

Professionals' reflections on the use of the *Estimule* Portal in the development of autistic children

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Abstract *The Estimule Portal is a technological tool for healthcare for autistic children, incorporating 97 playful activities with communicative, social and motor skills. The objective was to understand the experiences of using the Estimule Portal from the perspective of health professionals who monitor autistic children in public and private outpatient services, in a capital city in the Brazilian Northeast. Methodological research, with a qualitative approach. The Portal was used by 32 health professionals, who completed an instrument on their socioeconomic profile and the use of technology. The analysis was based on Semiotics. Positive and relevant experiences are reflected, evidencing the increase of technology as a supporting resource for professional practices regarding child development. It also brings negative aspects and needs for improvement. The Estimule Portal emerges as a tool in healthcare for autistic children, if it is conducted by trained health professionals. Its implementation can foster collaboration between multidisciplinary health teams, promoting specialized monitoring.*

Key words Autism Spectrum Disorder, Life Skills, Technology Assessment, Health Promotion

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Introduction

Daily activities are human acts carried out throughout the day and are imbued with purposes, signs and meanings. Subjective and continuous experiences in children's lives involve the development of a set of personal and cultural meanings inherent to the socio-historical processes of each individual. The set of experiences lived by children are structuring actions for the representation of themselves, their family and community^{1,2}.

Children's actions and participation in individual and social environments can be influenced by clinical-functional issues that have repercussions on development, skills and play, as in the case of those with autism spectrum disorder (ASD), which can result in an impoverished repertoire of play¹. For autistic children, persistent difficulties arise in communication and social interaction, as well as in the standardization of acts of restriction, repetition of behaviors, efforts or practice of activities, as postulated by the fifth edition of the American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders (DSM-5)³.

Authors^{1,4,5} also highlighted a relevant scenario in this context. They addressed the play of children with ASD, who may present behaviors that are harmful to experiences that go against subjective actions, in which pleasure, curiosity, sense of humor and spontaneity meet, characterizing a freely chosen behavior from which no specific result is expected. Thus, play involves pleasure, discovery, mastery of reality, creativity and expression, in addition to different performance components, with emphasis on sensory, motor, cognitive, affective and social.

The emergence of various technological devices has become predominant in everyday life, and these have become increasingly popular means of communication in society, especially among children⁶. These resources are also available to professionals and other users for different purposes, especially in the educational and health fields^{7,8}. Thus, the use of technology has offered a range of possibilities in multiple life contexts, including assistance to children with ASD⁹⁻¹¹, which allows for appreciation, integration and inclusion¹².

Different national and international initiatives are presented and considered essential to support the development of practical, socio-emotional and general skills of children living with disabilities, with the aim of providing independence and inclusion, through new tech-

nological approaches involving sensors, virtual reality, robotics, mobile applications, serious games, assistive technologies, portals, websites, e-learning and others¹³⁻¹⁵.

In this scenario, research points to the benefits that technologies bring to children with ASD and the consequences generated in health and educational services, evidencing the development of various skills based on the use of technologies¹⁵. The different effects of interventions with and without technology on daily activities of autistic children are also revealed. The literature¹⁶ shows that both types of intervention are effective for children with ASD, but those not based on technology can have a long-lasting effect, as they do not depend, for the most part, on major auxiliary supports.

Based on this evidence, it is important to guide professionals who work with autistic children on evidence-based interventions that are accessible in technological and non-technological forms so that families living with children with ASD can enjoy the best and most successful care¹⁶. It reinforces that, in this universe, the use of technologies aimed at the development of language, communication, cognitive and motor functions, academic reinforcement and even social interaction of these children is essential^{9,11,17,18}. It is worth noting that, in addition to being able to be used as devices to assist in teaching academic areas, technologies also emerge as supports and increase clinical-functional independence¹⁹.

The development of technologies based on evaluative issues, such as usability and user experience, is important for care provision. Therefore, studies are needed that focus on assessing the use of technologies based on users, families, educators and healthcare professionals who deal with children with ASD^{20,21}.

The use of technological resources for health and education purposes, especially for the promotion of fundamental skills for the development of children with ASD, which prioritize descriptions based on scientifically proven methodologies, are increasingly effective for the development of the biopsychosocial context of children and their families. It is worth noting that the experience of healthcare professionals who use play in their practical context with autistic children can contribute to a more rigorous, efficient and targeted assessment for the target audience, collaborating for a better analysis and use of health technologies in specific contexts with a focus on promoting comprehensive care^{20,22,23}.

