graph below:   | A) y = - 4x + 52<br>B) y = 48x + 52<br>C) y = 52x - 4<br>D) y = 13x + 52<br>E) y = 10x + 52   |
| 10. The value of a machine decreases linearly with time due to wear and tear. Knowing that today the machine is worth R\$ 10,000.00 and in five years it will be worth R\$ 1,000.00, the value of this machine three years from now will be:   | A) R\$ 5.300,00<br>B) R\$ 4.500,00<br>C) R\$ 4.600,00<br>D) R\$ 5.200,00<br>E) R\$ 5.000,00   |

Source: Elaborated by the authors (2021).

In Table 1, we can observe elementary questions about 1st degree functions, where we have topics that involve the law of formation of a function, calculation of the numerical value of a function, recognition of coefficients (angular and linear) and of a function from its graphic.

In Figure 4, we have an example of a question already structured and its appearance in the platform environment:



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Figure 4 – Structure of questions on the platform.

Source: Survey data (2021).

We can see in Figure 4 that the platform layout is attractive in its colors and shapes, which can arouse the student's interest, in addition to presenting a progress bar and a time counter, challenging him to be able to perform the task.

After the application of the game, we visualized the results on the platform, where we obtained general information about the participating students (Figure 5). It is worth mentioning that this data can also be saved and exported in spreadsheet format:

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|  | Nome                     |                 | Tempo                        | Pontos         |
| Avaliação Desempenho   |                          |                 | 7 min                        | 900            |
| 2º Período   |                          |                 | 4 247 min                    | 400            |
| ALFINETE: d8qi6u1pce9g7tau<br>Olá seja bem vindo e boa sorte |                          |                 | 16 min                       | 300            |
| 0  |                          |                 | 4 284 min                    | 300            |
| Total de Respostas   |                          |                 | 10 257 min                   | 200            |
| 0 0  |                          |                 | 4 233 min                    | 100            |
| Respostas no mes   |                          |                 | 4 240 min                    | 100            |
|  |                          |                 | 4 243 min                    | 100            |

Figure 5 – Global results of the applied game.

Source: Survey data (2021).

Upon completing the application of the game, students were asked to answer a questionnaire on Google Forms (form) to evaluate their experience with the platform. More detailed results and responses from this questionnaire are presented in the next section.

# **Research ethics**

This research involves human beings, but we self-declare that all participants' identities were preserved, as well as we reinforce that the ethical issues that correspond to the analysis and interpretation of the data collected in this research were met. We also declare that this research does not offer potential risks to the participants, since it was carried out remotely, in which each participant cooperated with the data collection being in a safe place, respecting the measures of social distance. The research complies with the ethical parameters adopted by the Educitec journal, which take into account the regulations of the National Research Ethics Commission, based on Resolution 466/12, Resolution 510/2016 and the principles contained in the Codes of Ethics of the Committee on Publication Ethics (COPE), according to legislation available

https://bvsms.saude.gov.br/bvs/saudelegis/cns/2016/res0510\_07\_04\_2016.html.

# Results and discussion

In this section, we bring a compilation of the data collected on the results of the application of the game in more detail, as well as the impressions gathered in the questionnaire answered by the students. In Figure 6, we can visualize the answers selected by the students in each of the questions formulated:

