

# Journal of Engineering Research

## ACTIVE METHODOLOGIES AND THEIR USES IN MATHEMATICS: GAMIFICATION AS A LEARNING STRATEGY

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**Abstract:** The modern world calls for modern solutions and education could not be different. Many active methodologies are being proposed so that mathematics classes in particular can become more meaningful for children and young people in general. Therefore, the use of active methodologies, in particular gamification, presents itself as a good answer to increasing students' academic performance. The objective of this article was to verify whether there was a gain in the performance of students in the 5th and 6th years, elementary school at Santa Luzia school, in the city of Campos Gerais/MG. Linked to the Anglo/SOMOS network. Such observations were carried out during the period from April to October 2023. Such an effort is justified by presenting an effective use of technologies in favor of the school and not generating a war between students and teaching and learning methods used by young people, that is, speaking the same language they are speaking. (H0) is confirmed to the detriment of (H1) when at the end of the second two months there was a gain of 20 to 30%, on average, in students' quantitative learning and performance. The methodology used to carry out this work is predominantly observational and the results are presented in a descriptive manner. It is, therefore, a qualitative research. Held with students in the 5th and 6th years, elementary school at Santa Luzia school, in the city of Campos Gerais/MG. Linked to the Anglo/SOMOS network. Such observations were carried out during the period from April to October 2023. Finally, it must be noted that gamification does not provide 100% benefits and that some care must be taken. The fact that the network has integrated and transversal material is reinforced, as well as other games that favor the diversification and progression of students, so that it does not become a boring and repetitive activity.

**Keywords:** Active methodologies. Learning

strategies. Gamification. Matfic.

## INTRODUCTION

The modern and dynamic world requires modern and dynamic schools that can respond in a timely and satisfactory manner to the demands offered. In this context, a clear separation must be made between the response time given by private schools and public schools. We also cannot fail to highlight the fact of the socio-family context that involves the participants in the educational process as a whole (Ribeiro; de Abreu; Costa & Coelho, 2023).

After having made this initial clarification, we are developing an analysis of the use of technologies as auxiliary tools in the teaching and learning process in a private school with resources and qualified personnel to implement this methodology.

As the SOMOS/ANGLO network has been working with games since the early years and in the case of mathematics there is a module called MATIFIC in which children from kindergarten to high school are challenged to participate and "compete" with themselves, making these contents become much friendlier and in a playful way student can absorb very abstract concepts and definitions (Ribeiro; da Sila; Carlos & de Paula, 2023).

In this article we will objectively address some situations experienced and successfully developed by the school where we carried out the internship and pedagogical practices.

By first hypothesis (H0), it is expected that students will perform better in games, they will also perform better in the classroom and there will be a gain in the overall performance of the classes, which in this section are students in the 5th and 6th grades of elementary school. I and II.

Therefore, the aim of this effort is to verify whether there has been a gain in the performance of the students in question. Such

an effort is justified by presenting an effective use of technologies in favor of the school and not generating a war between students and teaching and learning methods used by young people, that is, speaking the same language they are speaking.

The methodology used to carry out this work is predominantly observational and the results are presented in a descriptive manner. It is, therefore, a qualitative research. Held with students in the 5th and 6th years, elementary school at Santa Luzia school, in the city of Campos Gerais/MG. Linked to the Anglo/SOMOS network. Such observations were carried out during the period from April to October 2023.

## **DEVELOPMENT**

### **CHALLENGES FOR TEACHERS THROUGHOUT HISTORY**

Starting our studies on the challenges faced by teachers in Literacy, it is worth highlighting the concept that Soares (2020, p. 63) says that “literacy is not just learning to read and write”, “it is much more than just teaching to code and decode”.

