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Learning Mathematics with Emerging Methodologies—The Escape Room as a Case Study

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Abstract: Nowadays, different methodologies are booming in the field of education, and active gamification-based methodologies such as the Escape Room are an example of these methodologies, which is the base of this research. The purpose of this research is to analyze the effectiveness of the use of an Escape Room as an active methodology to learn mathematics. A quantitative research method was performed through an experimental design. Two study groups were set up. With the control group, a traditional training methodology was used, and with the experimental group, an innovative one was used through an Escape room experience. A total of 62 students of the 3rd level of Secondary Education from an educational center in Ceuta (Spain) participated. Results show how the experience developed through the escape room improved achievement, motivation and autonomy in a significant way. It has also reduced learning anxiety significantly. It is concluded that the use of the Escape room in Mathematics improves learning achievement, anxiety, motivation and autonomy, with gender being a variable to be taken into account, especially in motivation and autonomy. Therefore, the escape room has a greater potential than a traditional methodology in Mathematics.

Keywords: active methodology; educational innovation; escape room; gamification; methodological contrast; mathematics; secondary education

1. Introduction

In recent times, traditional education, or more precisely, traditional teaching methods, gave place to a non-central place, and innovation is increasingly taking center stage [1]. Traditional teaching in mathematics is understood as the teacher being the main figure of the educational act, which is a situation more focused on teaching. On the other hand, there is talk of new didactic approaches, when they focus on the student, and on learning as the main action of the educational act. This is causing new innovative teaching modalities to appear that produce a higher incidence in students, such as flipped learning, gamification or problem-based learning [2]. The new didactic environments and approaches allow a greater involvement of the students in the daily life of the classroom and, above all, in the participation of their training process [3]. All this promotes profound changes in education, as well as in people's lives and in their daily actions [4]. Furthermore, this is supported by a total increase in the use of technology [5], as the main support for educational innovation today [6]. For this reason, education approaches the idea of a digital society in which students live daily [7].

This transformation takes place within the framework of constant adaptation of teaching to the digital society and to new ways of life [8]. For all these reasons, fundamental concepts such as that of active methodology derive, as the main source of new forms of teaching, transmission of

knowledge and new forms of participation in the educational process of all the agents involved in it. In this new paradigm, the student takes the leading role to become responsible for their training process, always guided by the teacher and always trying to achieve the objectives and strengthen the content [9]. All this tends to have, as its main source, the construction of self-knowledge by the students, and undoubtedly produces new opportunities and means available to students [10]. In this sense, their motivation is increased, causing students a greater interest and a better attitude towards learning [11].

Today's students live in a world surrounded by technologies, as well as with great stimulation caused by this. Therefore, all these actions are aimed at concluding a favorable process for the development of students, with increasingly virtual environments [12]. These innovative learning environments produce a ubiquity in spaces and times dedicated to teaching [13]. Similarly, new methods are generated for a better understanding of the contents [14].

1.1. Gamification as an Innovate Tool

When we talk about gamification, we are referring to one of the active methodologies that, in recent years, has been most developed by teachers and students from all over the world [15]. For this reason, it has earned a place among the most widely used and studied methodologies [16]. As its name suggests, it bases its main focus on the application of the game phenomenon and on converting spaces reserved for formal learning into recreational spaces in which to continue learning [17,18]. Gamification involves the use of tools and elements typical of the game in the classroom, bringing along different benefits as pupils feel more motivated, active in class, and even want to take part in their learning processes in an active way, as within the game structure they feel less pressure in class. [19]. This methodology focuses on facilitating the effort of the students and making their task more enjoyable. For this reason, it focuses on the game as a tool to achieve high levels of learning and achievement of objectives [20]. How could it be otherwise? The game has also undergone a transformation over the years, passing by the classics to the most modern ones, with a great load of virtual reality, an aspect that has been transferred to education [21]. The use of the game, as an educational tool, has had a high success rate, taking into account what has been studied in different investigations, considering it to be an effective and adequate method to put it into practice with students of any age [22,23] and even any educational stage in which their training is developed [12,24].

