

Design of a methodological strategy for the inclusion of university students with ASD in ICT educational programs

Diseño de una estrategia metodológica para la inclusión de estudiantes universitarios con TEA en programas educativos TIC

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Summary. The educational inclusion of students with autism spectrum disorder (ASD) in higher education poses both challenges and opportunities, especially in Information and Communication Technologies (ICT) programs, characterized by their high cognitive and technological demand. This paper proposes a methodological strategy oriented to the pedagogical accompaniment of students with functional ASD in ICT careers, with the aim of promoting meaningful learning, active participation and academic permanence. The proposal is based on a theoretical review, the analysis of real university experiences and the integration of international best practices. The strategy addresses curricular, technological, social and emotional dimensions in a comprehensive manner, seeking to ensure a more inclusive and equitable higher education. This approach seeks to establish solid foundations for the design of specific support for students with neurodevelopmental conditions, favoring their academic success. It also highlights the role of ICT as key tools to enhance motivation, engagement and autonomy, through the creation of adaptive learning environments sensitive to individual needs, which promote the integral development of students with ASD.

Key words: Educational inclusion, autism spectrum disorder, information and communication technologies.

Resumen. La inclusión educativa de estudiantes con trastorno del espectro autista (TEA) en la educación superior plantea desafíos y oportunidades, especialmente en los programas de Tecnologías de la Información y la Comunicación (TIC), caracterizados por su alta demanda cognitiva y tecnológica. Este artículo propone una estrategia metodológica orientada al acompañamiento pedagógico de estudiantes con TEA funcional en carreras TIC, con el objetivo de promover el aprendizaje significativo, la participación activa y la permanencia académica. La propuesta se basa en una revisión teórica, el análisis de experiencias universitarias reales y la integración de las mejores prácticas internacionales. La estrategia aborda las dimensiones curricular, tecnológica, social y emocional de manera integral, buscando garantizar una educación superior más inclusiva y equitativa. Este enfoque busca establecer bases sólidas para el diseño de apoyo específico para estudiantes con trastornos del neurodesarrollo, favoreciendo su éxito académico. Asimismo, destaca el papel de las TIC como herramientas clave para potenciar la motivación, el compromiso y la autonomía, mediante la creación de entornos de aprendizaje adaptativos y sensibles a las necesidades individuales, que promueven el desarrollo integral de los estudiantes con TEA.

Palabras Clave: Inclusión educativa, trastorno del espectro autista, tecnologías de la información y la comunicación.

1 Introduction

Education at the university level represents a great challenge especially in careers related to Information and Communication Technologies (ICT), where advanced technical competencies and specific cognitive skills are required. Students with autism spectrum disorder (ASD) face particular barriers at this educational level due to the academic and social demands of these careers. Therefore, it is critical that learning environments are not only accessible, but also tailored to their individual needs to ensure their education. These barriers include difficulties in social communication, cognitive rigidity, sensory overload and a preference for structured and predictable environments [1].

At the same time, ICT careers offer an environment with the potential to support inclusion by enabling more visual, autonomous and structured learning modalities, which can align with the cognitive strengths of many students with ASD, such as logical-sequential thinking and attention to detail.

This article presents the design of a methodological strategy that integrates approaches such as the TEACCH model, Universal Design for Learning (UDL), Project Based Learning (PBL) and the use of ICT, to promote inclusive and equitable education at the university level. This proposal responds to the need to transform teaching-learning environments into accessible, personalized spaces focused on neurocognitive diversity.

2 Theoretical framework

The World Health Organization defines autism spectrum disorder (ASD) as a neurodevelopmental condition characterized by persistent difficulties in social communication and restricted and repetitive patterns of behavior [1].

Other features associated with this disorder are deficits in social-emotional reciprocity, communicative behaviors, motor stereotypies, insistence on monotony and very restricted and fixed interests. In addition, individuals may exhibit hyperreactivity to sensory stimuli such as apparent indifference to pain or temperature, adverse response to sounds or textures and a visual fascination with lights or movement [2].

Because of the characteristics of the condition, the difficulties for college students are considerable upon entry at this level. Many may be victims of bullying, develop inferiority complexes and often feelings of frustration that together can lead to other disorders in the form of crises [3].

