ISBN-13 : 978-81-908459-9-1

ROLE OF LIBRARY ASSOCIATIONS IN LIBRARY MOVEMENT IN THE COUNTRY

Proceedings of Three-Day International Seminar On Role of Library Associations in Library Movement in the Country & Media and Information Literacy

Date: 20 – 22 December, 2024
University of Calcutta

Organized by:
The Bengal Library Association

In Collaboration With:
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Financial Assistance By:
Indian Council of Social Science Research

বঙ্গীয় গ্রন্থাগার পরিষদ

Published By:
The Bengal Library Association
P-134, C.I.T. Scheme 52, Kolkata – 700 014
2024

BENGAL LIBRARY ASSOCIATION
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The Bengal Library Association
P-134, C.I.T. Scheme 52, Kolkata – 700 014
2024

Published by:
Dr. Joydeep Chanda, General Secretary, The Bengal Library Association
P-134, C.I.T. Scheme – 52, Kolkata – 700 014
Contact No.: 827603-2102

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Dewey Decimal Classification No.: 020.62
Main Entry according to AACR2R:

International Seminar on Role of Library Associations in Library Movement in the Country *(2024 Dec. 20-22 : Kolkata)*

Role of library associations in library movement in the country : proceedings of Three-day International Seminar on Role of Library Associations in Library Movement in the Country and Media and Information Literacy / organized by The Bengal Library Association, in collaboration with University of Calcutta ; edited by Arup Raychaudhury … [et al.]. – Kolkata : Bengal Library Association, 2024

p. : ill.

ISBN 978-81-908459-9-1

1. Library association – Congresses 2. Information literacy – Congresses I. Raychaudhury, Arup, *ed.* II. Title

Printing & Typeset By:
Laser World
P-4A, C.I.T. Road, Kolkata-700014
Contact No.: 9831161961

ISBN -13: 978-81-908459-9-1

Price: Rs. 1000.00

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ADULT DIGITAL LITERACY METRICS: A UNESCO Framework Based Review

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Abstract: *This study systematically reviews existing tools for measuring adult digital literacy through the UNESCO Digital Literacy Global Framework, identifying the adaptation and validation of various instruments across different contexts and demographics. The review covers 22 studies from multiple countries, focusing on the development, validation, and contextual adaptation of digital literacy tools. The primary aim was to evaluate how these instruments align with the UNESCO framework, which delineates seven core aspects of digital competence critical for adult integration into the digital world. The analysis reveals a comprehensive effort to tailor digital literacy tools to specific professional needs and cultural settings, highlighting both the diversity of approaches and the common challenges of ensuring relevance and reliability in rapidly evolving digital landscapes.*

Keywords: *Systematic Review, Digital Literacy Measurement, UNESCO Digital Literacy Global Framework*

Introduction:

"A technical invention as such has comparatively little social significance until it has been adapted to existing social and economic conditions" (Williams, 1983). For example, while the printing press was invented in the fifteenth century, "the rise in reading, and in quality, was in fact steady" (Williams, 1965). However, more than three centuries after Gutenberg's invention, literacy in Britain became widespread and gave rise to a middle-class reading public (Laughey, 2007).

The printing press analogy highlights the need for digital literacy today. Like the printing press, digital technologies require widespread skill adoption to reach their full potential. Digital literacy is essential for economic, cultural, and political participation, its absence limits digital transformation. Governments and institutions support integrating digital tools in education to enhance global competitiveness, workforce readiness, and academic success (Covello, 2014). In India, there exists schemes like the *National Digital Literacy Mission (NDLM)* and *Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA)*. The primary target of these schemes is to train people in Digital Literacy across the country, with specific focus on Rural India (GoI, 2019).

Definition – Digital Literacy:

According to the Ministry of Electronics and Information Technology, Government of India, "Digital Literacy is the ability of individuals and communities to understand and use digital technologies for meaningful actions within life situations. Any individual who can operate a computer/laptop/tablet/smartphone and use other IT related tools is being considered as digitally literate" (GoI, 2019).

