Journal of Digital Educational Technology
2026, 6(2), ep2618
e-ISSN: 2752-5503
https://www.jdet.net/

Research Article

OPEN ACCESS

A large-scale AI supported systemised review of the development of digital literacy in higher education academics

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Citation: Matthews, B. (2026). A large-scale AI supported systemised review of the development of digital literacy in higher education academics. *Journal of Digital Educational Technology, 6*(2), Article ep2618. https://doi.org/10.29333/jdet/18859

ARTICLE INFO

Received: 16 Sep. 2025

Accepted: 09 May 2026

ABSTRACT

The digital literacy of academics in higher education is an important consideration. The role of the academic extends beyond that of teacher or tutor, and includes tasks around research, development, and administration. These tasks can be made more efficient and effective with a more developed digital literacy. Collection of the data around levels of digital literacy development and discussion around the findings of quantitative and qualitative studies through systemised review can inform professional development opportunities. Within this systemised review, the discovery phase resulted in 86,060 papers, an AI supported screening methodology resulted in 47 papers being included in the thematic review. The review identified themes around self-perception of digital literacy, difficulties with the study design, areas of weakness, influencing factors and development of digital literacy. The difficulty with many of the study approaches is the use of non-comparable datasets that have affected the usability of the findings in such a review. It was discovered that areas that would benefit from development to improve effectiveness and efficiency, and also the ability to approach tasks laterally, for the academic in their role are lacking. The review identified underdevelopment in areas of data security which puts the organisation at risk.

Keywords: digital literacy, academic, professional development, digital skills, digital capability, higher education

INTRODUCTION

Digital literacy of students in academia is often discussed. Far less consideration has been given to the digital literacy of the academics themselves. Higher education is expected to be a progression from compulsory education for many students in England. The students increasingly expect the use of digital tools to support the teaching and learning activities.

It has been shown that the development of digital literacy of the academic has a positive effect on the learning value for students (Dang et al., 2024). Development in all areas of digital literacy for the academic is essential in providing a quality and effective teaching experience, and contributes to the students digital literacy development. When given the opportunity to consider the digital literacy of academics, a higher proportion of students consider the academics to have a intermediate level of digital literacy (de Obesso et al., 2023). A more developed digital literacy within academics not only enhances teaching activity, but also has a positive effect on learning. With many students now seeing digital tools an essential and foundation component to effective learning (Karroum & Elshaiekh, 2023), academics must become proficient and confident in the use of existing and new technologies.

Further to the implications on the learning of the students, an increase in digital literacy benefits multiple aspects of academic work. Development of digital literacy can be seen to reduce 'technostress' where 62.2% of observed variance in technostress can be directly attributed to digital skills development (Vásquez-Pajuelo et al., 2024).

METHODOLOGY

The objective of this systemised review was to attempt to complete a review that was close to saturation. The difficulty in completing a truly exhaustive search on this topic is the lack of a consensus on terminology (Matthews, 2021). Therefore, instead of a systematic review the author completed a systemised review (Grant & Booth, 2009). This approach allowed for an extensive rather than exhaustive search of published literature. This systemised review used novel methodology where search terms were intended to be exploratory and lack in specificity. AI was then used to support the screening process through the prediction of inclusion in the final study.

Firstly, the author identified keywords utilising an informal exploration of relevant published work (Dundar & Fleeman,

Table 1. Key words from non-specific search for digital literacy in academia

[environment]	[descriptor]
higher education	digital literacy
Universit* academic*	digital skills
academic	technology enhanced learning
	information literacy digital learning
	digital technolog*
	ICT

2017). Key words were discovered using an informal search within an academic search engine and considering the first six relevant academic articles. The key words were then utilised to form Boolean search strings using the framework of [environment] AND [descriptor] (**Table 1**). For example: 'university* academic*' AND 'information literacy'.

The combination of keywords resulted in 21 search strings that were used to discover related papers within EBSCO Education Databases, ERIC, Scopus, and Taylor and Francis. The search was conducted in October 2024 with a limit of 10 years (2014 onwards) on searching. Citations were downloaded in *.ris or *nbib format and duplicates were removed using a citation manager then uploaded into the AI review tool Rayyan (Ouzzani et al., 2016). The first 5% of titles were manually screened to train Rayyan's algorithm. Rayyan's predictions were refreshed after further 1000 papers were screened by title, or all papers with a prediction of ⩾50% had been assessed.

