ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

DIGITAL COMPETENCE FOR SUSTAINABILITY IN EDUCATION: A BIBLIOMETRIC ANALYSIS

**** Kaneez Fatmah***

JRF Scholar, SNDT women's university, Department of Education

Abstract:

The objective of this study is to determine annual growth and publication trends and to investigate the literature in the Scopus database on sustainability in education through digital competence. A total of 303 research articles were selected for bibliometric analysis in RStudio. The findings showed that there was a peak in publications in the year 2025, with a decrease in the year 2026, as per 18 April 2026. For the most influential authors' publications, Spain garnered attention in both single- and multiple-country publications. The word cloud showed that the most often used keywords were sustainability, sustainable development, higher education, engineering education, and others, along with the most cited author, Cebrián (2020). The topics that were trending were sustainability, followed by higher education, and the co-occurrence network between sustainability and sustainable development in the related area. This study contributes by identifying research trends, especially for future researchers in developing countries like India.

Keywords: *Digital competence, Sustainability, Education, Bibliometric Analysis.*

Introduction:

Digital competence for sustainable education enables the use of information and communication technologies (ICT) effectively to support and promote the learning and teaching processes through an inclusive environment. It is essential to integrate digital tools into educational practices, which can enhance the educational outcomes and support sustainable development goals (SDGs). The digital competences among teachers and learners stand crucial for achieving and ensuring inclusivity and equitable quality education and promoting lifelong learning opportunities for all, for SDG 4. Teachers' digital skills and competence facilitate the use of digital platforms, online classes, and other resources that enhance educational quality and accessibility for learners (Gutiérrez-Ángel et al., 2022; Méndez et al., 2022).

The transformation of education digitally, driven by the Fourth Industrial Revolution, is aiming to reshape curricula by incorporating sustainable practices and digital technologies, supporting the transformation of curriculum development and enhancing innovation within the system of education (Shenkoya & Kim, 2023). Also, the field of environmental, i.e., e-sustainability, promotes the responsible use of digital technologies to support sustainable practices and for teacher training. For the future teachers' knowledge of e-sustainability would play a vital role in fostering sustainable behaviors among students, enabling them with the 21st-century skills to navigate and utilize digital technologies with alertness (Urrea-Solano et al., 2021). Therefore, a comprehensive review of the existing studies from different perspectives on methodologies in western regions,

ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

with a clear focus on the upliftment and integration of sustainability in educational practices in education across the globe that emerged, due to the Millennium Development Goals and Sustainable Development Goals of the UN. There is a lack of bibliometric analysis on this topic in the eastern region.

To address this gap, the present research reviews 303 research papers published between 2011 and 2026, from the Scopus database, adopting a quantitative approach to learn how digital competence can help in promoting sustainability in the educational field, particularly effective for analyzing extensive research landscapes. The review addresses the following research objectives:

RO1: To find the progress of research on digital competence over time, with growth trends and shifts.

RO2: To find and evaluate the most influential articles, authors, journals, and collaborations with digital competence in sustainability in education.

RO3: To find out the trending topics in the areas through keyword analysis.

Review of Literature: Digital competence for sustainability in education enhances the accessibility of information and fosters critical thinking skills for responsible digital device use. It incorporates digital literacy skills into the educational practices for supporting the areas of inclusion, equity, and quality, along with SDG goals, through organizations like OECD and UNESCO, and prepares the students to engage with social and environmental challenges (Gutiérrez-Ángel et al., 2022). As for enhancing language learning outcomes, it can happen by incorporating sustainable practices, such as digitalized learning materials and virtual classrooms, contributing positively to language learning by teachers in educational settings (Cao et al., 2023).

Digital competence has evolved into a more holistic approach by integrating sustainability for reframing teachers' roles and competencies to embrace a convergence of digital, human, and ecological dimensions to foster agentive engagement with sustainable university missions, beyond the functionalist views emphasizing eco-pedagogies and care that prioritize sustainability, inclusivity, and social justice within the educational ecosystem at all levels (Markauskaite et al., 2023). While (Lozano Rivas et al., 2023) focused on the computer-aided design in the context of sustainability education, in which students are applying eco-design principles to create educational spaces to foster creativity and equip themselves with the competencies for addressing the complex sustainability challenges by linking technical drawing education with sustainability competencies established by UNESCO.