United Nations Educational, Scientific and Cultural Organization, hereafter referred to as *UNESCO*, identifies a similar definition, "Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs and entrepreneurship. It includes competences that are variously referred to as computer literacy, ICT literacy, information literacy and media literacy" (UNESCO, 2018).

Measuring Digital Literacy:

Digital literacy has become a key research focus in the 21st century, prompting efforts to assess public digital skills. Academia has developed various tools for measuring digital literacy, but differing theoretical approaches hinder a unified understanding (Chen et al., 2023). Studies often focus on specific groups, such as educators (Ata & Yıldırım, 2019), students (Reddy et al., 2022), medical professionals (Holt et al., 2020), and corporate staff (Cetindamar et al., 2021), creating occupation-specific assessment tools. These studies are limited in scope, failing to capture society-wide digital competencies. To address this, the research systematically reviews existing measurement tools through the UNESCO Digital Literacy Framework, which offers a comprehensive, globally applicable model with seven core aspects, from basic device use to career skills, enabling broader population assessment.

Aims of the Study:

This systematic review aimed to (1) identify and critically appraise studies that involved the assessment of digital literacy among adults and (2) evaluate how digital literacy instruments used in existing studies address the elements of digital literacy using the *UNESCO Digital Literacy Global Framework*, hereafter referred to as *DLGF*. Taking cue from the European Commission's Digital Competence (DigComp) Framework, DGLF identifies 7 key areas of Digital Competence: (1) Devices and Software Operations, (3) Information and Data Literacy, (3) Communication and Collaboration, (4) Digital Content Creation, (5) Safety, (6) Problem-Solving, (7) Career-Related Competences (UNESCO, 2018).

This research focuses on measuring adult digital literacy due to its critical importance in adapting to evolving technological demands in employment, education, and civic life. Unlike younger generations, adults face challenges like generational gaps, limited training access, and varying tech exposure. Aligning with the UNESCO Digital Literacy Framework, the study emphasizes digital skills for work, civic engagement, and societal participation, primarily targeting adults.

Existing Works:

Limited systematic reviews have explored digital literacy assessment tools for adults broadly. One review focusing on digitally underserved populations linked low eHealth literacy to factors such as age, language, educational background, geographic location, and race (Chesser et al., 2015). Another review sought to identify trends in digital literacy research (Tinmaz et al., 2022) but did not evaluate digital literacy measurement tools using a validated framework.

Only one study has specifically analysed digital literacy tools, focusing on digital health literacy among older adults. This research used the European Commission's Digital Competence (DigComp) Framework as its basis (Oh et al., 2021). However, no studies to date have evaluated digital literacy measurement instruments using UNESCO's Digital Literacy Global Framework (DLGF).

Methods:

This systematic review was carried out by performing searches across two electronic databases, adhering to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (McInnes et al., 2018). This study utilized the SCOPUS and Web of Science databases, with searches conducted exclusively on titles. A combination of keywords was carefully selected and matched to database-specific indexing terms. To ensure a contemporary understanding of digital literacy, only studies published after the year 2000 were included.

To ensure no relevant studies were overlooked, initially recorded articles are manually examined by a team of researchers. *Zotero*, a reference management software, was employed to manage and organize the database effectively.

Selections Criteria:

The review focused exclusively on journal articles, adhering to three primary parameters for selection. First, the articles had to be published in English. Second, they needed to target an adult population. Third, the study had to either develop a new validated instrument or use an existing one to measure digital literacy. Articles were excluded if the target population did not consist of adults. For instance, studies focusing on school students were not included in the final selection.

PRISMA Protocol:

Two investigators (AC and AH) evaluated studies based on selection criteria. From 210 records initially identified (147 from Scopus, 63 from Web of Science), 186 remained after removing duplicates. Title screening excluded 94 irrelevant records, those irrelevant to digital literacy measurement. Abstract reviews eliminated 39 non-English studies and those lacking validated instruments or essential details. Full-text reviews confirmed the use of validated tools to assess adult digital literacy and checked for broader applicability of profession-specific tools. An additional reviewer (SD) oversaw the process, resolving disagreements through discussion. After excluding 31 more studies, 22 were included for analysis.

