



Development of a Proposal for the Digitalisation of a Support Needs Assessment for Children and Adolescents with Intellectual Disabilities

Paula Cristina Stopa¹, Iasmin Zanchi Boueri², Sabrina Fernandes de Castro³, Vitor Gonçalves⁴

¹Federal University of Paraná, Brazil

²Federal University of Paraná, Brazil

³Federal University of Santa Maria, Brazil

⁴Polytechnic Institute of Bragança, Portugal

Abstract

This study describes the digitalisation of the Supports Intensity Scale – Children’s Version (SIS-C), which measures the support needs of children and teenagers aged 5 to 16 with Intellectual and Developmental Disabilities [5] [6]. As part of a broader research project, it aims to adapt the original paper-and-pencil version into a digital alternative while preserving the psychometric integrity established in prior studies. This exploratory study developed a digital model based on data from 801 participants. The process involved key stages: reorganisation and repositioning of variables and response categories; validation by expert judges; interface adaptation; and methodological adjustments to support implementation. Variables were reorganised and repositioned to ensure usability, traceability, and effective data management, including the addition of identification fields tailored to the Brazilian context. Following these modifications, the instrument underwent validation by expert judges in Special Education and Educational Technology. Their feedback informed structural revisions and interface refinements, leading to distinct forms for interviewers, respondents, and participants. Once these revisions were implemented, the instrument was developed into a digital version integrated into a database. Google Workspace tools (Forms and Sheets) were selected for their accessibility, usability, and data management capabilities, providing a cost-free interface. The data from 801 participants were processed in the R statistical environment, ensuring computational accuracy and enabling automated score calculation, reducing manual errors and enhancing reliability. The system also enabled analytical visualisation and longitudinal monitoring, features that were not previously available. The digital version improved application efficiency, analysis speed, and large-scale data management, while preserving conceptual equivalence with the original instrument. The study demonstrates that successful digital adaptation requires validation and contextual redesign, rather than simple format migration. The SIS-C Digital contributes to advancing support needs assessment in Special Education by providing a more efficient tool for data collection, analysis, and interpretation.

Keywords: *Special Education, Intellectual Disability, Supports Intensity Scale, Instrument Digitalisation.*

1. Introduction

In Brazil, according to data from the Brazilian Institute of Geography and Statistics (IBGE), 18.6 million Brazilians aged two or older are considered People with Disabilities (PwD) [1]. In addition, according to the 2023 School Census released by the National Institute for Educational Studies and Research Anísio Teixeira (INEP), there were 952,904 Special Education enrolments in Basic Education of students diagnosed with Intellectual and Developmental Disabilities (IDD) [2].

Although students with IDD represent a significant share of diagnoses in Basic Education, the assessment of IDD has not been an easy task since the 1950s, when it was carried out based on Intelligence Quotient (IQ) tests. Over the years, intelligence tests began to be rethought, and adaptive behaviour assessment instruments started to be developed to support the diagnostic process [3].

In this regard, the *American Association on Intellectual and Developmental Disabilities (AAIDD)* published the first version of the Supports Intensity Scale (SIS) in 2004, intended to assess the intensity of supports needed by youths and adults aged 16 and older [4]. At this point, the supports paradigm became central, and the instrument’s purpose shifted away from diagnosis toward guiding professional practice and improving the quality of life of individuals with disabilities.



In 2014, AAIDD developed the Supports Intensity Scale – Children’s Version (SIS-C), which aims to measure the relative intensity of the support needs of children and adolescents with intellectual and developmental disabilities and developmental delays, between five and 16 years old [5]. The children’s version became necessary because “[...] the settings and activities of childhood differ from the settings and activities of adult life” [6].

