DINO +: DIGITAL GAME FOR PEOPLE WITH ASD

DINO +: JOGO DIGITAL PARA PESSOAS COM TEA

DINO +: JUEGO DIGITAL PARA PERSONAS CON TEA

https://doi.org/10.56238/sevened2026.008-013

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ABSTRACT

This article discusses the development of a digital game aimed at children with ASD. Digital games are a strategy used in various activities to support the learning process of these children, serving as a link with a multidisciplinary and interdisciplinary team. This article focuses on developing an educational game accessible to people with autism. The objective of this article is to develop a game in Unity by integrating scriptwriting, visual art, and sound composition through programming, addressing autism, and making it usable by teachers, children, and those interested in the subject. The methodological process of this article is based on a literature review, providing a rich and well-founded reference to contribute to the game's development.Finally, a free game is presented in both desktop and web versions, along with a mobile version for Android, available on the mentioned platforms and accessible to any user.

Keywords: Autism. Digital Games. Technology. Accessibility. ASD.

RESUMO

Este artigo aborda o desenvolvimento de um jogo digital voltado para crianças com TEA. Os jogos digitais são uma estratégia utilizada como diversas atividades para o aprendizado dessas crianças, podendo ser o elo, com a equipe multidisciplinar e interdisciplinar. Este artigo pensou-se no desenvolvimento de um jogo educacional acessível às pessoas com autismo. Para este artigo, pensou-se como objetivo: desenvolver o jogo no Unity integrando, roteiro, arte visual e composição sonora através da programação, abordando o autismo e possa ser utilizada por professores, crianças e interessados no assunto. O processo metodológico deste artigo baseou-se em uma revisão literária, possibilitando um referencial rico e embasado para contribuir com o desenvolvimento do jogo. Por fim, é apresentado um

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jogo gratuito em desktop e web e uma versão para dispositivos móveis em Android, disponível nas plataformas citadas e pode ser utilizada por qualquer cidadão.

Palavras-chave: Autismo. Jogos Digitais. Tecnologia. Acessibilidade. TEA.

RESUMEN

Este artículo analiza el desarrollo de un juego digital dirigido a niños con TEA (Trastorno del Espectro Autista). Los juegos digitales son una estrategia utilizada en diversas actividades de aprendizaje para estos niños y pueden servir como enlace con equipos multidisciplinarios e interdisciplinarios. Este artículo se centra en el desarrollo de un juego educativo accesible para personas con autismo. El objetivo fue desarrollar el juego en Unity, integrando guiones, artes visuales y composición sonora mediante programación, abordando el autismo y haciéndolo accesible para docentes, niños y cualquier persona interesada en el tema. El proceso metodológico de este artículo se basó en una revisión bibliográfica, proporcionando una referencia rica y bien fundamentada para contribuir al desarrollo del juego. Finalmente, se presenta una versión gratuita del juego para escritorio y web, así como una versión para dispositivos móviles Android, disponible en las plataformas mencionadas y accesible para cualquier persona.

Palabras clave: Autismo. Juegos Digitales. Tecnología. Accesibilidad. TEA.

1 INTRODUCTION

A neurological condition that impacts people's development, including their social interaction, cognitive development, among others and that can come with symptoms that vary from person to person, such as difficulty in verbal and non-verbal communication, repetitive behaviors and difficulty in changing their routines, characterized by these daily challenges, autism is a global developmental disorder that is diagnosed in several children and adults. Thinking about possibilities and activities to contribute to the development of people with Autism Spectrum Disorder (ASD) is a challenge for the family and for a multidisciplinary team. It is important to note that some of these people with ASD have exceptional abilities in some specific areas. (Soares, et al, 2024).

For (Carvalho and Nunes, 2014), children with ASD often have a forgotten childhood, where interdisciplinary and multidisciplinary work is necessary, sometimes requiring more than one therapist in each meeting. Also in his work, he highlights the therapy that was based on the cognitivist developmental view, defended by researchers such as Piaget and Vygotsky and on autism scholars, such as Kenner, Bosa, Lampréia, Passerino among others with the great objective of stimulating the improvement of social interaction and language of the children served, through multidisciplinary work, involving pedagogues, psychologists, doctors, etc.

