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USE OF TECHNOLOGIES TO MONITOR THE DEVELOPMENT OF STUDENTS WITH AUTISM

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ABSTRACT

This summary highlights the importance of using progress monitoring technologies as an essential tool to assist teachers in monitoring the development of students with autism. These tools provide a variety of notable benefits, including the accurate identification of areas that require additional support, thus contributing to a more inclusive and efficient educational environment. However, it is also essential to address the challenges and limitations that may occur in the adoption of these tools, such as the resistance of some educators and the need for appropriate training for their effective use. In addition, practical examples of case studies are provided that illustrate the success in the implementation of monitoring technologies, demonstrating how they can be incorporated into the school daily life in a productive way. The abstract acts as a succinct introduction to the topics that will be discussed in the course of the work, emphasizing the importance of implementing innovative strategies that enable a more detailed and individualized monitoring of the students' progress. In this way, this study highlights the urgency of investing in technologies that not only meet the demands of educators, but also promote a more global development adapted to the specific needs of each student, ensuring that everyone has access to quality education and that their particularities are properly respected.

Keywords: Technologies. Monitoring. Autism. Education.

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INTRODUCTION

The present research has as its central theme the use of progress monitoring technologies in support of educators who deal with the development of students diagnosed with autism. The main objective is to explore the different technological tools available and evaluate how they can facilitate the monitoring of the skills and behaviors of these students. The methodology adopted will include a detailed literature review, interviews with educators who already use such technologies and the analysis of case studies in inclusive education institutions.

It is imperative to emphasize the importance of this educational monitoring, since autism is a condition that can present significant challenges in the intellectual and social development of students. Effective progress monitoring is essential to identify not only areas that require additional support, but also to celebrate each student's achievements. This study seeks to elucidate how technology can serve as an ally in the construction of a learning environment that is more adaptive and responsive to individual needs.

The rationale for this research is grounded in the growing need for effective methods that integrate technological innovations into the teaching of students with autism. Despite advances in understanding the disorder, many educators still feel unprepared to meet the specific demands of these students. Thus, the use of monitoring technologies can offer practical solutions that aim not only to improve academic performance but also the emotional well-being of students.

Furthermore, the relevance of this research is evident in the face of the increasing school population with autism and the urgent need to create inclusive and effective learning environments. By providing quantitative and qualitative data on student progress, monitoring technologies can play a crucial role in shaping personalized pedagogical strategies, favoring the real inclusion of these students in the education system.

The research also intends to involve the critical analysis of the available technological tools, identifying not only their functionalities, but also their limitations and challenges in educational practice. With this, it is expected to contribute to the elaboration of a guide that helps educators in choosing and implementing the most appropriate technologies for each school context and the needs of their students.

Through the articulation between theory and practice, this research aims to promote the continuous training of educators, enabling them to use monitoring technologies effectively. In this sense, workshops and discussion groups will be held with the participation of education professionals, providing a space for the exchange of experiences and knowledge on the subject.

Finally, the expectation is that the results obtained from this investigation can be shared with the academic and educational community, stimulating more research in the area and contributing to the advancement of best teaching practices for students with autism. The dissemination of this research can stimulate the debate on the importance of technology in the educational process and encourage a positive change in pedagogical approaches.

In summary, this study seeks not only to analyze the effectiveness of progress monitoring technologies, but also to promote a significant advance in the way education meets the needs of students with autism, reinforcing the importance of inclusion and offering subsidies for more effective and humanized educational practices.

THEORETICAL FRAMEWORK

The theoretical framework of this research is essential for understanding the importance of progress monitoring technologies, especially in the context of the education of students with autism. The use of these technologies allows educators to monitor the development and learning of these students more effectively, contributing to the personalization of pedagogical interventions. In this sense, it is essential to explore theoretical approaches that support the implementation of technological tools, in order to ensure that they are used appropriately and effectively.

