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ORIGINAL RESEARCH ARTICLE

Measuring what matters: a systematic review and VOSviewer-based bibliometric approach to digital literacy assessment instruments, competency dimensions and challenges in education

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Digital literacy is a critical competency in education across all levels, from primary to higher education. It includes skills such as technical proficiency, information evaluation, online collaboration, creativity and ethical technology use. This study conducts a Systematic Literature Review (SLR), following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, to examine types of instruments used to assess students' digital literacy, the competencies targeted and the methodological challenges in their development. A total of 23 peer-reviewed articles published between 2014 and 2024 were selected from Scopus, PubMed, Crossref and ERIC. This review shows that assessment instruments include Likert scale-based questionnaires, framework-aligned tools (DigComp and DQ Framework) and digital performance-based methods. These instruments are applied across diverse educational settings: primary, secondary, tertiary and adult education with varying emphases based on age and learning context. Whilst core competencies are addressed, several limitations persist, such as reliance on self-reporting, limited cross-cultural validation and lack of authentic performance assessment. This study highlights the need for more comprehensive, validated and context-sensitive instruments that integrate digital safety, ethics and practical digital skills. The findings offer insights for researchers, educators and policymakers to improve digital literacy measurement across education sectors.

Keywords: digital literacy; measurement instrument; digital competency

Introduction

Digital literacy is increasingly recognised as a vital skill for students in the modern era, as it supports access to diverse literacy practices, critical thinking and informed technology use (Momdjian et al., 2024; Newland & Handley, 2016; Yuan et al., 2019). It encompasses abilities such as information search, digital communication, content creation and ethical awareness (Herro, 2014; Shin, 2015), all of which are essential in today's technology-integrated classrooms (Churchill, 2020). In response, researchers

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have developed various assessment tools including questionnaires, skill-based tests and self-assessments to measure students' digital literacy (Choi et al., 2023; Mieg et al., 2023; Son & Ha, 2024). However, these instruments differ widely in focus, ranging from technical proficiency to critical thinking and online safety, and there is still no universally accepted standard, making it difficult to compare digital literacy outcomes across contexts (Afandi et al., 2024; Oh et al., 2021).

Recent international frameworks including selfie for teachers based on DigCompEdu (Economou et al., 2023), the DQ Framework that integrates technical, cognitive and socio-emotional competencies (DQ Institute, 2023; Park & Gentile, 2019) and UNESCO's ICT Competency Framework for Teachers (UNESCO-UNEVOC, 2023) emphasise that digital literacy is inherently a multidimensional construct. These models underline the theoretical importance of developing assessment instruments that are holistic, theoretically grounded and context-sensitive, capable of capturing not only technical proficiency but also ethical reasoning, pedagogical integration and socio-emotional adaptability across diverse educational and cultural settings.

Although digital literacy has been widely studied, limited research has critically examined the instruments used to assess it in a comprehensive and multidimensional manner. Most existing studies focus on isolated components, such as internet safety or basic software usage, whilst essential dimensions like information evaluation, online collaboration and digital ethics are frequently overlooked (Mainz et al., 2024; Nguyen & Habók, 2023; Siddiq et al., 2016). Furthermore, few studies evaluate the applicability of these instruments across diverse educational contexts, including underserved schools and culturally diverse classrooms (Herzog-Punzenberger et al., 2020; Lawson et al., 2024).

This gap highlights the need for assessment tools that reflect the full scope of students' digital competencies. Unequal access to digital tools (Snyder et al., 2002) and overreliance on technology without proper support (Ruffini, 2022) may limit learning, particularly for students with lower executive functioning. The lack of consensus on definitions and frameworks complicates efforts to create standardised instruments. Although holistic frameworks like DigCompEdu and Information and Communication Technology – Competency Framework for Teachers (ICT-CFT) consider cognitive, social and emotional aspects (Cabero-Almenara et al., 2023; Magnago et al., 2024; Villoria-Mendieta, 2023), their practical implementation is constrained by the limited availability of validated, context-sensitive tools (Guo, 2024). Therefore, this study calls for a systematic review to evaluate digital literacy assessment instruments across educational settings, identifying instrument types, the core competencies measured including technical, cognitive, socio-emotional and ethical dimensions and methodological limitations. Special attention is given to trends in authentic tasks, cross-cultural validation and alignment with global frameworks such as DigComp and DQ, to inform the development of inclusive and effective instruments for primary through higher education. Based on these objectives, the research questions guiding this review are:

RQ1. What types of assessment instruments have been developed to measure students' digital literacy across different educational levels?

RQ2. What specific competency dimensions are targeted by these instruments, and how do they reflect evolving definitions of digital literacy

RQ3. What methodological limitations and contextual challenges are present in current instruments, and what directions can be proposed for future development to improve accuracy, inclusiveness and relevance?

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Method

This study employed a Systematic Literature Review (SLR) guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The use of PRISMA ensured transparency, replicability and rigour in the review process. The review procedure consisted of four key stages: identification, screening, eligibility and inclusion, followed by thematic synthesis and analysis of the included studies.

To complement the systematic review, a bibliometric analysis was conducted using VOSviewer version 1.6.19, focusing on co-occurrence analysis of author keywords. This software was selected due to its recognised capacity to generate accurate and interpretable network visualisations, making it a widely adopted tool in bibliometric and educational research. The dataset comprised the 23 peer-reviewed articles included in the final synthesis. Through keyword co-occurrence mapping, VOSviewer facilitated the identification of key conceptual clusters, recurrent themes and emerging research trends such as 'digital competence', 'assessment' and 'Educational Contexts'. This analysis provided additional interpretive depth to the review and supported the development of targeted recommendations for future research.