It is estimated that approximately 1% of the world's population has ASD; however, the proportion of students with autism at the university level is considerably lower. A study conducted in the United Kingdom indicates that about 0.4% of university students identify as having autism, evidencing an underrepresentation relative to the overall prevalence [4].

This discrepancy may be due to a variety of barriers, including challenging transition from secondary education, lack of specific support at universities, stigmatization, or no formal recognition of the diagnosis. At the university level, students with ASD require strategies that not only consider their cognitive performance, but also their emotional well-being, social integration and autonomy. To address these needs, the proposed methodological strategy is based on three complementary approaches:

- TEACCH model (Treatment and Education of Autistic and Communication related handicapped Children): is a structured educational approach focused on visual organization, individualization of learning and promotion of autonomy. Although the characteristics of people with ASD are different from each other, they also present some similarities, so TEACCH seeks to provide interventions that help balance these characteristics with the norms and culture of the social environment [5]. Although it was initially designed for children, it has been shown to be effective in university settings by adapting its principles to higher education.
- Universal Design for Learning (UDL): is a comprehensive framework that seeks to shape the design of learning environments so that they are accessible to all learners. Its overall goal is to foster autonomy for the learning process by planning and designing for an optimal experience that fits their specific needs. It focuses on transforming the learning environment rather than transforming learners and emphasizes intentional design to minimize barriers and provide meaningful learning experiences [6].
- Project Based Learning (PBL): aims to improve students' academic performance and skills. This method has been adopted in various fields of education. PBL not only seeks to improve academic performance and maintain students' attention and engagement, but also to develop technical and non-technical skills that are key to professional success [7].

3 Methodology design

Education at the university level represents a great challenge especially in ICT-related careers, where advanced technical competencies and specific cognitive skills are required. Students with ASD face particular barriers at this educational level due to the academic demands of the field.

The proposal of this methodology not only aims to address the barriers to learning and participation faced by students, but also to enhance their capabilities by considering their cognitive processes, interests and learning rhythms through a flexible, accessible and structured pedagogical environment. Figure 1 shows a clear and systematized path of action divided into phases, which include instruments and procedures that allow addressing the individual needs of each student.

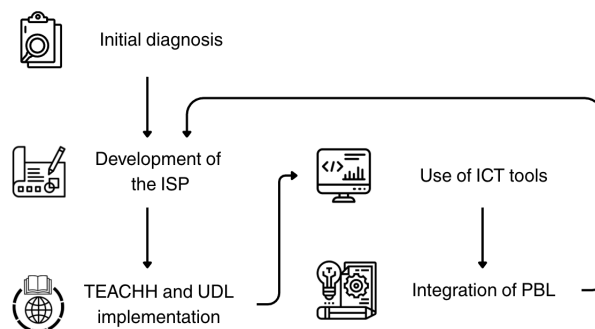


Figure 1. Methodology phases.

3.1 Initial diagnosis

This stage is the starting point for understanding the student's profile and planning personalized interventions. It involves gathering relevant information on cognitive, emotional, sensory, communicative and social aspects. Since these are university students, many of them already have a formal initial diagnosis of ASD, so the process should focus on:

- Update relevant information on their profile and evolution.
- Identify current barriers in the academic and social context.
- Recognize strengths, personal resources and compensatory strategies previously developed.
- Establish specific needs for reasonable support and curricular adjustments.

3.1.1 Instruments

In order to carry out a meaningful evaluation and collect information in a multidimensional manner, we propose the use of validated instruments adapted to the university context, in order to provide a comprehensive view of the student's profile:

- **Strengths and Difficulties Questionnaire (SDQ):** is a questionnaire for the detection of abnormal behaviors, which consists of 25 items distributed in five subscales, which considers emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and prosocial behavior. This is measured on a Likert scale to obtain the corresponding score [8]. As shown in Figure 2, the interpretation is classified into ranges, where a high score may indicate the need for further evaluation.

Self-completed SDQ			
Total difficulties score	0-15	16-19	20-40
Emotional problems score	0-5	6	7-10
Conduct problems score	0-3	4	5-10
Hyperactivity score	0-5	6	7-10
Peer problems score	0-3	4-5	6-10
Prosocial score	6-10	5	0-4
Impact score	0	1	2-10

Figure 2. SDQ Scale [9].