And it also complements, being a complex and multifaceted process that goes beyond the simple decoding of letters and words, also involving a deep understanding of written language and its social context, in addition to valuing the language and culture of students, promoting a meaningful and inclusive. (SOARES, 2020)

Much research has been done on the history of literacy and teacher training, and at the beginning of the 20th century where the concept of literacy was still “teaching the first letters”; “teaching reading”; “simultaneous teaching of reading and writing” (Mortatti, 2011), we can see the concern with who will direct these skills “of school reading are, at the same time, historians and pedagogues”. [...]

“It may be preferable, in fact, to know a little about history to make proposals for school reform, invent teaching tools, and train future teachers”, (MORTATTI, 2011)

Given the educational problems with literacy today, we are inclined to believe that in our time or in ancient times, studying was better. Students were more likely to learn, schools taught more and teachers were more prepared. Exposed to difficult times, we believe that going back would be a good thing. But going back on literacy is not worth it, because most of the problems we face today come precisely from this past. So when we look back we realize that reading and writing were privileges of the elites and that it was only at the end of the 20th century that the vast majority of the population began to have access to education (ROJO, 2004).

### **TEACHER TRAINING AS A KNOWLEDGE PROFESSION**

Thinking about the idea that it is the teacher who teaches reading and writing skills, it is necessary to reflect on what it means to be a teacher, as the teaching profession is seen as a “profession of knowledge” and becomes a learning experience. as Zabalza (2000, apud Marcelo, 2007) highlights, “pleasant experience of learning something new every day”.

It is interesting when talking about teacher training because it is where we learn to learn and where, according to Marcelo (2007), commitment, motivation and a redoubled effort of confidence are required from teachers to continue learning and teaching. According to Marcelo García (1999), practical and theoretical knowledge is necessary so that together they can carry out interventions in the teaching-learning process. Marcelo Garcia, (1999, p. 29), also tells us that:

Teacher training, both initial and ongoing, must take into consideration, the

epistemological reflection of practice, so that learning to teach is carried out through a process in which practical knowledge and theoretical knowledge can be integrated into a curriculum oriented towards teaching action.

According to Charlot (2008), to solve so many problems in the classroom, the teacher is invited to adapt his action to the context. Like this,

The school and teachers must develop a political-pedagogical project, taking into account the characteristics of the neighborhood and the students, mobilize cultural and financial resources that make it possible to improve the effectiveness and quality of training, form partnerships, develop projects with students, etc., Charlot. (2008, p. 20).

Faced with so many demands, training becomes ineffective, as the teaching curriculum is still inserted in a universe of traditional culture, as Charlot points out, (2008, p. 20)

Teachers were not taught to work on emotions and attitudes, deal with problems arising from social contexts, adapt to political-social changes, deal with conflict situations or position themselves as an eternal learner, Charlot, (2008, p. 20).

So, what must teachers actually know and what must they actually teach? And, how to teach?

According to Tardif (2002), the relationship between teachers and knowledge is not restricted only to the transmission of knowledge already constituted (Ribeiro; da Sila; Carlos & de Paula, 2023). He explains that teaching practice integrates different types of knowledge and maintains different relationships with them. In addition to defining teaching knowledge,

“[...] as a plural knowledge, formed by the amalgam, more or less coherent, of knowledge originating from professional

training and disciplinary, curricular and experiential knowledge”, TARDIF (2002, p. 36).

From this perspective, teachers' professional knowledge, according to Tardiff (2002), is linked to their training and life trajectory. Being classified into “disciplinary knowledge, curricular knowledge and experiential knowledge”. And we go a little further, according to Marcelo (2009) the teacher's professional identity is a construction of the professional self, evolving throughout the career through experienced knowledge, technical/scientific knowledge, beliefs, values, configuring a tangle of stories, knowledge, processes and rituals (Ribeiro; da Sila; Carlos & de Paula, 2023).

Therefore, it is recommended that professionals have a type of training according to Canário (1998), which points to overcoming and “articulation between personal, professional and organizational dimensions”, a “school-centered training”.