Another emphasizes that the digital revolution influences individuals' behaviors and attitudes towards technology, necessitating innovative pedagogy and curricula aligned with sustainability goals (Ossiannilsson, 2020), resulting in enhanced social well-being while balancing environmental and developmental needs (Méndez et al., 2022). Thus, all of these studies promote and pave the way for the practice of sustainability in the education sector.

Methodology: The study adopted the Bibliometrics analysis, which is a statistical technique for assessing and quantifying the number of publications and their citations in a particular year and in the field, allowing the researchers to identify the intellectual structure, conceptual structure, trends of publications, and future directions of the authors and their works (Garfield, 1979; Ma & Ismail, 2025).

Result and Discussions: Bibliometric analysis encompasses (a) Performance Analysis, (b) Science Mapping,

ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

and (c) Network Analysis, each of which contributes to the understanding of the intellectual, conceptual, and social dimensions within a field as outlined by Donthu et al. (2021).

Annual Publication Trends:

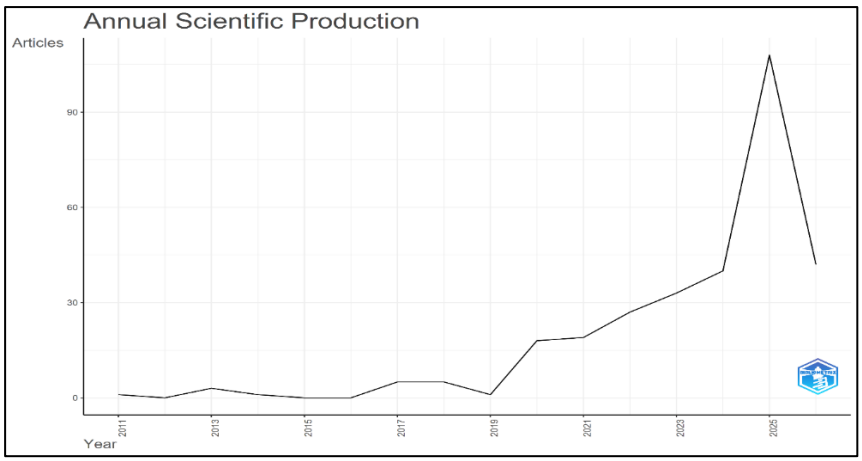

Table 1: Annual publication (source: Bibliometric R Studio software)

Table 1 shows the publications based on the search string used in the Scopus database ("Digital competence AND sustainability AND education") from 2011 to 2026, which have generally increased over time, with a slight decrease shown in the year 2026, as conducted on 18 April 2026.

The most influential corresponding authors' countries:

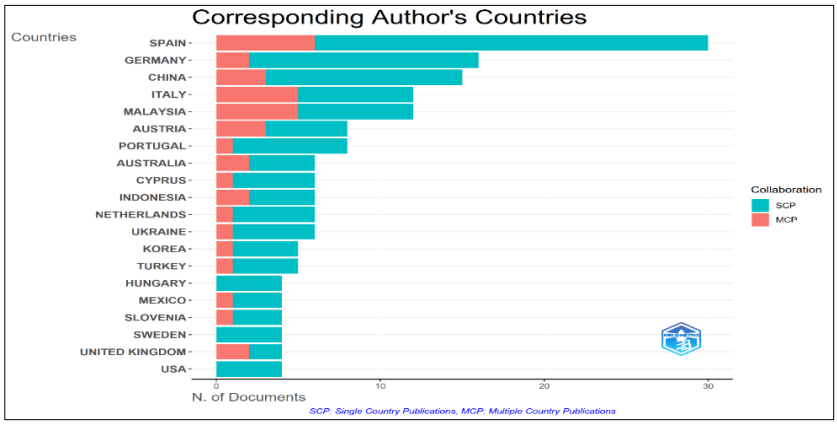

Fig:2 corresponding Authors of different countries (Source: Bibliometric R Studio software)

