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The Use of Digital Technologies to Support Children and Adolescents with Intellectual Disabilities in Participation and School Learning Activities

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Abstract In agreement with the American Association on Intellectual and Developmental Disabilities' concept of intellectual disability, which emphasizes significant limitations in both intellectual functioning and adaptive behavior and expresses them in conceptual, social, and practical adaptive skills, we propose in this paper to discuss the support needs of children and adolescents with intellectual disabilities and the digital technologies that could support them in school participation and learning activities. To this end, we carried out a survey whose data analysis and discussion were based essentially on data collected through the version adapted for Brazilian culture of the Intensity of Support Scale for children and adolescents with Intellectual Disabilities, which was applied to 801 individuals, more specifically on data referring to four adaptive skills related to the use of digital technologies. The results show that many teachers face difficulties integrating these technologies due to inadequate training and technical support. It is, therefore, essential to educate teachers to integrate these digital devices and technologies as allies in the teaching and learning of conceptual, social, and/or practical adaptive skills.

Keywords Intellectual disability · Inclusive education · SIS-C

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1 Introduction

We start from the premise that when we think about inclusive education for students with intellectual disabilities (ID), we can no longer limit educational planning to a diagnosis/intelligence level report, i.e., a 'list' of limitations in intellectual functioning that are attributed, even without an assessment of adaptive behavior. This is because we assume ID as a construct based on a multidimensional approach, with a perspective related to capacities and human rights, bringing a more holistic approach to human functioning, where classification is based on the intensity of support and educational planning is directed by support systems.

We can thus see the concept of intellectual disability presented by the American Association on Intellectual and Developmental Disabilities (AAIDD), where ID is characterized by significant limitations in both intellectual functioning and adaptive behavior, which can be expressed in conceptual, social and practical adaptive skills (p. 13) [1].

Where intellectual functioning is the common defining characteristic of intelligence (such as reasoning, planning, problem-solving, and abstract thinking…), adaptive behavior comprises conceptual, social, and practical skills related to age expectations and the demands of the subject's context. All people learn and perform conceptual, social, and practical adaptive skills daily.

Support systems are 'an interconnected network of resources and strategies that promote a person's development and interests and improve an individual's functioning and personal well-being' (p. 56) [1].

The concept of support systems is thus based on a multidimensional perspective, which recognizes that people with ID have a wide range of needs but also potential, relying on an approach that considers the social, emotional, conceptual, and practical dimensions, proposing that support should be tailored to promote well-being and develop the individual's maximum potential [1].

In this context, in line with the concepts presented by the AAIDD (2021), we propose to discuss the support needs of children and adolescents with intellectual disabilities and the use of digital technologies in school participation and learning activities. In other words, to present digital technologies that could help support people with ID in schools. These technologies can also support education professionals and family members in planning and developing school activities with an approach centered on potential, with evidence-based practices and constant evaluation of results.

With the incorporation of these changes and the increasing use of electronic devices in everyday school life, digital technologies or information and communication technologies can become tools for educational purposes. We're talking mainly about Assistive Technologies. It is, therefore, essential to equip teachers to use these devices as allies in teaching conceptual, social, and/or practical adaptive skills. It's not a question of using digital technology to automate learning processes but of recognizing these tools' pedagogical value in integrating the curriculum in mainstream schools.

2 Methodology and Development

This survey was essentially based on applying the Support Intensity Scale for Children and Adolescents with Intellectual Disabilities (SIS-C) [2], a version adapted for Brazilian culture. The SIS-C is an instrument whose purpose is to assess the support needs of children with intellectual disabilities (ID) in a fair (reliable and valid) way using a uniform procedure [2]. It is aimed at the population between five and 16 years old. The SIS provides information that can help planning teams, agencies, and institutions understand the support needs of people with ID and other related developmental disabilities.

801 SIS-C applications were conducted with children and/or adolescents and their families and/or teachers and/or special education professionals (pedagogues, psychologists, speech therapists, and/or occupational therapists).

The applications were conducted in person or online at regional units of regular schools, special schools, or care centers in Brazil's five regions (South, Southeast, Centre-West, Northeast, and North).