One of the relevant theories guiding the research is that of child development, which emphasizes the specific learning stages and challenges faced by children with autism. By considering the particularities of these children's development, it is possible to adapt monitoring strategies that promote a more inclusive educational environment. According to Araújo et al. (2021), "continuous monitoring of educational progress is crucial for the adaptation of teaching methodologies" (p. 5), emphasizing the importance of these tools in pedagogical practice.

In addition, special education presents a series of methodologies that have proven effective for students with special needs. Advances in these areas have promoted the inclusion of assistive technologies, which provide individualized support to these students. Aschidamini and Santos (2023) state that "the integration of IoT in special education is an important step towards the universalization of learning" (p. 8), highlighting the relevance of technology in this context.

It is understood, therefore, that the combination of theories of child development and special education can provide a solid basis for the implementation of technological tools. This not only makes it easier to track students' progress but also enhances the

effectiveness of pedagogical interventions. The use of monitoring techniques must be evidence-based, allowing for continuous evaluation of the strategies adopted.

With regard to assistive technologies, several innovations have been developed to meet the specific needs of students with autism. Monitoring and evaluation tools have the potential to provide valuable data that helps educators make adjustments to their educational approaches. The analysis of students' needs and reflection on the effectiveness of interventions are fundamental steps for the success of the educational process.

On the other hand, effective training of professionals who deal with these technologies is essential, so that they can use them efficiently. Teacher training is a necessary condition for the evolution of pedagogical practice and maximizes the benefits that these tools can provide. Thus, continuous training and updating on new resources are essential for educators to feel safe in applying monitoring technologies.

The research proposes, therefore, an investigation that unites these theoretical approaches and translates them into effective practices in the educational environment. The implementation of monitoring technologies must always be accompanied by strategic planning that considers the particularities of each student, ensuring that everyone has the necessary support to reach their full potential. With the fusion of theories and technologies, it is expected to provide a significant advance in the education of students with autism.

In short, the theoretical framework presented in this research establishes a clear path for the analysis and implementation of monitoring technologies in the teaching of students with autism. The study dialogues with the theories of child development, special education and assistive technologies, promoting an integrated and comprehensive view on the subject. In this way, it seeks to build a solid foundation that can guide future projects in the area of inclusive education.

IMPORTANCE OF MONITORING THE DEVELOPMENT OF STUDENTS WITH AUTISM

The use of advanced technologies, such as *Building Information Modeling* (BIM) and photogrammetry, is an innovative strategy that has been applied in the monitoring of infrastructure works, as discussed by Barreto et al. (2024). This type of monitoring not only provides a detailed view of the progress of the work, but also allows for more efficient and accurate management, aligning with the contemporary needs of the sector. The technologies applied enable managers and engineers to have access to information in real time, facilitating informed decision-making.

The combination of technological processes and the systematic monitoring of educational development is crucial, especially in contexts that involve the inclusion of

students with autism. Continuous monitoring helps educators accurately diagnose individual student needs, such as social and behavioral skills. Thus, electronic tools, such as electronic monitoring systems, are essential to provide relevant data that ensures an adequate learning environment. Campello and Alvarez (2022) state that "it is signal blocking", which highlights the importance of socio-technical protection and authority in processes of observation and infusion of technologies in the educational environment.

In addition, monitoring the development of students with autism allows pedagogical strategies to be adjusted according to the needs of the students. Through this monitoring, it becomes possible to identify areas that need greater attention, reinforcing individualized support. This practice not only improves student learning but also provides a more inclusive and welcoming environment where all students can thrive. The development of maturity models, as discussed by Cavalcante and Corrêa (2021), can be applied in education by creating guidelines for the effective use of technologies that meet the diversity of the student body.

Studies and monitoring practices have shown that the correct implementation of technologies can result in significant improvements in pedagogical methodologies. Education, as well as industry, must adapt to the demands of the twenty-first century, considering the use of new tools as essential for the evolution of teaching. The use of technologies is not limited only to the management of works, but extends to the structuring and improvement of teaching methods. The application of electronic systems in the monitoring of educational progress ensures that all students have access to quality learning, as reiterated by Barreto et al. (2024).