Identification

In the identification phase, relevant peer-reviewed articles were systematically collected from major academic databases like Scopus and Crossref to ensure comprehensive coverage. The Publish or Perish (PoP) software was used to enhance source quality and recency, enabling controlled filtering of metadata from Google Scholar and Crossref. Keywords such as 'Digital Literacy Assessment', 'Measurement Instruments', 'Digital Competence' and 'Educational Contexts' were selected based on recent systematic reviews and policy frameworks, combined using Boolean operators to maximise retrieval relevance. The primary search query was ('Digital Literacy' OR 'Digital Competence') AND ('Assessment' OR 'Measurement') AND ('Education' OR 'Educational Contexts'). PoP allowed filtering by year (2014–2024), citation count and indexing source to identify high-impact studies. Articles were exported to Mendeley for duplicate removal and preliminary screening. Only those meeting inclusion criteria relevant to digital literacy assessment, focused on education, peer-reviewed, in English, and fully accessible were retained. Excluded were studies unrelated to assessment instruments, inaccessible or outside the defined timeframe.

Table 1. Systematic Literature Review research scope based on the Population, Intervention, Comparison, Outcome framework.

Concepts	Explanations
Population (P)	Teachers and students at various levels of education (primary, secondary and tertiary) involved in the process of developing and assessing digital literacy in the context of formal education.
Intervention (I)	Development and use of instruments to measure digital literacy
Comparison (C)	Comparison of results obtained with different types of digital literacy instruments to measure certain specific competencies.
Outcomes (O)	The outcomes highlight the effectiveness of measurement instruments in enhancing students' digital literacy and identify challenges in their implementation across educational contexts.

Table 2. Inclusion and exclusion criteria.

Inclusion	Exclusion
Articles must discuss the use of digital literacy instruments in measuring specific competencies.	Articles that lack relevance to the research topic, particularly those that do not address the application of digital literacy instruments.
Articles must be indexed in Scopus, PubMed, Crossref and ERIC to ensure academic quality and reputation.	Articles not indexed in Scopus, PubMed, Crossref and ERIC are removed from the list.
Articles must be peer-reviewed journal articles or proceedings.	Articles categorised as book chapters, reviews, e-books or any publication types other than journals and proceedings are excluded.
Articles must be written in English.	Articles written in languages other than English are excluded.
Articles must be published between 2014 and 2024.	Articles published before 2014 or after 2024 are excluded from the analysis.
Articles from both open-access and subscription-based (non-open access) journals were considered.	Non-peer-reviewed articles.

The identification stage in this study is based on the Population, Intervention, Comparison, Outcome (PICO) approach. The PICO approach is a systematic method for determining the relevance of studies. This approach is recommended by Nishikawa-Pacher, A., 2022, to ensure that each piece of literature analysed contributes to the research objectives. The following is the application of PICO in this study:

Screening

During the screening phase, a structured approach was employed to guarantee that the chosen articles aligned with the research objectives. This stage focused on filtering out articles that failed to satisfy the predefined inclusion and exclusion criteria whilst maintaining the quality required for SLR analysis. Duplicate entries were identified and removed using the reference management software (Mendeley Desktop). Below are the criteria for article inclusion and exclusion in this review.

During the screening stage, articles were selected using search tools like PoP and filtered automatically by publication year, language and accessibility. Initially, 323 papers were identified, with 20 duplicates removed. Of the remaining 303 articles, only 133 met the inclusion criteria after full-text evaluation.

Eligibility

At the eligibility stage, articles that pass the screening are evaluated based on methodology, relevance and contribution to the research topic. This process ensures that the articles used in the SLR meet the standards of highly reputable international journals. Table 3 contains the evaluation criteria, including research focus, methodological design, context, data and analysis, and journal quality.

After the eligibility evaluation, 56 articles from the screening stage were evaluated. A total of 33 articles were eliminated due to irrelevance, inadequate methodology or

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Table 3. Eligibility evaluation criteria.

No	Eligibility element	Checklist
1	Research Focus	Does the article address digital literacy assessment or measurement in an educational context?
2	Methodological Design	Is the research methodology used in the article relevant and adequate to answer questions related to digital literacy assessment?
3	Research Context	Is the research context appropriate to the field of education, particularly focusing on assessing students' digital literacy?
4	Data and Analysis	Is the data presented in the article sufficiently complete and is the analysis thorough enough to support conclusions related to digital literacy assessment?
5	Journal Quality	Is the article published in a reputable peer-reviewed journal?

not published in peer-reviewed journals. A total of 23 articles met the criteria and proceeded to the synthesis stage for further analysis.

This multi-stage selection process is visually summarised in the PRISMA flow diagram (Figure 1), which illustrates the number of records identified, screened, excluded and finally included in the review. The figure provides a clear overview of how the final 23 articles were systematically selected based on rigorous inclusion and exclusion criteria.

Result

Twenty-three articles were chosen based on their publication year, covering the years 2014 to 2024. The publications were chosen for study based on predetermined criteria and an SLR technique. The articles were analysed using research on the identification of existing instruments, specific competencies that are the focus of instrument measurement, analysis of the weaknesses and challenges encountered when using them, and solutions to overcome these weaknesses. There are several sorts of studies on the use of instruments to assess students' digital literacy. Figure 2 illustrates the distribution of years of publication for publications in SLR research from 2014 to 2024.

According to Figure 2, the most papers about research on the application of tools to test or measure students' digital literacy skills appeared in 2024. In this situation, the majority of articles discussing the topic are published in journals, with a few appearing in proceedings. In 2020, there has been no mention of measuring digital literacy for kids in schools, according to the graph. This information was collected by a study of the titles and abstracts of articles discussing the usage of these instruments. The following are the findings from an examination of 23 publications that passed screening based on the topic and research question in this literature review study, as shown in Table 4.

The distribution of article topics regarding the use of instruments to measure digital literacy has been widely discussed in research. From various types of instruments, ranging from closed, open and online-based instruments to Likert scale-based ones, there are self-report instruments, instruments related to self-learning and self-evaluation instruments. The distribution of article topics can be seen in Figure 3, which is displayed in the VOSviewer application.

