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Article

Curricular adaptations based on Information and Communication Technologies for students with special educational needs

Adaptaciones curriculares con base en las Tecnologías de Información y Comunicación para estudiantes con necesidades educativas especiales

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Abstract

The objective of the research was to design curricular adaptations based on Information and Communication Technologies for students with special educational needs. It was carried out in the Educational Unit of the Provincial Council of Carchi, Ecuador, with a qualitative, descriptive, transversal and field methodology. An interview was conducted with eight elementary school teachers and a representative of the Student Counseling Department to determine the special educational needs of a study group of 60 students, as well as the relevance of curricular planning. The findings identified several deficiencies in 16 students such as difficulty in Mathematics, reading and writing problems, behavioral disorders, autism and mild intellectual disability. In addition, it was evidenced that there is no

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relevance in the didactic planning that includes curricular adaptations related to special educational needs. Based on this, digital tools and strategies for students with special educational needs are proposed in order to strengthen pedagogical practice and contribute to learning, inclusion and development of skills in these students. This study emphasizes that curricular adaptations for special educational needs are an alternative for priority attention to students with various limitations.

Keywords: Curricular adaptations, Information and Communication Technologies, Special Educational Needs, Digital Tools, Educational Inclusion.

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Resumen

La investigación tuvo como objetivo diseñar adaptaciones curriculares con base en las Tecnologías de Información y Comunicación, para estudiantes con necesidades educativas especiales. Fue realizado en la Unidad Educativa Consejo Provincial del Carchi, Ecuador, con una metodología de enfoque cualitativo, de tipo descriptivo, transversal y de campo. Se aplicó una entrevista a ocho docentes de Básica Elemental y a un representante del Departamento de Consejería Estudiantil, para determinar las necesidades educativas especiales en un grupo de estudio de 60 estudiantes, así como la pertinencia de las planificaciones curriculares. Los hallazgos identificaron varias deficiencias en 16 estudiantes como la dificultad en la asignatura de Matemáticas, problemas de lectoescritura, trastornos de conducta, autismo y discapacidad intelectual leve. Además, se evidenció que no existe pertinencia en las planificaciones didácticas que incluyan adaptaciones curriculares relacionadas con necesidades educativas especiales. En base a ello, se proponen herramientas digitales y estrategias para alumnos con necesidades educativas especiales con la finalidad de fortalecer la práctica pedagógica y contribuir con el aprendizaje, inclusión y desarrollo de habilidades en estos estudiantes. Este estudio enfatiza que las adaptaciones curriculares para necesidades educativas especiales son una alternativa para la atención prioritaria a los estudiantes con diversas limitaciones.

Palabras clave: Adaptaciones curriculares, Tecnologías de Información y Comunicación, Necesidades Educativas Especiales, Herramientas Digitales, Inclusión Educativa.

Introduction

Nowadays, the vertiginous advance of Information and Communication Technologies (ICT) has significantly transformed various aspects of our society, and the educational field is no exception. In this context, the importance of incorporating ICT-based curricular adaptations for students with special educational needs (SEN) has become evident, recognizing the diversity of learning styles and the different abilities of students (López and Valenzuela, 2015) (Ponce, 2016) (Bedoya and Moreno, 2019) (Jiménez & Campoverde, 2020).. These adaptations not only seek to provide equitable access to education, but also to enhance learning opportunities, foster inclusion, and prepare students to face the challenges of an increasingly digitized society (Clavijo et al., 2020)..

The integration of ICT in the design of curricular adaptations has opened up a range of possibilities to personalize teaching, address the specific needs of each student and promote an inclusive educational environment (Colás et al., 2019). From the implementation of accessible digital tools to the creation of multimedia resources, ICT-based adaptations seek to transcend traditional barriers and provide meaningful learning experiences (Chávez, et al., 2018)..