Of the total number of participants with intellectual disabilities, 662 (82.65%) used verbal communication, and 95 (11.86%) used some form of alternative and/or augmentative communication. The sample was evenly distributed between the age groups, namely: 5 and 6-year-olds 138 (17.23%); 7 and 8-year-olds 139 (17.35%); 9- and 10-year-olds 150 (18.73%); 11 and 12-year-olds 152 (18.98%); 13 and 14-year-olds 118 (14.73%) and 15 and 16-year-olds 103 (12.86%). Regarding gender, 521 (65.04%) of the sample was male and 269 (33.58%) females. Ethnicity was predominantly white 408 (50.94%), followed by black and brown 161 (20.10%) and other 207 (24.97%). In terms of associated diagnoses, 301 (37.58%) had autism spectrum disorder, and 173 (24.60%) had developmental delay.

In order to present the variables and discuss correlations, the original database from the main SIS-C validation project in Brazil was cut out. The answers obtained from the 801 participants were selected in relation to each skill of the instrument that relates to the subject of this article. The raw data was transferred to an Excel spreadsheet, and 100% stacked column graphs were generated so that the correlation could be visually verified. The quantitative data will be presented, and the theoretical analyses and discussions will be carried out in the next sections.

3 Results and Discussion

The levels of support intensity assessed using the SIS-C Brazil version in the four adaptive skills emphasized in this paper will be presented, namely: (1) 'Operating electronic devices' in the 'Activities of Domestic Life' domain; (2) 'Learning how to use educational materials, technologies, and tools' in the 'School Learning Activities' domain correlated with (3) 'Being included in mainstream classrooms' in the 'School Participation Activities' domain, and (4) 'Keeping up with the curriculum content of

the mainstream class in which they are included' in the 'School Learning Activities' domain. The operationalization of these skills is shown in Table 1 and is based on the SIS-C applicator's manual developed by [3].

In the SIS-C assessment, the level of intensity of support required by children and adolescents with intellectual disabilities to fulfill each of the adaptive skills is measured based on three parameters: Type of support, Daily support time, and Frequency of support. In general terms: the type of support refers to the nature of the support needed; the frequency is related to checking how often certain support is provided to the individual being assessed and; the daily support time points to how many total minutes or hours per day the support is provided to the child or adolescent with ID.

It is worth pointing out that the higher the level of intensity of support, the more dependent the individual is on carrying out activities of daily living related to adaptive skills, and the lower the level of intensity of support, the better their autonomy in carrying out these activities.

In order to demonstrate the possible relationship between the variables studied, we chose to present the data using the 100% stacked column graph model, where the

Table 1 Presentation of the operationalization of the domains and adaptive skills assessed

Domain: domestic life activities refers to activities completed in a home. It focuses on the support that children and adolescents with ID need to engage in activities related to life in the home, in the family. The items included relate to activities involving personal care, as well as maintenance and cleaning of personal belongings and the home environment	
Skill or ability: operating electronic devices	Supports needed to operate computers, toys and entertainment devices such as radios, TVs and DVD players
Domain: school learning activities focus on access to the mainstream curriculum. Specifically, the items draw attention to the support needed to engage in learning activities associated with the acquisition of knowledge and/or skills	
Skill or ability: learning and using educational materials, technologies and tools	Learning and using educational materials (e.g. worksheets and books), technologies (e.g. computers and calculators) and tools (e.g. scissors and pencils)
Skill or ability: keeping up with the curriculum content of the mainstream class in which they are placed	Support to participate in lessons where the content is linked to the curriculum objectives (e.g. benefiting from the Universal Design of the curriculum, actively participating in co-operative learning groups, benefiting from differentiated instruction)
Domain: school participation activities refer to activities associated with participation in the school community and focus on support that ensures the child truly belongs to the school community	
Skill or ability: being included in mainstream classrooms	Supports participating in a regular classroom environment during structured and unstructured periods

Reference Material from the SIS-C User Manual [3]

ordinate axis shows in percentage which levels of support are needed to perform the skill assessed, varying according to the legend from level zero (no support needed) to level 4 (high support needed), the abscissa axis shows the skills assessed and the type, time and frequency of support needed separated by columns.