## **GAMIFICATION: ITS ADVANTAGES AND DISADVANTAGES**

Gamification is the use of game design elements and techniques in non-game contexts to engage, motivate and influence people's behavior (Ribeiro; da Sila; Carlos & de Paula, 2023). This approach has gained popularity in a variety of fields, including education, marketing, business, and healthcare, due to its ability to make everyday tasks and activities more engaging and fun.

Some of the common elements of gamification include:

1. Scoring: Assign points to participants to reward their performance and encourage engagement.
2. Challenges: Create specific tasks or goals that participants must achieve, providing a sense of accomplishment.

3. Rewards: Offer tangible or virtual rewards, such as badges, prizes or discounts, to encourage desired behavior.

4. Levels: Divide the experience into increasing levels of difficulty, challenging participants to progress.

5. Feedback: Provide immediate and informative feedback on participants' performance.

6. Narrative: Creating a story or context that engages participants and motivates them to engage more deeply.

Gamification can be applied in a variety of ways, from using mobile apps that reward meeting fitness goals to creating interactive corporate training programs that use gaming elements to motivate employees.

## **MAIN AUTHORS IN THE WORLD WHO TALK ABOUT GAMIFICATION**

Many authors and experts have written about the concept of gamification and its applications. Some of the most influential authors in the field of gamification include:

1. Jane McGonigal: Jane McGonigal is a games author and researcher famous for her book "Reality Is Broken: Why Games Make Us Better and How They Can Change the World." She argues that games can have a positive impact on society and can be a tool for solving real-world problems.

2. Yu-kai Chou: Yu-kai Chou is a gamification pioneer and author of the book "Actionable Gamification: Beyond Points, Badges, and Leaderboards." He developed the Octalysis Framework, a widely used model for creating gamification experiences.

3. Gabe Zichermann: Gabe Zichermann is an author and gamification expert and wrote the book "The Gamification

Revolution". He is known for his work promoting gamification in business and other fields.

4. Andrzej Marczewski: Andrzej Marczewski is a gamification author and consultant. He is the author of the book "Even Ninja Monkeys Like to Play" and is known for his blog about gamification, where he shares insights and ideas on the subject.

5. Kevin Werbach: Kevin Werbach is a professor at the Wharton School of the University of Pennsylvania and author of the online course "Gamification." His book "For the Win: How Game Thinking Can Revolutionize Your Business" is an important read on the subject.

6. Sebastian Deterding: Sebastian Deterding is a researcher in game design and gamification and has contributed significantly to academic research in this area.

These authors offer valuable perspectives on how gamification can be applied in different contexts, from education and business to health and well-being. His works are useful resources for anyone who wants to learn more about the subject and how to effectively use gamification to achieve specific goals.

## **MAIN BRAZILIAN AUTHORS ON GAMIFICATION**

In Brazil, there are authors and experts who support the use of gamification in various areas. Some of these Brazilian authors include:

1. Cristina de Matos: Cristina de Matos is the author of the book "Gamification and Game-Based Learning", which addresses the application of gamification in education.

2. Renato Alves: Renato Alves is a gamification expert and author of the

book “Gamification: How to create engaging learning experiences”. He is known for his work applying gamification concepts to corporate education and training.

3. Flávio Lenz: Flávio Lenz is the author of the book “Gamification and Consumer Behavior”. It explores how gamification can be used to engage and motivate consumers.

4. Nando Moura: Nando Moura is one of the pioneers of gamification in Brazil and author of “Gamification: How to create engaging learning experiences”. He is known for his work applying gamification to education.

5. Gisele Barreto: Gisele Barreto is the author of the book “Gamification and Social Media: Communication Strategies in the Digital Era”. She examines how gamification can be used to increase engagement on social media.

6. Ricardo Ramos: Ricardo Ramos is the author of the book “Gamification and Corporate Learning: How to Engage Employees”. It focuses on applying gamification to employee training and development.