The SIS-C was validated and adapted to the Brazilian context through the study “Adaptation and Validation of the Supports Intensity Scale for Children and Adolescents (SIS-C) with Intellectual Disability in Brazil” [7]. For this study, the SIS-C was administered in all regions of the country, with a total of 801 administrations [8] completed manually using the printed, paper-and-pencil version of the instrument. The SIS-C was translated and validated for the Brazilian context and, during the establishment of its psychometric parameters, yielded an overall Cronbach’s Alpha coefficient of 0.968, indicating excellent internal consistency and item reliability during the establishment of its psychometric parameters, yielded an overall Cronbach’s Alpha coefficient of 0.968, indicating excellent internal consistency and item reliability.

The paper-and-pencil version is widely known and is the most common way to complete instruments; however, it can be prone to errors, especially during result generation [9]. This is a problem shared by several instruments that rely on manual entry followed by calculation for analysis, as human error can occur during the calculation process [10].

One strategy to minimise the errors of paper-and-pencil completion is the digitalisation of instruments. Instruments are considered digital when their organisation and administration are carried out by a computer or via the Internet [11]. Although the digitalisation of instruments is not new, the use of technology to automate manual processes continues to grow, especially in the United States and in Europe [9] [12]. In Brazil, where studies began later, growth has been gradual since 2004 [9].

In a literature review conducted on the CAPES Journal Portal (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) using the Boolean operators “Escala de Intensidade de Apoio” OR “Escala de Intensidade de Suporte” OR “Escala de Intensidade de Apoio - Versão Criança” OR “Escala de Intensidade de Apoio - Versão Adulto” OR “Supports Intensity Scale - Children’s Version” OR “Supports Intensity Scale - Adult’s Version” AND “Informatização de Instrumentos” OR “Avaliação Informatizada” OR “Computerized instruments” OR “Computerized Assessment” OR “Teste Informatizado” OR “Computerized Test”, no studies were found that demonstrated this transition from the paper-and-pencil version to an automated version. Thus, the need to conduct this study to digitalise the SIS-C scale in Brazil was identified.

The digitalisation of psychometric instruments is not a neutral technical process. Research in this area consistently demonstrates that format transitions can affect construct validity, measurement invariance, and response equivalence if not systematically managed [Bugbee, 1996; Mead & Drasgow, 1993]. Mode effects – differences in scores attributable to the medium of administration rather than to the underlying construct – have been documented across cognitive, behavioural, and adaptive scales, particularly when respondent populations include individuals with low digital literacy or atypical cognitive profiles [Cella et al., 2007]. Accordingly, the digitalisation of the SIS-C must be framed not merely as a technological upgrade but as a validity-sensitive psychometric endeavour that requires explicit attention to measurement equivalence, interface accessibility, and procedural fidelity.

Therefore, this study, which is part of a larger study [13], aims to describe the digitalisation process of the Supports Intensity Scale – Children’s Version (SIS-C) for children and adolescents aged five to 16 with Intellectual and Developmental Disabilities (IDD).

2. Methods

This study is characterised as quantitative, with a non-experimental, cross-sectional, and exploratory design [14] [15], aimed at developing a digital version of the SIS-C in Brazil.

2.1 Data Source

This study was based on data from the Brazilian adaptation and validation study of the instrument. The SIS-C sample consisted of 801 children and adolescents (five to 16 years old) with IDD, distributed across five Brazilian regions, 20 states, and 120 cities, ensuring broad geographic representativeness of the national territory [8].

2.2 Instrument



The SIS-C is organized as follows: Section 1) Exceptional Medical and Behavioural Support Needs, composed of subscale 1A – Medical and 1B – Behavioural; Section 2) Support Needs Scale, composed of seven subscales: Part 2A Home Living Activities; Part 2B Community Living Activities; Part 2C School Participation Activities; Part 2D School Learning Activities; Part 2E Health and Safety Activities; Part 2F Social Activities; Part 2G Self-Advocacy Activities; and Section 3) Scoring and Profile Form [5]. As already emphasised, this instrument is a standardised assessment tool designed to measure the support needs of a child or adolescent aged five to 16 with IDD to succeed in age-appropriate community settings [8]. Accordingly, the visual presentation of the SIS-C Digital result charts sought to display the scores obtained in Section 1. Exceptional Medical and Behavioural Support Needs, which represent the summary of scores, and the scores obtained in Section 2. Support Needs Scale, which represents the child or adolescent’s support needs profile.