A review of papers by abstract and full read was then conducted within the Rayyan tool and inclusion and exclusion criteria applied. Inclusion required being primary research and presented in a peer-reviewed journal or as a conference proceeding, and related to digital literacy, competence, skills or similar in academics in higher education. Papers were excluded that only considered students, did not consider higher education, and unrelated to digital literacy in academic practice. Once complete the papers were reviewed and themes were reported on.

An indiscriminate search was also completed to identify literature that proposed expected levels of digital literacy development of academics. In addition, a literature map was created within LitMaps (2023) to surface additional studies through relationships identified.

RESULTS

A total of 1026 *.ris or *.nbib files were created from database searching, that included 86060 references. After duplicate removal, 46234 references remained. Through manual screening within Rayyan, 608 papers were included and 9201 were excluded. The remaining papers within Rayyan received a probability of <50% for inclusion in the final review. Of this 608, 131 papers were included after inclusion by title, and finally 47 papers were included in the literature review (**Figure 1**).

Literature used within this review originated from Spain (7), China (4), Andalusia (3), Ecuador (3), Portugal (3), Indonesia (3), India (2), Pakistan (2), Australia (1), Columbia (1), a joint study within Ecuador and Spain (1), Ethiopia (1), Iran (1), Lebanon (1), Mexico (1), Nigeria (1), Philippines (1), Poland (1), Romania (1), Saudi Arabia (1), a joint study between Spain and Latin American countries (1), Sweden (1), Turkey (1), UAE (1), USA (1), Vietnam (1), Croatia (1) and a joint study between Argentina, Brazil, Colombia, Chile, Peru, Mexico, Portugal (1). Nine of the studies created a bespoke tool, with others using published digital literacy tools and frameworks, and the majority of studies (38) included all fields of academia. Themes were discovered around self-perception (27), training (17), age and/or academic level (16), development of digital literacy (14), gender (14), creation (12), motivation (12), data security (11), attitude (10), future (4), networking (4), and reflection (1). The discovered themes informed the structure of the thematic review, enabling synthesis of key issues that have been discussed in relation of to the digital literacy of academics globally.

THEMATIC REVIEW

Self-Perception and Self-Reporting

The biases that are presented as a result of the self-reporting of digital literacy, and the self-perception of digital literacy presents a concern when evaluating data and is seen as a potential limitation (Pera et al., 2022). Such a methodology is further called into question where studies compare such self-reporting and observed levels of digital literacy development (Mercader & Duran-Bellonch, 2021). This concern is further compounded by the large variation in assessment tools which restricts meaningful comparison.

Where levels of digital literacy were comparable, or could be approximated by thematic grouping, the reported digital literacy was variable with a number of conclusions drawn. A number of papers reporting the digital literacy of the academics averaging within the beginner or intermediate levels (Esteve-Mon et al., 2022; Jorge-Vázquez et al., 2021; Martín-Párraga et al., 2023); whereas some studies reported much more positive levels of digital literacy development within the expert levels of development as an average or majority (Müller & Varga, 2020; Wiannastiti et al., 2019).

An identified difficulty with self-perception studies, is that the participants may misunderstand the elements of the tool or have a differing definitions than intended. Where qualitative data was collected to examine such interpretation, discomfort with the use of technologies was considered as a technical issue (Subaveerapandiyan & Nandhakumar, 2021). Whether such an interpretation of this affected either the way in which the tool was completed, or how such considerations affected the way in which the study participants answered, was not discussed.

The Development of Digital Literacy

Academics generally perceive that the development of digital literacy is linked to their personal and professional development (Thiyagu & Joshith, 2021). Many academics also believe that they could develop a greater digital literacy with appropriate support. Such support should be personalised to that individual to ensure the most effective development journey.