These Brazilian authors have contributed to the understanding and implementation of gamification in several areas, including education, marketing, corporate training and consumer behavior. His works offer valuable insights into how gamification can be applied effectively in the Brazilian context.

However, it is important to note that gamification is not appropriate for all contexts and is not always effective. If designed poorly, it can appear artificial or manipulative. Therefore, it is essential to carefully consider how gamification principles can be applied ethically and effectively in each specific scenario.

Gamification, which involves incorporating game elements into non-game contexts, has several advantages and disadvantages to be considered. Here are some of the main advantages and disadvantages:

## ADVANTAGES OF GAMIFICATION

1. Engagement: Gamification can increase people’s engagement, making activities more fun and engaging. This is particularly useful in learning, training, and marketing contexts.

2. Motivation: It can motivate people to achieve goals and complete tasks, offering rewards, challenges and a sense of accomplishment.

3. Interactive Learning: In education, gamification can make the learning process more interactive, encouraging students to actively participate and learn in a practical way.

4. Immediate Feedback: Gamification elements allow you to provide immediate feedback on performance, allowing participants to adjust their behavior and improve.

5. Friendly Competition: Healthy competition can stimulate performance and engagement as people seek to outperform others.

6. Information Retention: Gamification, with its narrative and challenges, can help people retain information for longer.

## DISADVANTAGES OF GAMIFICATION

There is a consensus among the main references in the area that the inappropriate use of gamification presents problems, namely:

1. Superficiality: If poorly designed, gamification can be perceived as superficial, failing to engage participants in a meaningful way.
2. Exhaustion: Constant exposure to rewards such as points and badges can lead to exhaustion and loss of interest on the part of participants.
3. Inequality: If not applied carefully, gamification can create disparities between participants, where some have advantages over others.
4. Extrinsic Motivation: Gamification often relies on extrinsic motivation (external rewards) rather than intrinsic motivation (internal motivation), which may not be sustainable in the long term.
5. Frustration: Overly difficult goals and challenges can lead to frustration rather than motivation.
6. Ethical Issues: Inappropriate use of gamification can raise ethical concerns, such as manipulating people or exploiting gaming addictions.
7. Loss of Authenticity: In some cases, gamification can seem forced and artificial, losing the authenticity of the original context.

The effectiveness of gamification depends on appropriate application, target audience and specific objectives. It is important to use gamification in an ethical and balanced way to maximize the advantages and minimize

the disadvantages. Furthermore, it is essential to adjust gamification strategies according to participant feedback and needs to obtain the best results.

### **MATIFIC: A MATH APP THAT TEACHES CONCEPTUAL UNDERSTANDING<sup>1</sup>**

Each activity has been meticulously designed to ensure students genuinely learn - and have fun doing it. Matific builds student confidence from the first session and works on their skills towards complete fluency.

Students can play our activities as many times as they want, and they will have new questions each time. Matific offers unlimited opportunities for students to focus their efforts on improving their skills.

Our responsive feedback provides tips for students to develop and learn independently. When students answer a question incorrectly, our immediate interventions encourage them to identify their mistakes, keep trying, and achieve their learning goals.

### **MATIFIC: ADAPTIVE LEARNING ALGORITHM<sup>2</sup>**

Our intelligent algorithm analyzes each student's performance and provides them with an adaptive, personalized experience. Whether students need correction, practice, motivation, or some combination, Matific helps them grow in their own way!

Spaced repetition is built into our adaptive algorithm for students to review and refresh skills they have already mastered. With Matific, your students will always be prepared to take the next step in their learning journey.

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1.Information collected as on the MATIFIC company website: <https://www.matific.com/bra/pt-br/home/teachers/>

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## **MATIFIC: DEEP REAL-TIME ANALYSIS<sup>3</sup>**

Matific keeps records of everything so you don't have to! You can easily see how much time your students spend on the platform, see who completed work, measure student growth, and more.