| pontos | 01. A fung | pontos da | 05. Um vei | pontos da | 03. Uma er   | mpresa co | nta com um i | represent | tante com  | ercial e di | versos vende   | dores. O r | epresentant | e comerci | al recebe R\$ | 1 200,0 | ) por semana. | Os vend | edores traba | alham po |
|--------|------------|-----------|------------|-----------|--------------|-----------|--------------|-----------|------------|-------------|----------------|------------|-------------|-----------|---------------|---------|---------------|---------|--------------|----------|
| 600    | (C) 3 e 5  | 100       |            |           |              |           | D) y = 200   | 100       | C) R\$ 4.6 | D 10        | D              |            | C) 7 anos   | 100       | (C) 21 km     | 100     |               |         | C) p = 30x   | 100      |
| 200    | (C) 3 e 5  | 100       | D) 1.038 r | 100       |              |           |              |           |            |             |                |            |             |           |               |         |               |         |              |          |
| 800    | (C) 3 e 5  | 100       | D) 1.038 r | 100       | (E) f(x) = 5 | 100       | D) y = 200   | 100       | C) R\$ 4.6 | 0 10        | 0 E) y = 0,1x  | 100        | C) 7 anos   | 100       | (D) 25 km     | 0       | C) y = 52x    | 0       | C) p = 30x   | 100      |
| 500    | (C) 3 e 5  | 100       | D) 1.038 r | 100       | (E) f(x) = 5 | 100       | D) y = 200   | 100       | C) R\$ 4.6 | D 10        | D              |            |             |           |               |         |               |         |              |          |
| 300    | (C) 3 e 5  | 100       | D) 1.038 r | 100       |              |           |              |           | C) R\$ 4.6 | D 10        | 0              |            |             |           |               |         |               |         |              |          |
| 300    | (C) 3 e 5  | 100       | D) 1.038 r | 100       |              |           |              |           |            |             |                |            | C) 7 anos   | 100       |               |         |               |         |              |          |
| 400    | (C) 3 e 5  | 100       |            |           | (E) f(x) = 5 | 100       | D) y = 200   | 100       |            |             |                |            | C) 7 anos   | 100       |               |         |               |         |              |          |
| 400    | (C) 3 e 5  | 100       | D) 1.038 r | 0         | (E) f(x) = 5 | 100       | D) y = 200   | 100       | D) R\$ 5.2 | 0           | 0 D) y = x + 2 | 0          | A) 5 anos   | 0         | (C) 21 km     | 100     | A) y = -4x -  | 0       | 3) p = 50x   | 0        |
| 100    | (C) 3 e 5  | 100       |            |           |              |           |              |           |            |             |                |            |             |           |               |         |               |         |              |          |
| 100    | (C) 3 e 5  | 100       |            |           |              |           |              |           |            |             |                |            |             |           |               |         |               |         |              |          |
| 900    | (C) 3 e 5  | 100       | D) 1.038 r | 100       | (E) f(x) = 5 | 100       | D) y = 200   | 100       | C) R\$ 4.6 | D 10        | 0 E) y = 0,1x  | 100        | C) 7 anos   | 100       | (C) 21 km     | 100     | C) y = 52x    | 0       | C) p = 30x   | 100      |
| 100    | (C) 3 e 5  | 100       |            |           |              |           |              |           |            |             |                |            |             |           |               |         |               |         |              |          |
| 200    | (C) 3 e 5  | 100       | D) 1.038 r | 100       |              |           |              |           |            |             |                |            |             |           |               |         |               |         |              |          |
| 400    | (C) 3 e 5  | 100       |            |           |              |           | D) y = 200   | 100       | C) R\$ 4.6 | D 10        | 0              |            | C) 7 anos   | 100       |               |         |               |         |              |          |
| 600    | (C) 3 e 5  | 100       |            |           | (E) f(x) = 5 | 100       | D) y = 200   | 100       | C) R\$ 4.6 | D 10        | 0 E) y = 0,1x  | 100        | C) 7 anos   | 100       |               |         |               |         |              |          |
| 400    | (C) 3 e 5  | 100       | D) 1.038 r | 100       |              |           | D) y = 200   | 100       | C) R\$ 4.6 | D 10        | 0              |            |             |           |               |         |               |         |              |          |
| 600    | (C) 3 e 5  | 100       |            |           |              |           | D) y = 200   | 100       | C) R\$ 4.6 | D 10        | 0 E) y = 0,1x  | 100        | C) 7 anos   | 100       |               |         |               |         | C) p = 30x   | 100      |
| 400    | (C) 3 e 5  | 100       |            |           | (E) f(x) = 5 | 100       | D) y = 200   | 100       |            |             |                |            | C) 7 anos   | 100       |               |         |               |         |              |          |
| 600    | (C) 3 e 5  | 100       |            |           |              |           | D) y = 200   | 100       | C) R\$ 4.6 | 0 10        | 0 E) y = 0,1x  | 100        | C) 7 anos   | 100       | (C) 21 km     | 100     |               |         |              |          |
| 300    | (C) 3 e 5  | 100       | D) 1.038 r | 100       |              |           |              |           |            |             | E) y = 0,1x    | 100        |             |           |               |         |               |         |              |          |

| Figure 6 – | Sample of | results by | score of t | he question | naire applied. |
|------------|-----------|------------|------------|-------------|----------------|
| 5          |           | ,          |            |             |                |

Source: Survey data (2021).

In Figure 6, it is possible to see the score obtained by each student, the date and time of completion of the activity performed, as well as the alternatives marked in each of the proposed questions, which provides the teacher with an idea of which subjects the student still presents. difficulties, based on your answers. In fact, it is possible for the student to just mark any alternative, but they were guided by the teacher to try to



answer the questions so that the data were reliable, and the teacher could identify their main difficulties.