Reinforcing the proposal of (Carvalho and Nunes, 2014), the multidisciplinary team and professionals in the area of education have the challenge of proposing activities that contribute to the development and learning of autistic people, through therapy, extracurricular activities, weekly meetings and the use of technology becomes a great ally to support this process. Among the technologies that can be used, electronic games stand out, which through their interaction, entertainment and playful universe, becomes a digital alternative for this audience.

In the therapeutic and educational context, electronic games become a significant tool for autistic people. Through electronic devices, these games approach learning in an engaging and adaptive way, contributing with various skills and aspects in the development of people with ASD. Adapting games that meet the specific needs of this audience has become innovative, facilitating and contributing to their learning, in addition to creating environments that allow interaction and integration, thus favoring the practice of these skills. (Freitas, et al, 2024).

For (Freitas, et al, 2024) traditional approaches are no longer sufficient due to the use of large technologies, making electronic games effective in the development of social skills of autistic people, allowing social interactions in an adapted and controlled environment.

Depending on the games and their mechanics, it is possible to include inclusive activities involving several other people.

Also in his work, (Freitas, et al, 2024) cites (Filho, et al, 2023, p. 75), which demonstrates the power of games, citing that it is possible to have a safe virtual environment, allowing the simulation and practice of social interactions of children with ASD, increasing their engagement and interest in the proposed activities, such as interaction with the characters in the game, real-world simulation and even conflict resolution.

In the work of (Lira, et al, 2023), which he cites (Schell, 2020) brings the information that the game is closely related to the ability to solve problems, and this when intentionally removed ceases to be classified as a game and becomes an activity.

Also, according to (Schell, 2020), cited by (Lira, et al, 2021), it is possible to stimulate autistic children through the elements that make up a game, such as mechanics, story, aesthetics, and technology.

Games are already present in children's daily lives, thus enabling their development and learning. This technology has characteristics of visual dynamism, proposition of challenges, combination of rules and reward mechanisms. That is, at the same time that a digital game can serve as entertainment, it is possible to align with the teaching and learning process. (Ramos and Cruz, 2018).

Among one of the main advantages for the use of games are: cognitive skills, autonomy in decision-making. The new types of games also enable something impressive and that was highlighted in the pandemic period: contact with people in real time and virtually. In addition, it allows it to become a good educational tool, when aligned with the teacher in the classroom. (Ramos and Cruz, 2018).

In view of the above, the use of digital games in the development of social skills in children with autism has proven to be a significant alternative in the educational and therapeutic field. Autism Spectrum Disorder is characterized by difficulties in social interactions, communication, and restricted and repetitive behaviors. The implementation of digital games adapted to the needs of this population has become an innovative strategy, with the aim of facilitating the learning of essential social skills, such as empathy, communication, and conflict resolution. By integrating digital games into the educational and therapeutic context, it is possible to create interactive environments that favor the learning and practice of these skills, in addition to promoting the engagement of children with ASD in a playful and stimulating way.

This article demonstrates a digital game, working with three main aspects: the development and logic, the import of scenarios and characters and finally the script and

application of the game's sound. The proposal will serve to disseminate the theme in all schools in the country, where people can become aware of a very worrying topic among the various professionals adapted to meet the specific needs of people with autism, offering valuable opportunities for learning and development.

It is in this perspective that this work aims to align the concepts of games with a very important theme, but which is often forgotten. And the digital game can make this link, collaborating with the multidisciplinary and interdisciplinary team. Given the importance between the areas, the development of an educational game was considered, with the objective of being accessible to people with autism. The intention is for the game to be freely accessible through the internet, desktop and mobile devices, helping teachers with the educational process in a playful way.

2 THEORETICAL FRAMEWORK

Thinking about possibilities and innovative tools has been highlighted in the advancement of technology and inclusion and accessibility is no different. Specifically for people with ASD, games have become effective resources in cognitive, social, and motor development for these individuals. This chapter aims to contextualize and support the conception of a digital game aimed at children with autism. For the theoretical enrichment of this work, we highlight concepts of ASD and Digital Games, primordial subjects for this research.