Critical Appraisal Using CCAT:

To evaluate the methodological quality and rigor of the 22 included articles, we employed the Crowe Critical Appraisal Tool (CCAT). The CCAT is a comprehensive, standardized framework designed to assess research articles across a variety of domains, ensuring consistency and objectivity in appraisal. Each article was appraised and scored independently using the CCAT guidelines, version 1.4 (Crowe, 2013).

The CCAT provides a maximum score of 40, with higher scores indicating greater methodological quality. Each article was assigned a score out of 40 based on the CCAT's eight domains: (1) Preliminaries, (2) Introduction, (3) Design, (4) Sampling, (5) Data collection, (6) Ethical matters, (7) Results, and (8) Discussion. The scoring was guided by the CCAT User Guide (ibid.) to ensure alignment with the tool's intended criteria. Discrepancies in scoring between appraisers were resolved through discussion to achieve consensus.

This rigorous appraisal demonstrated that the selected studies met a minimum quality threshold, enabling a robust evaluation of the digital literacy measurement scales within the context of this research.

Instruments were then assessed on the basis of UNESCO DLGF's 7 competence areas of digital literacy: (CA0) devices and software operations (operating digital devices and software), (CA1) information and data literacy (browsing, searching, retrieving, evaluating credibility), (CA2) communication and collaboration (interacting, sharing, collaborating through digital tools), (CA3) digital content creation (developing, editing digital content), (CA4) safety (protecting devices, personal data, privacy), (CA5) problem-solving (identifying and resolving technical issues), and (CA6) career-related competences (specialized digital skills for specific professions).

Findings:

The 22 reviewed studies examine digital literacy across diverse global contexts and demographics, including older adults, professionals, and students, in countries like Italy, Brazil, South Korea, Lebanon, and the US. These studies focus on developing, validating, and adapting digital literacy tools for specific cultural or professional needs, with most using cross-sectional designs. Examples include Hallit et al. (2020) validating the GCWCU scale for Lebanese pharmacists, Lin (2011) developing a computer literacy scale for Taiwanese nursing students, and Na-Nan et al. (2019) introducing the DIQ questionnaire for Thai SME employees. Broader tools, like the DIGISOC questionnaire (Peart et al., 2020), assess civic engagement through digital skills, highlighting the importance of tailored measurement for varied groups.

Articles	Scale Used	CCAT Score (Out of 40)
Chung et. al. (2015)	eHEALS	38 (95.0%)
Lin (2011)	Computer Literacy Scale	36 (90.0%)
Yoon et. al. (2022)	DHTL-AQ	36 (90.0%)
Kocak (2020)	PDCMS	36 (90.0%)
Gumus et. al. (2023)	Digital Competence Scale	36 (90.0%)
Basakha et. al. (2020)	ICT acceptance questionnaire	36 (90.0%)
Yildirim et. al. (2024)	DLS	35 (87.5%)
Moret-Tatay et. al. (2019)	CPQ/MDPQ	35 (87.5%)
Peart et. al. (2020)	DIGISOC	35 (87.5%)
Roque et. al. (2018)	MDPQ	34 (85.0%)
Hallit et. al. (2020)	GCWCU	34 (85.0%)
Surian et. al. (2019)	ISS	34 (85.0%)
Hargittai (2006)	Web-Oriented Digital Literacy Survey	33 (82.5%)
Choi et. al. (2023)	ELDQ	32 (80.0%)
Niyigena et. al. (2020)	nan	32 (80.0%)
Stephens (2006)	BCSE/GCSE	31 (77.5%)
Na-Nan et. al. (2019)	DIQ	31 (77.5%)
Vega et. al. (2019)	TDSI	30 (75.0%)
Sengpiel et. al. (2015)	CLS	29 (72.5%)
Mialhe et. al (2023)	eHEALS	29 (72.5%)
Bunz (2004)	CEW Fluency Scale	28 (70.0%)
Pereira da Cruz et. al. (2024)	CPQ	28 (70.0%)