2.3 Framework for the Digitalisation of SIS-C:

After the ethical procedures, the digitalisation involved four key stages: Phase 1 – reorganisation and repositioning of variables and response categories; Phase 2 – validation by expert judges; Phase 3 – interface adaptation; and Phase 4 – methodological adjustments to support implementation, as presented in Figure 1.

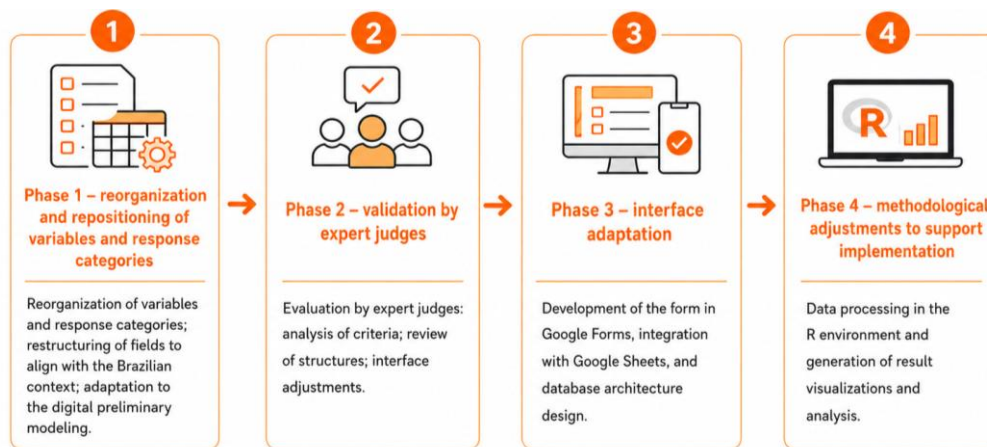


Figure 1. Framework for the digitalisation development of the SIS-C. Developed using ChatGPT.

The selection of expert judges followed purposive sampling criteria based on three conditions: (a) a minimum of five years of active research or professional practice in Special Education or Educational Technology; (b) authorship of at least two peer-reviewed publications relevant to psychometric instrument design, adaptive behaviour assessment, or digital learning systems; and (c) institutional affiliation in Brazil or Portugal, ensuring contextual familiarity with both the source instrument and the target implementation environment. Units receiving 75% or higher agreement were considered priorities for revision. Below this threshold, decisions were made based on technical and conceptual relevance, as assessed by the research team in consultation with the original instrument manual.

2.4 Data Analysis Procedures

To test data entry on the platform, 95% of the source data was used in the digital version. Sequential stages of the data analysis procedure adopted for the SIS-C Digital, illustrating the parallel workflow between platform data entry, automated score processing in R/RStudio, and computational equivalence verification against the original paper-and-pencil dataset.

Data analysis procedures were conducted in parallel with the digitalisation framework (Section 2.3) and with progressive data entry into the platform (Figure 2). A total of 95% of the source dataset (n = 763) was used to test computational fidelity, with raw scores processed in the R statistical environment using RStudio, enabling automated score calculation and normative comparisons based on the age-referenced parameters from Appendices B and C of the SIS-C manual. To verify equivalence, digitally processed scores were compared with the original, manually calculated values using Pearson's correlation coefficient and mean absolute error, ensuring that no systematic bias was introduced during the format transition.