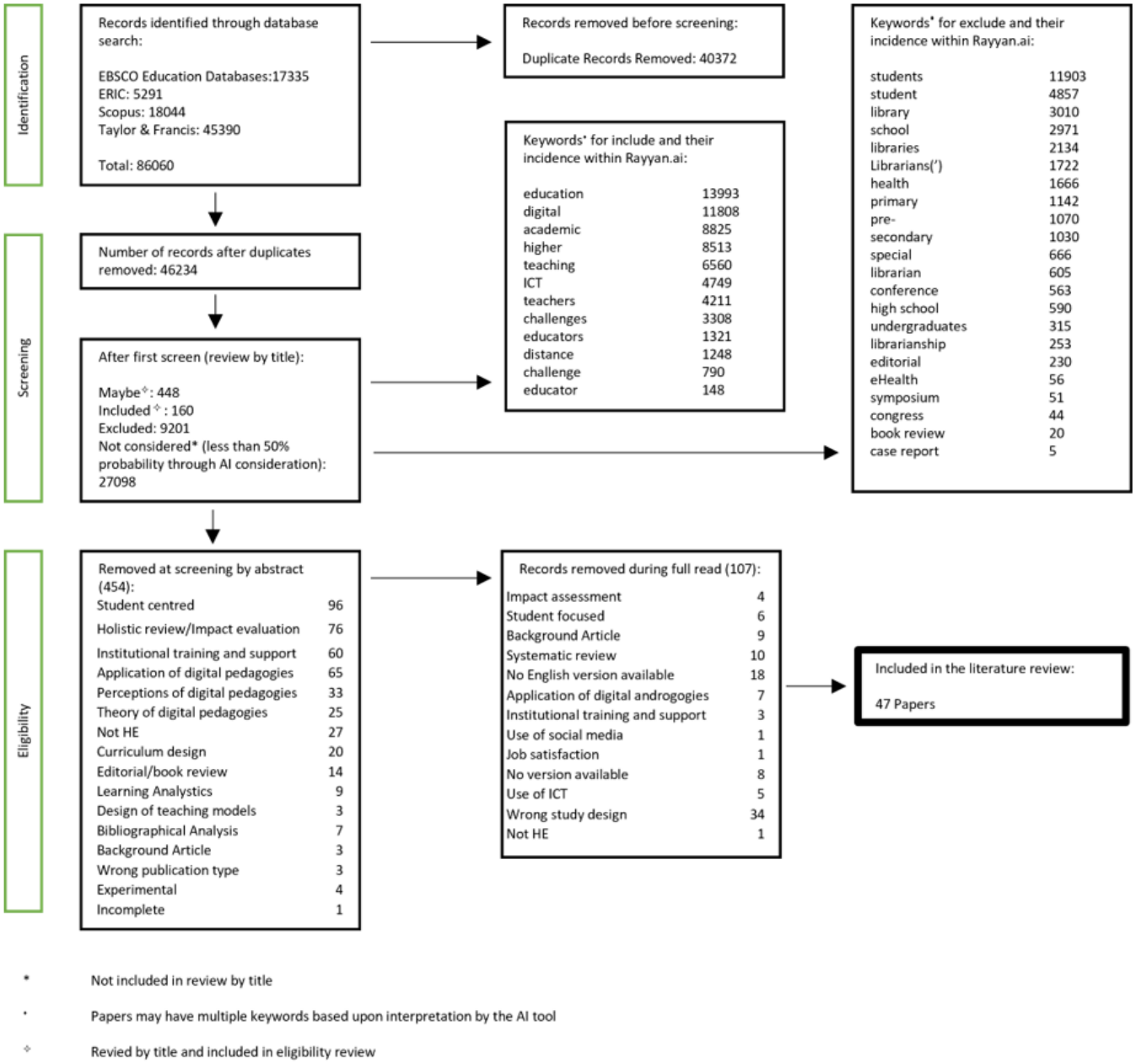

Figure 1. Adapted PRISMA diagram of the search protocol (Page et al. 2020)

The development of organised learning activities that allow for a personalised experience of development, such as targeted Nano-MOOCs or NOOCs (Nano Open Online Course), allows for targeted development that the user can adapt to their own personal learning goals and the institution can direct learning activity towards their ongoing development strategy (Basantes-Andrade et al., 2022). Such activities within an institution could include the digital literacy development of the students and student satisfaction objectives.

One aspect of the development of digital literacy that academics saw as beneficial, was the resultant observable benefits in improved learning experiences and digital literacy development in students (Zhao et al., 2020). A more developed digital literacy not only allows for the use of technology within teaching, learning and assessment activities, but increased self-efficacy in digital results in the lateral use of technologies to support learning alongside the literal use of more advanced technologies.

In earlier works, the ownership of digital devices and the development of digital literacy can be observed as being correlated in earlier literature discovered (Marcial, 2017). This may become less relevant as access to digital devices increases, and there may be influence from the types of digital devices owned that needs to be investigated due to the greater variation in types of devices available and their functionality.