2.1 AUTISM SPECTRUM DISORDER

Kanner (1943) conceived autism as a disorder of affective contact, leading to social isolation. In the 1970s and 1980s, there was a departure from Kanner's vision and autism came to be seen as due to cognitive impairment. In 1980, it was classified as a disorder that would lead to a developmental deviation and not to a delay.

ASD is defined as a neurodevelopmental disorder that results in difficulties in communication and social interaction, as well as the presence of restricted and repetitive behaviors or interests. Such core symptoms are recurrent in individuals diagnosed with ASD in varying degrees, resulting in the adoption of the term "autistic spectrum", which encompasses the heterogeneity of responses to stimuli, maintained skills and evidenced impairments (Höher; Bosa, 2009; Schwartzman, 2011).

Also, according to (PAHO/WHO, 2017), the autism process begins at early ages, up to five years of age, persisting in the adolescent phase until adulthood and there are already cases where people are identified late, only in adulthood. It is common for people with this

disorder to have problems such as epilepsy, depression, anxiety, and attention deficit hyperactivity disorder (ADHD). Also, according to PAHO/WHO | Pan American Health Organization, the autism process begins at early ages, up to five years of age, persisting in the adolescent phase until adulthood and there are already cases where people are identified late. It is common for people with this disorder to have problems such as epilepsy, depression, anxiety, and attention deficit hyperactivity disorder (ADHD). It is important to clarify, according to the same guidelines, that the intellectual development of autistic people varies at different levels.

When thinking about the development of a new technology that involves accessibility and inclusion, it is necessary to understand well the definitions that surround this theme. According to (PAHO/WHO, 2017), Autism spectrum disorder is a series of conditions that compromise people's social behavior, including communication and language, where activities become unique with repetitive actions for these people.

2.2 TECHNOLOGY, DIGITAL GAMES AND AUTISM

The child with autism may have a rigid or inflexible behavior and this can lead to problems in terms of acquiring new habits or having recreation. In this sense, (Cunha, 2012) clarifies that pedagogical activities with the objective of developing the skills of children with autism must be observed aspects such as: sensory capacity; spatial capacity; the ability to symbolize; subjectivity; language; cognition; hyperactivity; stereotypies; psychomotricity; socialization and affection. With regard to digital games, there is a growing use of these in rehabilitation and functional development services. Thus, due to the digital characteristic, which requires little physical contact, low sensory load, intermittent learning with positive reinforcement, digital games can bring more comfort and linearity to the objective proposed with use.

In, (Winnicott, 1975) presents the child's relationship with the object, which according to (Saboia, Gosmes, Viodé, Gilles, Ouss and Golse, 2017) this concept postulates the child's ability to make use of this object and how it can interfere with the traits of psychic organization. The feeling of continuity is absent in the use of objects, which is related to the way the autistic child deals with them. In this, the experience is compromised by the non-spontaneous way of using objects, since the symbolic capacity of play requires skills that need to be developed in the child with (Saboia, Gosmes, Viodé, Gilles, Ouss and Golse, 2017). The use of different technologies for learning purposes is the responsibility of the education and health professional to plan the use of these resources, with well-established guidelines and strategies, as presented (Bölte, Golan, Goodwin and Zwaigenbaum, 2010); (Sigafoos, 2011);

and (Ploog, Scharf, Nelson and Brooks, 2020) the use of some tools for didactic use with a focus on innovation and good practices.

In his work, (Lira, et al, 2021), he highlights learning strategies using technology, presented by (Bölte, Golan, Goodwin and Zwaigenbaum, 2010); (Sigafoos, 2011); and (Ploog, Scharf, Nelson and Brooks, 2013) the use of some tools for didactic use with a focus on innovation and good practices.