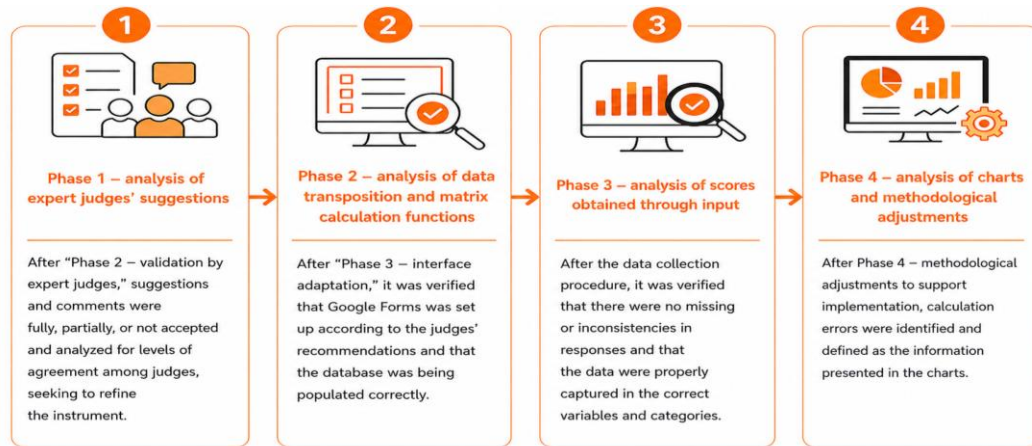


Figure 2. Stages of the Data Analysis Procedure of the SIS-C Digital. Developed using ChatGPT.

3. Results and Discussion

For the development of the digital version of the scale, the variables (general items and adaptive behaviours) and categories (respondents' answers) of the paper-and-pencil SIS-C were tabulated as presented, thus yielding the first digital version, named "SIS-C Digital Scale - Pilot 2021". The same procedure was applied when importing the database of the Brazilian SIS-C adaptation and validation project, which resulted in the second digital version, named "Database - Pilot 2024".

When comparing the two versions, differences were identified, specifically in the variables and categories of the cover sheet related to types of associated diagnosis, kinship, types of residence, and educational stages. This was because the "Database - Pilot 2024" version had incorporated variables and categories derived from the instrument's open-ended items, collected during the validation study administrations. Therefore, the variables and categories of the two versions were merged to be complementary, resulting in the third version, named "SIS-C Digital Scale + Database".

After grouping the variables and categories, the list of the 27 Brazilian states was included to map the geographic distribution of respondents. In addition, new variables were included in the "Associated Diagnosis" field, which was renamed "Primary Diagnosis" and complemented by the "Secondary Diagnosis" variable, while new categories were added to the "Person who provides support" variable. To facilitate the inclusion or exclusion of variables in future versions, each variable and category, whether open-ended or closed, was coded; that is, a numerical value was assigned to each, as recommended in the literature [15]. As a result of this process, a fourth version was created, named "SIS-C Digital Scale Pre-Equivalence Test".

Once all the information was organised, the platform was selected, and the variables and categories were transposed to *Google Forms*, the platform chosen for the development of the interface and the digital version. It is worth noting that, although *Google Forms* is not a platform designed for psychometric assessments, this interface was chosen because it is free, does not require purchasing a domain, has a simple, intuitive, and well-organised interface, and can generate a storage base in *Google Sheets*.

Once *Google Forms* was created, a visual identity was designed using the colours of the paper-and-pencil version, and the pilot model of the scale was developed and organised into three forms: one for interviewer registration, another for respondent registration, and a third form containing the fields for the "Participant Profile" and Sections 1 and 2 of the Scale.