Fig 2: CCAT Analysis

The CCAT scores of the 22 studies highlight their methodological rigor and scale validation quality. Top scorers, such as Chung and Nahm (38), Basakha et al. (36), Gümüş and Kukul (36), and Yıldırım et al. (35), excelled in comprehensive design and contextually appropriate validation. For example, Chung and Nahm's eHEALS for older adults demonstrated exceptional reliability, while Basakha et al. tailored an ICT acceptance questionnaire for older adults in Tehran. Mid-range scores (30–34), like those of Hallit et al. (2020) and Roque and Boot (2015), showed solid methodologies but narrower demographic reach or adaptation. Lower scores (under 30), such as Cruz et al.'s CPQ (28) and Bunz's CEW Fluency Scale (28), reflected smaller sample sizes or limited scope, impacting generalizability and depth.

Measurements	**DLGF Elements (out of 7)**	**Standardised Score (%)**
Computer Literacy Scale (CLS) (Lin, 2011)	6	86
Mobile Device Proficiency Questionnaire (MDPQ) (Roque & Boot, 2015)	6	86
Computer Proficiency Questionnaire (CPQ) (Boot et al., 2015)	5	71
Digital Competence Scale (DCS) (Gümüş & Kukul, 2023)	5	71
Personal Digital Content Management Scale (PDCMS) (Koçak, 2020)	5	71
Digital Health Technology Literacy Assessment Questionnaire (DHTL-AQ) (Yoon et al., 2022)	3	43
Digital and Socio-Civic Skills (DIGISOC) Questionnaire (Peart et al., 2020)	6	86
Teaching Digital Situation Index (TDSI) (Vega et al., 2019)	6	86
ICT acceptance questionnaire (ICT-AQ) (Basakha et al., 2020)	3	43
Internet skills scale (ISS) (Van Deursen et al., 2015)	6	86
Everyday Digital Literacy Questionnaire (ELDQ) (Choi et al., 2023)	5	71
General Confidence with Computer Use (GCWCU) (Hallit et al., 2020)	2	29
EHEALS (Norman & Skinner, 2006)	2	29
Computer Literacy Scale (CLS) (Sengpiel & Jochems, 2015)	4	57

Business Computer Self-Efficacy (BCSE) (Stephens, 2006)	6	86
Digital Intelligence Quotient (DIQ) (Na-Nan et al., 2019)	5	71
Digital Literacy Scale (DLS) (Bayrakcı & Narmanlıoğlu, 2017)	7	100
Computer-Email-Web Fluency Scale (CEW-FS) (Bunz, 2004)	4	57

Fig 3: Assessment of Digital Literacy Measurement Instruments on the basis of UNESCO DLGF

UNESCO Framework Assessment:

From the 22 selected articles, the researchers were able to find 18 measurement scales that attempt to measure various Digital literacy competence areas from multiple perspectives. The scales were often focused on specific professions and certain groups, which limits their application to a broader population. A few selected studies used scales that were developed by others. In order to assess these scales, we have used the original articles. These scales are: EHEALS (Norman & Skinner, 2006), CPQ (Boot et al., 2015), ISS (Van Deursen et al., 2015), and DLS (Bayrakcı & Narmanlıoğlu, 2017).

After reviewing the 18 scales and analysing their alignment with the seven Digital literacy elements defined in UNESCO's Digital Literacy Global Framework (DLGF), it is found that the majority of these scales satisfy 4 to 6 aspects. The study also finds out that Digital Literacy Scale (DLS) developed by Bayrakcı, Serkan & Narmanlıoğlu, Haldun (2021) in the context of Turkey, satisfies all 7 aspects identified by UNESCO DLGF. The scale was revalidated by Yıldırım et al. (2024).