The colors illustrate the levels of intensity of support presented by the participants, with blue (level 0) being the most expected result because it represents the least need for support, green (level 1) demonstrating the level of support for the type of monitoring, which is carried out rarely and takes less than 30 min. Level 2, in yellow, shows that the individual needs visual and gestural cues, often and for up to two hours, while level 3, in orange, requires partial physical help, very often and for a long period of time, lasting between 2 and 4 h of daily support. Finally, level 4, colored red, requires total physical assistance, which is always provided and lasts for more than 4 h.

Figure 1 shows the percentage of support levels for the four adaptive skills assessed. After the figure, we will discuss each of these skills.

In the 'Operating electronic devices' skill, 71–75% of the participants had a support level of 0 and 1, with little variation between the Type, Frequency, and Time of support needed. It can be said that, among the skills analyzed for this article, this one shows the highest level of independence and the lowest intensity of support. Among the answers given by the participants, there were reports that of all the domestic activities, this was the one that least required a specific teaching process; the individual's own interest in electronic devices such as tablets, mobile phones, televisions, and even household utensils seemed sufficient to provide moments of daily learning in a natural environment.

The adaptive behavior presented in second place, 'Learning how to use educational materials, technologies, and tools', shows data that is opposite to the first skill already described.

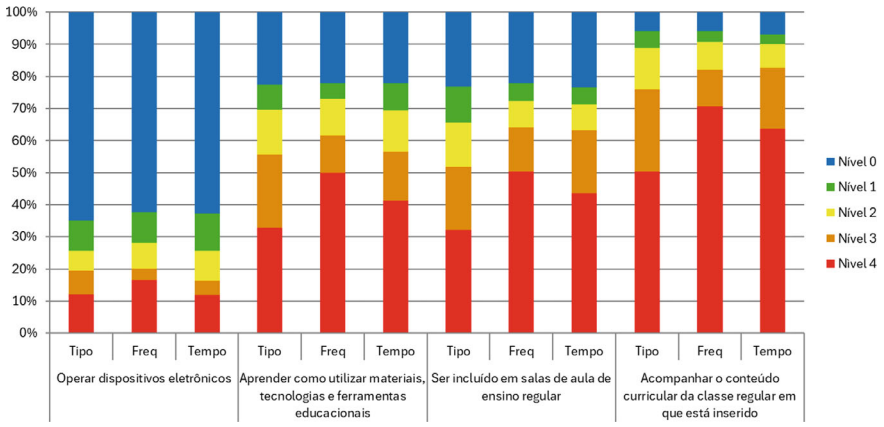

Fig. 1 Percentage of levels of support separated by type, time and frequency of adaptive skills assessed

If we add together levels 3 and 4, we see that 56% of the participants have partial or total physical help, 61% need support almost always or always, and 56% need more than 4 h of support to be able to use these tools in the school environment. In the records made during the application of the scales, the respondents attributed the time to more than 4 h because this was the time the individual spent at school. If they were in a situation where they needed to use these tools, they would require constant support.

This is related to the fact that if there is a mastery and use of technology at home, why isn't this knowledge used in the school environment to facilitate learning processes and keep students motivated? This question is in line with what [4] and [5] explore as 'digital natives', those people who are more comfortable using technology, suggesting the importance of a planned approach to integrating technology into an inclusive school environment.

The third adaptive skill assessed, and shown in Fig. 1, refers to 'Being included in mainstream classrooms', and it can be seen that more than 50% of the participants being included in mainstream classrooms would require support always or almost always and throughout the shift they would be in school. With the nuances observed, between 34 and 27% of the children and adolescents with intellectual disabilities in the sample are independent or require level 1 support. This shows that being in a mainstream school and attending class has been an arduous challenge for this population, requiring high support. We can infer the significant role of assistive and digital technologies in increasing the autonomy of children and adolescents with intellectual disabilities in mainstream school environments since these tools can improve engagement and learning outcomes.

When it comes to 'Keeping up with the curricular content of the regular class they are in', compared to the other skills presented, this one has the highest intensity of support (total and partial physical support), with 75% of the participants having it, 80% always or almost always needing support and 85% of the children and adolescents requiring this support for four or more hours a day.