Gamification allows teachers to develop their own learning program for their students, based on formal knowledge structures, with the certainty of achieving more than acceptable academic indicators in factors as important as the ability to solve problems [25]. In addition, the interactive process that occurs between the agents involved in the educational process [26] and the collaboration between these same agents [27] are benefited. It also increases factors that are influential in the maturational development of the student, such as motivation [28], a positive attitude towards learning [29], interest in knowing their own training [30], the autonomy of the student [31], commitment to the educational act [32], dedication to teaching by teachers and learning by students [33,34], as well as attraction, enjoyment, absence of negative feelings and the satisfaction of facing the task [35,36].

The success of gamification is supported by focusing its method on a system of rewards that make the student increase his attitude and predisposition towards teaching, having a very positive impact on the psychosocial indicators [37] that we have mentioned and which, inescapably, will produce an increase in performance that is obtained from the dedication of the students [38].

In the field of mathematics, recent studies on the use of active and gamified methodologies show very beneficial results for teachers and students who have put it into practice, with all the aforementioned areas and others, such as effective resolution of practices, being developed and promoted [39,40].

1.2. Using the Scape Room as a Gamification Tool

Within gamification, there are many ways to put it into practice. One of them is the Escape Room [41]. This is considered a training modality that is based on the resolution of challenges, tests or problems posed to students by teachers, which give rise to various situations in which students must have adequate knowledge to solve the practice of learning [42]. In an Escape Room, people—students in this case—are locked in a room and they are given several enigma and challenges, which they have to solve to be able to find the way out [43]. Therefore, this method is supported by the game design, with the students having to solve a series of tests, knowing how to self-manage their own knowledge, individually, and collectively to share their knowledge. This causes an increase in the participation of students when solving the aforementioned challenges or problems [44]. The method consists of "locking" the classrooms or spaces ready for practice, where they have to carry out various tasks and activities to solve puzzles and to be able to leave the place in the shortest possible time [45].

Several studies about the application of the Escape Room in the classroom offer us very favorable results in terms of its application in different contexts [46–48]. Thus, its application improves all the indicators previously exposed in relation to gamification. In this line, it produces a high motivation index in students [49], improves their activation and participation in the teaching and learning process [50], produces greater satisfaction for learning and attraction to it [51] and supposes a greater assimilation and reinforcement of the contents [52]. All this, as it cannot be otherwise, leads to a better and greater acquisition of content, positively impacting the student's grades and academic performance [53]. All this, produced by the learning environment, is very favorable for the attitudes of the students, and for their collaborative and personal practice [54].

In the area of mathematics, there are some investigations and training actions that lead to the success of students' learning through the use of the Escape Room. Despite typical problems, a lack of attention to instructions, as occurs in traditional teaching, turns out to be beneficial in its application in the field of mathematics, since it increases competitiveness for learning, motivation and student interest [55].

In addition, the implementation of activities related to the Escape Room in the field of mathematics, promotes the autonomy of students, and facilitates learning, increasing teamwork and the ability of students to resolve conflicts or challenges posed by the teacher [56]. All this favors collaborative work, as well as the autonomy of the students, enabling them to face future learning [57].

1.3. Justification and Objectives

Gamification implies the use of tools, design, and elements of games in classrooms [19]. This teaching methodology eases the students' effort, making it more enjoyable. The implementation of this innovative methodology fosters students' participation and motivation towards their learning processes [11]. Students take the leading role and become more responsible in their learning process, which is guided by teachers [9].

As it has been seen in the previous section, the use of Escape Rooms in education fosters better results in students' motivation [48], activation and participation in their learning processes [49], and satisfaction for learning and attraction to it [50].