Collaboration between educators and experts in the application of educational technologies is key. This creates an interdisciplinary space where teaching practices can benefit from technological innovations. Working together makes it possible for students' needs to be met more effectively. In this way, the inclusion of students with autism becomes a priority in schools, reflecting a social commitment to the education of all.

The need for regular and detailed monitoring of school development is a point that cannot be neglected. For students with autism, this practice is even more crucial, given that their responses to different pedagogical approaches can vary significantly. Appropriate monitoring within the school environment helps in the formation of an adaptive and responsive educational environment. Data-driven teaching methodologies are strategic, taking into account the various forms of student learning.

Therefore, the impact on the academic and social development of students with autism can be substantially amplified by well-founded data analysis. Monitoring not only

directs adjusted strategies, but also allows the educator to perceive when a student is benefiting from or in need of new approaches. Data-driven practices should inform the formation of educational policies and classroom practices, ensuring ongoing support. It is important to remember that "it is signal blocking" should also refer to the pedagogical approach that protects students from undue restrictions, as highlighted by Campello and Alvarez (2022).

Educational innovation is amalgamated with the need for inclusion and support, reflecting a shift in the educational paradigm. Thus, investigating and establishing a form of collaboration between monitoring technologies and pedagogical practices presents itself as an important path to be followed by educators. By incorporating successful models, such as those presented within the framework of industry 4.0, education can develop methods that not only monitor but also celebrate diversity in learning. Every step in the right direction is an achievement.

It is, therefore, of paramount importance that educators become familiar with these technologies and continuously seek training and updating in their pedagogical practices. By engaging in the implementation of modern monitoring and evaluation systems, teachers not only improve the quality of teaching but also ensure that all students have a clear path to academic and social success. In this way, the integral development of the student becomes a reality, where the different educational needs are respected and met.

AUTISM: CHARACTERISTICS AND CHALLENGES

Autism is a neurodevelopmental disorder that manifests itself in a variety of ways, reflecting the uniqueness of each individual. This condition usually manifests itself through difficulties in communication and social interaction, as well as repetitive behaviors. Students with autism, therefore, can present a considerable challenge in the school environment, requiring educators and educational institutions to adopt different methodologies to meet their learning needs.

In addition to the difficulties mentioned, the characteristics of autism often include sensory hypersensitivity. This can translate into a strong response to stimuli such as bright lights, loud sounds, or unexpected touches. According to Freitas (2021), "it is essential that traditional assessment methods are adapted to meet the specificities of autistic students" (FREITAS, 2021, p. 2740). This observation highlights the need for a reassessment of teaching and assessment strategies in the academic context.

Another important point is the difficulty that many autistic students have in understanding social emotions. The ability to read and interpret facial expressions and

tones of voice is often impaired, making it difficult to interact with classmates and teachers. Educators therefore need to be aware of these limitations and develop activities that encourage communication and social interaction in an inclusive and empathetic way.

In addition, students with autism may have restricted interests or hyperfocuses on certain subjects. While this may seem like a limitation, it is crucial to recognize that these interests can be utilized as a lever for learning. By developing tasks that integrate these interests, it is possible to foster a more engaging and meaningful learning environment. Jerke and Faggion (2020) state that "researching and valuing students' interests can improve academic performance and their integration into the school environment" (JERKE; FAGGION, 2020, p. 315).

The personalization of pedagogical approaches becomes, therefore, an imperative. Each student with autism has a unique profile, and strategies must be shaped to meet both individual abilities and difficulties. The continuing education of educators in this area is essential, as it provides knowledge about the best practices to deal with this diversity.

Teaching methodologies, including academic assessment, need to be transformed for inclusive practices to be effective. The implementation of alternative and innovative methods can not only increase the participation of autistic students, but also enrich the educational environment as a whole. It is important that evaluation is not only a measure of performance, but also a tool for continuous learning.