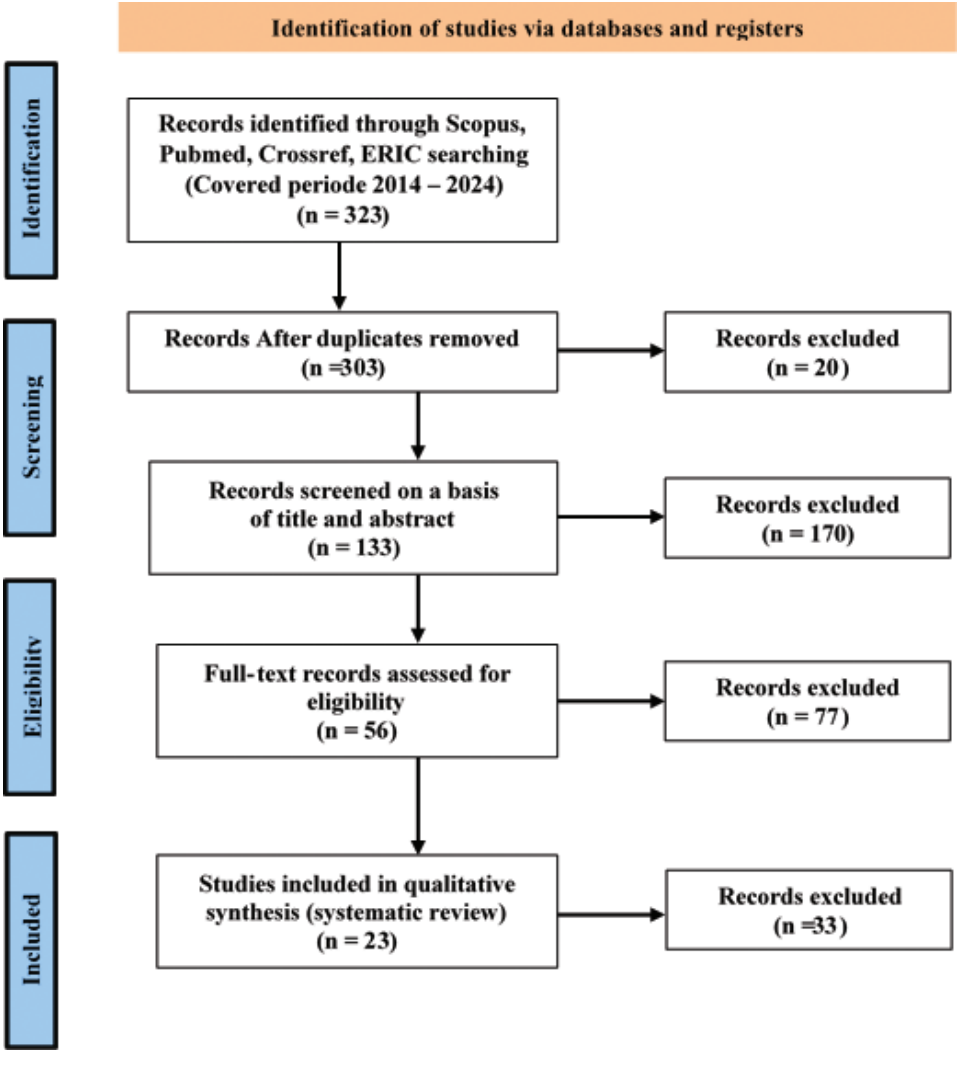

Figure 1. Flow chart of Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Although many studies have examined various types of instruments for measuring students' digital literacy skills, no one has produced universally applicable instruments for different types of research subjects. This is because applying these instruments to certain study topics requires various digital literacy competencies. This is the guideline for writing an SLR article that discusses what sorts of digital literacy instruments are utilised, what competencies serve as indicators of the instrument and the obstacles and limitations of utilising the instrument.

Discussion

RQ1. What types of assessment instruments have been developed to measure students' digital literacy across different educational levels?

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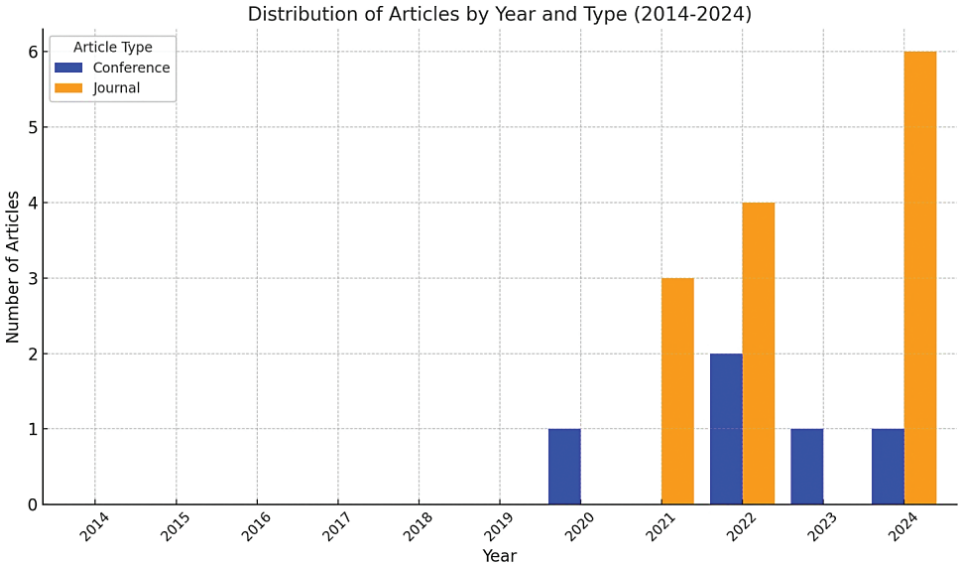

Figure 2. Distribution of Article Types in 2014–2024.