This study was carried out at the third level of the Secondary Education stage of the Spanish educational system, due to the lack of motivation students have towards learning and practicing mathematics, as revealed in the scientific literature [58,59].

To check if the lack of motivation was caused by the methodology carried out by the teacher, the main aim of this experimentation is to analyze the effectiveness of the use of educational Escape Rooms in mathematics lessons, as compared to the implementation of a traditional methodology focused on teacher's lectures and presentations without the use of innovative materials and resources. In summary, the following dimensions were measured: learning achievement (as a number obtained in final evaluation of the subject); learning anxiety (example: I have felt nervous during classes); motivation (example: Does the methodology applied affect your motivation with regard to mathematical content?);

and autonomy (example: To what extent has the methodology applied in the field of mathematics contributed to their autonomy?).

Bearing in mind this general purpose of this study, the specific aims are:

- To analyze the effects of traditional methodology on mathematics learning;
- To determine if the use of educational Escape Rooms have an effect on mathematics learning;
- To analyze the impact of educational Escape Rooms on academic achievement;
- To analyze the strength or impact of differences between those two methodologies.

In addition to the objectives described, the following research questions arise:

- Does the type of methodology affect learning achievement?
- Does the type of methodology influence learning anxiety?
- Does the type of methodology influence motivation?
- Does the type of methodology influence autonomy?

1.4. Intervention Description

Due to the lack of motivation and active participation of secondary students during mathematics lessons, teachers sought and searched for an innovative methodology that could foster this motivation and participation when learning mathematics. As it has been highlighted in the introduction of this study, this methodology or strategy has been proven to be useful in education, and that is the reason for having chosen it for this experimentation.

In the implementation of the didactic unit carried out, mathematics contents have been worked on and they have been practiced. Within this didactic unit, different challenges and enigmas were designed. Different elements were taken into consideration, following another study about this methodology [57]. These elements were important to design the Escape Room experience, and they were:

- Type of students: It is very important to know what type of students are within the group, to create all the enigmas according to them;
- Time: It will determine the kind of project that can be done;
- Difficulty: The difficulty must be selected or designed regarding the type of students in the group. In this experience, homogeneous groups were organized and some of the enigmas were easy and others a bit more difficult, to maintain attention, but not making them impossible to solve.
- Learning aims: They were to practice mathematics contents, which, according to their teachers, were usually very difficult to pay attention to.
- Theme and space: Recreation in class was important. The recreation of a castle was done.
- Enigmas: They are the core of the Escape Room and they were related to mathematics but from a game point of view.
- Materials and technology: They were chosen according to the ones that can be used in class. Mobile phones were forbidden in school, so they were out of this experience.
- Evaluation: A control list was used on different items to assess the different learning objectives and competences needed.
- Trial: before doing the experience in class, a trail was done, to verify everything was in the right order.

All of these elements were merged into one story to engage the students. The story told by the teacher had a theme centered on action and suspense to encourage the motivation of the students. All this was done with the purpose that the students were immersed in the formative action in an active way.

2. Materials and Methods

2.1. Research Design and Data Analysis

Experimental design through a descriptive and correlational analysis was carried out, which was based on the quantitative perspective following experts within this field [60,61]. The students were classified into two different groups to be analyzed. On one hand, the control group followed traditional teaching methodology. On the other hand, an experimental group followed an Educational Escape Room as a methodology for practicing the mathematics contents. Methodology was defined as an independent variable; other dimensions and the effectiveness of methodologies were selected as dependent variables to be evaluated. Stratified sampling was used to select participants. Stratified sampling is a technique where the researcher divides the entire population into different subgroups. Then, it randomly selects the final subjects from the different strata proportionally. Both groups share a course, work area, content and teachers, so it is established that there is no prior significant difference in both groups.