Given the complexity and difficulties of autistic children and their families, from playing to other social acts, the question is: what are the perceptions of healthcare professionals about the use of the *Estimule* Portal to assist in the development of autistic children?

Based on this guiding question, this study aimed to understand the experiences of using the *Estimule* Portal from the perspective of healthcare professionals who monitor autistic children in public and private outpatient services in a capital city in northeastern Brazil.

Method

Methodological research was carried out, with a qualitative approach and based on semiotics²⁴, a theoretical framework that assumes that science is permeated by the contribution of systems and processes of meaning in culture and nature. It is added that semiotics studies the forms, types, systems of signs and the effects of the use of signs in life, observing signs, clues, or symbols that give rise to meaning, communication and interpretation²⁴.

Thus, the technological artifact studied – *Estimule* Portal – is a health support tool for use by professionals who monitor children with ASD, which incorporates a database with 97 playful activities classified by skills, such as communicative, social and motor to promote child development.

The *Estimule* Portal was developed in 2021 by an interdisciplinary team from a private university in northeastern Brazil. To design the tool, we investigated skills developed or encouraged by playful activities and resources that contribute to the health promotion of children with ASD, based on a broad review of Brazilian and international literature.

The technology assessment stage, which is the object of this study, was conducted from January to July 2022. In this stage, the procedures adopted included four distinct moments.

Initially, 32 healthcare professionals were recruited through the contact network of one of the study researchers, using the snowball sampling technique²⁵, which is a type of non-probabilistic sampling that uses reference chains and is useful in research with groups that are difficult to access. From an initial informant, people with the necessary profile for the research are located and they can indicate others. In this way, the sample, which was previously difficult to calculate probabilistically or even difficult to access, expands, in most cases, satisfactorily²⁶.

Healthcare professionals with at least two years of clinical experience in caring for children with ASD, who used playful activities (games) in their clinical practice and had skills with digital technologies and availability to participate in meetings for presentation and training in the use of technology were included. Healthcare professionals who only treated autistic adolescents or adults were excluded.

In the second stage, one of the researchers contacted professionals specialized in ASD by email or WhatsApp to present the study. This moment sought to create a link between the research team and participants, clarifying questions and presenting the objectives of the study. After accepting the invitation, an individual online session was scheduled, via Google Meet, according to the date and time previously scheduled.

In the third stage, data collection took place through Google Meet. The session began with participants accessing the tool through the electronic address <https://estimule.vercel.app>, followed by individual training on how to use the *Estimule* Portal. The mean duration was 45 minutes.

The Informed Consent Form (online version) was presented and signed by participants. The researcher then provided a detailed explanation of the data collection instrument (“Technology Assessment Form by Experts”) for later completion by participants. The instrument includes topics related to personal data, professional profile and open-ended questions to collect comments and suggestions about usability, written and visual language (structural aspect), understanding of information contained in the tool, design and functionality²⁷ of the *Estimule* Portal.

Professionals were also instructed to use the *Estimule* Portal at their workplaces or at home, emphasizing that both environments were safe and peaceful, favoring the protection of ethical violations or data compromise. Participants could use the portal for up to 30 days to complete the assessment, and could clarify any doubts with the researcher by phone call or WhatsApp. It is worth noting that professionals were instructed to use the tool regularly. The technology also has a monitoring and follow-up center for users, which allowed the researchers to intervene when they detected that the tool was not being used systematically by participants.

The fourth stage involved returning the forms completed by participants via WhatsApp or email, with subsequent confirmation of re-

ceipt by the researcher. The research followed the confidentiality and secrecy guidelines, in which interviews were not recordings but rather written reports, with only the healthcare professional and the researcher participating.

The information collected from personal data and professional profiles was organized in a database and analyzed using SPSS version 20.0 to characterize participants. The written reports, in the open responses field for comments and suggestions, were organized according to thematic content analysis (pre-analysis, material exploration and treatment of results)²⁵. Interpretative analysis was supported by the concepts of sthemiotics²⁴, giving rise to two topics described in the results.