Training

As digital literacy progresses, so does the approach to training and self-development. More formal training supports those with a lower level of digital literacy development to identify their learning needs and develop reflective practice. Motivations and attitude of the academics towards the development of digital literacy can influence training uptake if presented as optional or undirected. Such as can be seen in 'Followers' who would attend directed development training but be unlikely to seek out self-development opportunities as

a 'Pioneer' would (Nsouli & Vlachopoulos, 2021). Those who do take part in organised professional and digital literacy development do show a higher level of digital literacy development compared to those who do not (Jorge-Vázquez et al., 2021), further showing the importance of such professional development opportunities. Self-reflection can also be developed through the use of appraisal or goal setting within the academics career development.

The use of frameworks can aid in not only the design of training opportunities, but the self-realisation of digital literacy within academics (Dias-Trindade & Albuquerque, 2022). The combination of the use of such frameworks for development, such as those developed by JISC (2023) or within the EU (Redecker & Punie, 2017) can also support direction when considering self-development or the use of personalised learning opportunities. Frameworks could be utilised to support academic career development where they have been aligned to commonly recognised tool such as the UK Professional Skills Framework (Advance HE, 2023).

One concern would be the potential rigidity of such a framework, and the field of digital teaching and learning is ever evolving, and therefore the required skill set is growing (Jorge-Vázquez et al., 2021). The result of which is a greater requirement for contemporary training and development opportunities to ensure that the academic can meet the demands of changes within their role (Sánchez-Macías et al., 2023). Technologies encountered by all academics within modern higher education, such as Virtual Learning Environments, can be underutilised for teaching, learning and assessment if training and learning opportunities are not offered to academics (Müller & Varga, 2020).

Training is not the end to organised development of digital literacy, and space and time must be allocated for practice and experimentation (Antón-Sancho et al., 2022). Without this, the academics self-efficacy in the use of digital tools and the application of learned digital skills will not develop. Such an approach of a facilitated practice space could allow for development rather than exposure, where no correlation has been found within academics between exposure to digital devices and the development of digital literacy (Rubio-Gragera et al., 2023).

Reflection, Attitude and Motivation

Despite the realisation that technology enhances productivity (82.7%) and academic performance (90.0%) by a large number of academics, 32.0% of academics reported that they were anxious or very anxious with the use of digital tools (Thiyagu & Joshith, 2021). Anxiety can result in fear, which has been seen when approaching new technologies (Ruiz-Cabezas et al., 2020) further evidencing the significance of training and development within technologies as they develop. Problem solving abilities can be seen as a higher level skill within digital literacy development, and the development of these abilities can reduce the frustration when attempting to use digital tools enhancing motivation in digital tool usage and potentially removing anxiety of 'things going wrong'.

Poorly developed digital literacy can result in a negative cycle of low confidence, reduced motivation, limited development, and growing frustration and a poor attitude towards the use of technology (Ferede et al., 2022). Academics who are experiencing this cyclical model have been discovered to use digital technologies less in their role (Rahimi & Tafazoli, 2022) therefore further reducing the opportunity to develop.

Societal and organisational influences affect the digital tools being used, but to be motivated to develop digital literacy the academic must be able to relate the tool being used (Sjöberg & Lilja, 2019). Where the institutional influence is too strong, the academic can reduce their motivation to develop digital literacy through exploration and experimentation within their role. The number of digital tools available to academics can be overwhelming, and having the ability to transfer digital skills between digital tools is a part of a more developed digital literacy (Montoro et al., 2015) rather than concentrating on the mastery of single tool.

Future

Future digital literacy needs concern both academics and their students. For the academic, a more developed digital literacy would allow for the transfer of digital skills to new or novel technologies to support them in their role (Antón-Sancho et al., 2022). A more developed digital literacy can be seen as helping the academic to become more effective in a field that is surrounded by an ever-expanding array of digital tools (Dias-Trindade & Albuquerque, 2022).

The development of digital literacy within academics can assist with any required development in students as they move into higher education (Dias-Trindade & Albuquerque, 2022). As teaching should be pedagogy lead and technology enabled, the way in which the technology can enable learning will be limited by the level of digital literacy development possessed by the student. To facilitate a move to embedded digital literacy development into a modern curriculum (Matthews, 2024) academics need to be able to develop a digital literacy that allows them to teach these elements, which is a higher level of development. Truly developing digital literacy in students, rather than digital skills, gives them the ability to continue to learn and adapt to technological developments not only in their chosen career, but also in their personal usage of digital.

