

INSTRUMENTS FOR ASSESSING STUDENTS' DIGITAL COMPETENCES IN BASIC EDUCATION: A SYSTEMATIC LITERATURE REVIEW (2020–2024)

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Abstract

This study presents a Systematic Literature Review (SLR) aimed at identifying and characterizing the instruments used to assess students' Digital Competences (DC) in basic education. The methodology followed the recommendations of the PRISMA statement, in order to ensure the rigour and replicability of the analysis carried out. After applying the predefined inclusion and exclusion criteria, the corpus of this analysis consisted of 22 scientific articles published between 2020 and 2024. The analytical process was organized around four categories: C1. Type of instruments, C2. Assessment objects, C3. Conceptual framework, and C4. Assessment tasks. The results of the SLR, described according to these dimensions, suggest that: a) Quantitative instruments predominate, with performance tests and self-report questionnaires being the most frequently applied; b) Most studies adopt an integrated perspective, addressing knowledge, skills, and attitudes; c) International frameworks, particularly the European Digital Competence Framework for Citizens, dominate the reviewed studies, and d) Tasks are mainly based on recognition, selection, or self-report, often using Likert scales. Real performance and observation-based tasks are less common. In light of these findings, this article brings together relevant elements to advance the current state of the art in the field of assessing DC in basic education, based on recent studies that present instruments specifically developed for this purpose. Beyond identifying trends, this study highlights gaps for future research on the topic, underscoring the need to promote the assessment of DC as a more integrated and formative process that moves beyond the predominance of quantitative approaches centered on performance tests and self-report instruments. Future research should prioritize assessment designs that better capture the complexity of DC through the articulation of knowledge, skills, and attitudes, incorporate observation and real performance tasks in authentic contexts, and further contextualize international frameworks, such as DigComp, to national curricular realities in Basic Education.

Keywords: Assessment, Digital Competence, Basic Education.

1 INTRODUCTION

The issue of assessing students' Digital Competences (DC) within the context of compulsory schooling has become one of the most pressing concerns in research in the field of Educational Sciences. Given the increasingly prominent role that digital technologies play in contemporary society, there is an urgent need to empower individuals to use technologies critically and effectively [1][2]. The promotion of DC must therefore be closely linked to appropriate resources and mechanisms for learning assessment, so that pedagogical strategies can be adequately designed and implemented with the aim of fostering students' DC.

Despite the acknowledged relevance of DC assessment and the inseparable triad of teaching–learning–assessment, existing instruments and resources for measuring DC appear to be either scarce or insufficiently appropriate, particularly when it comes to younger learners [3]. In this context, and with the aim of outlining an overview of recent research trends in the assessment of DC among students in Basic Education (BE), a review was conducted to identify the main contributions and challenges highlighted in the most recent literature on this topic. The specific objectives were to: (i) identify the types of instruments used to assess students' DC in BE; (ii) map the assessment objects of the identified instruments, analysing whether they predominantly focus on knowledge, skills, attitudes, or combinations of these components; (iii) analyse the conceptual frameworks underpinning the development of these instruments, identifying the models or frameworks that support the DC being assessed; and (iv) examine the types of tasks included in the instruments used to assess students' DC in BE.

As part of a doctoral research project in Educational Sciences, entitled “Assessment of Students' Digital Competence in the Early Years of Compulsory Schooling”, the results of this Systematic Literature Review (SLR) provide a comprehensive mapping of the state of the art concerning the intentional

assessment of students' DC in BE. These findings will inform the conceptual and methodological choices of the subsequent phases of the research¹, which aim to develop a Digital Competence Assessment Model for BE students.

2 METHODOLOGY

To achieve the proposed objectives, a SLR was conducted on the assessment of students' DC in BE. To operationalize this review, a search strategy was defined, which included the selection of databases, the identification of keywords, and the establishment of inclusion and exclusion criteria, as described below.

The search strategy was designed based on sets of keywords organized into three thematic axes: digital competences, assessment, and Basic Education. In the first axis, terms such as “digital competence,” “ICT competence,” “digital literacy,” “ICT literacy,” and “digital skills” were considered; the second axis included “assessment,” “evaluation,” “instrument,” “test,” “assessing,” “evaluating,” and “testing”; and the third axis comprised “primary education,” “primary school,” “pupils,” and “basic education.” Searches were conducted in the Scopus, Web of Science, and Scielo databases.