- **Honey-Alonso Questionnaire of Learning Styles (CHAEA):** this is an instrument widely used at the university level and is useful to identify and establish the level of preference of a student's learning style, which allows improving their preferred styles and enhancing their less developed styles [10]. It consists of 80 items divided into four groups of 20 each, where participants respond by indicating their degree of agreement or disagreement. In this way, a more complete understanding of their learning strategy is achieved, which will allow teachers to adapt their methods to meet the diversity of styles present in the classroom. Figure 3 shows a graph with the 4 learning styles: active, pragmatic, reflective and theoretical.

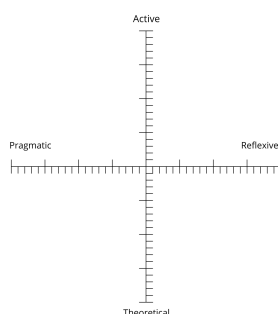


Figure 3. Graph with learning styles.

In addition to standardized instruments, semi-structured interviews are a key tool to complement the understanding of the student's profile. Through them, it is possible to access subjective and contextual information that is not always reflected in questionnaires, allowing to identify perceptions, previous experiences and dynamics that influence their educational process. In the interviews it is suggested to address:

- With the student: perception of his/her abilities, challenges in academic and social life, previous experience with support or curricular adaptations, interests, motivations and coping strategies.
- With family members or guardians (only if authorized by the student): medical and diagnostic history, school transitions, aspects that have facilitated or hindered adaptation in other contexts.
- With teaching staff: previous experiences with the student, barriers observed, responses to different situations or methodologies and level of participation in school activities.

Table 1 shows the activities and those responsible for the application of the instruments in order to obtain the expected products.

Table 1. Activities for the application of instruments

Activity	Content	Responsible
Background check	Data collection on an institutional basis	Psychoeducational support staff
SDQ application	SDQ questionnaire	Psychologist or academic staff
CHAEA application	CHAEA questionnaire	Academic staff
Interviews	Interviews elaborated for the university context	Psychologist and academic staff

3.2 Individualized Support Plan (ISP)

From the previous assessment, the Individualized Support Plan (ISP) is constructed, which is a process of development, implementation and evaluation of individual goals and objectives related to personal outcomes in terms of the amount of support and the degree of adaptive behavior [11].

This plan should include a summary of the individual profile that captures the most relevant information derived from the initial diagnosis. It should also specify the support strategies needed to achieve the objectives, which may include methodological adaptations such as the use of visual materials, adaptations to assessments, integration of technologies, among others. Table 2 shows an example of the contents of the ISP.

Table 2. Contents of the ISP

Section	Content
General data	Name, university career, semester, diagnosis (when applicable and with full consent).
Individual profile summary	Predominant learning style, cognitive and technical strengths, difficulties (academic, sensory, social), coping strategies.
Individual objectives	Academic: specific goals related to the subjects of the career. Social: integration in teams, communication and interaction with group mates. Autonomy: use of technologies for their own organization, as well as sensory self-regulation.
Support strategies	Methodological and evaluative adaptations, technologies to be used.
Indicators and monitoring	Rubrics, logs, progress logs and self-assessment tools.

Review dates	Planning of periodic reviews: at the beginning, middle and end of the semester, adjusted to the academic calendar.
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The ISP should have a periodic review together with the student and a teacher or a group of teachers, which will allow adjustments to be made according to academic progress, changes in needs or teacher feedback, so it is advisable to use rubrics, logs and self-evaluations.

3.3 Adapted pedagogical implementation

At this stage, the ISP ceases to be a static document and is transformed into concrete actions within the classroom and learning spaces. It is based on the TEACCH model and the UDL, following some pedagogical principles:

- TEACCH: visual organization of the space: clearly differentiate areas, such as the blackboard or projector, teacher's desk and students' places. Structured routines: schedules indicating due dates, start and end dates of activities, class schedules, among others. Breakdown of tasks into steps: e.g. "Step 1: identify a variable, Step 2: write in pseudocode, Step 3: test an algorithm".
- UDL: multiple forms of representation: videos with subtitles, printed or digital infographics, audio materials, among others. Multiple forms of expression: digital portfolios to upload evidence, mind maps with visual tools, short oral presentations with visual aids. Multiple forms of involvement: relate technical content with personal interests (e.g., developing short video games), use open questions in virtual forums to promote reflection, offer optional challenges of gradual complexity, use gamification techniques.