Creation

The digital literacy domain of creation has either been discovered as a general area of weakness (Basantes-Andrade et al., 2022), or weak in areas that are not student facing (Calle-Alvarez, 2022). With the requirement to produce increasingly sophisticated Virtual Learning Environments to support learning in an innovative way, web creation skills are potentially required which again have been discovered as lacking (Calle-Alvarez, 2022).

When asked on the perception of their own skills, 42.4% of academics considered themselves to be bad within creation using digital tools, and 43.4% bad at creating web-based digital spaces such as the virtual learning environment (Zhao et al., 2021). This self-perception is not true within all studies, with self-reporting finding that academics were able to create and modify digital resources (Muammar et al., 2022), or intermediate within these skills when utilising the DigCompEdu framework (Torres Barzabal et al., 2022).

To build on classifications around motivations, further classifications of creativity are offered (Esteve-Mon et al., 2022). These classifications include 'teachers' who use digital tools to their potential in teaching and learning opportunities, 'creators' who can create and modify digital resources effectively as well as demonstrating developed digital skills in teaching and learning, and 'tutors' who create a personalised learning experience for the students above that of creating resources.

A basic digital literacy may not be sufficient for an academic. The modern student expects an innovative approach to education (Sjöberg & Lilja, 2019). Innovation with digital tools is becoming increasingly important to encourage learning in different ways, and appeal to students a higher level of digital literacy may be required.

Data Security

Alongside creation within digital tools, data security is seen as an area of weakness within academics. This is of concern due to not only the intellectual property of the institution that an academic may have access to within their role, but also the amount of personal information by an institution. Academics are working in a hybrid format, so the responsibility on the security of data has shifted from the institution, towards the academic having more of a significant role in the handling of large amounts of sensitive data.

A number of papers have identified that data security is a weakness within academics (Basantes-Andrade et al., 2022; Calle-Alvarez, 2022; Qin & Qin, 2023). Conversely, this was not true of all papers with self-perceived level digital literacy within data security reported as good (69.6%) or very good (16.2%) (Zhao et al., 2021). Despite this single source, it can be seen within the majority of literature discovered that the area of digital security is not an area that academics consider as being well developed. The attitude towards digital security may have an effect on the development within this competence, with the attitude of *'the institution takes care of it so I do not have to'* being found a number of recipients (Hoang et al., 2022).

Networks

Building a professional network as an academic can be supportive and developmental. Using digital tools to build both internal and external networks can be beneficial. One discovered limitation within works is how many frameworks and studies consider professional digital literacy as a distinct competency, and not as a transferable skill set between an academics professional role and their personal use of digital tools. This limiting contextualisation is also present with other areas where such delimiting would benefit, such as within information literacy or data security. This can be seen within those participants taking part in studies that did consider personal application of digital literacy, where despite considering themselves proficient in the use of social media in personal contexts these tools were not being used to build professional external networks (Calle-Alvarez, 2022).

Age, Academics Level, and Gender

The discovered papers varied on their discussion of whether age, academic level, or time in academia that was a determining factor for digital literacy development. A reduction in digital literacy development can be seen to be negatively correlated to age in a number of studies (Basantes-Andrade et al., 2022; Calle-Alvarez, 2022), those between 35-49 being more developed in others (Müller & Varga, 2020; Subaveerapandiyan & Nandhakumar, 2021) and comments were made around this age group showing the most responses to the data collection (Müller & Varga, 2020). Greater variation within the 20-30 age group was observed within academics than other age groups (Ayyildiz et al., 2021) which was attributed to a greater variation in motivation to develop. Discovered papers also reported no statistically significant variation in digital literacy development when compared to time related variables (Dias-Trindade & Albuquerque, 2022).

Those with academic titles that represent new career academics were also found to have a higher development of digital literacy (Müller & Varga, 2020), but this observation may be representative of age. Conversely, academics with between 6-15 years' experience were found to be more developed (Pera et al., 2022). More exploration is required to discover which of these variables (age, title, or time in academia) could be pseudo-replication or a true determining variable of digital literacy development.

Gender and its effect on digital literacy was discussed in a number of papers, such as how female academics had a large gap between self-perception and their actual ability (Mercader et al., 2021). Those female participants showed a higher level of digital literacy development than they had perceived, with the author presenting a discussion on how external factors affected this self-perception. One study discovered a higher development by female academics through self-reporting (Cabero-Almenara et al., 2021). This finding was attributed to previously held beliefs of a deficit resulting in targeted training which resulted in surpassing that of their male peers. Overall, the level of digital literacy development shown no significant differences between genders, but there were areas where male or female academics considered themselves more developed (Hoang et al., 2022). Female academics out-performed males in information and data literacy, but male academics shown higher self-perception in communication, collaboration, content creation and problem solving.