The reviewed studies indicate that digital literacy assessment instruments generally fall into three categories: Likert scale-based questionnaires, competency framework-based tools and technology-driven assessments. Questionnaires, such as the DHLI (Agormedah et al., 2022) and tools by Mattar et al. (2022), are widely used but often face perception bias. Framework-aligned instruments like those based on the DQ Framework (Tajuddin et al., 2024) and DigComp (Hwang et al., 2023) assess broader competencies, including ethics and AI awareness. Technology-based methods, including online surveys and automated assessments (Cabrera & Sosa, 2024; Restrepo-Palacio & De María Segovia Cifuentes, 2020), enhance data collection but vary in depth. Some studies use expert validation (Baharuddin et al., 2021; Lukitasari et al., 2022), whilst emerging performance-based tools combine self-report with simulation to improve accuracy (Jashari et al., 2024; Nguyen & Habók, 2024).

In reinforcing the international perspective, it is important to highlight the Jisc Digital Capabilities Framework, which has been widely adopted by higher and further education institutions in the UK. This framework defines six key elements: (1) ICT proficiency & productivity, (2) information, data and media literacies, (3) digital creation and problem solving & innovation, (4) digital communication and collaboration & participation, (5) digital learning & development and (6) digital identity & well-being. When compared to the instruments reviewed in this study, which focus mostly on technical skills and digital access, the Jisc framework offers a more holistic approach and evolves over time. In addition to functional skills, the framework also emphasises critical engagement, professional digital identity and digital well-being, which are often undercovered in existing instruments (Jisc, 2023). This comparison reveals important gaps in current digital literacy measurement practices, particularly in capturing students' ability to use technology responsibly, ethically and reflectively. Therefore, the Jisc framework is worthy of reference in designing digital literacy assessment instruments that are more integrated, inclusive and responsive to future developments.

Table 4. Classification of digital literacy instruments by educational level and focused competencies.

No	Author's name/year of publication	Educational level	Type of instrument	Competencies measured in the instrument	Challenges and weaknesses
1	(Yasa & Rahayu, 2023)	Elementary School	Survey-based questionnaire (4 aspects)	Hardware/software use, digital data processing, communication, collaboration and content creation	Low student ability in device use and content creation
2	(Ventivani et al., 2024)	Secondary School	Likert-scale questionnaire	Tech-supported learning, communication skills and curriculum-integrated digital literacy	Limited testing at lower education levels
3	(Tajuddin et al., 2024)	Secondary School/ General	DQ-based assessment instrument	Media evaluation, identity protection, privacy awareness and digital risk awareness	High youth vulnerability to data misuse and privacy breaches
4	(Ussarn et al., 2022)	Higher Education (Community College)	Digital literacy questionnaire with statistical analysis	Use of spreadsheet, presentation and word processing tools	Curriculum does not yet support students' digital literacy
5	(Sari et al., 2020)	Education Students	Closed-ended non-test questionnaire	Basic digital skills, evaluation and technology use	Unequal access in online surveys using mobile devices
6	(Rubach & Lazarides, 2021)	Elementary/Junior High School	Surveys, tests, interviews, group discussions and open-ended questions	Information/data literacy, communication, content creation, problem-solving and reflection	Complex design often misses participants' actual context
7	(Ristiyana Puspita Sari et al., 2021)	High School/Vocational School	Digital Literacy Assessment Scale (DLAS)	Knowledge access, academic engagement and socio-emotional factors	Too many items may cause fatigue and reduce data quality
8	(Restrepo-Palacio & De María Segovia Cifuentes 2020)	Higher Education	Closed questionnaire (25 items) based on digital competence framework	Digital citizenship and technological dimensions	Overweighting of certain items; needs diversification

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Table 4. (Continued)

No	Author's name/year of publication	Educational level	Type of instrument	Competencies measured in the instrument	Challenges and weaknesses
9	(Ramirez-Rodriguez et al., 2022)	Early University Students	Likert scale to measure digital information management	Information selection, searching and processing	Limits depth of perception and experience exploration
10	(Nguyen & Habók, 2024)	Higher Education Teachers	Self-evaluation combining subjective and objective assessments	Instructional tech, professional development and learning outcomes	Lack of objective evaluation limits understanding of competencies
11	(Mattar et al., 2022)	Higher Education	Questionnaires, self-assessment and closed-ended questions	Digital tech use, pedagogy and professional growth	Self-assessment prone to bias
12	(Lukitasari et al., 2022)	University Students	Questionnaire with numerical items	Communication, exploration and creation of digital content	Lacks depth in capturing students' digital literacy experiences
13	(Jashari et al., 2024)	High School & Higher Education	Self-reports and authentic performance (multidimensional)	Technical, cognitive, ethical skills and academic representations	Difficult to assess real-world digital skills without skill-based tasks
14	(Irhandayaningsih, 2022)	Higher Education	Self-directed learning and assessment model	LMS usage, self-directed abilities and digital literacy relationships	Limited validation across diverse populations
15	(Hwang et al., 2023)	University Students	Questionnaire with 23 items (quantitative survey)	Critical understanding, AI awareness and ethical behaviour	Limited to university sample, not generalisable
16	(Hernández-Marín et al., 2024)	Higher Education Teachers	Likert-scale instrument using digital competency frameworks	Critical reflection, teacher competencies and media literacy	Focused on university students, underrepresents other education levels
17	(Harutyunyan et al., 2024)	General Public (Adult Learning)	Personal Information Index (PII) and econometric analysis	ICT access and usage quality	Regional and socio-economic variability affects generalisability
18	(Harlanu et al., 2023)	High School/Vocational School	Questionnaire with 20 items	Creativity, critical thinking, social understanding and digital safety	Questionnaire-only design limits practical skill measurement

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Table 4. (Continued)

No	Author's name/year of publication	Educational level	Type of instrument	Competencies measured in the instrument	Challenges and weaknesses
19	(Forzani et al., 2021)	Junior High/High School	Questionnaire (MORQ)	Online reading motivation, self-efficacy and values	Does not assess technical digital skills
20	(Febliza & Okatariani, 2020)	Elementary, Junior High, High School and Teachers	Likert-scale (3 categories)	School readiness, teacher/student digital competence	Limited validity due to local context
21	(Cabrera & Sosa, 2024)	High School	Online questionnaire (39 items)	Digital skills and application in academic and personal settings	Regional limitation affects generalisability
22	(Baharuddin et al., 2021)	School Teachers	Content-validated questionnaire	Technical, cognitive and socio-emotional competencies	Limited expert review, no population testing
23	(Agormedah, et al., 2022)	High School Students	DHLI-based questionnaire	Health information literacy and digital navigation	Not tested across broader educational levels