Statistical Package for the Social Sciences (SPSS) v25 program was used for statistics analysis. For this analysis, the descriptive statistics mean (M) and standard deviation (SD) were used. The measurement of the effect size has been obtained by biserial correlation (r) established by Cohen [62]. In addition, a $p < 0.05$ is established in the study as a statistically significant difference. The value of the effect size of Pearson r correlation varies between −1 (a perfect negative correlation) to +1 (a perfect positive correlation). In this case, after verifying that the data do not follow a normal distribution, non-parametric statistics are used. Specifically, the Mann–Whitney U test is used to compare two groups with no normal distribution [63].

2.2. Participants

The participants were 62 students from secondary education who took part in this experiment. Recently it has been determined by studies of relevant impact that the sample size in these type of investigations does not condition the performance of these experiments [64].

The selection of students was done carrying out an intentional sampling, thanks to the ease of access to the students. They are enrolled in an educational center of the Autonomous City of Ceuta (Spain). One of the workers in this center detected the need of this research after working with these students.

These students were specifically selected from the third level of the Secondary Education stage of the Spanish educational system (n = 62; M_{age} = 15 years; SD = 1.62). The composition of both groups, control and experimental ones, is specified in Table 1.

Table 1. Study groups by sex.

Groups	Boys *n* (%)	Girls *n* (%)	Total *n* (%)
Experimental group	16 (51.61)	15 (48.39)	31 (50)
Control group	13 (41.93)	18 (58.07)	31 (50)
Subtotal	29 (46.77)	33 (53.23)	62 (100)

2.3. Instrument

Data collection was acquired by an ad hoc questionnaire. The design of this tool was done following other validated instruments found within the scientific literature [65,66]. The questionnaire has 32 items in total, which are divided into 20 different dimensions. A Likert scale type is followed with a range of five points (from 1 = Strongly disagree to 5 = Strongly agree).

The instrument was validated first in a qualitative manner and afterwards in a quantitative way. In the first phase, a Delphi method was carried out to do the qualitative validation. Within this procedure, 8 experts in active methodologies in education of different universities were involved. Reviewers rated each item based on its transparency and relevance on a scale of 1 to 6, recommended

indicators in the literature [67]. The questionnaire was highly valued by these experts (M = 4.87; SD = 0.21; min = 1; max = 6), and the recommendations given were followed. Kappa de Fleiss and W de Kendall were applied to achieve the indexes of concordance and relevance of observations granted, this showing positive results (K = 0.87; W = 0.89). Afterwards, for the validation, an exploratory and confirmatory factor analysis by the principal components' method with varimax rotation was done quantitatively. The results show an appropriate factorial structure to the initial theoretical approach, and the correlations among factors are positive. The tests determined the dependence between the delimited variables (Bartlett's test of sphericity = 2647.21; $p < 0.001$) and the adequacy of the sample (Kaiser–Meyer–Olkin = 0.86).

More statistical analyses were used to measure the reliability of the questionnaire, such as Cronbach's alpha (α), compound reliability (CR) and average variance extracted (AVE), confirming the internal consistency of all the results of the questionnaire.

2.4. Procedure

The experiment was carried out in several phases. First of all, the ad hoc instrument was designed, and validated. Then, the selection of students who took part in the research was done. Family consent had to be asked to develop this study. In this research, ethical principles of confidentiality were respected. Thus, students were in a random manner divided into two groups with the same number of them, one being established as a control group and the other as an experimental group.

Data collection took place before and after the teaching procedure, with two months' time between them. Teachers taught contents during 10 sessions, through a traditional method with the control group and an innovative method using an Escape Room with the experimental group. The sessions lasted 55 min. The contents taught were related to solving problems using systems of linear equations with two unknowns.