The pilot model of the SIS-C Digital was then submitted for equivalence review by two judges, one from the field of Special Education (SE) and the other from Educational Technology (ET), from Brazil and Portugal, selected based on their publications in the areas of SE and ET. The judges' comments included suggestions for incorporating certain variables and categories, for the presentation format of variables and categories, and for the organisation of the form. The remarks were discussed, and the suggestions were incorporated, resulting in a fifth version of the scale, named "Expert Judges Version". The development of a pilot model is an important stage in the instrument development process, as testing the pilot allows comments and revisions to be made and refined based on respondents' contributions [14]. For this reason, it is recommended that the pilot model of an instrument be administered to a sample composed of specialists in the field, such as expert judges. This administration is intended to evaluate the instrument items and verify whether the categories and variables, as well as their response formats, are understandable and aligned with the proposed objectives, enabling adequate administration to the remaining participants [11].



With the fifth version of the scale, a new form was created in *Google Forms*, structured as a single form, organized into: Section 1 – Interviewer Data; Section 2 – Respondent Data; and Section 3 – Interview and Profile Form – Child or Adolescent Data; subsection 1 – Exceptional Medical Support Needs and Exceptional Behavioural Support Needs; subsection 2 – Support Needs Scale, with its seven subscales. As a result, the “Expert Judges Version” was submitted for validation by eight expert judges, three from the field of SE and five from the field of ET, selected based on their experience and length of work in these areas, whether in SE or ET, in addition to being researchers from Brazil and Portugal.

A total of 52 comments and suggestions were received from the expert judges. Of these, 21 were disregarded as repetitive or as commendations of the proposal. The remaining 31 comments and suggestions were tabulated and grouped into 14 units of analysis according to the type and nature of the comments and suggestions, which were then grouped by semantic proximity into four categories: a) Scale Structure; b) Interviewers; c) Respondents; d) Participant Profile.

Next, the percentage of judges ($n = 8$) who indicated, in their comments, the need for adjustments in each of these units of analysis was calculated, and they were then classified, regarding the decision to incorporate the suggestions, in three ways: 1) Fully accepted (AI): suggestions and comments that contributed to the clarity, functionality, or appropriateness of the digitalisation; 2) Partially accepted (AP): suggestions and comments that contributed to improving the scale but, to some extent, conflicted with the structure of the original scale, or in which the comments conflicted with each other; 3) Not accepted (NA): suggestions and comments that would alter the structure of the scale and the data, that contradicted what is proposed in the instrument’s manual, that fell outside the proposed objective of the validation, or that referred to cultural differences between Brazil and Portugal.

It is worth noting that the decision to incorporate suggestions and comments was not based solely on the percentage (%) of agreement across thematic convergence among the expert judges, but also on their technical relevance and importance for improving the scale, as shown in Table 1.

Table 1. SIS-C Digital validation data by expert judges [13]

Unit of analysis	Category	Type of comments	Agreement %	Classification
1. Layout, legibility and/or formatting adjustments	Scale Structure	Font, text formatting, visual organization, watermark, display	100%	AI
2. Review of administration instructions	Scale Structure	Clarity of instructions, explicitness of procedures	25%	AI
3. Inclusion/adjustment of confidentiality and/or ethics statement	Scale Structure	Consent and confidentiality	25%	NA
4. Numbering and organization of questions	Scale Structure	Numbering of items and blocks	25%	AP
5. Required fields and/or completion validation	Scale Structure	Required fields	50%	AP
6. Review of the scoring key and score presentation	Scale Structure	Calculations and automation of results	37.5%	AI
7. Adjustments to the navigation logic/usability of the digital scale	Scale Structure	Separation of the Form	12.5%	NA
8. Inclusion of an “Other” option	Scale Structure/Profile	Inclusion of the “Other” category in closed fields	87.5%	AI
9. Comments on changing, extending, or shortening the instrument	Scale Structure	Scale length and completion time	25%	NA
10. Adjustments to the professional profile field	Interviewer	Role, position, professional council, interviewer qualifications	50%	AP
11. Adjustments to the respondent/family member profile	Respondent	Kinship, cohabitation, respondent data	25%	AP
12. Review of form terminologies/acronyms	Respondent	Ambiguous acronyms and terminology	25%	NA
13. Adjustments to participants’ sociodemographic variables	Profile	Sex/gender, race/ethnicity, states, etc.	25%	AP