In order to protect participant identity and anonymity, participants were coded using the letters HP (healthcare professional) and a number. The ethical and legal aspects followed the regulations of Resolution 466 of December 12, 2012, and were submitted and approved by the Research Ethics Committee of a Brazilian university under Opinion 5.182.107.

Results

Based on the snowball technique and eligibility criteria, 32 healthcare professionals were recruited, including 4 physiotherapists, 13 speech therapists, 7 psychologists and 8 occupational therapists, of which 29 were female and 3 were male. Ages ranged from 26 to 56 years, with the majority being between 26 and 35 years old, which indicates that they were younger professionals at the beginning of their careers. However, 27 professionals were specialists, four had master's degrees and only one had a doctoral degree. Regarding the length of experience, the range was from 2 to 25 years.

From the qualitative data, the following topics emerged: positive and relevant experiences; and negative experiences and recommendations. These were analyzed in light of semiotics²⁴.

Positive and relevant experiences

The set of meanings attributed by healthcare professionals emerges from aspects that provided positive experiences with technology. The experience, as a subjective construction, is shaped by a series of factors that go beyond the simple functionality of the tool. Hence, semiotics²⁴ allowed us to unveil the layers of this mean-

ing that made up these experiences, revealing how it is constructed, shared and transformed over time. Thus, the *Estimule* Portal was able to evoke several reactions in participants, which refer to the following aspects: technology accessible from anywhere; relevant content; simple and easy-to-understand language; meeting the needs of the children assisted; contributing to encouragement of children by professionals, family members and educators; improving interaction of children with professionals, family members and educators.

Very cool technology. It offers simple and easy-to-understand content and language. It is a tool that professionals will always have available to access regardless of where they are, when they need to apply an activity, meeting the child's needs (HP3).

I would like to congratulate you on the platform initiative. The content will be of utmost importance and contribution to professionals, family members and educators, [...], in addition to enabling creative development and interaction between children and parents (HP19).

[...] The idea is wonderful because it will help parents at home to encourage their children through the games that are on the portal, [...] I think this tool could also be extended to other professionals beyond the health area. Congratulations! (HP24).

Negative experiences and recommendations

Another finding of this study and a relevant point for reflection was the use of the portal, experienced regularly by participants. Some aspects pointed out were considered unfavorable, which refer to the structural and presentation aspect of the portal. Despite this, these aspects were considered potentially valuable by the evaluators, and this in-depth, rich and complex reflection favored understanding these (negative) reports, which predicts a strong contribution to (re)formulating these elements, providing a more effective portal that is suited to the needs of healthcare professionals and everyone involved. As the reports show:

The structure of the application can and should be improved further. Using resources such as videos, photos or illustrative images. Some text settings leave something to be desired, whether due to the font size or the text layout (HP4).

I think the material left something to be desired, with only images and/or videos. We know that many children with ASD like to watch,

and this facilitates imitation, which is a tool for speech. If there were images or videos, it would be easier for the child and therapist to view (HP7).

[...] I believe the portal should be more playful, objective and direct, with pictures of the games and less text. It ended up being very repetitive and tiring, [...] giving space to more self-explanatory information would make the tool more attractive (HP18).

I believe that with images of the games and a more objective explanation, it would be more functional. I found the same explanation for games at different levels tiring (HP32).

Despite the comments presented, professionals pointed out that the portal is presented as a supporting tool and that it can contribute to providing assistance to children with ASD.

[The portal] is relevant because, thinking about the future, in addition to passing through the hands of specialists, it could reach the hands of other caregivers or other audiences, such as education professionals. [...] this way it can assist and provide continuity to therapy services at home, or even in other environments, ensuring that the child does not remain only in the therapeutic environment... (HP4).

The games included in the Estimule Portal are important for child development, whether for children with ASD or children with typical development, as they work on a set of skills that are important for development. It is important to highlight the importance of a multidisciplinary assessment, as well as seeking guidance from the professional who is monitoring the child, in case the person responsible/caregiver needs any necessary adaptation in the game [...] (HP17).

Discussion

The profile of the interdisciplinary team that develops and assesses health technologies supports other studies, so the participation of this team in the different stages of the development and assessment of health technologies is crucial to ensure that these tools are clinically relevant to everyday care practices. The diversity of knowledge and perspectives of healthcare professionals, engineers, designers and computer scientists, among others, contributes to the creation of solutions that are more aligned with the needs of users and the health system^{28,29}.