Participants were divided into two groups, which happened to be the group classes where they are enrolled. The control group followed a traditional methodology learning process. In the traditional teaching methodology, the role of the teacher focuses on the presentation of the contents and on the completion of the exercises on the blackboard. All participation in the teaching process has the teacher. The student focuses attention on the actions carried out by the teacher. Therefore, students play a passive role. This hinders and prevents the interaction of educational agents to carry out learning and solve problems in a collaborative way. The students did the problems using systems of equations individually in their own class notebooks. Meanwhile the experimental group followed a learning methodology based on the Escape Room. This fostered the interaction of students with their peers, teamwork, motivation, and participation of students to learn and practice contents.

The Escape room was designed by mathematics teachers with the help of the researchers, who are experts in the field. There were two computers in the room, and a tablet, so the students could surf the net to try to solve the codes that needed its use. There were 5 enigmas hidden in the room, which were based on mathematics problems that needed to be solved, and when one enigma was solved, it led to the other one, because it had a track for the next one. The mathematical problems were problems to practice mathematics in an innovative way. An example of the tasks performed in the Escape Room is as follows: The narrator tells a story to set the students in a haunted house where the doors have been mysteriously closed and a strange noise has been heard. The shadow of a ghost peeks out and tells them that in order to get out of the haunted house they have to solve various problems. The ghost in each test provides students with a card with exercises (Figure 1) that they will have to solve in a satisfactory way to continue advancing in the story and to reach the exit. All the tests, depending on their complexity, have a certain time for the students to solve them. Once the time had elapsed, the students received a clue or puzzle to find the next test.

$$\begin{cases} \frac{x+3y}{2} = 5 \\ 4 - \frac{2x-y}{2} = 1 \end{cases} \quad \begin{cases} \frac{x+1}{3} + \frac{y-1}{2} = 0 \\ \frac{x+2y}{3} - \frac{x+y+2}{4} = 0 \end{cases}$$

Figure 1. Example of tasks performed.

Teachers were only assessors or guides in the experience, as the students, in groups, had to solve the enigmas with cooperative work. Each group had a color, and the enigmas had the same colors themselves, so each group had to find the tracks of their colors. The enigmas were hidden around the classroom. In order to find them easily, they had to pay attention to the details told in the story. Each time an enigma was solved, the students got a badge, which could be exchanged for a reward afterwards. The rewards could gain extra points in the attitudinal section of the subject in the participation block or new clues to find the enigmas. This was done with the experimental group, meanwhile the control group had the same number of mathematical problems, which was five, displayed on the board in the class, and they had to solve them. These problems were to practice mathematics, so they needed no specific explanation as the processes of those problems were previously explained and they had to practice them. To complete the study, the data were collected and analyzed.

3. Results

All dimensions have had a significant improvement after applying the Escape Room as a pedagogical tool (Table 2). Regarding learning, we find significant values of Learning Achievement (U = 339,000; Z = −2073; $p = 0.038$) with a large effect size (d = 0.525). Related to Learning Anxiety, we get similar results (U = 339,000; Z = −5754; $p = 0.000$) with a large effect size (d = 0.528). Motivation and Autonomy show significant differences too (U = 654,000; Z = 2480; $p = 0.013$ and U = 654,500; Z = 2461; $p = 0.014$).

Table 2. Mann–Whitney U test for control and experimental groups differences.

	Group	Ranks	U	Z	*p*	*d* *
L Achievement	Control	26.94	339,000	−2073	0.038	0.523
	Experimental	36.06				
L Anxiety	Control	44.61	74,000	−5754	0.000	0.528
	Experimental	18.39				
Motivation	Control	25.90	654,000	2480	0.013	0.653
	Experimental	37.10				
Autonomy	Control	37.11	654,500	2461	0.014	0.655
	Experimental	25.85				

* Cohen's *d* small < 0.20, Medium < 0.50, large > 0.50.

Effects sizes can be considered large d = 0.653 and d = 0.655. In all analyzed dimensions (Achievement: $R_{C\,=}$ 36.06; R_E = 26.94; Motivation: R_c = 25.90; R_E = 26.94 and Autonomy R_c = 37.11; R_E = 25.85), the experimental group obtains higher values than the control group. In anxiety, where these values are different, values are lower in the case of the experimental group (R_c = 44.61; R_E = 18.31). Based on the results, the experience developed has caused significant effects on all the dimensions analyzed.