Regarding the inclusion criteria, scientific articles published between 2020 and 2024 in peer-reviewed journals were considered, focusing on the assessment of students' DC in BE or equivalent levels. Only studies written in Portuguese, English, French, or Spanish were included. Conversely, non-empirical studies, such as systematic literature reviews or theoretical works, as well as studies that did not address students' DC, did not specifically focus on their assessment, or concerned education levels other than BE, were excluded.

After the search was conducted between August and September 2025, 211 scientific articles were identified. In a subsequent phase, duplicates, non-empirical studies, and articles that did not address the assessment of DC or did not focus on BE were removed. The entire screening process was conducted in accordance with the recommendations of the PRISMA statement [4]. After the analysis of titles, abstracts, and full-text reading, the corpus of this SLR consisted of 22 articles, coded from A1 to A22 for reference throughout the text: A1 – [5]; A2 – [6]; A3 – [7]; A4 – [8]; A5 – [9]; A6 – [10]; A7 – [11]; A8 – [12]; A9 – [13]; A10 – [14]; A11 – [15]; A12 – [16]; A13 – [17]; A14 – [18]; A15 – [19]; A16 – [20]; A17 – [21]; A18 – [22]; A19 – [23]; A20 – [24]; A21 – [25]; A22 – [26].

Based on the objectives of this SLR, analysis categories were defined to guide the systematic organization of the information extracted from the studies. Each category corresponds to a specific objective of the SLR: C1. Type of instruments, C2. Assessment objects, C3. Conceptual framework, and C4. Assessment tasks. The subcategories were constructed inductively, based on the data emerging from the analyzed articles, with the exception of the Assessment object category, whose subcategories were defined deductively, using the components of DC established in DigComp 2.2 [27] as a reference. Consequently, this categorization enabled the construction of a results matrix, from which a quantitative and qualitative analysis of the findings was conducted.

3 RESULTS

This section presents the contributions resulting from this SLR, which focused on identifying the requirements considered essential by recent research in the assessment of students' DC. In this regard, the following subsections present the preliminary results of this SLR, organized according to the analysis categories previously defined.

3.1 Type of instruments (c1)

In alignment with the first objective defined for this SLR (“To identify the types of instruments used to assess students' DC in Basic Education”), the first category, entitled “Type of instruments,” brings together, as systematized in Table 1, the different types of instruments used to collect information on students' level of DC.

¹ The methodological–conceptual pathway designed for this research follows the principles of Design-Based Research and encompasses five interrelated stages: (1) Mapping, (2) Design, (3) Validation, (4) Testing, and (5) Consultation and Refinement. In the “Mapping” stage, a survey of the essential requirements for the assessment of students' digital competences (DC) is envisaged through two axes of analysis: (i) a systematic review of studies on the topic and (ii) an analysis of instruments and/or curricular documents designed to support this assessment.

Table 1. Distribution of articles by type of assessment instruments

| CATEGORY | SUBCATEGORY | ARTICLES |
|-------------------------|--|--|
| C1. Type of instruments | 1.1 Performance test | A1, A3, A4, A5, A6, A7, A10, A11, A12, A13, A14, A15, A16, A17, A20, A21 |
| | 1.2 Self-report/perception questionnaire | A1, A4, A5, A7, A8, A10, A11, A12, A13, A16, A18, A19, A20, A21, A22 |
| | 1.3 Observation grid | A2, A9, A14, A20 |
| | 1.4 Digital portfolio | A14 |

Source. Elaborated by the authors.