ICT-based curricular adaptations are not only limited to technological accommodations, but also encompass innovative pedagogical strategies that leverage the potential of digital tools to improve the participation, engagement, and academic performance of students with SEN (Luz, 2018) (Poveda-Pineda et al., 2020).. From content personalization to the implementation of collaborative platforms, this approach seeks to take full advantage of the transformative power of technology for inclusive education (de la Torre and Domínguez, 2012). (Aguirre et al., 2015)..

This study proposes curricular adaptations based on ICT for students with SEN belonging to Elementary Education of the Carchi Provincial Council Educational Unit, in the city of Tulcán, Ecuador. Specifically, we identify the students' SEN, describe the relevance of the curricular adaptations implemented for students with SEN in the teachers' didactic planning, and finally, we propose a range of digital tools and strategies to support educators in the implementation of these curricular adaptations.

Materials and methods

Description of the study area and study group

The research was carried out in the Educational Unit "Consejo Provincial del Carchi" in the canton of Tulcán, Ecuador. It is currently part of Zone 1, Educational District 04D01. It is made up of 850 students, 49 teachers, three administrative staff, two support personnel from the Student Counseling Department, and two service personnel. (Carchi Provincial Council Educational Unit, 2020).

Research approach and type of research

It was framed in a qualitative approach because it was necessary to collect information about the students who present SEN of elementary basic education in the Educational Unit. The type of research was descriptive because it details the functioning of the variables and categories involved, in addition to the fact that an analysis of curricular planning was carried out according to the curricular level. Finally, it is a field research, because the information was collected directly with the teachers who attend the students with SEN of the Educational Unit.

Research technique

An interview was conducted with eight Elementary Basic Education teachers of second, third and fourth grade, as well as with the coordinator of the Student Counseling Department (DECE), in order to determine the SEN in a group of 60 students. In addition, the relevance of the curricular plans was analyzed in order to know the perspectives and opinions on the topic of the research.

Research phases

Phase 1: Students' Elementary Education Special Education Needs

The interview technique was applied by means of a script of open-ended questions addressed to 89 classroom teachers and the institution's DECE representative. A differentiated instrument adapted to the interviewees was applied, i.e., one model for the teachers and another for the DECE coordinator. In addition, a grouping by categories of each of the responses was used, using the MAXQDA system, which is a software to manage and analyze qualitative information for each established category.

Phase 2: Relevance in the teaching didactic plans of the curricular adaptations implemented for the attention of students with SEN.

A detailed review of the curricular plans of three elementary school teachers was carried out, using the technique of content analysis through an instrument known as analysis or evaluation matrix. In this way, the strategies used by the teachers and their respective relevance to educational inclusion were determined.

Phase 3: ICT-based curricular adaptations for SEN students

With the results of Phases 1 and 2, a range of tools and strategies were proposed to support educators in the implementation of these curricular adaptations.

Bioethical considerations

The research was developed considering the bioethical principles contemplated in the Organic Law of Intercultural Education (LOEI) supported in its Art. 4 and Art. 6. In addition, this research was carried out with the explicit authorization of the educational authorities of the Educational Unit, the classroom teachers and the Student Counseling Department.

Results

Phase 1: SEN of the students

Table 1. *Identification of SEN in* students

Category	Analysis
SEN in the classroom	Sixteen students with special educational needs were identified in the elementary cycle, from 2nd year to 4th year of basic education, with different characteristics and conditions, among them: autism, literacy learning disorder, difficulty with mathematics, behavioral disorder such as hyperactivity and also mild intellectual disability. Most of the teachers expressed that they were able to identify the special educational needs of the students through daily work in class, as well as through dialogue and communication with parents.
Attention to SEN in the classroom	The attention is personalized by teachers for children with special educational needs associated and not associated with a disability, providing support with the use of materials, guiding in each of the stages of the methodological process and with the pedagogical accompaniment. Inclusive education not only involves the integration of students to schooling, it also favors the development of tools that help in the teaching-learning processes, therefore several strategies are used such as: group work, games, dynamics, readings of awareness towards