Based on the information in the table, we have that the questions that were correctly marked show the alternative marked inside the cell and a score of "100" in the next cell. In incorrectly marked questions, the worksheet shows the marked alternative and the zero-score next to it. Unanswered questions (because the student skipped or didn't find it on the map) show a blank cell, both for the alternative and for the score. In addition, the questions in the worksheet do not appear in the order in which they were entered on the platform, but in the order in which the students answered, that is, which questions they accessed first on the map.

Questions 1, 3 and 6 were the most correct by the students and had as topics recognizing a function from its graph and writing the law of formation of a function from a problem situation. The other questions fluctuated – around half of the class got it right and the other half got it wrong or left it blank. These questions explored the numerical value of a function and the interpretation and resolution of problem situations involving more than one step to arrive at the result.

During the process, the teacher observed a greater engagement and motivation of the students to carry out the activity in a gamified way. The game involving contents worked in the classroom, from a compensation (score) mobilized the students' interest, through individual competition.

In Table 2, we have the students' responses obtained from a form on Google Forms that seeks to collect data on the experience lived with the platform.

| Have you ever used Escape Factory in the classroom?  |                             |  |  |  |  |  |  |  |
|--|-----------------------------|--|--|--|--|--|--|--|
| Answers  | Usage of the Escape Factory |  |  |  |  |  |  |  |
| Yes  | 0                           |  |  |  |  |  |  |  |
| No   | 20                          |  |  |  |  |  |  |  |
| Was using Escape Factory helpful to you in evaluating performance on the 1st grade teaching role topic?  |                             |  |  |  |  |  |  |  |
| Yes  | 18                          |  |  |  |  |  |  |  |
| No   | 2                           |  |  |  |  |  |  |  |
| Would you suggest using Escape Factory for other content or for other subjects at school?                |                             |  |  |  |  |  |  |  |
| Yes  | 20                          |  |  |  |  |  |  |  |
| No   | 0                           |  |  |  |  |  |  |  |
| Do you think your participation in the virtual classroom has<br>improved with the use of Escape Factory? |                             |  |  |  |  |  |  |  |
| Yes  | 16                          |  |  |  |  |  |  |  |
| No   | 4                           |  |  |  |  |  |  |  |

| Table 2 - I | Final form | questions. |
|-------------|------------|------------|
|-------------|------------|------------|

Source: Survey data (2021).



The information collected and presented in Table 2 shows that no student had used the Escape Factory platform, revealing it as a novelty for the class. About the help provided by the platform in carrying out activities, 90% of students said that the platform helped in something. The suggestion of the platform as a resource not only for the mathematics subject, but for other areas was unanimous and, finally, 80% of the students said they were more interested in participating in the class using the platform.

The teacher asked the students about their view of the experience with the platform. Below is an excerpt of the dialogue between them, during the remote class on the Google Meet platform, showing some of their main impressions about using the platform:

> "I thought the game was cool, I could have more classes like that". "You have to respect a test like that, with game and everything". "The internet went down then it took me a while to start, I lost time, but it worked". "The experience was cool". "I found it difficult to make the doll walk at first, but then it worked". "My cell phone crashed. I didn't have time to do everything".

"The questions were difficult, but the game was cool".

Some statements were repeated, that is, students with the same opinion/impression. However, based on these reports, we can see that the platform was well accepted by the students, even with the difficulties of access or equipment.

After the game, the teacher observed which questions the students had the highest rate of errors and/or difficulties, seeking to reorganize their lesson planning to review the content, solving any doubts.

Regarding the difficulties encountered in the development of this activity, we highlight some points that are lacking in the platform, which are: clarity of information about students' mistakes and successes when imported into .xls format (Excel spreadsheet); the need for good quality internet to access the game, as the platform becomes slow when used on older smartphones; the difficulty in formatting the game layout; feature limitations for the free version of the platform. Another difficulty, which does not specifically concern the platform, was the fact that many students do not have access to fixed internet or mobile data, a common situation in the reality of the rural school where the research was developed.

Thus, among the pros and cons about using the platform, we concluded that it can be a resource that brings dynamism to classes, it awakens the student's interest and creativity, collaboration, autonomy, among other advantages that gamification itself in its practice. However, many difficulties were presented in this study, at least in the reality of the rural school. Some of these difficulties were the lack of student equipment (computers and smartphones with up-to-date systems), quality internet access, lack of ability with digital resources, among other particularities. However, we believe that under ideal conditions, the platform is a resource with great potential to be explored, not only for teaching mathematics, but also for other subjects.

### **Final considerations**

The use of digital resources such as software, applications, platforms, among others, can facilitate the teaching of Mathematics, making a parallel between what is seen in



the classroom and the game, providing fertile ground to instigate student imagination, creativity, autonomy, and learning. In this way, it is believed that gamification can contribute to the mathematics teacher in the elaboration of their classes, being a resource that enables active learning, motivating students to engage in the discipline.