The majority of the articles resort to the application of performance tests (16 out of 22) and self-report/perception questionnaires (15 out of 22). In these articles, performance tests are referred to under different designations, ranging from more generic ones, such as “Problem-solving test” (A1), “Prueba de evaluación de competencias” (A5), “Instrumento de evaluación de la CD” (A6), “Prueba de Evaluación” (A16), and “Didactic tests” (A17), to more specific ones, such as “ECC-ICT test” (A3), “Prueba de Evaluación de la Competencia Digital de Estudiantes” (A4, A7, A11, A12, A13, A15, A20, A21), and “Digitest” (A10). A significant proportion of the instruments presented in the articles (A1, A4, A5, A7, A11, A12, A13, A16, A20, A21) combine performance tests to assess knowledge and skills with self-report questionnaires focused on the attitudinal component of students’ DC.

Self-report/perception questionnaires make use of Likert-type scales, with variations in the number of points and in the focus of the DC assessed. Some studies use four-point Likert scales (A8), five-point scales (A5, A16, A19, A22), and six-point scales (A10). A significant set of articles (A4, A7, A11, A12, A13, A20, and A21) uses the “Prueba de Evaluación de la Competencia Digital de Estudiantes (ECODIES)” to assess respondents’ attitudes in a given DC domain through a five-point scale. Article A22 is particularly noteworthy, as it integrates multiple previously developed self-perception scales, such as: “1st century learning and innovation skills scale” [28], “Digital literacy scale for 10–12 year old students” [29], and “Awareness scale for Web 2.0 tools” [30]. Overall, instruments of this type are mainly used to assess attitudes towards the digital domain and to collect respondents’ self-perceptions regarding their DC.

With regard to subcategory 1.3, four studies (A2, A9, A14, and A20) opted for the use of observation grids to support the collection and systematization of information on students’ DC. Article A14 deserves particular attention, as in this study the learning observation grid was not used in isolation. In the “Competence Assessment Model” (identified by the acronym CAM) presented in this article, observation was combined with other data collection processes, such as tests and some evidence that was systematized in a digital portfolio (which led this study to also be categorized under subcategory 1.4), thus enabling the collection of richer information about what students had learned. In study A20, the observation grid was used in an initial phase to subsequently interpret the results obtained from the application of the test in a second phase.

Overall, the findings gathered in this category highlight a predominance of quantitative approaches in the assessment of students’ DC, with a strong emphasis on performance tests and self-report questionnaires, often combined in order to cover the different components of DC. However, the use of observation grids and digital portfolios, although less frequent, proves to be an added value when articulated with other data collection instruments, as identified in A14, within a logic of complementarity between summative and formative assessment.

3.2 Assessment objects (c2)

After mapping the types of instruments used to assess students’ DC in BE, it was considered relevant to determine which component(s) of students’ DC (knowledge, skills, and/or attitudes) the DC assessment processes described in the studies are directed towards, in order to understand which aspects of DC are being valued in assessment. Table 2 presents the distribution of the articles according to the assessment focus of the instruments, categorizing them into Knowledge, Skills, Attitudes, and Not specified.

Table 2. Distribution of articles by assessment objects

| CATEGORY | SUBCATEGORY | ARTICLES |
|------------------------|-------------------|---|
| C2. Assessment objects | 2.1 Knowledge | A1, A2, A3, A4, A5, A6, A7, A9, A10, A11, A12, A13, A14, A15, A16, A19, A20, A21 |
| | 2.2 Skills | A1, A2, A3, A4, A5, A6, A7, A9, A10, A11, A12, A13, A14, A15, A16, A17, A19, A20, A21 |
| | 2.3 Attitudes | A1, A4, A5, A6, A7, A10, A11, A12, A13, A14, A15, A16, A19, A20, A21 |
| | 2.4 Not specified | A8, A18, A22 |

Source. Elaborated by the authors.

The majority of the studies (15 out of 22) include instruments whose assessment focus encompasses the three components of DC in an interrelated manner. Subcategory 3.1 “Knowledge” and subcategory 3.2 “Skills” appear in 18 and 19 articles, respectively, while Attitudes appear in 15. It should be noted that in three articles (A8, A18, and A22) there is no mention of the components of students’ DC that are the objects of assessment in the studies.