	inclusion, generation of leadership to support and collaborate in class work.
The methodology of Curricular Adaptations and its scope in learning achievements.	One of the strategies to reach students with Special Educational Needs has been the use of concrete material (images, photos, clippings, magazines, cards), teachers know the right way for children to learn, through the application of didactic and innovative strategies, which not only are liked by the student, but also help to focus attention, development of thinking, analysis, language development and stimulates creativity. It was identified that most of the Curricular Adaptations applied are grade 1 or 2, with a decrease in the degree of difficulty of the performance skill to be developed in class, thus obtaining an expected level of performance; however, the collaborative work of parents is key to reinforce the activities in class and thus contribute to effective learning.
Use of ICTs and SAD	Teachers are willing to implement new technologies; they consider the use of these tools important and necessary, as long as there are complete resources (computers-internet); the adequate use of ICTs depends on this. There is evidence of the need to improve pedagogical practice as an opportunity to learn, applying new technologies.

Table 2. *Interview with the DECE coordinator*

Category	Analysis
Actions developed by DECE	The DECE is responsible for the first intervention with the parent for referral to the ADAI Department (District Inclusion Support Unit) and subsequently refers to the Ministry of Public Health. This is the process to be followed for the identification and assessment of an educational need. According to the medical reports, planning is adapted according to the learning difficulty presented by the student.
Recommendations to teachers for meeting the needs of teachers in the following areas **Educational.**	The recommendations are based on the analysis of the reality of the student with SEN. It is suggested to the teacher to adapt appropriately according to the medical report with the corresponding methodology. The disability card is an important document to identify certain educational needs, however, parents avoid obtaining this identification, without realizing that it has many benefits, so that children are part of the vulnerable group and are treated as a priority. In addition, they recommend parents to recognize from an early age different traits or attitudes in their children, to go quickly to the respective health agencies.

Curricular Adaptations	Curricular adaptations are modifications of the planning, which are applied according to the educational need, these are an important resource to achieve learning. The Universal Design for Learning is a methodological instrument that integrates teaching strategies for the class group in general.
Implementation of technological tools	The implementation of new technologies is necessary for the development of education, innovating with creative tools that enable meaningful learning.

Phase 2. Relevance of the curricular adaptations in the teaching didactic plans.

The Evaluation Matrix was used, which was applied in the planning of each basic year (Table 3-5). This instrument consisted of reviewing the curricular plans, with the objective of describing the pertinence of the curricular adaptations implemented for the attention of students with SEN in the teachers' didactic plans.

Teaching Planning Evaluation Matrix 2nd Year General Basic Education

N	Evaluation criteria	Description of the criterion assessed
1	The didactic plans present curricular adaptations made by the teacher.	No curricular adaptations were observed.
2	The adapted strategies correspond to the educational needs presented by the children. students	There is no correspondence between the adapted strategies and the children's conditions.
3	The planning examined includes the innovative element in the didactic curricular adaptations.	It does not include innovative elements that motivate the interest of children with SEN.
4	Clarity and precision are observed in the strategies adapted by the teacher.	There are no adapted strategies.
5	The Institution promotes educational inclusion and supports didactic planning for children with SEN.	There are no curricular adaptations, however, there are 6 students with different special educational needs in this school year.
6	There is a direct link between the teacher's lesson plans and the lesson plan for students with SEN.	It does not exist.

Table 4. Teaching Planning Evaluation Matrix 3rd Year of Basic Education

N	Evaluation criteria	Description of the criterion assessed
1	The didactic plans present curricular adaptations made by the teacher.	Curricular adaptations with deficiencies were observed.
2	The adapted strategies correspond to the educational needs presented by the children. Students	There is no correspondence between the adapted strategies and the children's conditions.
3	The planning examined includes the innovative element in the didactic curricular adaptations.	It does not include innovative elements that motivate the interest of children with SEN.
4	Clarity and precision are observed in the strategies adapted by the teacher.	No, they are repetitive, mechanical and inaccurate.
5	The Institution promotes educational inclusion and supports didactic planning for children with SEN.	It is observed that the planning is evaluated by the coordinator and the academic board, however, there are no observations or orientations to the teacher.
6	There is a direct link between the teacher's lesson plans and the lesson plan for students with SEN.	There is a link in terms of content and objective, however, the evaluative activities do not respond to the achievements and competencies, but rather emphasize weaknesses.