(Lira, et al, 2021) highlights that as a result of rigid and inflexible behavior, autistic children have difficulties in acquiring new habits and brings the study by Cunha [8] who manages to demonstrate the development of skills, clarifying that pedagogical activities with the objective of developing the skills of children with autism must be observed aspects, such as: the sensory, spatial capacity to symbolize; Subjectivity; Language; Cognition; Hyperactivity; Stereotypies; Psychomotricity; Socialization and Affection.

Due to its very digital characteristic, requiring little physical contact, the digital game becomes a great ally and in growing use in the most diverse learning, rehabilitation and functional development services. (Lira, et al, 2021) cites the work of (Barbosa, Artoni and Felinto, 2020), which presents an overview of educational digital games for children with autism with a focus on helping communication and literacy present in the market. This research of available games is important for this work, precisely to mark and analyze how expensive some of these games are and therefore not accessible to low-income families.

In his work, (Santos, 2022), he brings the researchers (Alves, Cathcart and Santos, 2017), highlighting that the investment in the accessible games market is still small, due to the low financial return. It also complements the complexity of developing an accessible game, since it involves several characteristics (sound, visual and cognitive).

Still, in his work, (Santos, 2022) highlights (Kettler, et al, 2018), which brings the following reflection: "making a digital environment (website, application, games) inclusive, where all functions are available to all or a large portion of people (users) is the concept of digital accessibility. Collaborating with the difficulties of users. In the environment of a game, this becomes more complex, as a result of the dynamics and differentiated usability that often involves several components for the actions of the characters, thus requiring specific customizations for each type of need."

For Salen and Zimmerman [10] the distinction between "game" and "digital game" is up to the media, particularizing the objectives, strategies and playfulness of the gameplay. The relationship between the two categories (games and digital games) is united by the feasibility of learning through an action. In the context of physical games, which involve board

games, logical reasoning, reading and writing, among others, as educational resources, they stimulate the child's sensory aspects, working on different skills and functionalities.

This section stands out for contextualizing the importance of technology as a potential in helping the development of essential skills for people with autism. Digital games represent an innovative tool and with adaptation will contribute to learning and personal development, in addition to strengthening awareness on the topic proposed here.

3 METHODOLOGICAL PATH

The methodological process begins with a bibliographic survey (scientific articles, digital games on the subject) known as a systematic review of the literature to understand the characteristics and peculiarities related to autism. Among the researches, it was concerned with teaching programs for people with ASD, learning difficulties, accessibility guidelines and related works to understand the difficulties and explore characteristics that had not yet been used. In addition, educational and cognitive activities that could contribute and support the development of the game proposed here were researched.

This process supported the proposal aimed at the development of a game and contributing to the compilation of existing evidence on the use of games and play in the development of children with Autism Spectrum Disorder (ASD). According to Gil (2002), this methodology seeks to identify, evaluate and interpret all relevant research available on a specific topic, providing an understanding of the subject researched.

The databases used for the research were: Scientific Electronic Library Online (SciELO), the Virtual Health Library (VHL) and Google Scholar, in addition to consultations to repositories of theses and dissertations. The terms used in the searches included "Autism Spectrum Disorder", "autism", "digital games", "games for autistics", "games for autistic people", "cognitive functions for ASD", among other related variations.

During the process of documentary research and research in the area of understanding autism, some documents are important to read and among these documents, the DSM-V, the Diagnostic and Statistical Manual of Mental Disorders, a document of the American Psychiatric Association that classifies and organizes the criteria related to mental disorders, is listed. With it, it is possible to find reliable materials and information about disorders, sources, rules, making it a practical, functional and flexible guide organizing information that will help in the diagnosis and collection of evidence.

It is understood that games, because they have great potential for disseminating content, entertainment and motivation, and can be a great tool for the dissemination of knowledge, have become increasingly popular and one of the most promising markets. With

all its versatility, which can be adapted, games can help in the development of motor, cognitive, social and learning skills, serving as a sensory stimulus and contributing to the imitations of each autistic person.

