Revista ARACÊ
ISSN: 2358-2472

GAMIFICATION IN THE DEVELOPMENT OF COGNITIVE SKILLS AND LEARNING FOR STUDENTS WITH AUTISM SPECTRUM DISORDER (ASD)

https://doi.org/10.56238/arev6n4-025

Submitted on: 11/03/2024 **Publication date:** 12/03/2024

Michele Bitencourt Marques[1] and Paula de Castro Nunes[2].

ABSTRACT

The clinical picture of children with Autism Spectrum Disorder (ASD) is characterized by deficits in social interaction and communication, as well as repetitive interests and activities. Technology is an essential component in the education of students with special needs, as it allows them to access tasks that would otherwise be out of their reach. The general objective was to investigate the contribution of gamification in the development of cognitive skills and learning of students with Autism Spectrum Disorder (ASD). The most relevant results indicate that the interaction with digitized activities allowed concepts, such as mathematics, to be elaborated in a more accessible and attractive way for students, overcoming the barriers found in non-digital environments. The adoption of gamification as a teaching method has contributed significantly to the development of cognitive and social skills, highlighting the potential of these technologies to promote more inclusive and personalized learning. Despite the limitations, the results obtained reinforce the feasibility of using digital technologies in the teaching of students with ASD, aligning with the need for pedagogical innovations that meet the specificities of this audience. Thus, by adopting technologies as teaching tools, the education of students with ASD can become more dynamic, accessible, and effective.

Keywords: Education. Inclusion. Autism Spectrum Disorder. Gamification. Technology.

[1] Master's student in New Digital Technologies in Education
UniCarioca
Email: michele.bitencourt@yahoo.com.br
ORCID: 0009-0005-3564-4097
[2] Dr. in Bioethics, Applied Ethics and Collective Health from the interinstitutional consortium: UFF, UFRJ, UERJ and FIOCRUZ -PPGBIOS (2015)
E-mail: pnunes@unicarioca.edu.br

Revista ARACÊ
ISSN: 2358-2472

INTRODUCTION

The theme covering autism has been widely disseminated in literature, magazines, social media, and, therefore, society has been gradually, although incipiently, beginning to be interested in the subject, however, it is worth mentioning that there is still a need for comprehensive knowledge of the disorder, which can contribute to society and the difficulties faced by parents and family members who have children with this type of disorder in their contexts.

Currently, Autism Spectrum Disorder (ASD) affects a significant number of people who have communication and socialization difficulties, which results in complexities for their learning. Studies are being conducted indicating the use of technology and computer-based interventions to teach people with ASD language and social skills.

Corroborating, Moraiti et al., (2023) add that according to numerous studies, information and communication technologies (ICT) offer new opportunities for people with developmental disorders to develop their autonomy and independence in their daily activities. For Hodges and Fealko (2020), in particular, according to the following research participants with cognitive difficulties and autism spectrum disorder used two technological tools to carry out their educational activities. The combination of visual and textual information significantly helped students with cognitive disabilities and ASD to focus on the content presented, avoiding usability and accessibility issues and therefore improving their learning process.

The advancement of technologies is becoming present in the most diverse branches of the areas of human knowledge, and when it comes to education, it is evident that technologies are also increasingly present in the learning processes of students.

The use of new technologies as effective teaching tools can be the answer to some of the specific educational demands of students. According to Vlachou (2023), due to the accelerated pace of technological advancement and its effects on the educational scenario, the presence of information and communication technologies (ICT) in society is a reality that needs specific consideration and continuous evolution. In an effort to improve their teaching outlook using ICT equipment, most institutions have included this technology in their educational institutions.

According to Bouzas and Pérez (2022), the integration of the different types of digital games environments and SG in the educational context is increasingly noticeable, also in the field of Special Education. Specifically, people with ASD tend to prefer digital resources

Revista ARACÊ
ISSN: 2358-2472

over traditional ones, in order to interact for educational purposes, since their structure and support are adjusted - to a greater extent - to their cognitive processes.

Therefore, the playful activity in the form of games is actively correlated with the daily life of society, evidencing in itself its rules, ideas, limits, witnessing itself in society in norms and imposed rules that must be followed due to the cultural structures that are taught and passed on to the people to organize themselves in the society in which they live and that they act day by day, and each time appropriating new changes that occur in the historical-cultural context of society.