Figure 2 presents a correlation matrix showing the relationships between the four variables studied: AP5—'Learning how to use educational materials, technologies and tools'; AVD9—'Operating electronic devices'; APE1—'Being included in mainstream classrooms'; and AAE1 'Keeping up with the curriculum content of the mainstream class in which they are placed'. Colors and numerical values are used to show the strength and direction of the correlations calculated.

On the main diagonal, the correlations are equal to 1, as each variable is compared to itself. In the other quadrants, the values can vary between − 1 and 1, representing the strength of the relationship between two variables: Values close to 1 indicate a strong positive correlation, i.e. the variables increase or decrease together; values close to 0 indicate a weak or non-existent correlation; negative values indicate a negative correlation. In order to understand the data, we know that the colors in the graph reinforce the strength of the correlations. Darker shades of blue represent stronger positive correlations. The lighter shades of blue indicate weaker correlations. The worst cases are the red colors, which represent negative correlations.

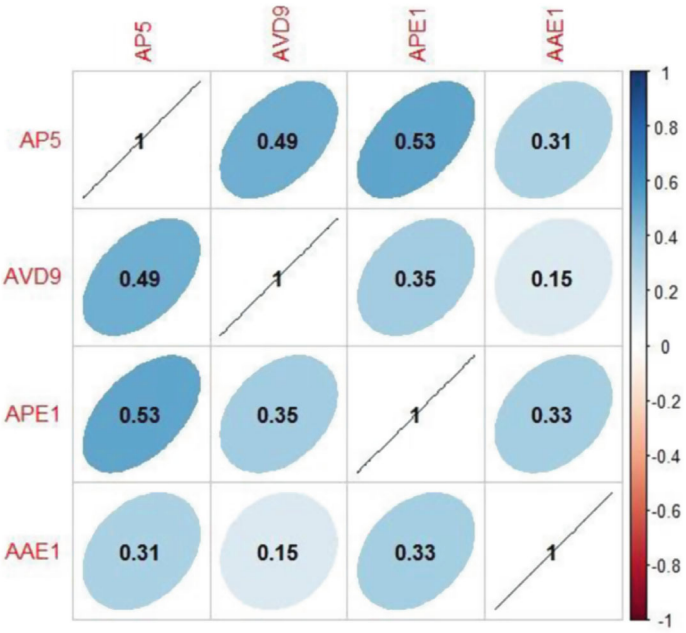

Fig. 2 Correlation matrix with density ellipses

Generally, the strongest relationship between different variables is between AP5 and APE1, with a correlation of 0.53. We can see that the AP5 and AVD9 variables have a moderate positive correlation (0.49), suggesting that there is a significant relationship between these variables, while the APE1 and AAE1 variables have a weak positive correlation (0.33), indicating a less consistent relationship. The variables AVD9 and AAE1 had the weakest correlation of 0.15.

The data thus suggests that digital technologies can be used as a bridge to improve other more challenging skills, such as 'keeping up with curriculum content'. As [6] suggests, incorporating digital technologies into the educational environment enables greater engagement of students with intellectual disabilities, promoting the development of adaptive skills in different contexts.

The study by [7] points out that 'innovations in educational technologies directly benefit students with disabilities, but also improve the learning experience for all students'.

As we mentioned before, the term Assistive Technology has evolved over the years. It identifies equipment or product systems, whether acquired, modified, or customized, that are used to increase, maintain, or improve the functional capabilities of individuals with disabilities. While Assistive Technology has been defined as a term over the years that specifically focuses on products developed for people with special needs, we argue that such products may have a broader use across mainstream users [8]. Although there are various definitions of assistive technologies, we thought

we would exemplify them with: (i) digital technologies for electronic notetaking; (ii) support technologies related to the keyboard; (iii) support technologies related to the use of the mouse; (iv) touch screens, as well as (v) software applications to guarantee accessibility and usability.

Assuming that three important components can be considered in the teaching–learning process (Pedagogy, Content, and Digital Technologies) from the teachers 'perspective and, consequently, from the students' perspective, we believe that it is important to reconcile the integration of digital technologies with their use in the context of pedagogical practices, highlighting the need for teacher and student training. To this end, training in active learning methodologies and digital technologies may be necessary.