Each Matific activity is a formative assessment and responding the right way has never been easier. Identify struggling or struggling students, then proceed with targeted assignments with just a few clicks.

## **METHODOLOGICAL PROCEDURES**

In this topic, we seek to explain the methodological process of this research, which began with data collection in a private school in Campos Gerais-MG, located in the urban area of the city, which is recognized for using innovative teaching methodologies in its projects. didactic, which makes it relevant within the scope of this research. The information was collected from the files of the school secretariat, in which the work of all students was available, whose age ranges between 10 and 11 years old and make up a 6th year elementary school class.

In the present research, the qualitative character predominates, as the data obtained is analyzed anchored in the theoretical foundation, in order to consider the uniqueness of each social or cultural phenomenon, and throughout this process the researcher explains this reality taking into consideration, the perspective of the collaborators involved in the object of study (SEVERINO, 2007)

As for its nature, it can be said that it is exploratory/descriptive research. According to Gil (2007), exploratory research aims to provide the researcher with greater familiarity with the problem and objective descriptive research primarily describes the characteristics

of a given population, phenomenon or the establishment of relationships between variables (GIL, 2007).

Regarding the bibliographic aspect of the study, data collection took place through searches for keywords named by the themes on the website of the Digital Library of Theses and Dissertations (BDTD), carried out in the months of February and April 2023. Besides, a bibliographic search was carried out in the Scientific Electronic Library Online – SciELO, which was chosen due to the importance that this tool has for the scientific communication process, as it consists of an electronic collection of academic production at the stricto sensu Postgraduate level of Educational Institutions Higher Education (IES) in Brazil.

The survey of articles for this study was carried out in the search for complete texts, accessed according to the free availability of the databases. In line with inclusion and exclusion criteria, articles that were not freely available in full did not participate in the results of this study.

The search strategies were adapted for each database, considering the peculiarities of each one, always with a view to the problem and objectives of this study and the inclusion and exclusion criteria mentioned above. Therefore, it was possible to maintain the coherence of the material selected for this work.

In the aforementioned databases, the keywords “learning strategies”, “gamification” and “matfic” were used to search for the material.

## **CONCLUSION**

The modern world calls for modern solutions and education could not be different. Many active methodologies are being proposed so that mathematics classes in particular can become more meaningful for children and young people in general.

3. Information collected as on the MATIFIC company website: <https://www.matific.com/bra/pt-br/home/teachers/>



The objective of this article was to verify whether there was a gain in the performance of students in the 5th and 6th years, elementary school at Santa Luzia school, in the city of Campos Gerais/MG. Linked to the Anglo/SOMOS network. Such observations were carried out during the period from April to October 2023. Such an effort is justified by presenting an effective use of technologies in favor of the school and not generating a war between students and teaching and learning methods used by young people, that is, speaking the same language they are speaking.

(H0) is confirmed to the detriment of (H1) when at the end of the second two months there was a gain of 20 to 30%, on average, in students' quantitative learning and performance. Furthermore, situations were observed in which some content that had not been properly assimilated was reinforced by playing games during the class period and outside of it, because instead of the students playing any other game with no pedagogical connection, they remained motivated to continue. And, this was reflected in their

behaviors within the classroom.

The methodology used to carry out this work is predominantly observational and the results are presented in a descriptive manner. It is, therefore, a qualitative research. Held with students in the 5th and 6th years, elementary school at Santa Luzia school, in the city of Campos Gerais/MG. Linked to the Anglo/SOMOS network. Such observations were carried out during the period from April to October 2023.

Finally, it must be noted that gamification is not 100% beneficial and that some care must be taken. The fact that the network has integrated and transversal material is reinforced, as well as other games that favor the diversification and progression of students, so that it does not become a boring and repetitive activity. But yes! Something pleasurable, fun and challenging. Therefore, when technology, content and correct stimuli are correctly articulated, the gains are evident.

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