The articles with the highest numbers of publications are derived from Spain (30), Germany(16), China(15), Italy and Malaysia(12), Austria and Portugal (8), Australia, Cyprus, Indonesia, the Netherlands, and Ukraine(n=6), Korea and Turkey(5), Hungary, Mexico, Slovenia, Sweden, United Kingdom, USA(4), Norway, Poland, Saudi Arabia, South Africa(3), Brazil, Canada, Colombia, Ecuador, Greece, India, Jordan, Lithuania, Romania, Serbia, Switzerland(2), Belarus, Bulgaria, Czech Republic, Denmark, Finland, France, Ghana, Hong Kong, Iran, Ireland, Israel, Kazakhstan, Latvia, Macedonia, Moldova, Montenegro, Pakistan, Peru, Rwanda, United Arab Emirates, Uzbekistan(1) with the least number of articles published throughout the year of 2011 to 2026.

ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

The most globally cited documents:

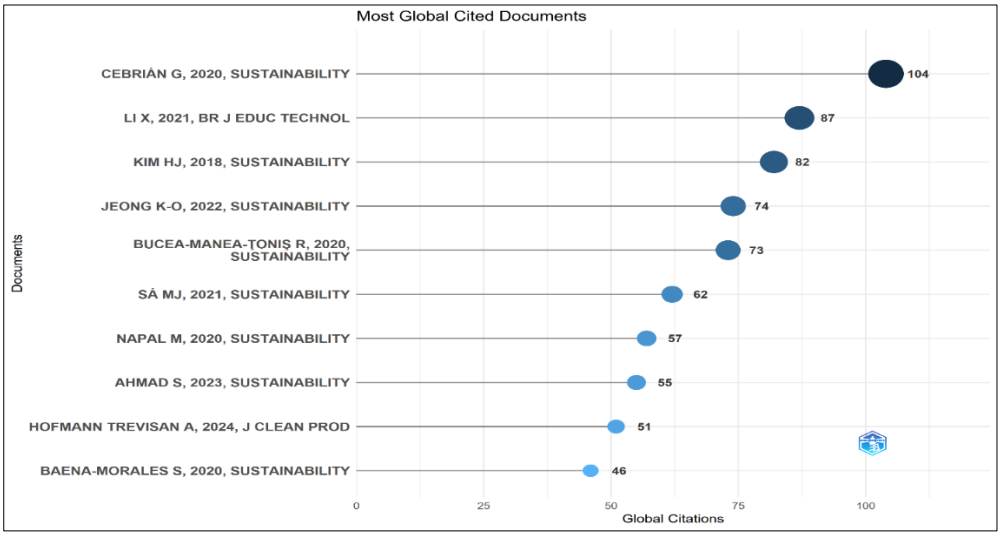

Fig. 3 Globally cited authors (Source: Bibliometric R Studio software)

The analysis of the most cited documents globally, from *Cebrián (2020)*, with 104 citations, establishes a strong foundation in this particular field of digital competence and sustainability in education. Followed by *Li (2021)* and *Kim (2018)*. Additionally, more recent studies from 2022 to 2024 by authors like Ahmad S (2023) and Hofmann Trevisan A (2024), J Clean Prod are gaining high citations, reflecting that the field is evolving rapidly.

Word Cloud:

Fig. 4 Word cloud (Source: Bibliometric R Studio software)

The term “sustainability” is used with a frequency of 83 times, followed by sustainable development 63 times. Other prominent keywords include education (55), teaching (39), higher education (37), students (36), learning (34), digital competence (24), and artificial intelligence (19), while others depicting smaller-sized words are repeated in less frequent times.

ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

Trending Topics:

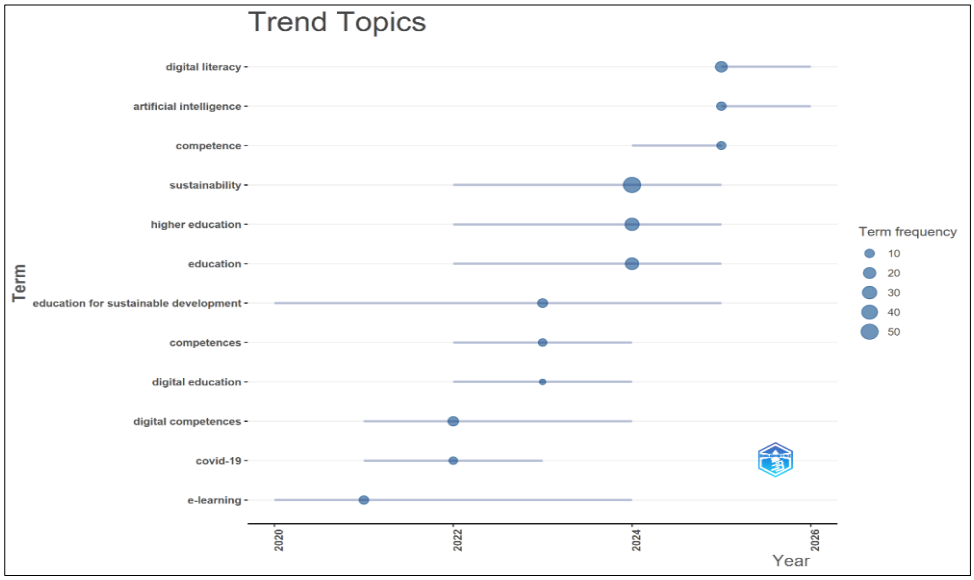

Fig. 5 Trending topics (Source: Bibliometric R Studio software)

The trend topics analysis shows that themes like sustainability have been frequent (51) from the year 2022-2025, followed by higher education from 2022-2025(29), education from 2022-2025(25), digital literacy from 2025(18), while digital competence from 2021-2024(13), highlighting the surge for technological advancement. Overall, the trend demonstrates a shift from digital adoption techniques to **integrating sustainability in education**.

Co-occurrence Network:

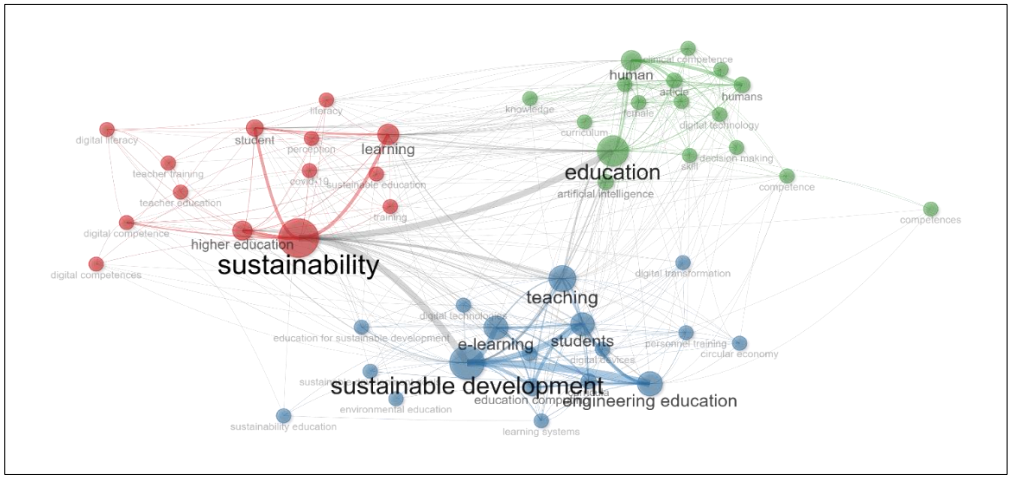

Fig. 6 Co-occurrence network (Source: Bibliometric R Studio software)

The circles represented for visualization depict the use of keywords, the larger size of the node indicates the high frequency of usage of keywords, the thickness of the lines indicates the strength of the co-occurrence relationship, and different colours represent the different clusters of thematic areas. For example, the keyword

ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

"sustainability" (the largest node of the network) is strongly linked with sustainable development, and moreover, it is connected with e-learning, students, teaching, and engineering education. Thus, these connections illustrate how different themes are interrelated between clusters, with strong integration between sustainability, digital competence, and education.