As highlighted by the authors³⁰, the complexity of contemporary health systems requires an interdisciplinary approach to technology development. Integrating knowledge from dif-

ferent areas is essential to ensure that health innovations are effective, safe and acceptable to users. Moreover, the perception of end users, especially patients, is also an essential aspect to be considered, since the technology must be intuitive and easy to use. As highlighted by Mohammadzadeh *et al.*²⁸, the active participation of users in the development process favors the adoption of technologies and the achievement of better health outcomes.

The findings of this study reveal that the Estimule Portal was configured for participants as an easy-to-use, dynamic tool, with language appropriate for users, in addition to being important for encouraging child development.

In this context, the semiotic theory²⁴ helped researchers verify fundamental points about the portal assessment, making evident professionals' understanding of the effects of meaning of significant elements (language, functionality and content - games) inherent to the therapeutic conduct and the comprehensive care necessary to assist children with ASD.

Healthcare professionals' statements demonstrate positive experiences, given the regular contact with the tool, mainly in relation to the support that playful activities (games) provide to children with ASD and the possibilities of encouraging communication, social and motor skills, favoring the comprehensive care of these children.

The importance of a reflective/evaluative approach, through experiences, demonstrates that this is a process capable of assessing the potential of the technological tool and the relevance of its attributes, being an indispensable stage in the process of using technologies. It is therefore important to emphasize that careful assessments of technologies developed for the fields of health and education should be encouraged. For this reason, many studies are carried out to assess the effectiveness and reliability of these resources^{16,31,32}.

As for the sections that refer to negative experiences and recommendations, there are notes that express the need to improve the Estimule Portal with regard to the provision of images and videos, making it more playful. It is believed that this change will be favorable to provide subsidies, supporting clinical practice and extending to other environments. From this perspective, semiotics²⁴ makes it possible to improve human-technology communication processes, making it more effective.

Despite some advances in the implementation of technologies, a study³³ on the devel-

opment of an online program for caregivers of autistic children used texts and video demonstrations to teach methods to improve children's linguistic, social and adaptive skills. It is admitted that the use of the program for four months did not significantly influence children's social communication compared to parents who did not have access. In this light, the authors recommended that more time be spent using the program³³. Therefore, it is prudent to take this factor into consideration in the next stages of research on the *Estimule* Portal.

The use of technological resources in the monitoring of children with ASD, when carried out early and supported by parents, has proven to be an important choice for achieving development goals in early childhood. Hence, the application of technological resources of any nature, including mobile health technologies (mobile health or mHealth technologies), are important for health promotion³⁴.

Despite these reflections, the advent of technologies seems to support the trend of benefits of new technological approaches. On the other hand, meta-analysis carried out on digital health interventions (DHI) highlighted 30 studies targeting ASD, attention deficit/hyperactivity disorder (ADHD), anxiety, depression, psychosis, eating disorders and post-traumatic stress disorder. This review showed that the benefits of digital interventions in the treatment of ASD, ADHD, psychosis and eating disorders are uncertain and there is a lack of evidence on the cost-benefit ratio of these interventions³⁵.

In articles reporting an integrative review⁶ and a meta-analysis³⁶, the authors showed the review of digital interventions in the treatment of ASD, in which 19 studies were assessed, namely: 14 computer programs; three applications for tablets; one robot; and one interactive DVD. It is clear that the research shows a low overall effect size, in addition to high heterogeneity in the studies, limiting the assessment of results and showing the need for more studies for assessment, as there are still methodological limitations, with standards that refer to the validation of these technological resources^{6,36}.

Although this is the first experience of using the *Estimule* Portal after its conception and development, it is understood that the reflections brought by participants were fundamental to identify their perceptions about the tool, highlighting the potentialities and weaknesses for later adaptations.

It is worth noting that studies on methods focused on evaluative, reflective and experien-

tial approaches are limited²⁰. However, there are increasing efforts to develop research to assess health technologies, specifically mobile applications. No studies were found on a single assessment approach, but one article³⁷ presents some criteria: a usability review and content quality.

The evaluators considered the use of the *Estimule* Portal by potential users, which goes beyond healthcare professionals. Evaluators' proposal favors the expansion of the use of technology for families and schools, incorporating the portal as a mediating instrument in a collaborative perspective to help encourage these children and allow this practice and interaction to be more effective, based on the games included in the portal.