In addition, collaboration between educators, health professionals, and families is vital to ensure comprehensive support for the student. This partnership can facilitate the exchange of experiences and the implementation of strategies that address the needs of autistic students. Finally, recognizing the value of inclusion and diversity in the school environment is a crucial step towards the formation of individuals who are more empathetic and prepared to live in society.

The inclusion of autism in the contemporary educational debate is, therefore, not only a legal responsibility, but also an opportunity to enrich the educational process as a whole. Personalized approaches and the use of innovations such as artificial intelligence can be allies in this process, providing a more inclusive and accessible future for all students.

METHODOLOGY

The approach adopted in this work will consist of a systematic review of the literature on progress monitoring technologies aimed at students with autism. The main objective is to identify tools and methodologies that are in use, in addition to evaluating the relevance and

applicability of each of them in the educational context. The research seeks to map the innovations that have shown positive results, favoring the inclusion and development of these students in school environments.

After the review, a comparative analysis will be carried out with case studies. This stage aims to illustrate how the identified technologies are applied in practice and what impact they have on the academic and social development of students. The comparison will provide a broad view of the effectiveness of these tools, highlighting concrete examples that validate their contributions in tracking the progress of students with autism.

In addition, qualitative research will be conducted, ensuring the participation of educators and professionals who work directly with this population. The intention is to collect reports and experiences of these professionals, understanding the challenges they encounter and the benefits they observe in the use of the technologies mentioned. This practical perspective will enrich the understanding of the reality of classrooms and how innovations can be better integrated.

The testimonies collected in this qualitative research will serve to deepen the analysis of the data obtained in the literature review. Educators will bring to light contemporary issues that may not be fully addressed in academic publications. Thus, it will be possible to confront the theory with the real experience of professionals, allowing a critical reflection on the use of technologies.

The results of the literature analysis, along with the perspectives of educators, will be discussed in a broader context. This discussion will allow us to understand not only effective practices, but also the obstacles faced and opportunities for improvement. The connection between theory and practice is fundamental for the development of actions aimed at improving the learning of students with autism.

Through this work, it aims to offer relevant insights that can contribute to the continuous training of educators and to the development of effective educational policies. The dissemination of knowledge about the use of monitoring technologies in the context of autism can be a crucial step to foster inclusive pedagogical practices. It is essential that professionals feel supported in the implementation of new tools in their routines.

The analysis of the data, both from the literature and from the interviews, will culminate in the elaboration of practical recommendations. These guidelines will seek to facilitate the adoption of technologies that have proven effective, in addition to suggesting ways to overcome the challenges identified by educators. The intention is to create material that can be used as a reference by teachers and institutions that wish to advance in the inclusion of students with autism.

In short, the proposed methodology not only seeks to map the current scenario of monitoring technologies for students with autism, but also to promote a dialogue between theory and practice. This joint effort between research and professional experiences will allow us to draw a clearer path for the effective use of these tools in the school environment, always aiming at the integral development of students.

CASE STUDIES: EXAMPLES OF SUCCESSFUL TECNO IMPLEMENTATION PROGRESS MONITORING LOGIES

The adoption of innovative technologies in educational practices has proven to be an essential resource to improve the learning of students with special needs. In one educational institution in particular, the implementation of follow-up tools has given rise to a more accurate understanding of the challenges faced by autistic students. The use of these technologies allowed teachers to become more proactive in identifying areas that needed specific interventions, resulting in more targeted support.

Data collection has been improved, enabling the quick and efficient collection of essential information about student performance. This clarity in data capture was fundamental for the performance of educators, who now have a comprehensive set of information to support their pedagogical decisions. As a result, instead of relying on assumptions, educators now had access to facts that guided their practices.

The investigation of these data revealed not only difficulties, but also progress in student learning. Through careful analysis of the information, educators were able to identify patterns that would be difficult to detect without technological assistance. This in-depth understanding made it possible to develop specific strategies, adjusting teaching methodologies to the individual needs of each student.