Target Digital Literacy

Through indiscriminate searching, many papers were discovered that considered the level of digital literacy or referred to an inadequate level of digital literacy development, but no discovery was made within published literature around the target or acceptable level of digital literacy development for academics. Frameworks are available that consider levels of digital literacy development based upon different contexts. It is instead then proposed that the level of digital literacy development for academics is instead considered in such a contextual nature rather than a determinant target. The ability to self-identify weaknesses and seek out learning opportunities would allow for meeting personal targets to be achieved through reflection on role, ability, and personal and professional goals. Using the appraisal process and digital literacy frameworks to support such activity would be beneficial (Cochrane & Jenkins, 2022).

A minimal level of digital literacy that enables academics to use basic digital tools for teaching, learning provision, and assessment may still be insufficient if this threshold leaves them frustrated or unable to troubleshoot effectively. Development in the areas of technical proficiency, self-development, and creation have been identified as key domains that support wider aspects of digital literacy within a digital competency plexus (Matthews, 2025). If the minimum standard were instead defined as a level that supports self-directed development across these domains, academics would be better positioned to expand their skills as needed and to enhance student-facing activities.

DISCUSSION

The papers reviewed within this systemised review are based upon self-reporting. Studies including observational components often reported discrepancies between self-reported and observed competence. Further compounding the difficulties of utilising self-perception as data is caused by the lack of standardised frameworks and diverse measurement tools. These concerns have been previously identified, but drawing accurate conclusions and producing comparisons that allows for the true exploration of digital literacy development within academics is exceptionally difficult. The dataset variability may stem from methodological inconsistencies, limiting the reliability of cross study comparisons.

What is clear from literature is that there are a number of areas that require focussed digital literacy development. Improving self-development and technical proficiency may address the cyclical challenges some academics face, including frustration and reduced motivation. Development in creation and data security is also critical.

Training and development opportunities are required to ensure that the academic is adequately developed to a level in which they can reflect and self-develop by seeking out opportunities. Once at a sufficient level of digital literacy development the ability to self-reflect and seek out these opportunities will ensure that the academic is prepared for a changing digital environment. Though no consensus exists on a target level for academics, reaching a self-development capable threshold would enable ongoing growth and adaptation to future digital demands.

CONCLUSION

This systemised literature review provides a comprehensive synthesis of the field of digital literacy development in academia. The substantial variation in assessment tools and reporting approaches continues to limit cross-study comparability, making robust generalisations challenging. However, the evidence consistently highlights concerns regarding underdeveloped digital literacy across several competencies essential to academic practice. What is also evident is the tendency to conceptualise digital literacy narrowly within professional tasks, often overlooking intersections with academics' personal digital practices. This separation may obscure opportunities for transferable skill development across contexts. The relationship between academics' personal and professional digital literacies warrants deeper investigation, with further consideration on how these domains interact to support or constrain holistic digital capability development.

LIMITATIONS

The rationale for the large and holistic approach to the search strategy was that there remains a lack of consensus over terminology and definition of digital literacy within academic literature. The result of this lack of consensus is that larger indiscriminate searching is required in an attempt to exhaust searching, but this still may not be possible. Work has been done around reaching consensus through doctoral thesis (Belshaw, 2012), books (Gilster, 1998), and through academic literature. This has been noted within published works (Matthews, 2021) and results in difficulty in producing systematic reviews that truly exhaust the literature available; and instead, a systemised review is more appropriate with only an attempt at an exhaustive search. Within the search completed within this systemised review, the lack of consensus can be observed within the use terminology where Digital Competence was the most encountered descriptor (21), also digital literacy (5), ICT competency (5), digital skills (4), digital teaching competency (2), ICT literacy (2), ICT skills (2), computer competency (1), digital literacy skills (1), digital mastery (1), digital proficiency (1), ICT (1), and technical proficiency (1).

Funding: No external funding is received for this article.

Ethics declaration: The author stated that the systemised review was produced as a part of a larger thesis for the award of Doctor of Education. Ethical approval for the systemised review is not required as secondary data was used.

AI statement: The author stated that Rayyan.ai AI tool was used to support the systemised review. Generative AI was not used in the creation of this manuscript.

Declaration of interest: The author declared no competing interest.

Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to the author.

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