Thus, the present study seeks to present strategies for teachers to achieve the inclusion of students with ASD, and the role of assistive technology, with identification of its benefits, among them: improvement of communication, organization, memory and attention skills.

Based on the results , it is expected that this research can contribute to the integration of people with ASD in the educational context with the help of technological means. Children with ASD have different learning characteristics. Each has a preferred learning style and specific needs when receiving information. Meeting these needs in a classroom setting can be a challenge for teachers, as many are not prepared to give students at various points on the autism spectrum beyond the undivided attention needed. With this, the need for technology as an educational tool to assist teachers and improve learning among students with ASD.

To this end, the general objective was to investigate the contribution of gamification in the development of cognitive skills and learning of students with Autism Spectrum Disorder (ASD).

THEORETICAL FRAMEWORK

The term "gamification" originated in the digital media industry. The first document that used it was published in 2008, but "gamification" was only widely adopted in the scientific community in 2010, when many promoters at symposia disseminated this designation (Rodrigues et al., 2019).

Costa et al., (2018) point out that the continuous growth of digital games as a media, cultural artifact and market product has made it possible to explore new ways of employing and applying game mechanics in different contexts. It is from this perspective that the concept of gamification emerges, a term derived from the English "gamification", any

Revista ARACÊ
ISSN: 2358-2472

application, task, process or context can, in theory, be gamified, which allows the implementation of gamification in a variety of areas.

Verzani and Serapião (2020) report that, among the strategies employed to increase motivation, gamification has stood out as a widely used resource. The application of techniques from the area of games, even if out of context, aims to foster motivation for the involvement, engagement and interaction of people, also reaching areas such as training and health. In addition, gamification contributes to the pursuit of goals through extrinsic motivation. However, when motivation is intrinsic, individuals tend to resume the practice on their own initiative, while those who are extrinsically motivated need an external stimulus to resume the activity.

Digital games employ several methods to engage and motivate the player to achieve their goals; Gamification seeks, therefore, to address these methods and apply them in everyday situations. Scoring systems, badges and other forms of reward can, in addition to encouraging the user, foster the creation of rankings and, consequently, promote a form of competition that stimulates participants. It is important to note that there are other elements that fit the context, which will be detailed in subsequent topics. Gamification can be implemented in digital or non-digital environments, creating both online and offline experiences that promote a greater degree of interaction and socialization. It must also be recognized that, just as there is no single type of game, there is no single method of gamification: the incorporation of game elements into the method — and the way they will be used — will depend entirely on the context in which they are inserted (Costa et al., 2018).

Magalhães et al., (2019) explain that gamification enables the recreation of reality, transporting the user to an environment that incorporates audiovisual and interactive elements and stimuli. This leads to an innovative approach to a given content, allowing the reconfiguration of daily activities both in the classroom and outside it. This process stimulates the user, and the design and elements of the games empower the player by transforming interactions with services, products, policies, and daily tasks that can be monitored and modeled. In this way, the player becomes part of this scenario, changing it with each interaction. Thus, the proposal of gamification is to create an environment that combines learning and playfulness.

The inclusion of students with ASD in the regular school system has been activated over the years in the Brazilian context in Brazil (Souza and Silva, 2019). When addressing

Revista ARACÊ
ISSN: 2358-2472

inclusive proposals, both public policies and pedagogical practices should not be limited only to providing access to education at all levels of education. A widely recognized and accepted conception currently considers that inclusion also implies the availability of all the necessary resources so that students with any type of disability can effectively become an active agent in their learning process, in addition to having ample opportunities to access historically and culturally constructed knowledge (Souza e Silva, 2019).

Corroborating, Stamberg et al., (2017) illustrate that in the contemporary social context, the promotion of inclusion represents one of the viable alternatives, with the insertion of digital resources in educational institutions being an additional tool for the development of teaching and learning of Mathematics. Thus, this study aims to present the ongoing actions resulting from a research project that proposes the use of technological tools, which are configured as a significant resource in the area of Mathematics, in addition to contributing substantially to the intellectual and emotional formation of students.

In the context of mathematics education, as in any educational field, Gomes et al., (2024) observe that technological advances radically modify the teaching and learning processes, with the use of new didactic methods and strategies, taking advantage of all the potentialities offered by them, including elements such as images, interactivity, dynamism and infinite resources, that can be used to the fullest.