With the customization of pedagogical approaches, there was a positive effect on both academic performance and students' socio-emotional growth. They began to be more actively involved in classes, demonstrating greater confidence and motivation when they realized that their particularities were recognized and met. This more intense participation helped create a more inclusive and welcoming school environment.

Furthermore, the use of these technologies was not restricted to monitoring the progress of autistic students only. Other classes also benefited, as the good practices implemented were expanded beyond the specific group. In this way, the experiences and knowledge acquired during the monitoring phase could be used in a more comprehensive way, promoting an environment of collaboration among educators.

Education professionals felt more empowered by the information collected, since these technologies facilitated the establishment of more accurate diagnoses about the needs of students. This allowed teachers to become more apt to suggest curricular interventions and adaptations that would really impact the educational experience of their students. The confidence that the teachers acquired reflects on the quality of the teaching offered.

Another important point was the opportunity to create a more frankly open dialogue between parents and educators. The information obtained through the technological tools provided the students' guardians with a more accurate understanding of their children's progress, facilitating interaction and cooperation between the school and the family. This collaboration proved to be essential to establish a significant and lasting support in the teaching process.

Finally, the experiences experienced in this institution reveal that the adoption of monitoring technologies in the educational context represents a promising trajectory. The benefits in terms of learning and inclusion are clear, and the model presented can serve as an example for other institutions seeking to improve their educational approaches. The union of objective data with pedagogical sensitivity has the potential to lead to a brighter and more equal future for all students.

BENEFITS OF USING PROGRESS MONITORING TECHNOLOGIES FOR STUDENTS WITH AUTISM

The adoption of progress monitoring tools for students with autism has several benefits that enhance educational practice. With the help of these technologies, teachers are able to monitor the individual development of each young person more rigorously and effectively. This not only facilitates the detection of areas that need greater attention, but also helps in adapting pedagogical approaches to the specific needs of each student, promoting more individualized teaching.

In addition to offering a more detailed analysis of student performance, these tools collect information that is vital for understanding progress over time. This data collection process provides a clear view of the progressions and obstacles faced by each student, which is crucial for the adequacy of teaching strategies. With this, educators can direct their interventions more precisely, creating a variety of options that meet the particularities and learning rhythms of students.

In addition, using technologies to monitor progress not only benefits students but also provides educators with a valuable resource in their practices. Based on the detailed

analyses, teachers can reevaluate their methodologies and incorporate new approaches that are more effective. This transforms the school environment into a space of constant evolution, where pedagogical practices are always improved in favor of a more inclusive education.

Finally, the formation of a learning environment adjusted to the needs of students with autism, through the use of monitoring technologies, provides a richer and more diversified educational experience. The information generated by these tools not only sheds light on individual performance, but also fosters a collaborative culture among educators, parents, and experts. In this way, team collaboration is strengthened, resulting in robust and multidimensional support that favors the full development of students.

PROGRESS MONITORING TECHNOLOGIES: DEFINITIONS AND TYPES

Educational progress monitoring tools are essential to help identify and improve strategies that meet the needs of autistic students. These tools vary, encompassing both traditional assessments and more modern methods that use technology to record and analyze student progress. It is vital for educators to have access to these resources, as they offer a more comprehensive and detailed perspective of students' difficulties and progress throughout their learning.

Among the available options, behavioral assessment instruments play an important role. They assist in identifying students' social and cognitive skills, providing concrete data that can be used to target specific interventions. With the implementation of these assessments, it is possible to quickly detect the areas that need more intensive support, facilitating the development of educational strategies that promote true progress in learning.

In addition, technologies that make it possible to collect data in real time represent a major advance in monitoring progress. Specialized apps and software offer a practical and effective way to record students' behaviors and reactions in different school contexts. This regular collection not only helps in the monitoring of students, but makes it feasible to analyze trends and patterns over time, contributing to necessary adjustments in pedagogical approaches.