3.4 Use of ICT

This phase focuses on providing students with tools that reinforce their learning, autonomy and organization, while facilitating the teaching work.

One of these tools is Trello, a visual work management tool that allows planning, managing and organizing tasks through visual lists and cards that can be labeled, scheduled and divided into subtasks, in a collaborative, productive and organized way [12]. It can be used as follows:

- Separate boards by subject, where each card represents an activity or project.
- Checklists on each card, with simple steps (e.g., "read a chapter", "solve an exercise", "submit an assignment").
- Integrated calendar to display due dates with alerts.

On the other hand, Notion is a more robust tool that combines notes, tasks, calendars and multimedia in a single highly customizable environment, allowing to organize and plan tasks and projects according to the needs [13]. In the university context, Notion can be used for:

- Agenda templates with sections for academic activities, quick notes or reminders.
- Resource database with links to videos, notes, code samples or documentation.
- Progress tracking modules where students record daily achievements and brief reflections on their academic progress.

In the case of technical subjects such as programming, visual and guided development environments can be used to facilitate the understanding of computational logic by minimizing the syntactic load and offering graphical support.

One of the most widely used applications is Scratch, a block-based programming environment that allows building algorithms by joining visual pieces to create digital stories, games and animations, promoting computational thinking and problem solving in a personal and collaborative way [14]. With this tool, the student can:

- Begin to focus on sequential reasoning without the need to memorize textual syntax.
- Make initial projects focused on block logic through animations or small games.
- Use preconfigured templates to avoid spending too much time on preconfigurations and concentrate on logic.

The Scratch interface simultaneously displays the scenario where the program runs, the blocks and the scripting area, providing a predictable and structured space. In addition, responding to events such as clicking,

typing or displaying messages reinforces the “cause-effect” relationship and encourages controlled experimentation, reducing the anxiety that could be generated by unexpected errors.

Another tool that can complement the approach to programming is PSeInt, a tool that allows focusing on the fundamental concepts of algorithms through pseudocode [15]. Among the main features of this software are:

- Write instructions in pseudocode and execute the algorithms step by step, visualizing, for example, the value of variables.
- Use pseudocode templates with basic conditional and loop structures already defined for the student to complete specific parts.
- Display contextualized warning messages with annotations indicating syntax errors or uninitialized variables, which helps to reinforce self-regulation in code debugging.

3.5 Incorporation of PBL

The PBL is organized in four short and structured phases, so that the student has clarity at all times about what is expected of him and how to progressively advance:

- Problem statement and planning: the formulation of the problem should be presented visually, through an outline that includes elements such as the objective, the steps to be followed and the final product. The timeline should appear as a simple timeline, without extensive text and with well-defined roles if it is a collaborative project.
- Development: activities should be divided into concrete and sequential steps. The teacher's indications should be available in writing, avoiding relying exclusively on verbal instructions, which may be difficult for some students to process.
- Testing: in the usability evaluation phase, it is recommended to use short forms with closed response items (e.g., "yes/no" or scales from 1 to 3). Necessary corrections should be marked visually, using colored labels on the work board, allowing the student to quickly identify the required adjustments.
- Final presentation: it is advisable to make the presentation format more flexible. A good practice is to prepare a short video showing the prototype in operation and explaining its logic. This can be complemented with diagrams illustrating the phases or steps followed during the development of the project.

3.6 Strengthening and sustainability of the methodological strategy

The effectiveness of a methodological strategy for the inclusion of students depends not only on the pedagogical design, but also on its comprehensive implementation, institutional support and capacity for continuous improvement, so the following complementary actions are proposed to strengthen and ensure the sustainability of this proposal:

- Teacher training and awareness: it is essential to incorporate continuous training processes for teachers, focused on the understanding of ASD, UDL and the use of technologies.
- Active student participation: the strategy recognizes the student with ASD as the protagonist of his or her educational process. Their active participation is promoted in the construction of the ISP, in the selection of tools according to their needs and in the definition of topics or approaches in academic projects according to their learning style.
- Evaluation and continuous improvement: to ensure the relevance of interventions, a continuous evaluation system should be established that includes instruments such as inclusive rubrics, monitoring logs, reflective interviews and periodic reviews of the ISP.
- Transition to the professional environment: given that ICT programs have a practical and professionalizing orientation, it is advisable to include activities that prepare students for their insertion into the labor market. This may include interview simulations, supervised professional internships and alliances with entities that are sensitive to diversity and labor inclusion.