The development of teaching strategies that are sensitive and adjusted to the individual abilities of students is essential for the consolidation of an effective Inclusive Education. This approach transcends the mere transmission of knowledge in subjects such as Mathematics or other areas, requiring the educator to have an in-depth understanding of the diversity and complexity present in their classroom (Santos, 2024).

According to Libâneo (2008), participation is one of the categorical elements for fruitful learning, as participation aims to ensure democratic teaching management. The student's participation in their own learning is inserted within a democratic management, which aims to democratize the school space by dialoguing with students and seeking to understand the local needs of the school community.

To effectively combat limited perceptions and promote an education that truly welcomes inclusion, it is imperative to develop and adopt innovative pedagogical practices. These approaches should be aligned with the specific needs of students with ASD, facilitating their academic and personal development. In the field of Mathematics

Revista ARACÊ
ISSN: 2358-2472

Education, there has been a significant growth in studies and research aimed at this purpose (Santos, 2024).

METHOD

For the preparation of this article, a quantitative methodology was adopted , on the influence of gamification in the improvement of cognitive abilities and in the learning process of students diagnosed with Autism Spectrum Disorder (ASD) as mentioned by Rocha and Aguiar (2003), this research modality aims to increase the volume of data in the academic sphere and improve the quality of life of a certain group. In this sense, it is possible to highlight, for the formulation of the research-intervention, important references, such as a certain conception of subject and group, of autonomy and practices of freedom, as well as that of transformative action.

Some applicable criteria will be outlined, which will be explained below. Among these criteria, the following stand out: ethical aspects, research environment, data collection procedures and data analysis procedures.

The first stage consisted of the preparation of an e-book that aims to present a Didactic Sequence that followed the following processes: present proposals that use different technological resources organized for students with Autism Spectrum Disorder (ASD).

An e-book (ISBN- 978-65-01-15093-2) was prepared, which aims to present a Didactic Sequence (S.D.) with proposals that use different technological resources organized for students with Autism Spectrum Disorder (ASD) in the Early Years of Elementary School, meeting the proposals of the BNCC - National Common Curricular Base for the teaching of Mathematics, for students with ASD, organized for students with ASD. This DS was applied within a private school unit, in the Brisa neighborhood of the city of Rio de Janeiro, to peers, where approximately 20 teachers participated in this moment.

In the Didactic Sequence, different technological resources and gamification strategies developed for the teaching of Mathematics were used, where teachers were able to perceive the performance of students with Autism Spectrum Disorder (ASD) in the activities proposed by the Didactic Sequence, taking into account the individual characteristics of the students, such as age, cognitive level, and ASD level.

The study involved the application of a DS entitled "Pedagogical Practices with the Use of New Digital Technologies Applicable to Mathematics Education for Students with

Revista ARACÊ
ISSN: 2358-2472

Autism Spectrum Disorder (ASD)". Before the application, the research participants were introduced to the theme of the dissertation and the methodological path chosen. Then, an authorization form for participation, the Informed Consent Form (ICF), was made available for knowledge and agreement, in which they were informed about their rights and duties.

The field study took place in a private school unit, located in the neighborhood of Brisa, in the city of Rio de Janeiro. The sample of teachers invited to participate in the research consisted of 20 teachers from Elementary School, Early Years. All 20 teachers of Elementary School, Early Years, participated in the training. The application of the Didactic Sequence was carried out in a classroom of the institution, where I presented and explained the DS through slides. After the application of the DS, a questionnaire was presented to the teachers to evaluate the proposed practices; for this, the Forms platform was used, in which 17 of the 20 invited teachers answered the questionnaire.

A field interview was conducted from July to September 2024, with the aim of investigating the difficulties faced by teachers. Data collection was carried out in person, through a semi-structured questionnaire, focusing on an exploratory research.

100% of the teachers who worked in this niche in a private school unit located in the Brisa neighborhood, in the city of Rio de Janeiro, were invited to participate in the research. With the acceptance of the professors, the completion of the Informed Consent Form (ICF) was requested. Then, a date was scheduled for the training to be carried out within the school unit, in which the teachers actively participated.