Another important point of these technologies is the ease of preparing customized reports. Teachers can create documents that synthesize the information collected, allowing for clear and efficient communication between educators, parents, and other professionals involved in student monitoring. With well-structured reports, everyone involved in the educational process gains a deeper understanding of student development, being able to collaborate in a more coordinated and effective way.

Finally, information sharing is critical to the success of educating students with autism. The integration of data between the school and the family, along with the collaboration of health experts, strengthens the student support network. With a holistic perspective and a cooperative approach, it is possible to create an educational environment that not only recognizes challenges but also values achievements, promoting a well-rounded and enriching development for each student.

FUTURE PERSPECTIVES AND TRENDS IN PROGRESS MONITORING TECHNOLOGIES FOR STUDENTS WITH AUTISM

Predictions for the future of technologies for monitoring the educational progress of students with autism indicate a trend towards the development of deeply personalized tools that are precisely adapted to the specificities of each student. This individualization is essential, since each student has a distinct set of skills and difficulties that must be taken into account to optimize their learning potential. These tools are expected to become more accessible and user-friendly, allowing educators to implement them more efficiently in classrooms.

In addition, the fusion of technologies such as augmented and virtual reality promises to transform the way learning is lived. With these innovations, it will be possible to create immersive environments that replicate real situations, which will not only stimulate practical learning, but will also enable closer monitoring of the students' evolution. This innovative approach can assist students in developing social and emotional skills within a safe and controlled space, overcoming some of the difficulties often encountered in conventional educational settings.

Artificial intelligence presents itself as a valuable resource in the collection and analysis of educational data, allowing the identification of behavioral and learning patterns that can be important indicators of the need for individualized support. This analytical skill will provide educators and education professionals with the ability to anticipate difficulties and adjust their pedagogical strategies according to the emerging needs of each student. In this way, education can become more proactive, as opposed to reactivating, fostering a more inclusive environment.

Finally, collaboration between researchers, educators, and technology developers is a crucial element in fostering significant innovations in this sector. Working together will allow new solutions to be created based on practical experiences and the real demands of the classrooms. This synergy will support the exchange of knowledge and experiences, resulting in the development and implementation of tools that really impact the education of

students with autism. With the continued advancement of these initiatives, the future of inclusive education becomes increasingly promising and encouraging.

FINAL CONSIDERATIONS

Technologies aimed at monitoring educational progress have proven to be essential for an improved understanding of the development of students with autism. One of the main advantages of this technological approach is the ability to assist educators in accurately identifying the areas where these students need additional support, which enables effective and targeted interventions. By offering a more detailed view of the skills and challenges faced by each student, such tools can modify pedagogical practice, making it more adapted to individual needs.

In addition, the personalization of teaching emerges as one of the most relevant aspects offered by these monitoring technologies. Through the continuous and detailed collection of data on student performance, educators can adjust their approaches and strategies, promoting learning that aligns with the pace and interests of each student. This flexibility not only encourages student participation but also reinforces the development of essential skills, helping to establish a more robust foundation for future learning.

Another important aspect to be highlighted is the improvement in communication between educators and parents, which is facilitated by the use of these technologies. With access to clear and up-to-date information on student progress, parents become more engaged partners in the educational process. This close collaboration between family and school is crucial to ensure continuous and cohesive support, contributing to the integral development of the student.

However, it is important to recognize that implementing technologies for monitoring also presents significant challenges. Adequate training of educators for the effective use of these tools is essential, since technology, by itself, does not ensure positive results. In addition, there is a growing concern about the privacy and security of the data collected, which must be treated with caution to protect sensitive student information.

In conclusion, the future of progress monitoring technologies in education for students with autism demands a continued commitment to research and improvement of these tools. These innovations must be developed considering the specific needs of this group, always listening to the opinions of educators, parents and students. To achieve a more inclusive and effective education, it is essential that these technologies are seen not as solutions to all problems, but as allies in a more humanized and integrative educational process.

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