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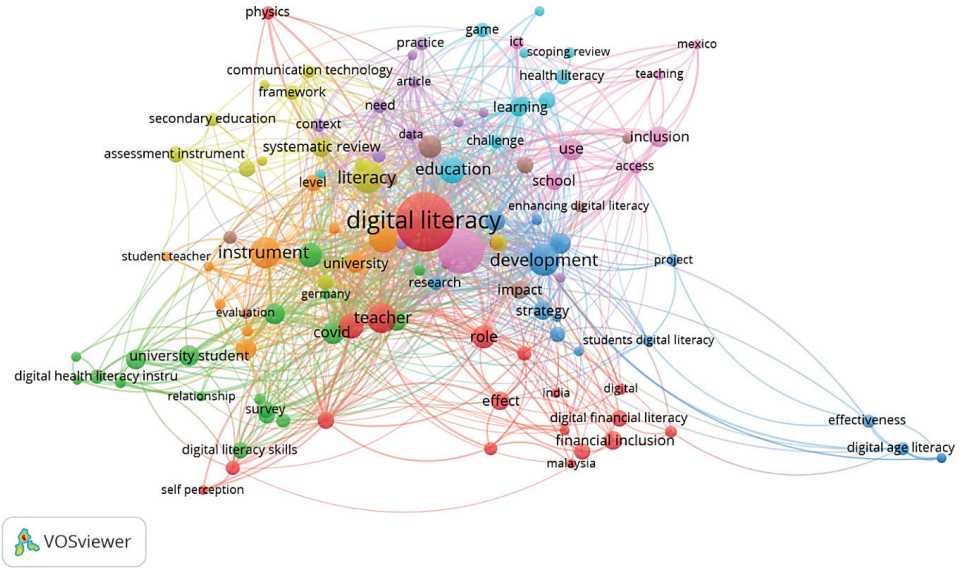

Figure 3. Data distribution related to the topic of the digital literacy measurement instrument in VOSviewer.

These findings confirm that digital literacy assessment instruments are not one size fits all; they must be tailored to the cognitive and developmental stages of learners, as digital competencies and the contexts in which they are applied differ significantly across educational levels. In addition to formal education-based assessment approaches, some studies have also developed digital literacy instruments at the individual community level, such as the Personal Informatization Index (PII) used in the Armenian context. This instrument is based on quantitative and econometric approaches and is designed to measure affordability, ICT skills and overall quality of technology use. Whilst not a direct educational instrument, this approach broadens perspectives on the forms and methods of digital literacy assessment that can be adapted to educational contexts by considering socio-economic and geographic determinants. There are not many instruments that measure digital skills through a performance-based approach, and most instruments have not been tested across cultural contexts and education levels. This suggests the need for a new approach to digital literacy instrument development that is more holistic, practical and cross-cultural.

RQ2. What specific competency dimensions are targeted by these instruments, and how do they reflect evolving definitions of digital literacy?

The reviewed instruments assess a wide range of digital literacy competencies, with a strong emphasis on technical skills such as the use of hardware and software (Mattar et al., 2022; Yasa & Rahayu, 2023). Other key dimensions include information processing and evaluation (Ramirez-Rodriguez et al., 2022; Restrepo-Palacio & De María Segovia Cifuentes, 2020), online communication and collaboration (Rubach & Lazarides, 2021), socio-emotional aspects like empathy and digital ethics (Baharuddin et al., 2021) and digital creativity

(Lukitasari et al., 2022). Some studies also address more specific competencies, such as digital health literacy (Agormedah et al., 2022) and awareness of AI's social impact (Hwang et al., 2023). These diverse dimensions reflect the evolving and holistic nature of digital literacy in increasingly complex learning environments.

Several studies confirm that the dimensions of digital literacy competencies are dynamic and not always linear with education level. For example, research shows that undergraduates have higher digital skills than graduates in certain aspects, and gender differences in digital literacy are narrowing. This indicates that digital literacy dimensions should reflect the diversity of learner contexts and continue to evolve, measuring not only technical skills but also meaningful use of technology in academic and social life (Nalaila & Elia, 2024).

The variety of dimensions measured indicates an attempt to approach digital literacy more holistically. However, most instruments still place their main focus on technical aspects and self-perception, whilst the more complex social, ethical and contextual dimensions have not been deeply integrated in the assessment design. In fact, increasingly complex technological developments demand a holistic and adaptive approach to digital literacy, so that assessments are truly able to describe students' readiness to face the challenges of the current and future digital era.

RQ3. What methodological limitations and contextual challenges are present in current instruments, and what directions can be proposed for future development to improve accuracy, inclusiveness and relevance?

Digital literacy instruments face notable challenges in terms of validity, dimensional coverage and contextual relevance. Heavy reliance on self-reporting can lead to perceptual bias (Mattar et al., 2022), whilst limited regional scope hinders generalisability (Cabrera & Sosa, 2024). Cross-cultural validation remains insufficient, as seen in the DHLI tested only in Ghana (Agormedah et al., 2022), and many instruments lack components that assess practical skills through real-world simulations (Jashari et al., 2024). Additionally, critical dimensions like digital safety, ethical use and online collaboration are often overlooked (Hwang et al., 2023; Sari et al., 2021). To address these gaps, future instruments should incorporate performance-based assessments, expand cross-context validation and include emerging competencies. Integrating technologies such as AI-driven simulations may also enhance assessment accuracy and relevance (Nguyen & Habók, 2024), making digital literacy tools more comprehensive and responsive to current educational needs.