Collaborative Network:

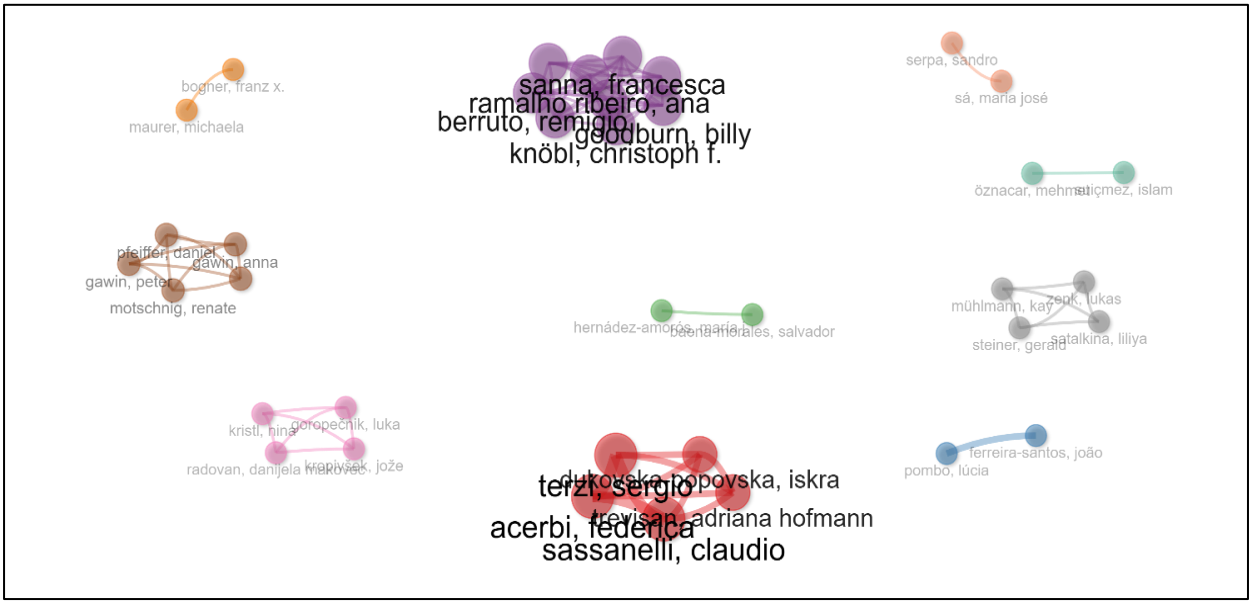

Fig.7 Collaborative Network between authors (Source: Bibliometric R Studio software)

The figure depicts a strong collaborative network between authors in red, Sassanelli, claudio, trevisan, Adriana Hofmann and others, followed by a purple colour collaboration network with the authors like Ramalho Ribeiro, Ana, Ana knöbl, christoph f, and others, while clusters, like the brown, pink, and grey ones, also show interconnected authors but little prominence, the pairs of orange, green and blue pairs nodes, illustrate only two collaborative authors across the network.

Implications of the Study:

There is a need for digital competence for sustainability in education. As educators, we must teach the learners the responsible and ethical use of digital tools and techniques to promote sustainable learning. Policymakers must also introduce digital education in the curriculum to create awareness and use it efficiently to have quality education and access to end the digital divide. In methodologically aspect, more empirical research is required to find out the associations, challenges, and integrative ways to promote sustainability in educational systems.