RESULTS AND DISCUSSION

The data collected with participating teachers revealed that in this continuous process of reflection on their practices, in daily activities, in the formulation of pedagogical practices, in the elaboration of projects that meet the interests of the school and the needs of the students.

Novoa (2019) makes an important approach, emphasizing that at the beginning of the twenty-first century, it became evident that both the contract and the educational model need to be reevaluated in a significant way. It is not just about improvements, improvements or innovations, but a true metamorphosis of the school institution.

Next, there was a survey on frequency and technological inclusion in the educational context. Among the participants, the majority, composed of 10 teachers, indicated that they

Revista ARACÊ
ISSN: 2358-2472

use technology "sometimes", which suggests an intermittent practice, possibly related to factors such as the type of content covered or familiarity with the available tools (Graph 1).

Three teachers stated that they use technology "rarely", which may indicate a resistance to the inclusion of these tools in their pedagogical practices or a perception that technology is not essential to their teaching methods.

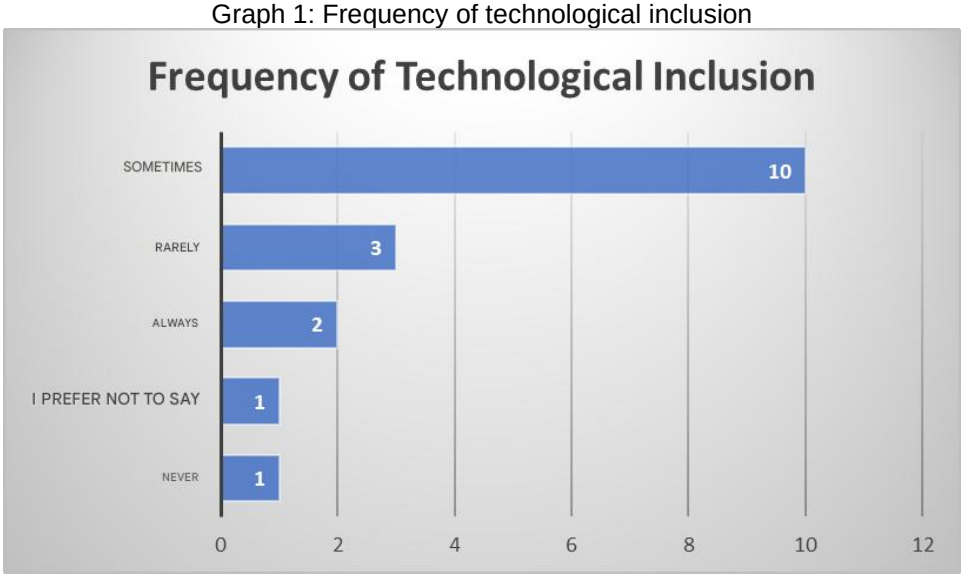
Only two teachers reported that they use technology "always", which may reflect a commitment to educational innovation and the search for strategies that promote more interactive learning.

One teacher chose not to answer, while another stated that he "never" relates technology in his classes, which is a concern, as it may indicate a disconnection with the current needs and expectations of students in relation to the use of digital tools in the teaching-learning process.

These data highlight the need for continuous training and support strategies to integrate technology more consistently and effectively into teaching practices.

According to Santos (2024), in order to implement a truly inclusive educational practice, it is essential to create learning environments that value diversity and meet the specific needs of students, awakening their interest in knowledge and fully integrating them into the teaching and learning process. This involves the adoption of innovative and non-exclusive pedagogical practices, which focus on the potential of students with Autism Spectrum Disorder (ASD), allowing the immersion of the learner both individually and collectively and promoting the pleasure of learning.