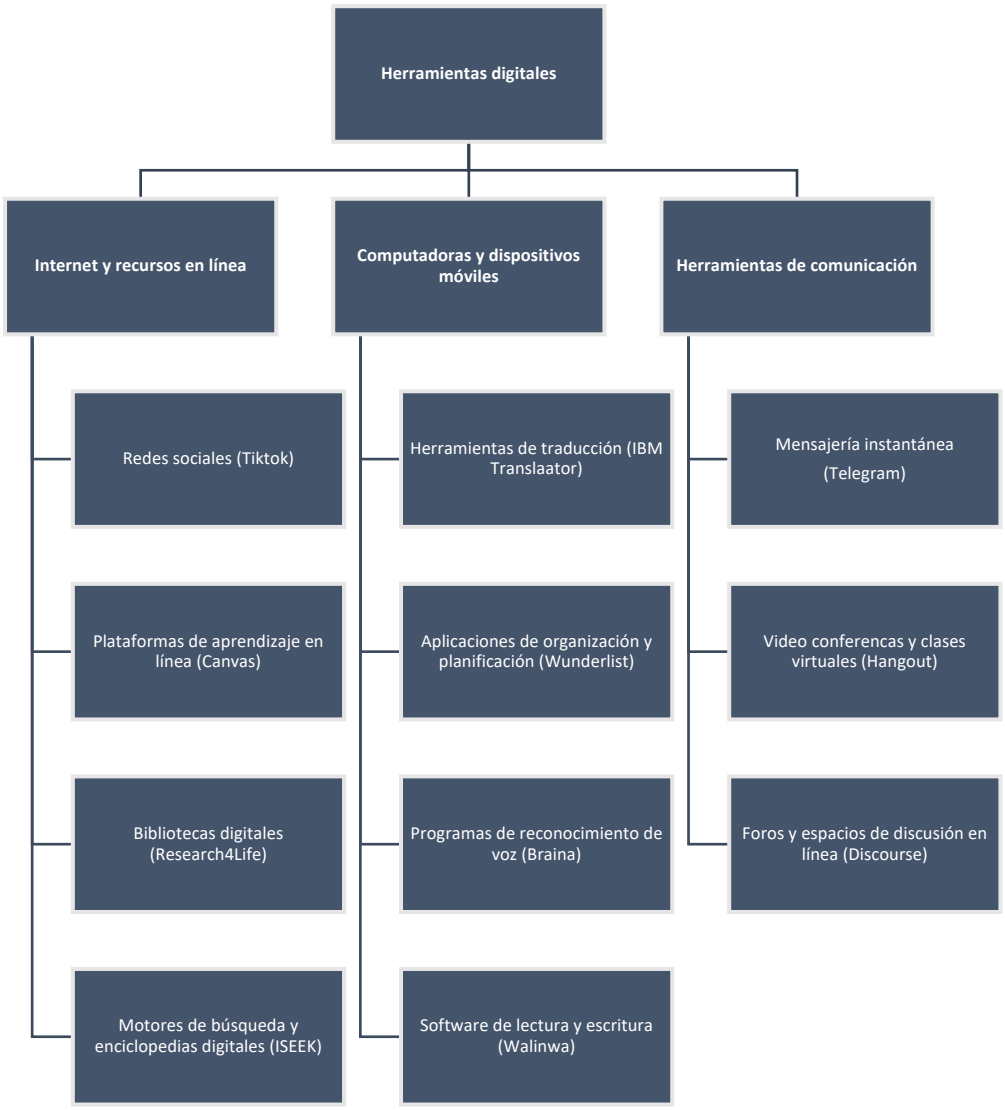
Teaching Planning Evaluation Matrix for 4th Year of Elementary Education