14. Criteria for IQ measurement and/or adaptive behavior and eligibility	Profile	Definition and recording of these data	12.5%	NA
15. Inclusion or refinement of information on supports/providers	Profile	Support person, contacts, support	12.5%	AI

It was observed that the contributions of the SE expert judges were more focused on the conceptual fidelity of the scale, the relevance of the variables and categories, and the eligibility and assessed constructs, whereas the contributions of the ET expert judges were more focused on the analysis of platform usability, navigation flow, and system functionalities. After evaluating all units of analysis, the suggestions and comments that were fully or partially accepted were incorporated, culminating in the development of a sixth digital version, named “SIS-C Digital”.

The suggestions and comments from the expert judges raise important reflections, since digitalising an instrument requires more than simply migrating from one format to another. The way it is administered must be rethought, as must the format of the variables and categories, requiring a contextual redesign and computational strategies that enhance efficiency, accuracy, and data management. This reinforces the need for instruments to be analysed, discussed, and validated by samples of specialists in the field [16] [11]. The results show that the digitalisation of the SIS-C required not only digital transposition but also the structural reorganisation of the variables, the redefinition of navigation flows, and methodological adaptation to preserve the conceptual equivalence of the scale.

Following the changes, the interface was updated by creating a form in *Google Forms*, and the Database (Matrix) in *Google Sheets* was initiated for data storage. The Matrix was organised according to the layout of the variables and categories of the SIS-C Digital, and the data from the 801 participants were individually transposed to the variables and categories of the final version of the SIS-C Digital. The data were then reviewed to ensure there were no errors or omissions.

Verifying transposed data is important in the digitalisation process because, as a manual procedure, errors can occur. However, such potential errors need to be corrected through individual review of the data and through the appropriate modifications [15].

After analysing the transposed data, methodological adjustments to support implementation were initiated by developing the calculation functions. To this end, a spreadsheet was created to receive data from the Matrix and perform calculations on the raw data, organised by the values of the items in each section of the scale. These data were automatically transferred to a new spreadsheet, and the raw values were submitted to automated operations for summing the scale parts and calculating the mean. Subsequently, the values were directed to specific spreadsheets, organised by age groups (for example, “5-6_y” and “7-8_y”), incorporating the reference values provided in Appendix B and Appendix C of the scale’s manual, which, in the paper-and-pencil version, serve to establish the parameters and define the participants’ support intensity levels.

This calculation stage, in the paper-and-pencil version, is performed manually in Section 3 “Scoring and Profile Form”. However, with digitalisation, this step becomes automated. As a result, this format offers several advantages, such as time savings in data entry and correction, score generation, and result verification, especially in reducing calculation and measurement errors [9] [10].

Upon completing the development of the Matrix’s calculation functions, a test was conducted using 95% of the data (n = 763) with the SIS-C Digital to ensure that the data entered remained unchanged. The comparison between manually transposed data and data processed by the SIS-C Digital showed equivalence of results in the analysed database, indicating the stability of the automated calculation functions and the consistency of the computational processing of the data.

One of the main advances observed with the SIS-C Digital concerns the automation of calculations, which is now performed quickly and with a significant reduction in the risk of human error, as reported in the literature. Unlike the paper-and-pencil version, in which calculations must be performed manually, the digital version enables greater accuracy in score generation and optimises the time devoted to correcting and analysing results. These findings corroborate theoretical discussions that highlight one of the main advantages of computerised tests: the computer’s ability to score responses without error, quickly and accurately [17]. Likewise, studies indicate that programs and computational resources could contribute to the presentation of statistical results [12].