Graph 1: Frequency of technological inclusion



Source: Prepared by the author

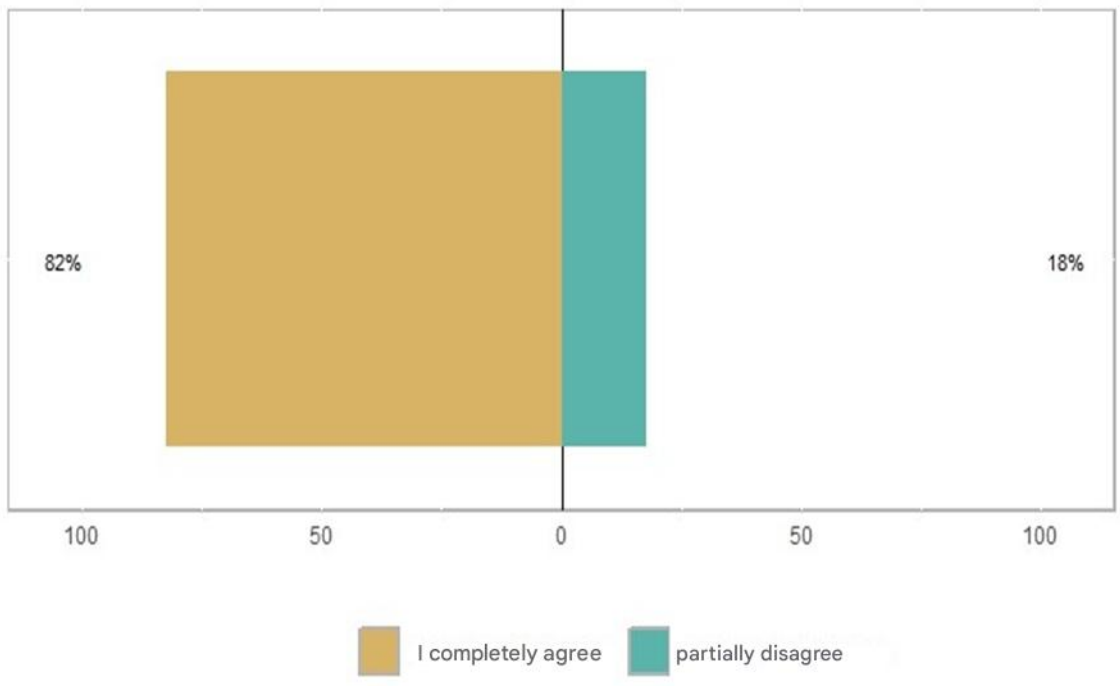
Revista ARACÊ
ISSN: 2358-2472

Next, an analysis of the respondents' perception of gamification as a facilitator of learning in mathematics teaching was carried out, as well as its contribution to increasing student engagement (Graph 2).

According to Sailer and Homner (2020), gamification in the educational context has attracted increasing attention and interest in the last decade, due to the hypothesized benefits in terms of motivation and learning. However, some researchers question whether the effects of games can be transferred to non-gaming contexts. Although the positive effect of gamification on cognitive learning outcomes can be interpreted as stable, the results on motivational and behavioral outcomes were less stable.

In a complementary approach, Souza (2019) emphasizes the importance of using digital technologies in the educational environment, arguing that, when integrated with well-structured pedagogical practices mediated by the teacher, these technologies can facilitate effective inclusion, respecting the particularities of autistic students. In this way, the use of technologies in conjunction with adaptive pedagogical strategies can avoid the exclusion of these students in the school context, promoting a more inclusive and effective teaching of Mathematics.

Graph 2: Gamification: engagement and math learning



Source: Prepared by the author

Revista ARACÊ
ISSN: 2358-2472

The relevance of the research is confirmed, as the results indicate that gamification and digital technologies can be effective in the learning process of children with ASD, especially with regard to the development of cognitive and social skills. The use of digital tools in the educational context not only facilitates student engagement, but also promotes the acquisition of concepts that would be more challenging in traditional approaches. This evidence reinforces the importance of incorporating assistive technologies and gamification as pedagogical strategies, especially when considering the growing demand for more inclusive and adaptive teaching methods.

Regarding the methodology adopted, the method used was adequate for the objectives of the study, as it allowed the analysis of teachers' experiences and the observation of the impacts of gamification on the learning of students with ASD. The construction of the e-book, as a pedagogical resource, provided a practical way to apply the didactic sequences and observe the direct effects of these practices on the engagement and cognitive development of students. The combination of interviews with teachers and the analysis of participants' responses provided a comprehensive and detailed insight into the effectiveness of gamification in this context.

FINAL CONSIDERATIONS

Thus, the present study aimed to investigate the contribution of gamification in the development of cognitive skills and learning of students with ASD is concluded, exploring different dimensions of the interaction between these pedagogical tools and the educational needs of this population. The proposed objectives were, in fact, achieved, corroborating the effectiveness of these approaches in the educational context.