From another perspective (Table 3), we seek to see if the gender variable could affect some of the changes produced during the experience. The gender variable only influences motivation (U = 52,000; Z = −2620; $p = 0.008$) and autonomy (U = 33,500; Z = −3365; $p = 0.001$) in the experimental group.

Women are the most motivated and show the highest level of anxiety in general. This effect does not occur in the control group, where there are no differences by gender. Women are the most motivated and show the highest level of anxiety in the control group, although these differences do not become significant.

Table 3. Mann–Whitney U test for control and experimental groups differences by gender.

Control						
	Group	**Ranks**	**U**	**Z**	***p***	***d*** *
L Achievement	Male	13.81	85,000	−1470	0.175	—
	Female	18.33				
L Anxiety	Male	15.88	118,000	−0.081	0.953	—
	Female	16.13				
Motivation	Male	13.31	77,000	−1754	0.093	—
	Female	18.87				
Autonomy	Male	13.53	80,500	−1567	0.119	—
	Female	18.63				
Experimental						
	Group	**Ranks**	**U**	**Z**	***p***	***d*** *
L Achievement	Male	16.65	125,500	0.349	0.731	—
	Female	15.53				
L Anxiety	Male	17.81	140,500	0.943	0.352	—
	Female	14.69				
Motivation	Male	11.00	52,000	−2620	0.008	—
	Female	19.61				
Autonomy	Male	9.58	33,500	−0.3365	0.001	—
	Female	20.64				

* Cohen's *d* small < 0.20, Medium < 0.50, large > 0.50.

Finally, it is relevant to know how the different dimensions analyzed are correlated, both for the control group and for the experimental group (Table 4). In the control group, where the Escape Room was not carried out, the different dimensions do not seem to maintain positive or negative correlations ($p > 0.05$). In the experimental group, positive and significant correlations appear. The positive relationship between motivation and achievement stands out ($r = 0.364$, $p < 0.05$), as does autonomy and achievement ($r = 0.404$, $p < 0.05$), and motivation and autonomy ($r = 0.684$, $p < 0.01$).

Table 4. Correlation between dimensions for each group.

Group			L Achievement	L Anxiety	Motivation	Autonomy
Control	L Achievement	*r*	1	−0.109	0.047	0.295
		p		0.558	0.801	0.107
	L Anxiety	*r*	−0.109	1	−0.162	0.055
		p	0.558		0.383	0.771
	Motivation	*r*	0.047	−0.162	1	0.160
		p	0.801	0.383		0.389
	Autonomy	*r*	0.295	0.055	0.160	1
		p	0.107	0.771	0.389	
Experimental	L Achievement	*r*	1	0.120	0.364 *	0.404 *
		p		0.519	0.044	0.024
	L Anxiety	*r*	0.120	1	0.231	−0.094
		p	0.519		0.212	0.616
	Motivation	*r*	0.364 *	0.231	1	0.684 **
		p	0.044	0.212		0.000
	Autonomy	*r*	0.404 *	−0.094	0.684 **	1
		p	0.024	0.616	0.000	

* Significance with values less than 0.05. ** Significance with values less than 0.01.

4. Discussion

The research carried out has made it possible to achieve the proposed general purpose of analyzing the effectiveness of the use of educational Escape Rooms in mathematics lessons, this compared to the implementation of a traditional methodology in the 3rd year of Secondary Education. The results obtained in this study have confirmed the potential of the literature on teaching innovation and the use of active methodologies in teaching and learning processes [1,2]. In this case, the research has focused on the use of the Escape Room as a methodology to gamify a subject as traditional and rigorous as mathematics.