	Evaluation criteria	**Description of the criterion assessed**
1	The didactic plans present curricular adaptations made by the teacher.	Few curricular adaptations with deficiencies were observed.
2	The adapted strategies correspond to the educational needs presented by the children. Students	There is little correspondence, because it tailors the material to reach the student with needs.
3	The planning examined includes the innovative element in the didactic curricular adaptations.	It does not include innovative elements that motivate the interest of children with SEN.
4	Clarity and precision are observed in the strategies adapted by the teacher.	No, they are monotonous and inaccurate.
5	The Institution promotes educational inclusion and supports didactic planning for children with SEN.	It is observed that the planning is evaluated by the coordinator and the academic board, however, there are no observations or orientations to the teacher.
6	There is a direct link between the teacher's lesson plans and the lesson plan for students with SEN.	There is a link in terms of content and objective, however, the evaluative activities do not respond to the achievements and competencies, but rather emphasize weaknesses.

Phase 3. Propose ICT-based curricular adaptations for students with SEN.

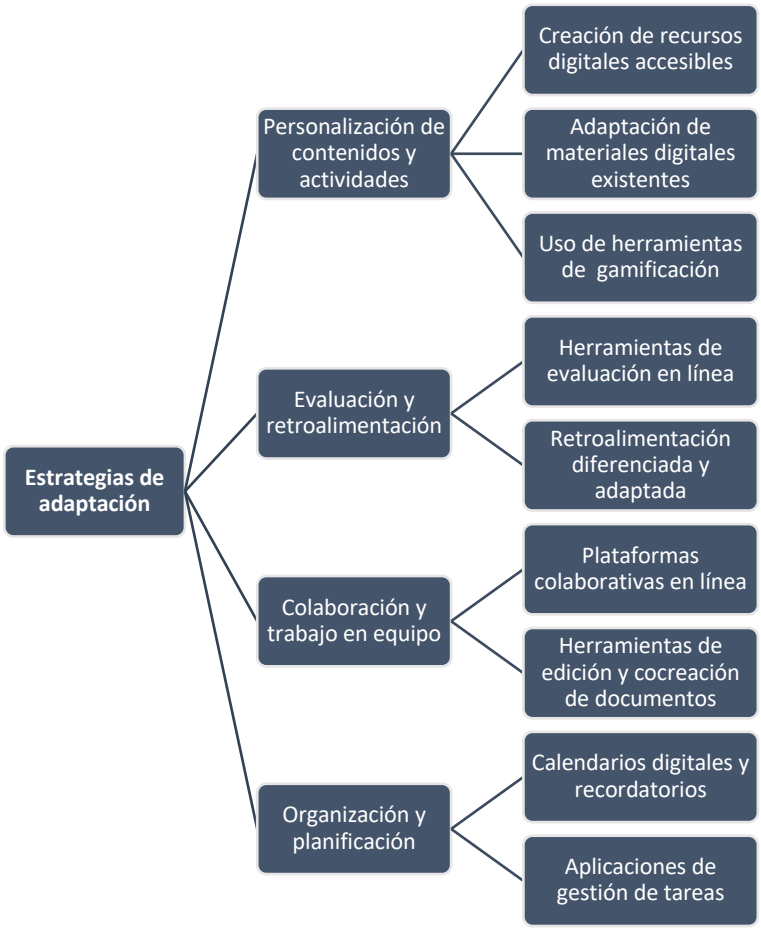
In this phase, digital tools and curricular adaptation strategies in elementary basic education were proposed for the educational attention of students with special needs. This proposal presents the most effective and appropriate digital tools to support the learning process of this group of students. It focuses on providing accessible, inclusive and adapted options to the diverse needs of students with physical, cognitive, sensory and developmental disabilities. Figure 1 presents various digital tools that can be used by students with SEN to support their learning process.

Figure 1. Digital tools to support research and curricular adaptations



The ICT-based curriculum adaptation (Figure 2) sought to optimize the teaching and learning process, emphasizing personalization, assessment and feedback, collaboration and teamwork, organization and planning, in order to meet the diverse needs and learning styles of students.