4 Final Considerations

In the context of supporting children and adolescents with intellectual disabilities in participation and school learning activities, it is essential to bring in assistive technologies and applications for school participation and learning, with the aim of highlighting the integrative approach to the use of resources and strategies focused on the development and interest of the person, aimed at improving human functioning, quality of life and personal well-being, as well as the possibility of using the development of a skill in different spaces, in this case, school, and home. Research such as that of [9] reinforces the idea that developing adaptive skills, supported by technology, is essential to prepare young people with disabilities for future challenges.

It is thus an approach centered on potential, using information and communication technologies, incorporating assistive technology, multidisciplinary teams, evidence-based practices, and constant evaluation of results.

Thus, with the increasing use of electronic devices in everyday school life, information and communication technologies, generically referred to as digital technologies, can become tools for educational purposes, so it is essential to educate teachers to use them as allies in the teaching–learning process of conceptual, social and/or practical adaptive skills. Let's remember [10], who pointed out that although technologies are increasingly accessible, many teachers face difficulties in integrating them due to a lack of adequate training and technical support.

Consequently, the results of the DISmode and IM-PRO-IN-DE European ERASMUS + projects [11, 12] will help minimize technological and digital barriers in training teachers and facilitators to support children and adolescents with intellectual disabilities in school participation and learning activities.

References

1. Schalock, R., Luckasson, R., Tassé, M.: Deficiência intelectual: definição, diagnóstico, classificação e sistemas de apoio. 12. ed. American Association on Intellectual and Developmental Disabilities, Washington, DC. Versão língua portuguesa/Brasil: Castro, S. F.; Boueri, I. Z. (2021)
2. Thompson, J., Wehmeyer, M., Hughes, C., Shogren, K., Seo, H., Little, T., Schalock, R.: Supports Intensity Scale—Children's Version. American Association on Intellectual and Developmental Disabilities, Washington, DC (2016)
3. Thompson, J., Bryant, B., Campbell, E., Craig, E., Hughes, C., Rotholz, D.: Supports Intensity Scale User's Manual. American Association on Mental Retardation, Washington, DC (2004)
4. Prensky, M.: Digital Natives Digital Immigrants. On the Horizon NCB University Press, vol. 9(5), pp. 1–6 (2001)
5. Demirbilek, M.: The 'digital natives' debate: an investigation of the digital propensities of university students. Eurasia J. Math., Sci. Technol. Educ., Turkey **10**(2), 115–123 (2014)
6. Edyburn, D.: Assistive technology and students with disabilities: from consideration to outcome measurement. J. Spec. Educ. Technol. **21**(1), 57–76 (2006)
7. Rose, D., Meyer, A.: The Future Is in the Margins: The Role of Technology and Disability in Educational Reform. U.S. Department of Education, Washington, DC (2000)
8. Zallio, M.; Ohashi, T.: The evolution of assistive technology: a literature review of technology developments and applications. CoRR (2022)
9. Alles, E.P., Minetto, M.F.J., Castro, S.F., Boueri, I.Z.: Teaching adaptive health and safety skills in the transition to adult life for young people with intellectual disabilities. Int. J. Dev. Educ. Psychol.: INFAD Rev. Psicología **1**(1), 123–132 (2022)
10. Selwyn, N.: Education and Technology: Key Issues and Debates. Continuum, London (2011)
11. Gonçalves, V., Vaz, P., Mesquita, E., Lazarov, A.: Dismode - Formación digital para animadores juveniles de ONG para que se conviertan en moderadores de apoyo a jóvenes con discapacidad. In: Álvarez-Arregui, E., Rodríguez-Martín, A., Rodríguez-Fernández, C., González-Melgar, C., Álvarez-Hevia, D.M. (eds.) Organización y Gestión de Edusistemas en Transformación: retos, visiones y propuestas de mejora, pp. 182–187. Universidad de Oviedo, Oviedo (2023)
12. Gonçalves, V., Mesquita, E., Vaz, P., Freire-Ribeiro, I.: Projetos europeus no IPB para promover a inclusão com tecnologias digitais. Rev. EducaOnline **18**(2), 90–100. ISSN 1983-2664 (2024)