Despite the acceptance and use of gamification by teachers in general [16], this work acquires its reason for being in the scarcity of studies concerning the use of the Escape Room in the area of Mathematics. Therefore, with the intention of increasing the impact of the literature on the state of the question, this study has been carried out.

This work is based on the analysis of previous research reported on gamification and, specifically, Escape Rooms. It has been conducted in order to analyze the dimensions that offer benefit to the scientific literature on this active methodology. Therefore, this study acquires its potential in presenting some findings on a training approach that has been scarcely studied in the subject of mathematics.

Studies on the implementation of the gamification and Escape Rooms reveal great benefits both in the teaching process [20,22], and in various indicators related to learning [25,27,55]. The latter have to do with an improvement in problem solving [26], in the interaction and collaboration between the people involved [27,28], in activation and attitude [53,57], in motivation [29,52,66] in satisfaction with the environment generated and the task to be carried out [54], and autonomy of students [33,68,69], as well as the results and academic performance achieved [38,64], among the indicators more outstandingly reflected in impact studies.

In particular, this research has been articulated in the analysis of four dimensions, such as learning achievement, learning anxiety, motivation and autonomy. The results show that these dimensions have experienced a significant improvement after the application of the Escape Room as a pedagogical

tool in the Mathematics subject. These findings are associated with previous studies on the use of this approach that reveal an improvement in the achievement of students in their formative action [38,56], in the control of learning anxiety [12], in motivation [29,41,52] and in student autonomy [31,56,57].

At a higher level of specificity, the gender variable has only influenced students' motivation and autonomy, as other studies reveal [68,69]. It has been found that women are more motivated and show a higher level of learning anxiety, in analogy with other works [70]. However, this effect produced is not found in the control group, where there are no differences by gender.

At the correlational level, in the control group the correlations are absent. In contrast, in the experimental group, there are correlations between Achievement-Autonomy, Motivation-Autonomy and Motivation-Achievement. This last correlation stands out, which generates a positive effect on students by increasing their motivation for learning and homework due to the achievement attained. These results are in congruence with the specific literature on the analyzed art [12,70]

5. Conclusions

This work shows the analysis of an escape room experience with students. The results obtained allow us to know the students' assessment of the intervention with the escape room and inform about the effect on learning process.

Based on these findings, use of the Escape Room in the Mathematics course has contributed to the improvement in the different dimensions studied, such as learning achievement, learning anxiety, motivation and autonomy (with gender being a variable to take into account), and in a general way, in motivation and autonomy. Therefore, the use of this active gamified methodology is positioned as a didactic approach with greater potential than traditional methodologies.

The potential of Escape Room education has been demonstrated. This resource is effective in both increasing motivation and promoting active learning. As in other studies, there is agreement on the idea that, through this type of game, it is possible to facilitate the learning of a specific topic in a motivating and efficient way.

6. Prospective and Limitations

The prospective of this research focuses on the promotion of the Escape Room and the promotion of gamified practices in the field of mathematics. As revealed in this study, the use of this active methodology benefits several important indicators in the training process. For this reason, the present work encourages the teaching community to use the Escape Room as a methodological alternative in the area of Mathematics. Furthermore, this research contributes to establishing the bases of this active methodology in this specific field, with the purpose of serving as a support for future research by other members of the scientific community.

The limitations of this study are focused on the particularities of the participants, who are involved in a specific context. Furthermore, this study lacks a prior analysis of the groups that have been subjected to experimentation and control, as they were classes already organized by the educational center, which assured its composition was based on heterogeneity. Although the effects are positive, we must take into account the area of work within mathematics. In this case, the positive results were obtained in the work in the areas of algebra, logic and geometry. Therefore, as a future line of research, it is intended to articulate a teaching network to apply the Escape Room in the Mathematics subject with the intention of obtaining a representative sample that allows the results to be generalized to the entire student population. In addition, another of the possible lines of action may focus on the application of this active methodology in different educational stages.

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