It was observed that the attitudinal component of DC is slightly less present in the studies comprising the corpus of this SLR. This difference may be related to the greater complexity required in assessing attitudes, since, as emphasized by Zabala and Arnau [31, p. 221], “(...) the written test is completely useless when it comes to assessing attitudes, insofar as the only way to know them is to place the student in conflictive situations while knowing that they are not being observed.”. If we consider that most of these studies are conducted in formal educational contexts, such as the classroom during the instructional time of a subject, authentically observing attitudes in contexts of digital technology use becomes more difficult to operationalize.

3.3 Conceptual framework (c3)

After analysing the types of assessment instruments and the assessment focus adopted in the studies, it was considered pertinent to identify the conceptual framework underpinning the construction of the DC assessment instruments analysed, insofar as the understanding underlying the adopted concept of DC influences central decisions in the assessment process (e.g., the nature of the proposed tasks, the type of instruments, and the context in which the assessment is implemented, among others). Based on the data emerging from the studies, the findings were organised into three subcategories: 3.1 Explicit alignment with international frameworks, 3.2 Explicit alignment with national frameworks, and 3.3 Indirect derivation (Table 3).

Table 3. Distribution of articles by conceptual framework adopted

| CATEGORY | SUBCATEGORY | ARTICLES |
|--------------------------|--|--|
| C3. Conceptual framework | 3.1 Explicit alignment with international frameworks | A1, A4, A5, A7, A10, A11, A12, A13, A14, A15, A16, A19, A20, A21 |
| | 3.2 Explicit alignment with national frameworks | A2, A3, A6, A10, A17 |
| | 3.3 Indirect derivation | A8, A9, A18, A22 |

Source. Elaborated by the authors.

A considerable proportion of the studies (14 out of 22) ground their instruments in international DC frameworks. The strong predominance of the European Digital Competence Framework for Citizens – DigComp [32] stands out, being explicitly adopted in articles A1, A4, A5, A7, A10, A11, A12, A13, A15, A16, A20, and A21. Article A14 is particularly noteworthy, as, in addition to being anchored in DigComp, it articulates this European framework with seven other DC frameworks applied in school contexts across different European countries. Only article A19 draws on a different international framework, being based on the “Digital Quotient Framework” [33].

Five articles are based on national frameworks, such as A2, developed in Spain based on a national document produced by the Government of the Basque Country [34], entitled “Competencia en el tratamiento de la información y competencia digital”, which defines the notion of DC, its dimensions, and specific indicators for BE.

Finally, category 3.3 Indirect derivation comprises a total of four articles (A8, A9, A18, and A22), which present assessment instruments resulting from the adaptation or reuse of instruments previously developed by other authors or in other studies, with or without explicit reference to the conceptual framework from which they originated. Examples include the instrument developed by Bastarrachea and Domínguez [35] in A8, the questionnaire based on Larraz [36] in A18, and the combination of scales [28], [29], and [30] in A22, but without a detailed discussion of the conceptual framework that underpinned their development.

3.4 Assessment tasks (c4)

In order to understand how students are encouraged to mobilize knowledge, skills, and attitudes in the digital domain within assessment situations, the assessment tasks present in the instruments described in the studies were identified and categorized into five subcategories (Table 4): recognition and selection tasks, simulated performance tasks or action scenarios, self-assessment and self-report tasks, observation and real performance tasks, and, finally, lack of sufficient information about the tasks.

Table 4. Distribution of articles by assessment tasks

| CATEGORY | SUBCATEGORY | ARTICLES |
|----------------------------|---|---|
| C4. Assessment tasks | 4.1 Recognition and Selection Tasks | A1, A5, A7, A10, A11, A12, A13, A16, A21 |
| | 4.2 Simulated Performance Tasks or Action Scenarios | A3, A6, A10, A11, A17, A21 |
| | 4.3 Self-assessment and Self-report Tasks | A1, A5, A7, A8, A10, A11, A12, A13, A14, A16, A18, A19, A20, A21, A22 |
| | 4.4 Observation and Real Performance Tasks | A2, A9, A10, A14 |
| | 4.5 Insufficient information about the assessment tasks | A4, A15, A20 |

Source. Elaborated by the authors.