The Escape Factory as an educational tool for the discipline of mathematics seems to be, at first, an interesting proposal, with regard to the use of the logic of the components of a game to instigate the participation of the students, aiming for better results and a positive return, having in view of the difficulties and lack of motivation of students in this discipline in the remote teaching scenario.

In this experience with the platform in a remote classroom, some elementary notions about teaching 1st grade functions were worked on, as a way of encouraging students to participate in the class, trying to immerse students in the game scenario, and seeking to motivate them. them to achieve better results from healthy competition.

Students showed interest in the activity through the platform, reporting that they would like it to be used more often and even in other subjects. Even with the difficulties faced in carrying out the activity - internet access, student equipment or even the lack of skills with this type of game - the reception of the platform was satisfactory.

We reflect that the reality of the rural school has its limitations, especially with regard to internet access, as it is usually an area with limited cell coverage and not all students have internet at home. Some students need to travel to the home of relatives or friends to attend classes. Thus, it is up to the teacher to observe the possible difficulties in the implementation of this type of activity, planning and analyzing the possible mishaps so that they are minimized.

Finally, as a future perspective for this study, we hope that gamification in the teaching of Mathematics with this platform can support the work of the mathematics teacher, because the platform offers a range of possibilities for creation, as well as a community of teachers who share their activities developed for free, for different levels of education.

# References

BARBOSA, F. E.; PONTES, M. M.; CASTRO, J. B. A utilização da gamificação aliada às tecnologias digitais no ensino da matemática: um panorama de pesquisas brasileiras. **Revista Prática Docente**, v. 5, n. 3, p. 1593-1611, 2020. Disponível em: https://doi.org/10.23926/RPD.2526-2149.2020.v5.n3.p1593-1611.id905. Acesso em: 10 mar. 2021.

BOYER, C. B. História da Matemática. 2 ed. São Paulo: Edgard Blücher, 1996.

BRASIL. Ministério da Educação. **Base Nacional Comum Curricular**: Educação é a base. Educação Básica. Brasília: MEC, 2018.

BRASIL. Ministério da Saúde. **Resolução nº 510, de 07 de abril de 2016.** Dispõe sobre as normas aplicáveis a pesquisas em Ciências Humanas e Sociais. Diário Oficial da República Federativa do Brasil, Brasília, DF, 24 maio 2016. Disponível em: https://bvsms.saude.gov.br/bvs/saudelegis/cns/2016/res0510\_07\_04\_2016.html. Acesso em: 21 jul. 2021.



CALIL, A. M.; VEIGA, J.; CARVALHO, C. V. A. Aplicação do *Software* GRAPHMATICA no Ensino de Funções Polinomiais de 1º grau no 9º ano do Ensino Fundamental. **Revista Práxis**, ano II, n. 4, p. 17-27, 2010. Disponível em: https://doi.org/10.25119/praxis-2-4-923. Acesso em: 10 mar. 2021.

CRUZ, L. F.; MONT'ALVERNE, C. R. S. A. O uso da tecnologia no processo avaliativo do ensino da função do 1º grau. **RACE – Revista de Administração do Cesmac**, v. 9, p. 105-113, 2021. Disponível em:

https://revistas.cesmac.edu.br/index.php/administracao/article/view/1388. Acesso em: 13 out. 2021.

EVES, H. Introdução à História da Matemática. São Paulo: Unicamp, 2007.

GIL, A. C. Como elaborar projetos de pesquisa. 4 ed. São Paulo: Atlas, 2002.

GUARDIA, Juan José et al. Innovation in the teaching-learning process: the case of Kahoot! **On the Horizon,** 2019. Disponível em: https://www.researchgate.net/publication/331079399 Innovation in the teaching-

learning process the case of Kahoot. Acesso em: 7 jun. 2021.

MARCONI, Marina de Andrade; LAKATOS, Eva Maria. **Metodologia do trabalho** científico: procedimentos básicos, pesquisa bibliográfica, projeto e relatório, publicações e trabalhos científicos. 7. ed. 6.reimpr.São Paulo: Atlas, 2011.

MARTÍNEZ, D. A. V. Competencias matemáticas: una mirada desde las estrategias de enseñanza en educación a distancia. **Góndola, enseñanza y aprendizaje de las ciencias**, v. 10, n. 2, p. 382-398, 2021. Disponível em: https://doi.org/10.14483/23464712.16167. Acesso em: 15 jun. 2021.