It can be seen from the results that supporting the development of essential skills that improve the health conditions of children with ASD is essential, especially with technology-mediated care. Therefore, the descriptions produced are aligned with semiotics²⁴, which helped in understanding how healthcare professionals appropriated, experienced and gave meaning to their interaction with the tool. It can be seen that evaluators' experiences of use allowed the identification of similar meanings, making it clear that there is a need for this tool to be expanded to other users, in addition to healthcare professionals.

The importance of theoretical and practical knowledge of professionals from different areas stands out, highlighting strategies arising from technological resources that, in addition to promoting actions that involve playful situations, as is the case of the *Estimule* Portal, have a focus on inclusive proposals that contribute to the improvement and development of skills of children with ASD^{37,38}.

The reports show that the *Estimule* Portal can bring significant benefits to interventions carried out by professionals in a clinical environment and also to continuity of care by family members at home and educators at school. The relevance of being able to provide attitudes and behavioral changes in family members, caregivers and educators is clear, through the knowledge gained, when using games that are allocated in the tool with children in the act of playing.

The study provides important insights and shows researchers the need to make adjustments to the portal, including organization, layout, texts, colors, among others, in order to meet users' suggestions. This way, it is possible to encourage continuous improvement of the system and make the user experience more pleasant²⁷.

The issues arising from the content presentation assessment bring to the table reflections on the conduct of possible readjustments and reformulations of games. Thus, healthcare professionals' engagement in these notes is of fundamental importance, since the tool is not yet ready for effective use, requiring back and forth, exchange of experiences, tests, assessments until its use is fully validated for end users²⁷. It is important to note that these phases are complementary and can be accessed several times until product excellence is achieved.

The next stages of this research foresee that the *Estimule* Portal will undergo improvements to promote a better organized, structured technological environment, with complete, accurate, motivating and pleasant information, enabling children with ASD to learn various skills.

Final considerations

The study emphasizes the role of the *Estimule* Portal from healthcare professionals' perspective and highlights their perceptions regarding its usability. The portal is seen as a supporting resource of quality and transformation for practices that use play for the development of children with ASD.

Many of the reflections brought by participants about the use of the *Estimule* Portal are positive, as they considered it a technology to support healthcare for children with ASD, offering different therapeutic alternatives through play. Positive perceptions fall on the following aspects: easy-to-access technology; relevant content; simple language; meeting the needs of the children assisted; contribution to the encouragement of children by professionals; improvement of interaction of children with professionals, family members and educators.

The unfavorable experiences with the portal concern the way the content is presented, which needs to be made clearer, despite being considered relevant. The structural and presentation aspects also require improvement to improve the user experience. Furthermore, professionals reveal the need to review and expand the visual cues and use multimedia resources to improve the tool.

Qualitative research, based on listening to participants, applying content analysis strategies and relying on semiotic theory, made it possible to verify that the *Estimule* Portal is seen by healthcare professionals as a powerful tool capable of contributing significantly to supporting healthcare for autistic children. It can also favor interaction within the multidisciplinary team and expand its use to other audiences (parents and caregivers) and professionals (educators), contributing to qualified monitoring of these children.

Therefore, by understanding the target audience's concerns and challenges, it is possible to develop innovative and personalized solutions that meet their specific needs. The results of this study support national and international literature, which points to the growing importance of technology in the field of health and, in particular, in the care of children with ASD. By identifying situations that can be transferred to other contexts, this work contributes to the advancement of research and the implementation of more effective practices. Thus, the need for technological tools, such as the *Estimule* Portal, that facilitate communication, social interaction and learning for children with autism is urgent and requires the collaboration of professionals from various field, such as health, education and technology.

The implementation of these technological tools in public healthcare services can represent a significant advance in the care of children with ASD. However, for these technologies to be effectively used, rigorous assessment and public policies that encourage their acquisition, development of qualified human resources and integration of these tools into work processes are essential.

The creation of collaborative networks between healthcare professionals, researchers and technology developers is essential to overcome challenges and ensure the sustainability of initiatives. In addition to this, it is necessary to consider the particularities of each context and involve families and caregivers in the process of developing and implementing these tools so that the solutions meet their needs and expectations.

Collaborations

All authors participated equally in all stages of preparation of the article

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