A significant proportion of the instruments presented in the articles make use of recognition and selection tasks (9 out of 22), mainly through multiple-choice items. In some cases, the studies provide explicit examples of this type of task, such as in A21, in which the student is asked to identify the most appropriate resource for a specific situation: “De las siguientes opciones, ¿qué programa utilizaría para comunicarme rápidamente con familiares que viven en otra ciudad?”. Similarly, in A11, there are items that require the recognition of the correct option in specific contexts of technology use, such as: “En un procesador de textos, ¿qué tipo de archivo de los siguientes NO se puede insertar?”. Nevertheless, in several studies (A1, A12, A13, and A16), the authors refer to the use of this type of task without providing concrete examples, which hinders the analysis of the instruments they used.

With regard to subcategory 4.2, simulated performance tasks or action scenarios appear in a more limited set of studies (6 out of 22), seeking to bring assessment situations closer to students’ real-life contexts. The instrument used in the study described in A21 clearly illustrates this approach, as it presents the respondent with a scenario in which a presentation software crashes during the preparation of a school assignment, asking how the problem would be solved: “De repente el programa se bloquea y ya no soy capaz de seguir trabajando. ¿Cómo resolvería este problema?”. Similarly, the instrument described in article A6 presents collaborative situations in a digital environment, such as the need to share files and work simultaneously on a document, requesting the selection of the option with the most appropriate tool. Nevertheless, in most cases, these tasks propose narrative scenarios without requiring respondents to perform actions in digital environments and, effectively, to mobilize the DC they have acquired.

Self-assessment and self-report tasks are present in the DC instruments described in the majority of the studies analysed (A1, A5, A7, A8, A10, A11, A12, A13, A14, A16, A18, A19, A20, A21, A22), generally through Likert-type scales used to assess attitudes and perceptions regarding one’s own level of DC. For example, in A16, students were asked to position themselves in relation to the following statement: “Pienso bien qué información voy a compartir antes de hacerlo”, and in A19, in relation to the statement: “I don’t add people I don’t know online”.

Observation and real performance tasks, organized under subcategory 4.4, are less frequent (A2, A9, A10, and A14) and aim, in the instruments described, to propose practical activities to students, such as online research on a given topic, the creation of digital products, or problem solving. In A2, for example, students collaboratively construct a digital mural, and in A10, they carry out concrete tasks using technologies, such as generating QR codes to provide access to specific information.

4 CONCLUSIONS

The analysis carried out made it possible to verify that, with regard to the type of instrument adopted to assess students' DC, there is a predominance of quantitative approaches, with particular emphasis on performance tests and self-report questionnaires. This prevalence may reflect the persistence of an assessment perspective centred on the objective measurement of learning, to the detriment of contextualized practices that capture the complexity of DC, thus running counter to the formative perspective [31] [37].

A positive point is that more than half of the studies integrate assessment instruments that encompass the three components of DC (knowledge, skills, and attitudes), contrasting with the findings of previous reviews that highlighted an emphasis on the procedural component [3]. This interrelation identified in some of the assessment instruments analysed may suggest an evolution both in the conception of DC adopted and in the intentionality of assessment processes in school contexts.

At the conceptual level, there is a strong predominance of international frameworks, particularly DigComp, which serves as a guiding framework for the definition, operationalization, and assessment of DC in most of the studies analysed. Conversely, the use of national frameworks is less expressive, pointing to the need for greater contextualization of DC assessment to national curricular realities, adapting assessment instruments not only to international guidelines but also to the specificities of the different educational systems in which they are applied.

Although several studies present instruments that combine different types of assessment tasks, which is consistent with the complexity of DC [31], there is a prevalence of recognition and selection tasks and self-assessment and self-report items, with a lower frequency of observation or real performance tasks. Self-assessment and self-report tasks may be more susceptible to respondent bias, and recognition and selection tasks, in turn, when applied in isolation, are not the most appropriate for capturing the mobilization of DC in authentic contexts.

In summary, this article brings together relevant elements for understanding the current state of the art in the assessment of students' DC in BE, based on the analysis of recent studies that present instruments developed for this purpose. By also highlighting aspects that require further in-depth exploration, the findings of this SLR provide important contributions to the development of more integrated, contextualized, and formative DC assessment instruments, effectively supporting the learning of DC throughout BE.

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