The *Digital Literacy Scale (DLS)*, developed by Bayrakcı & Narmanlıoğlu (2021), is a comprehensive tool designed to measure the digital literacy levels of university students and graduates. It is structured around six key dimensions:

Dimension	Focus Area
Ethics and Responsibility	Ethical and legal responsibilities in digital environments, cyberbullying, privacy, and copyright.
General Knowledge and Functional Skills	Basic technical competencies like understanding and installing software and hardware, configuring network settings.
Daily Usage	Using digital technologies for daily tasks such as online shopping, cloud storage, and e-government applications.
Advanced Production	Advanced skills like coding, application development, and using programming languages.
Privacy and Security	Safeguarding personal information, recognizing phishing attempts, managing privacy settings.
Social Dimension	Collaborative and creative abilities, including designing websites, blogging, and using professional software.

The scale underwent rigorous development and validation processes. These included an initial literature review, expert evaluations, exploratory and confirmatory factor analyses, and reliability testing with a sample of 1,738 participants. The final version comprises 29 items scored on a 5-point Likert scale, allowing for the assessment of digital literacy across five levels: poor, below average, average, above average, and high.

The DLS provides a robust framework for evaluating digital literacy in a manner that aligns with evolving technological demands, emphasizing both foundational and

advanced competencies. Its versatility makes it suitable for application across diverse demographic groups.

Apart from DLS, the researchers have identified three other scales - Computer Literacy Scale (Lin, 2011), MDPQ (Roque & Boot, 2015), DIGISOC (Peart et al., 2020) - which can be employed to measure digital literacy skills of a broader population. These three scales satisfied 6 aspects of the framework, where particularly Career Related Competencies (CA6) remained missing. However, these scales satisfied all five aspects of the European Commission's DigComp framework (Ferrari, 2013). DigComp's 5 areas of digital literacy includes: (1) information and data literacy, (2) communication and collaboration, (3) digital content creation, (4) safety, and (5) problem solving (ibid.).

The *Computer Literacy Scale* (Lin, 2011), initially designed for nursing students, measures various computer-related skills across 22 items that include software, hardware, multimedia, networks, information ethics, and security, and has undergone rigorous validation processes. The *MDPQ* (Roque & Boot, 2015), with its 46-item detailed assessment and a condensed 16-item version, ensures thorough and reliable evaluation of older adults' mobile device skills. Meanwhile, the *DIGISOC* (Peart et al., 2020), consisting of 75 items across six dimensions, supports the evaluation of digital and socio-civic skills among young people, highlighting its extensive validation. These tools collectively contribute to a comprehensive understanding and measurement of digital literacy, reflecting their specific utility and robustness in diverse educational and demographic settings.

Limitations:

This study has certain limitations. First, it exclusively focuses on adult populations, potentially overlooking the unique digital literacy challenges faced by younger demographics, such as children and adolescents.

Second, the search strategy was limited to two electronic databases, Scopus and Web of Science. While these are reputable sources, this approach may have overlooked relevant studies available in other databases or grey literature, potentially limiting the comprehensiveness of the review.

Conclusion:

This study systematically reviewed 22 articles on adult digital literacy measurement using the Crowe Critical Appraisal Tool (CCAT) and identified 19 assessment scales for analysis. These scales were evaluated against UNESCO's Digital Literacy Global Framework (DLGF). The analysis revealed varying degrees of alignment with the framework's seven competence areas, with the Digital Literacy Scale (DLS), developed by (Bayrakcı & Narmanlıoğlu, 2017), being the only instrument fully addressing all components. Most other tools demonstrated methodological rigor but consistently lacked career-related competencies, highlighting a critical gap in existing assessments.

The findings underscore the fragmented nature of digital literacy measurement, with tools often designed for specific professional or cultural contexts, limiting their broader applicability. Furthermore, the review identifies a notable gap in India-specific

digital literacy research, despite the country's diverse linguistic, cultural, and technological landscape.

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