Figure 2. Curricular adaptation strategies based on ICTs



The creation of accessible digital resources is essential to ensure that technology and information are available to all, contributing to a more equitable and enriching educational and social environment.

Adapting existing digital materials is crucial to create a flexible, inclusive and efficient educational environment that caters to the diverse needs of students and promotes meaningful learning.

The use of gamification tools brings playful elements to the educational process, improving motivation, engagement and learning. By making educational experiences more interactive and entertaining, a positive impact on student engagement and performance can be achieved.

Online assessment tools offer a number of benefits, from flexibility and accessibility to speedy feedback and the ability to customize and improve the assessment process.

Differentiated and tailored feedback is crucial to the personalization of learning, continuous improvement, and the creation of an inclusive and equitable educational environment. It provides students with the specific guidance they need to advance their learning in an effective and meaningful way.

Online collaborative platforms are key to improving communication, efficiency and creativity in a variety of environments, from education to business. They facilitate effective collaboration, enabling people to work together more smoothly and productively.

Document editing and co-creation tools are essential for efficient and effective collaboration in educational and professional environments. They facilitate communication, improve productivity and enable teams to work more smoothly, even when they are dispersed.

Digital calendars and reminders are essential tools for time management, personal and professional organization, and improving efficiency in completing tasks. They provide an effective way to stay on top of commitments and ensure more effective planning in daily life.

Task management applications are essential tools for personal and professional planning and organization. They help improve productivity, efficiency and satisfaction by providing a structured approach to tackling tasks and projects.

Discussion

The purpose of this research was to design curricular adaptations based on ICT for students with special educational needs in

elementary school of the Educational Unit "Consejo Provincial del Carchi" in the city of Tulcán; for this it was necessary to first identify the special educational needs in elementary education, i.e. from 2nd year to 4th year of General Basic Education. In addition, factors associated to the existing problems with learning difficulties were identified, such as social, pedagogical and emotional factors.

From the results obtained there are 16 children with various SEN, including difficulty in the subject of mathematics, literacy problems, behavioral disorders, autism and mild intellectual disability. These results, which reveal diverse deficiencies in students with SEN, are aligned with recent research that has addressed the specific challenges faced by this demographic group. The identification of difficulties in key areas such as Mathematics (Suárez et al., 2022)literacy (Álvarez and López, 2021), and the presence of behavioral disorders (Álvarez and López, 2021). and the presence of behavioral disorders (Arroyo and Toro-Mayorga, 2021)autism (Zaragoza et al., 2023) and mild intellectual disability (Armas-Alba and Alonso-Rodríguez, 2022)(Armas-Alba and Alonso-Rodríguez, 2022), coincides with trends observed in other international research.

Similar studies have consistently highlighted the importance of addressing difficulties in Mathematics, as this subject can represent a significant challenge for students with diverse educational needs (Gárate, 2023). Curricular strategies and adaptations designed to improve performance in this area can directly benefit the students identified in the present study. The findings of Novay et al. (2023)highlights that multimedia environments for the subject of Mathematics enable the diversification of activities, adjusting to the demands and learning needs of students. Likewise, the implementation of didactic strategies facilitates the promotion of educational games and work collaboration.

The presence of literacy problems has also been a recurring theme in the academic literature related to special educational needs. As mentioned by Rubio et al. (2023)an understanding of these challenges is essential to develop pedagogical approaches and specific curricular adaptations that address difficulties in the acquisition of reading and writing skills.

The inclusion of conduct disorders, autism, and mild intellectual disability as areas of impairment identified in this study reflects the diversity of needs within the group studied. Previous research has highlighted the importance of adapting teaching strategies and interventions to address the particularities associated with these disorders (Avaria, 2022) (Marí et al., 2022) (Sanz-Cervera et al., 2018).. A prominent aspect is the lack of relevance in curricular

planning, a finding that adds to the growing evidence highlighting the need to review and adapt educational practices to meet the specific demands of students with SEN (González-Benito, 2018) (Berrios et al., 2020).