Once the calculations were completed, programming was carried out in the R system using RStudio, and the development of visual presentations of the result charts to visualise support intensity levels was initiated. The presentation of the SIS-C Digital results was designed to be intuitive, clearly showing the support intensity levels of the child and adolescent, as well as those of other participants in the same age group. These data needed to be understood both by the interviewer and by Education or Health



professionals who design educational plans or interventions for the child or adolescent and who could therefore come into contact with the results of the SIS-C Digital, since the information is analysed and produces results that allow understanding the support needs that a child or adolescent requires to live in society with autonomy and independence [18].

For the presentation of scores, following the digitalisation of the scale in the SIS-C Digital, after data *input* and processing in the R system, it became possible to perform calculations automatically and generate chart data in a simpler, more efficient way for analysis.

In the SIS-C Digital, the data is received from Section 1. Exceptional Medical and Behavioural Support Needs are sent to the interviewer's registered e-mail. In the document, the Section 1 scores indicate the behavioural and medical needs items separately, and, for each of them, the items in which the child or adolescent most needs support are presented at the top, following the model of other studies of the scale in which Section 1 scores are organised starting from the highest scores [19].

The data received from the Section 2 Support Needs Scale, as well as those from Section 1, are stored in the Matrix and, once the scale has been completed, are sent to the interviewer's registered e-mail and presented to the interviewer in two ways:

1) Support Needs Profile: the first chart is the support needs profile chart, composed of the *Standard Score*, the Composite *Standard Score* (Support Needs Index), and the Percentile, according to Appendices B and C. In this chart, the age-group means for each part of the scale are represented by columns on the x-axis; alongside, a line indicates each participant's score.

2) Item Scores for each of the Parts: each of the seven subscales is given a chart in which the items for which the children or adolescents most need support are presented at the top, in descending order. The visualisation of the support needs chart, organised in this way, provides a concise, simple way to view a summary of scores across the seven parts and to indicate which items require greater attention for the child or adolescent [19].

Thus, we can affirm that the results obtained so far [13] show that the digitalisation of the SIS-C preserved the conceptual structure of the original instrument while also improving processing efficiency, reducing operational errors, and enabling new resources for data analysis and visualisation. In addition, the process showed that the digital adaptation of instruments requires methodological validation, structural reorganisation, and computational integration, and is not limited to a simple format migration. The SIS-C Digital now provides a system for monitoring the development of children and adolescents with IDD, as well as longitudinal analysis and continuous assessment, more faithfully reflecting the reality of the Brazilian territory.

4. Conclusions

Finally, this study achieved its proposed objective: to describe the digitalisation process of the Supports Intensity Scale – Children's Version (SIS-C) for children and adolescents aged five to 16 with Intellectual and Developmental Disabilities (IDD). It can be stated that the digitalisation of the SIS-C in Brazil contributed to greater speed in analysis and result generation, as well as to the reduction of human errors, since automated calculations are not subject to typing or mathematical errors and results are now generated.

The results also show that the SIS-C digitalisation process was not limited to migrating the paper-and-pencil version to digital, but also required structural reorganisation, validation by expert judges, and the development of computational strategies and programs, with the aim of preserving the scale's psychometric properties.

In addition, the structure developed for the SIS-C Digital enabled the creation of a data matrix capable of storing historical and longitudinal data on participants' information, enabling different possibilities of analysis regarding the support needs of children and adolescents with intellectual disability throughout the Brazilian territory (allowing different types of analyses).

Another aspect that needs to be highlighted concerns the generation of scores and the presentation of result charts, which facilitate data interpretation by Education and Health professionals and enable the historical and longitudinal monitoring of data by participants in Brazil.

As a limitation of this study, although functional tests and verification of the automated calculations were carried out, the results presented correspond to an initial stage of a broader study. Another limitation is the limited potential to replicate this study in other countries, because each country needs to work with its own standardised data, that is, statistical values that reflect the reality of that country. Based on these points, future studies may investigate the validity, usability, and reliability of the SIS-C Digital across different application contexts, as well as analyse the potential of the tool for longitudinal monitoring, indicator generation, and decision-making support in educational and clinical contexts.



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