A study by Nalaila and Elia (2024) revealed that first-year students outperformed final-year students in digital literacy, with no significant differences found by program or gender except for a narrowing gender gap, highlighting the need for assessments that consider contextual factors rather than assuming linear skill progression. In response to such methodological limitations, this article introduces the Model of Integrative Digital Literacy Assessment (MALDI), a conceptual innovation that integrates multi-method approaches to address weaknesses in existing instruments, particularly their reliance on self-reporting and limited cross-context validation. MALDI consists of four components: reflective questionnaires, real-world performance tasks, interactive AI-based simulations and

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digital portfolios each designed to capture a broader and more authentic range of competencies. These include technical skills, information processing, online collaboration, ethical literacy, AI awareness and digital social responsibility. The model also emphasises cross-cultural and cross-level validation to ensure global relevance and contextual adaptability. Its comprehensive yet efficient design supports practical implementation across educational settings, offering a meaningful contribution towards more adaptive, inclusive and forward-looking digital literacy assessment practices. Recent studies have emphasized the importance of contextual and culturally responsive approaches to digital literacy in vocational education (Yasa et al., 2024).

Contributions and educational implications

This study contributes significantly to the advancement of scientific knowledge by mapping and analysing existing digital literacy assessment instruments and identifying both methodological and contextual gaps. It highlights that most current tools rely heavily on self-perception and often fail to accurately capture learners' actual digital skills in authentic educational settings. By addressing the evolving dimensions of digital literacy, including technical, informational, ethical, social-emotional and AI-related competencies. This study provides a foundation for developing more holistic and adaptive assessment instruments. The findings hold practical implications across all educational levels: in primary education, by emphasising age-appropriate tools that support safe and guided technology use; in secondary education, by encouraging performance-based assessments aligned with curricular goals; and in tertiary education, by supporting discipline-specific assessments that reflect real-world academic and professional demands, such as digital research competencies, data management and the ethical use of AI. The proposed recommendations offer valuable guidance for curriculum developers, educators and policymakers in designing inclusive, context-sensitive and globally relevant digital literacy assessment strategies.

Conclusion

This study concludes that digital literacy assessment instruments in education employ diverse approaches, such as Likert scale-based questionnaires, competency framework-aligned tools (e.g. DigComp and DQ Framework) and technology-based performance assessments. When categorised by educational sector, distinct emphases emerge. In primary and secondary education, instruments primarily focus on foundational digital skills, including the use of digital devices, information searching and basic online communication. In higher education, the assessments shift towards advanced competencies such as digital content creation, critical evaluation of information and responsible technology use. In adult education, instruments often target practical digital problem-solving and the application of technology for lifelong learning.

Despite these developments, several limitations persist across all sectors. Many instruments rely heavily on self-report measures, lack authentic performance-based tasks and are rarely validated across cultural or contextual boundaries. These limitations indicate that existing tools, although useful, do not yet capture the full spectrum of digital literacy required in an increasingly complex digital environment. Future

research should prioritise the development of sector-specific instruments that incorporate simulations or real-world tasks to enhance practical assessment. Moreover, expanding validation efforts across diverse educational and cultural settings, as well as integrating emerging dimensions such as digital safety, well-being and technological ethics, is essential to ensure a more comprehensive and globally relevant understanding of digital literacy.

References

Afandi, A. N. H., Kusumaningrum, S. R., Dewi, R. S. I., & Pristiani, R. (2024). Digital literacy questionnaire instrument: Based on the integration of elementary school students' characteristics. *International Journal of Elementary Education, 8*(2), 344–353. https://doi.org/10.23887/ijee.v8i2.76773

Agormedah, E. K., Quansah, F., Ankomah, F., Hagan, J. E., Srem-Sai, M., Abieraba, R. S. K., Frimpong, J. B., & Schack, T. (2022). Assessing the validity of digital health literacy instrument for secondary school students in Ghana: The polychoric factor analytic approach. *Frontiers in Digital Health, 4*, 968806. https://doi.org/10.3389/fdgth.2022.968806

Baharuddin, M. F., Masrek, M. N., Shuhidan, S. M., Razali, M. H. H., & Rahman, M. S. (2021). Evaluating the content validity of digital literacy instrument for school teachers in Malaysia through expert judgement. *International Journal of Emerging Technology and Advanced Engineering, 11*(7), 71–78. https://doi.org/10.46338/ijetae0721_09

Cabero-Almenara, J., Gutiérrez-Castillo, J.-J., Barroso-Osuna, J., & Palacios-Rodríguez, A. (2023). Digital teaching competence according to the DigCompEdu Framework. Comparative study in different Latin American universities. *Journal of New Approaches in Educational Research, 12*, 276–291. https://doi.org/10.7821/naer.2023.7.1452

Cabrera, W. R. R., & Sosa, J. E. P. (2024). Validation of an instrument for assessing the digital literacy of Mexican students. *Edutec, 88*, 200–219. https://doi.org/10.21556/edutec.2024.88.3131

Choi, J., Choi, S., Song, K., Baek, J., Kim, H., Choi, M., Kim, Y., Chu, S.H., & Shin, J. (2023). Everyday Digital Literacy Questionnaire (EDLQ): Development and validation for older adults in South Korea (Preprint). *Journal of Medical Internet Research, 25*, e51616. https://doi.org/10.2196/51616

Churchill, N. (2020). Development of students' digital literacy skills through digital storytelling with mobile devices. *Educational Media International, 57*, 271–284. https://doi.org/10.1080/09523987.2020.1833680

DQ Institute. (2023). *The 2023 DQ Global Standards Report: Defining digital literacy, digital skills, and digital readiness*. Retrieved from https://joint-research-centre.ec.europa.eu/digcompedu_en

Economou, A., Vuorikari, R., & Punie, Y. (2023). *DigCompEdu: European framework for the digital competence of educators – SELFIEforTEACHERS adaptation and implementation*. Publications Office of the European Union. Retrieved from https://op.europa.eu/en/publication-detail/-/publication/3a69fc0c-2e00-11ee-a9ce-01aa75ed71a1