4 DEVELOPED GAME

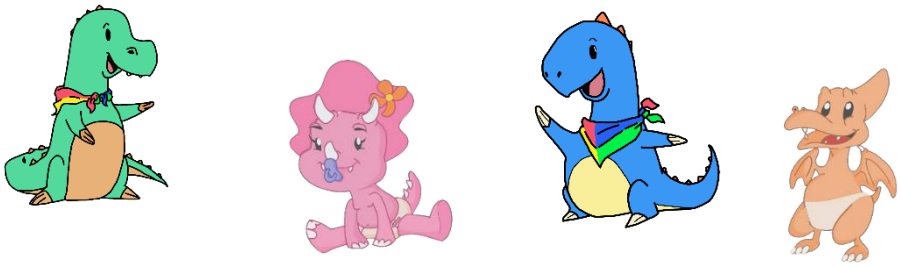
This article demonstrates the development of the digital game proposed here. In the following subsections it is possible to discuss each stage of development.

4.1 CHARACTERS

Here in this subsection we highlight the characters that have been developed for the game. It is important to emphasize that all the art of the games was developed by the students who were part of the team. They were drawn freehand and later transferred to digital software. The green dinosaur is named Tino, while the blue one is Dino. The other characters are Dudinha (the one in pink) and Audism (Orange), represented in figure 1.

Figure 1

Characters: Tino, Dudinha, Dino and Audismo



Authors' Source

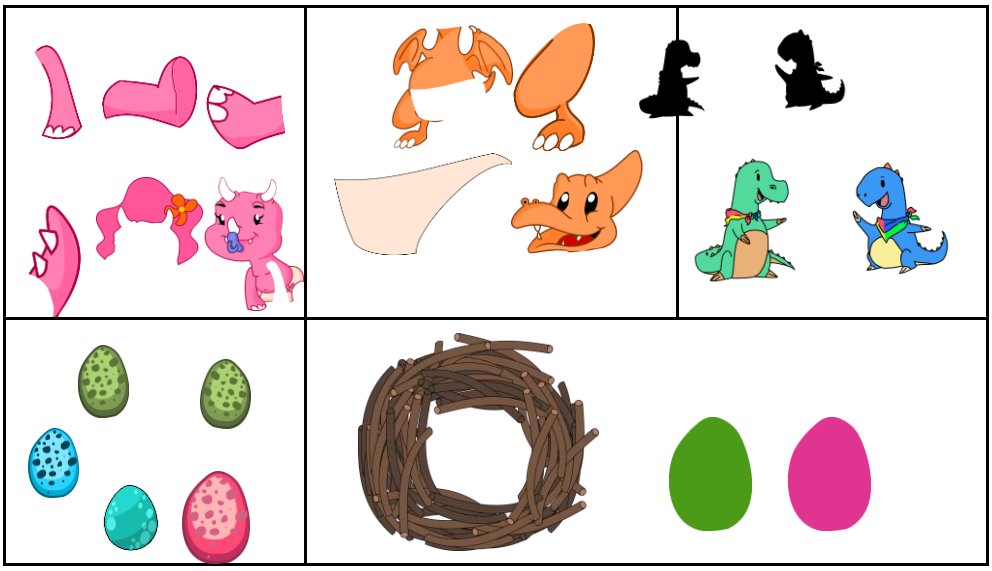
The art developed for this game was based on vector images formed by lines, curves and geometric shapes that have the support of mathematical equations for their definition, contributing to the scalability process, preserving the quality of the image. This is important, as it is a multiplatform proposal and responsiveness is paramount. When comparing it to another art style, such as *pixealart*, for example, it is clear that the visual style is more consistent and modern. When passing this art to the digital medium, the tools used were: Adobe Illustrator and Photoshop and Inkscape.

4.2 GAME MECHANICS

Table 1 describes the sprites developed by the team. Each sprite is used for the mechanics of the game, through the tasks and activities proposed.

Table 1

Sprites of the main characters (separately)



Authors' Source

As you can see, the sprites are organized with the body parts, in the case of Dudinha and Audismo. As for the characters Tino and Dean, they overlap another sprite for the correct combination. In this table, the eggs that are part of the first two scenes were also made available, where players need to make the correct association.