Regarding the relevance in the teaching didactic planning of curricular adaptations for students with SEN, there is little relevance at the time of planning, since the lesson plans are made for all the children in the class, differentiating only with the degree of difficulty, and in the evaluation process, reference is made with images. With this, it can be determined that curricular adaptations are planned simply and not technically, indicating what degree of adaptation is necessary for a given case.

The finding of a lack of relevance in didactic planning that should include curricular adaptations to address SEN highlights a critical challenge in addressing diversity in the educational context. The findings are aligned with recent studies that have explored the implementation and effectiveness of curricular adaptations in inclusive educational settings (Paz-Maldonado, 2020) (Paz-Maldonado et al., 2022). (Saltos et al., 2023). .

Previous research has pointed out the importance of didactic planning focused on the diversity of students, especially those with SEN. The lack of relevance in curricular planning can be attributed to several reasons, including the lack of adequate training for teachers in the implementation of inclusive and adaptive strategies (Okyere et al., 2019). (Engelbrecht, 2020).

Several studies have shown that, despite inclusion-oriented pedagogical policies and approaches, the gap between theory and practice persists (Quitián-Bernal et al., 2020). (Quitián-Bernal et al., 2020). (Børte et al., 2023).. Lack of specific training and lack of adaptive resources may contribute to the lack of relevance in didactic planning (Bartolomé et al., 2018). (Muñoz et al., 2022).. Teacher training in inclusive strategies and access to adapted materials are crucial factors in closing this gap.

In addition, it is necessary to consider the need for a holistic approach to curriculum planning that goes beyond the simple incorporation of superficial adjustments. Effective curriculum adaptation involves a thorough understanding of the individual needs of students and the implementation of pedagogical strategies that encourage their participation and academic success.

The lack of relevance in curricular planning may also indicate the need for a cultural change in educational institutions as emphasized

by Melo (2021)promoting an inclusive mentality and valuing diversity as an asset in the educational process. Collaboration between teachers, inclusive education specialists and other professionals can play a key role in the design of curricular plans that effectively address SEN.

On the other hand, the proposal to use digital tools and specific strategies for students with SEN reflects a growing trend in the educational literature that advocates for the effective integration of technology to enhance inclusion and adaptive learning. This approach aligns with several recent studies that explore the transformative potential of ICT in the inclusive educational setting.

The application of digital tools such as the Internet and online resources, computers and mobile devices, and communication tools highlights the importance of leveraging the accessibility and versatility of technology to accommodate the diverse needs of learners (Hennessy et al., 2022).. These tools can provide personalized content, access to specialized resources, and encourage the participation of students with SEN (Cheng & Lai, 2020). As mentioned by Novay and Chacin (2022).the fundamental skills that have been cultivated in students, especially in higher education, is the ability to access information, manage it efficiently, use the Internet and cope in virtual environments.

The adaptation strategy focused on creating digital resources and adapting digital materials is consistent with research that highlights the ability to customize educational content to meet individual learner needs (Xie et al., 2019). Adapting digital materials can include modifying formats, incorporating multimedia, and presenting information in a more accessible way, which contributes to more meaningful learning.

The inclusion of gamification tools in the proposal is especially relevant, as gamification has proven to be effective in motivating and engaging students, including those with SEN. Gamification can turn the learning process into a more interactive experience, increasing participation and facilitating the understanding of concepts (Alsawaier, 2018). Additional strategies, such as the use of online assessment tools, differentiated and tailored feedback, online collaborative platforms, document editing and co-creation tools, digital calendars and reminders, as well as task management applications, complement the proposal by addressing various dimensions of the educational process (Castro, 2019). The implementation of these strategies can improve efficiency, participation and individualized support for students with SEN.

The proposal aligned with the use of digital tools and specific strategies highlights the potential of technology to level the educational playing field and provide more inclusive and personalized learning experiences. These findings are consistent with the growing evidence that technology can be a significant catalyst for improving the quality of education, especially for those with special educational needs.

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