These complementary actions ensure that the methodological proposal not only responds to the academic demands of the present, but also provides tools for students autonomy and professional development.

4 Conclusions and future work

The proposed methodological strategy, which integrates TEACCH, UDL and PBL has proven to be coherent and effective by articulating from the initial diagnosis to the final presentation of the project, offering multiple access paths and clear structures that favor the autonomy and motivation of students with ASD; in addition, the link between the ISP and each phase of the project, together with a continuous evaluation system, has made timely adjustments possible and has laid the groundwork for its institutional sustainability.

Although its pilot scope was limited to a software development course and the reliance on certain digital platforms may require additional teacher training, these first experiences pave the way for validating the methodology in other subjects.

In parallel, longitudinal studies are proposed to follow several promotions of students with ASD from their entry into the labor market, measuring not only indicators of academic performance and time to graduation, but also variables of autonomy, socioemotional skills and professional success in the medium and long term. On the other hand, the exploration of immersive technologies will make it possible to evaluate their capacity to offer immediate feedback and adjust activities according to the level of cognitive load and individual learning style. In the field of artificial intelligence, we plan to develop prototypes of recommendation systems that suggest personalized resources, step-by-step guides or alternative presentation formats based on the interaction history of each learner.

Finally, with the aim of consolidating a global community of practice, an open repository will be built in the cloud to house methodological guides, adaptive templates, documented case studies and discussion forums, facilitating the exchange of experiences and the replication of the model in different institutional contexts.

References

- [1] World Health Organization: Autism, <https://www.who.int/es/news-room/fact-sheets/detail/autism-spectrum-disorders>, last accessed 04/2025.
- [2] American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorder. 5th edition (2013).
- [3] Alcántud, F., Alonso, Y.: College Students with Autism Spectrum Disorders: Review of their Needs and Notes for their Attention. Siglo Cero (2021).
- [4] Diverse Education: Autism and Higher Education, <https://www.diverseeducation.com/demographics/disabilities/article/15292315/autism-and-higher-education>, last accessed 04/2025.
- [5] Noni, Soetikno, N., Mar'at, S.: TEACCH for Parents and Child with Autism Spectrum Disorder: A Review of the Literature. Proceedings of the 1st Tarumanagara International Conference on Medicine and Health (TICMIH 2021), Atlantis Press (2021).
- [6] Roski, M., Sebastian, R., Ewerth, R., Hoppe, A., Nehring, A.: Learning analytics and the Universal Design for Learning (UDL): A clustering approach. Computers & Education, Vol. 214 (2024).
- [7] Lavado, S., Velasco, P., Terrón, M.: Project-Based Learning (PBL) as an Experiential Pedagogical Methodology in Engineering Education: A Review of the Literature. Education Sciences, (2024).
- [8] Garcha, J., Smith, A.: Associations between Autistic and ADHD Traits and the Well-Being and Mental Health of University Students. Centre for Occupational and Health Psychology, School of Psychology, Cardiff University, (2023).
- [9] Goodman, R.: The Strengths and Difficulties Questionnaire: A Research Note. Journal of Child Psychology and Psychiatry, Vol. 38 (2006).
- [10] Juárez, C.: Propiedades psicométricas del cuestionario Honey-Alonso de estilos de aprendizaje (CHAEA) en una muestra mexicana. Revista de Estilos de Aprendizaje, 7(13). (2014).
- [11] Al-Atwi, R.: The Effectiveness of the Individual Support Plan (ISP) in Enhancing the Adaptive Behaviour of Individuals with Intellectual and Developmental Disabilities. Journal of Al-Quds Open University for Educational & Psychological Research & Studies. (2023).
- [12] Trello: Capture, organize and tackle your to-dos from anywhere. Atlassian. <https://trello.com/home>, last accessed 05/2025.
- [13] Notion: The happier workspace. "Write. Plan. Collaborate. With a little help from AI". Notion Labs. <https://www.notion.com>, last access 05/2025.
- [14] Scratch Team: Scratch. MIT Media Lab. <https://scratch.mit.edu/>, last access 05/2025.
- [15] PseInt: Pseudo Interpreter. Pablo Novara. <https://pseint.sourceforge.net/>, last access 05/2025.