Febliza, A., & Okatariani, O. (2020). Pengembangan Instrumen Literasi Digital Sekolah, Siswa Dan Guru. *Jurnal Pendidikan Kimia Universitas Riau, 5*(1), 1. https://doi.org/10.33578/jpk-unri.v5i1.7776

Forzani, E., Leu, D. J., Yujia Li, E., Rhoads, C., Guthrie, J. T., & McCoach, B. (2021). Characteristics and validity of an instrument for assessing motivations for online reading to learn. *Reading Research Quarterly, 56*(4), 761–780. https://doi.org/10.1002/rrq.337

Guo, J. (2024). Approaches to improve digital literacy of higher vocational teachers. *Occupation and Professional Education, 1*(3), 25–30. https://doi.org/10.62381/O242304

Harlanu, M., Suryanto, A., Ramadhan, S., & Wuryandini, E. (2023). Construct validity of the instrument of digital skill literacy. *Cakrawala Pendidikan, 42*(3), 781–790. https://doi.org/10.21831/cp.v42i3.59703

Harutyunyan, G., Manucharyan, M., Muradyan, M., & Asatryan, H. (2024). Digital literacy of the Armenian society: Assessment and determinants. *Cogent Social Sciences, 10*(1), 2398652. https://doi.org/10.1080/23311886.2024.2398652

Hernández-Marín, J. L., Castro-Montoya, M. D., & Figueroa-Rodríguez, S. (2024). Media, information and digital literacy: Assessment instrument analysis. *Investigacion Bibliotecologica, 38*(99), 55–73. https://doi.org/10.22201/iibi.24488321xe.2024.99.58865

Herro, D. (2014). Techno Savvy: A Web 2.0 curriculum encouraging critical thinking. *Educational Media International, 51*(4), 259–277. https://doi.org/10.1080/09523987.2014.977069

Herzog-Punzenberger, B., Altrichter, H., Brown, M., Burns, D., Nortvedt, G.A., Skedsmo, G., Wiese, E., Nayir, F., Fellner, M., McNamara, G., & O'Hara, J. (2020). Teachers responding to cultural diversity: Case studies on assessment practices, challenges and experiences in secondary schools in Austria, Ireland, Norway and Turkey. *Educational Assessment, Evaluation and Accountability, 32*, 395–424. https://doi.org/10.1007/s11092-020-09330-y

Hwang, H. S., Zhu, L. C., & Cui, Q. (2023). Development and validation of a digital literacy dcale in the artificial intelligence era for college students. *KSII Transactions on Internet and Information Systems, 17*(8), 2241–2258. https://doi.org/10.3837/tiis.2023.08.016

Irhandayaningsih, A. (2022). Digital literacy assessment model in learning management system: A self-directed learning perspective. *E3S Web of Conferences, 359*, 03017. https://doi.org/10.1051/e3sconf/202235903017

Jashari, X., Fetaji, B., & Guetl, C. (2024). Assessing digital literacy skills in secondary and higher education: A comprehensive literature survey of validated instruments. *2024 47th ICT and Electronics Convention, MIPRO 2024-Proceedings* (pp. 688–692). https://doi.org/10.1109/MIPRO60963.2024.10569399

Jisc. (2023). *Digital capabilities definitions: Individual digital capabilities framework*. Jisc. Retrieved from https://digitalcapability.jisc.ac.uk/what-is-digital-capability/individual-digital-capabilities/

Lawson, T.K., Knox, J., Romero, E., Palacios, A.M., & Fallon, L.M, (2024). Check yourself! Exploring current culturally responsive teaching assessment measures. *Psychology in the Schools, 61*(6), 2649–2667. https://doi.org/10.1002/pits.23189

Lukitasari, M., Murtafiah, W., Ramdiah, S., Hasan, R., & Sukri, A. (2022). Constructing digital literacy instrument and its effect on college students' learning outcomes. *International Journal of Instruction, 15*(2), 171–188. https://doi.org/10.29333/iji.2022.15210a

Magnago, W., Baiôcco, L.V., Lima, R.C.M., Junior, A. B., Soprani, L. C. P., Azevedo, J. D. F., Pinheiro, R.B., & Nunes, P.D.C. (2024). Digital education and the role of technological literacy in cognitive and socioe-motional development. Lumen et Virtus, 15(42), 6548–6553. https://doi.org/10.56238/levv15n42-002

Mainz, A., Nitsche, J., Weirauch, V., & Meister, S. (2024). Measuring the digital competence of health professionals: Scoping review. *JMIR Medical Education, 10*, e55737. https://doi.org/10.2196/55737

Mattar, J., Ramos, D. K., & Lucas, M. R. (2022). DigComp-based digital competence assessment tools: Literature review and instrument analysis. *Education and Information Technologies, 27*(8), 10843–10867. https://doi.org/10.1007/s10639-022-11034-3

Mieg, H.A., Klieme, K.E., Barker, E., Bryan, J., Gibson, C., Haberstroh, S., Odebiyi, F., Rismondo, F.P., Römmer-Nossek, B., Thiem, J., & Unterpertinger, E. (2023). Short digital-competence test based on DigComp2.1: Does digital competence support research competence in undergraduate students? *Education and Information Technologies, 29*, 139–160. https://doi.org/10.1007/s10639-023-12251-0

Momdjian, L., Manegre, M., & Gutiérrez-colón, M. (2024). Digital competences of teachers in Lebanon: A comparison of teachers' competences to educational standards. *Research in Learning Technology, 32*(1063519), 1–18. https://doi.org/10.25304/rlt.v32.3203

Nalaila, S., & Elia, E.F. (2024). Students' digital literacy skills for learning in selected Tanzania's public universities. *Cogent Education, 11*(1), 2355350. https://doi.org/10.1080/2331186X.2024.2355350

Newland, B., & Handley, F. (2016). Developing the digital literacies of academic staff: An institutional approach. *Research in Learning Technology, 24*(1063519), 1–12. https://doi.org/10.3402/rlt.v24.31501

Nguyen, L. A. T., & Habók, A. (2023). Tools for assessing teacher digital literacy: A review. *Journal of Computers in Education, 11*, 305–346. https://doi.org/10.1007/s40692-022-00257-5