4.3 GAME MENUS

Figure 2 highlights the game menus. When you start the game, the main menu appears, and when you click enter, a second menu appears with a play or credits button. In the credits option, the developers and guidance who participated in the development of the game are listed.

Figure 2

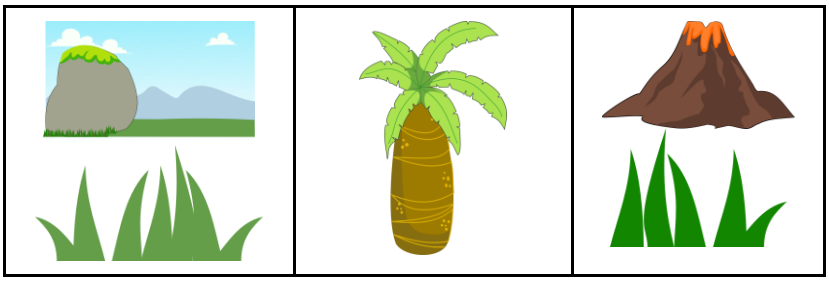
Dino Game Menus

Authors' Source

Table 2 highlights the separately sprites that form the game menu, which when starting the main menu appears and when clicking enter another menu appears with a play or credits button.

Table 2

Sprites for forming the menus (separately)



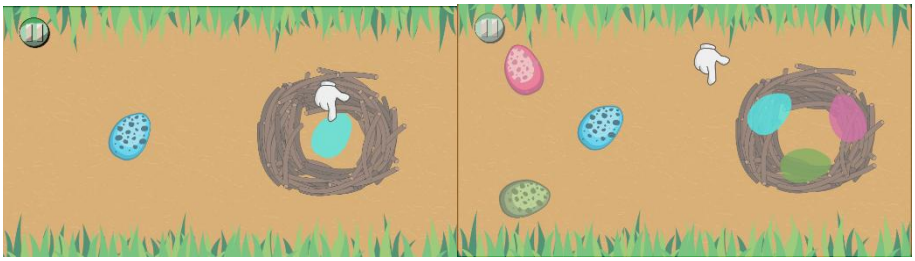
Authors' Source

4.4 THE PHASES OF THE GAME

The first stage to be presented contains a blue egg, where the player needs to drag to the correct combination. When you get it right, an image of congratulations appears and soon after the second phase appears with a degree of difficulty, because now there are 3 eggs and no longer 1. The reasoning is the same, if you hit the 3 combinations a congratulatory image appears with the message of winning. When there is an error in the combination, a simple sound is emitted demonstrating that it was wrong. Represented in figure 3.

Figure 3

Phases 1 and 2 of the Dino Game



Authors' Source

Figure 4 presents the congratulations screen, simple and light. The balloons appear moving so that the player realizes that there is celebration for his or her hit.

Figure 4

In-game congratulations screen

Authors' Source

Figure 5 shows the main phases of the game. In the first image, it is necessary to make the correct association of Tino and Dino. After that, if the player wins, it will be possible to play the Dudinha phase that needs to hit the combination and associate the assets correctly. Finally, Audismo with the same idea as Dudinha. It features the congratulations screen, simple and light. The balloons appear moving so that the player realizes that there is celebration for his or her hit. Each phase was designed to place a support (a hand) to indicate the way and if the player got it right.

Figure 5

Game Levels and Congratulations Screen for Completing All Levels

Authors' Source

4.5 GAME PLATFORMS

Initially, the game proposed here was available on two platforms, including the desktop, available for the Windows operating system and for the *web*. But, with digital convergence and some feedback, a version for mobile devices was developed, but at the moment, only for *Android*. Below, some figures with the game available on mobile are highlighted. A demonstration can be seen in figure 6.

Figure 6

Game Levels and Congratulations Screen for Completing All Levels

Authors' Source

5 OUTCOME AND CONCLUSION

In this article, an educational game was developed that is available to students, education and health professionals and all society that wants to know. The game is aimed at autistic children, allowing them to play in different environments, including residential homes, schools, universities, among others. This game is available on platform *desktop*, *Web* and *Android*. In future versions of this game, it is intended to extend it to the mobile version of the *IOS*.

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