NASCIMENTO, R. S.; ARAÚJO, A. W. B.; OLIVEIRA, I. C.; RODRIGUES, M. A. Aplicação de Função Afim no cotidiano: um estudo do desempenho de alunos do Ensino Médio. **Anais...** VI Congresso Internacional das Licenciaturas, COINTER -PDVL, 2019. Disponível em: https://doi.org/10.31692/2358-9728.VICOINTERPDVL.2019.0016. Acesso em: 10 abr. 2021.

SÁ, A. L.; MACHADO, M. C. O uso do software GeoGebra no estudo de funções. **Anais...** XIV Encontro Virtual de Documentação em Software Livre e XI Congresso Internacional de Linguagem e Tecnologia, 2017. Disponível em: http://www.periodicos.letras.ufmg.br/index.php/anais\_linguagem\_tecnologia/article/vi ewFile/12142/10362. Acesso em: 10 mai. 2021.

SANTOS, G. R. F. Ensino de Matemática: concepções sobre o conhecimento matemático e a ressignificação do método de ensino em tempos de pandemia. **Revista Culturas e Fronteiras**, v. 2, p. 40-57, 2020. Disponível em: https://www.periodicos.unir.br/index.php/culturaefronteiras/article/view/5369/pdf. Acesso em: 11 abr. 2021.

SCHWANZ, C. B.; FELCHER, C. D. O. Reflexões acerca dos desafios da aprendizagem matemática no ensino remoto. **Redin – Revista Educacional** 



**Interdisciplinar**, v. 9, n. 1, p. 91-106, 2020. Disponível em: http://seer.faccat.br/index.php/redin/article/view/1868. Acesso em: 11 abr. 2021.

SILVA, L. R.; OLIVEIRA, R. G. L. Ensino de Funções voltadas às práticas do cotidiano por meio da contextualização. **Revista Acadêmica Educação e Cultura em Debate**, v. 3, n. 2, p. 187-199, 2017. Disponível em: http://revistas.unifan.edu.br/index.php/RevistaISE/article/view/292. Acesso em: 15 jun. 2021.

SILVA, R. J. R.; RODRIGUES, R. G.; LEAL, C. T. P. Gamification in Management Education: A Systematic Literature Review. **BAR-Brazilian Administration Review**, v. 16, n. 2, 2019. Disponível em:

https://bar.anpad.org.br/index.php/bar/article/view/370. Acesso em: 7 jun. 2021.

SILVA, J. B.; SALES, G. L.; CASTRO, J. B. Gamificação como estratégia de aprendizagem ativa no ensino de Física. **Revista Brasileira de Ensino de Física**, v. 41, n. 4, 2019. Disponível em: https://doi.org/10.1590/1806-9126-RBEF-2018-0309. Acesso em: 01 mar. 2021.

SOUSA, R. T; AZEVEDO, I. F.; ALVES, F. R. V. Jogos de RPG: Uma proposta didática para aulas de Matemática. **Indagatio Didactica**, v. 12, n. 5, p. 329-343, 2020. Disponível em: https://doi.org/10.34624/id.v12i5.23484. Acesso em: 17 dez. 2020.

TENÓRIO, A.; TAVARES, M. A. O.; TENÓRIO, T. O emprego de jogos educativos digitais como recurso auxiliar para a aprendizagem de funções polinomiais do 1º grau. **REMAT: Revista Eletrônica da Matemática**, v. 2, n. 1, p. 29–45, 2016. Disponível em: https://periodicos.ifrs.edu.br/index.php/REMAT/article/view/1297. Acesso em: 01 jun. 2021.

TOLOMEI, Bianca Vargas. A gamificação como estratégia de engajamento e motivação na educação. **EAD em foco,** v. 7, n. 2, 2017. Disponível em: https://eademfoco.cecierj.edu.br/index.php/Revista/article/view/440. Acesso em: 07 jun. 2021.

Received: 25/06/2021 Approved: 11/03/2022 How to cite: SANTIAGO, P. V. S.; SOUSA, R. T.; ALVES, F. R. V. Teaching 1st grade functions through gamification with Escape Factory. Educitec - Revista de Estudos e Pesquisas sobre Ensino Tecnológico, v. 8, e178822, 2022. Authorship contribution: Paulo Vitor da Silva Santiago: Software, data curation, writing (original draft), writing (review and editing) and methodology. Renata Teófilo de Sousa: Writing (original draft) and writing (review and editing). Francisco Régis Vieira Alves: Project management and supervision. Responsible Editor: landra Maria Weirich da Silva Coelho Copyright: This article is licensed under the Creative Commons Attribution 4.0 International License.