Nguyen, L. A. T., & Habók, A. (2024). Tools for assessing teacher digital literacy: A review. *Journal of Computers in Education, 11*(1), 305–346. https://doi.org/10.1007/s40692-022-00257-5

Nishikawa-Pacher, A. (2022). Research Questions with PICO: A Universal Mnemonic. *Publications, 10*(3), 21. https://doi.org/10.3390/publications10030021

Oh, S. S., Kim, K. A., Kim, M., Oh, J., Chu, S. H., & Choi, J. (2021). Measurement of digital literacy among older adults: Systematic review. *Journal of Medical Internet Research* 25(2), e26145. https://doi.org/10.2196/26145

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., …Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71

Park, Y., & Gentile, D. (2019). Establishing digital intelligence (DQ) as a universal standard for digital literacy, skills and readiness. OECD Education Working Papers, No. 193. OECD. https://doi.org/10.1787/19939019

Ramirez-Rodriguez, L. T., Sanchez-Pimentel, J. I., Osorio-Galvan, R. C., & Perez-Ortiz, J. O. (2022). Design and validation of an instrument to measure digital skills in university students of the first cycles of health careers. *Proceedings of the 2022 IEEE 2nd International Conference on Advanced Learning Technologies on Education and Research, ICALTER 2022*. 16–19 November 2022, Lima, Peru: ICALTER.

Restrepo-Palacio, S., & De María Segovia Cifuentes, Y. (2020). Design and validation of an instrument for the evaluation of digital competence in Higher Education. *Ensaio, 28*(109), 932–961. https://doi.org/10.1590/S0104-40362020002801877

Ristiyana Puspita Sari, A., Sidauruk, S., Meiliawati, R., & Anggraeni, M. E. (2021). Development of Digital Literacy Assessment Scale to measure student's digital literacy. *Jurnal Ilmiah Kanderang Tingang, 12*(02), 137–143. https://doi.org/10.37304/jikt.v12i02.128

Rubach, C., & Lazarides, R. (2021). Addressing 21st-century digital skills in schools – Development and validation of an instrument to measure teachers' basic ICT competence beliefs. *Computers in Human Behavior, 118*, 106636. https://doi.org/10.1016/j.chb.2020.106636

Ruffini, C. (2022). La comprensione del testo digitale e cartaceo in età scolare: il ruolo delle Funzioni Esecutive. In S. Ulivieri (Ed.), *Studies on Adult Learning and Education* (pp. 305–317). Firenze University Press. https://doi.org/10.36253/979-12-215-0081-3.20

Sari, C. M. W., Huda, I., Pada, A. U. T., Rahmatan, H., & Samingan. (2020). Construct validity of digital media literacy instrument for student teachers. *Journal of Physics: Conference Series, 1460*(1), 012053. https://doi.org/10.1088/1742-6596/1460/1/012053

Shin, S. K. (2015). Teaching critical, ethical and safe use of ICT in pre-service teacher education. *Language Learning & Technology, 19*(1), 181–197. https://doi.org/10.10125/44408

Siddiq, F., Hatlevik, O. E., Olsen, R. V., Throndsen, I., & Scherer, R. (2016). Taking a future perspective by learning from the past – A systematic review of assessment instruments that aim to measure primary and secondary school students' ICT literacy. *Educational Research Review, 19*, 58–84. https://doi.org/10.1016/j.edurev.2016.05.002

Snyder, I., Angus, L., & Sutherland-Smith, E. (2002). Building equitable literate futures: Home and school computer-mediated literacy practices and disadvantage. *Cambridge Journal of Education, 32*(3), 367–383.

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Son, M., & Ha, M. (2024). Development of a digital literacy measurement tool for middle and high school students in the context of scientific practice. *Education and Information Technologies, 30*, 4583–4606. https://doi.org/10.1007/s10639-024-12999-z

Tajuddin, S. N. A. A., Bahari, K. A., Al-Majdhoub, F. M., Maliki, N. K., & Baboo, S. B. (2024). Developing and measuring an assessment instrument for media literacy among digital natives using Digital Intelligence (DQ) framework. *Journal of Media Literacy Education, 16*(2), 29–45. https://doi.org/10.23860/JMLE-2024-16-2-3

UNESCO-UNEVOC. (2023). *ICT competency framework for teachers (ICT-CFT) Version 3*. UNESCO International Centre for Technical and Vocational Education and Training. Retrieved from: https://unevoc.unesco.org/home/ICT-CFT

Ussarn, A., Pimdee, P., & Kantathanawat, T. (2022). Needs assessment to promote the digital literacy among students in Thai community colleges. *International Journal of Evaluation and Research in Education, 11*(3), 1278–1284. https://doi.org/10.11591/ijere.v11i3.23218

Ventivani, A., Ul Muyassaroh, L., Sakti, K. F. L., Masrur, M. F., & Kharis, M. (2024). A measuring tool for assessing digital literacy competence among Mandarin language students. *International Journal of Engineering Trends and Technology, 72*(10), 336–343. https://doi.org/10.14445/22315381/IJETT-V72I10P132

Villoria-Mendieta, M. (2023). Teacher digital competences: Formal approaches to their development. In *Digital education outlook*.

Yasa, A. D., & Rahayu, S. (2023). A survey of elementary school students' digital literacy skills in science learning. *AIP Conference Proceedings, 2569*, 060015. https://doi.org/10.1063/5.0113483

Yasa, A. D., Rahayu, S. D., Handayanto, S. K., & Ekawati, R. (2024). Investigating the effects of digital literacy on primary student attitudes in Indonesia. *International Journal of Elementary Education, 8*(1), 11–19. https://doi.org/10.23887/ijee.v8i1.70413

Yuan, C., Wang, L., & Eagle, J. (2019). Empowering English language learners through digital literacies: Research, complexities, and implications. *Media and Communication, 7*(2), 128. https://doi.org/10.17645/mac.v7i2.1912