Limitations and Future Directions:

This study is limited to English-language publications, excluding research from other languages. Finally, bibliometric analysis focuses on quantitative patterns. Future researchers may opt for other software, such as Vosviewer, and use different methodological techniques.

ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

Conclusions:

The study has conducted a bibliometric analysis using RStudio on digital competence for sustainability in education. The findings reveal publication trends, a collaborative network of authors, a co-occurrence network, and trending topics, to identify gaps and theoretical integrations for future researchers, and to align digital competence with sustainable practices for education.

References:

1. ***Aria, M., & Cuccurullo, C.*** *(2026). Science Mapping Analysis - A primer with Biblioshiny.* McGraw-Hill, *ISBN: 978-88-386-2297-7.*
2. ***Aria, M., & Cuccurullo, C.*** *(2017). bibliometrix: An R tool for comprehensive science mapping analysis.* Journal of Informetrics, *11(4), 959-975.*
3. *Cao, J., Bhuvaneswari, G., Arumugam, T., & Aravind, B. R. (2023). The digital edge: examining the relationship between digital competency and language learning outcomes. Frontiers in psychology, 14, 1187909.*
4. *Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285296.*
5. *Ferrari A, Punie Y, Brečko B (2013) DIGCOMP: a framework for developing and understanding digital competence in Europe. https://doi.org/10.2788/52966*
6. *Garfield E (1979). Is citation analysis a legitimate evaluation tool? Scientometrics 1(4):359–375. https://doi.org/10.1007/bf02019306*
7. *Gutiérrez-Ángel, N., García-Sánchez, J. N., Mercader-Rubio, I., García-Martín, J., & Brito-Costa, S. (2022). Digital competence, validation, and differential patterns between Spanish and Portuguese areas as assessed from the latest PISA report as a pathway to sustainable education and social concerns. Sustainability, 14(19), 12721.*
8. *Lozano Rivas, F., Del Cerro Velázquez, F., & Morales Méndez, G. (2023). Key competences for sustainability: a technical project supported by Ecodesign of educational spaces to achieve SDGs. Sustainability, 15(5), 3959.*
9. *Ma, H., & Ismail, L. (2025). Bibliometric analysis and systematic review of digital competence in education. Humanities and social sciences communications, 12(1), 185.*
10. *Markauskaite, L., Carvalho, L., & Fawns, T. (2023). The role of teachers in a sustainable university: From digital competencies to postdigital capabilities. Educational technology research and development, 71(1), 181-198*
11. *Méndez, D., Méndez, M., & Anguita, J. M. (2022). Digital Teaching Competence in Teacher Training as an Element to Attain SDG 4 of the 2030 Agenda. Sustainability 2022, 14, 11387.*
12. *Ossiannilsson, E. (2020). Reflection on 21st-century competences, smart learning environments, and digitalization in education. Near East University Online Journal of Education, 3(2), 87-93.*

ISSN: P-2455-0515
E- 2394-8450

Educreator Research Journal

OPEN ACCESS

Volume–XIII, Issues–III

May – June 2026

Original Research Article

13. *Rosyidah, U., Sudarmiatin, S., & Sumarsono, H. (2023). Digitalization and internationalization of SMEs: A systematic literature review. Journal of Enterprise and Development (JED), 5(3), 479-499.*
14. *Shenkoya, T., & Kim, E. (2023). Sustainability in Higher Education: Digital Transformation of the Fourth Industrial Revolution and Its Impact on Open Knowledge. Sustainability, 15(3), 2473. https://doi.org/10.3390/su15032473*
15. *Urrea-Solano, M., Hernández-Amorós, M. J., Merma-Molina, G., & Baena-Morales, S. (2021). The Learning of E-Sustainability Competences: A Comparative Study between Future Early Childhood and Primary School Teachers. Education Sciences, 11(10), 644. https://doi.org/10.3390/EDUCSCI11100644*

Cite This Article:

Fatmah K. (2026). *Digital Competence for Sustainability in Education: A Bibliometric Analysis*. **In Educreator Research Journal: Vol. XIII (Issue III),** pp. 77-84