The study carried out was of great importance for teachers, especially for Mathematics teachers who work with students with ASD. These educators face specific challenges in the teaching-learning process and, therefore, need adequate tools and resources to support the development of their students. The study highlighted the importance of providing teachers with access to strategies and materials that can facilitate this process, guaranteeing them the right to use all available resources to promote more efficient and inclusive learning.

The methodology adopted was effective for the objectives of the study, allowing an analysis of teachers' experiences and observing the impacts of gamification on the learning of students with ASD. The creation of the e-book as a pedagogical resource enabled the

Revista ARACÊ
ISSN: 2358-2472

practical application of the didactic sequences, enabling the observation of the direct effects of these practices on the engagement and cognitive development of students. The combination of interviews with teachers and the analysis of participants' responses provided a comprehensive and detailed view of the effectiveness of gamification in this context.

Therefore, the adoption of gamification as a teaching strategy has demonstrated a significant impact on the development of students' cognitive and social skills, highlighting the potential of these technologies to promote more inclusive, personalized, and effective learning.

Revista ARACÊ
ISSN: 2358-2472

REFERENCES

1. Bouzas, N. L., & Pérez, M. E. M. (2022). Gamified environments and serious games for students with autistic spectrum disorder: Review of research. Review Journal of Autism and Developmental Disorders.

2. Costa, D. L., Abrantes, M. B. N., Albert, F., & Barcelar, M. (2018). Bibliographic review of the aspects and methods components of gamification in education. In Proceedings of the XVII SBGames (pp. XX–XX). Foz do Iguaçu, PR, Brazil: October 29–November 1.

3. Gomes, E. de A., Góes, A. R. T., & Melo, J. da C. de. (n.d.). Playful in the teaching and learning of integers: Game goes up and slides. Available at: https://infoprojetos.com.br/revistas/index.php/Cienciaminhapraia/article/view/6. Retrieved on October 2024.

4. Hodges, H., Fealko, C., & Soares, N. (2020). Autism spectrum disorder: Definition, epidemiology, causes, and clinical evaluation. Translational Pediatrics, 9(Suppl 1), S55–S65. https://doi.org/10.21037/tp.2019.09.09

5. Libâneo, J. C., et al. (2008). School education: Policies, structure and organization (6th ed.). São Paulo: Cortez.

6. Magalhães, Y. C., Oliveira, A. M. A. de, Oliveira, R. S. de, Almeida, G. K. F. C., & Almeida, W. R. M. (2019). Contributions to environmental education using gamification in learning selective collection. Projection and Teaching, 9(2), 94–105.

7. Moraiti, I., Fotoglou, A., Stathopoulou, A., & Loukeris, D. (2023). Strategies & digital technologies for autism integration. Brazilian Journal of Science, 2(5), 107–124.

8. Novoa, A. (2019). Teachers and their training in a time of metamorphosis of the school. Education & Reality, 44(3), e84910.

9. Posar, A., & Visconti, P. (2018). Sensory alterations in children with autism spectrum disorder. Jornal de Pediatria (Rio J.), 94(4), 342–350.

10. Sailer, M., & Homner, L. (2020). The gamification of learning: A meta-analysis. Educational Psychology Review, 32, 77–112.

11. Santos, D. M. A. de A. P. (2024). Implications of digital technologies in the mathematics education of subjects with autism spectrum disorder. Perspectives in Dialogue: Journal of Education and Society, 11(27), 167–182.

12. Souza, A. C., & Silva, G. H. G. (2019). Including is not just socializing: The contributions of digital educational technologies to the mathematical learning of students with autism spectrum disorder. Bolema, 33(65), 1305–1330.

13. Stamberg, C. S., Pereira, A., Stochero, A., & Forrati, S. F. M. (2017). Mathematics allied to the use of technology in the teaching and learning of autistic students. In Proceedings of the VII International Congress on Mathematics Teaching. Canoas, RS, Brazil: ULBRA, October 4–7.

14. Vlachou, J. (2023). Digital technologies for autistic spectrum disorder students' education. World Journal of Advanced Engineering Technology and Sciences, 9(1), 330–341.

15. Verzani, R. H., & Serapião, A. B. S. (2020). Smartphone applications and physical activities: Contributions and limitations. Revista Pensar a Prática, 23, e59569.