A Review of Seamless Learning on Research Publications

Fatimah, Atin.

Universitas Sultan Ageng Tirtayasa. Indonesia

fatimah.79@untirta.ac.id

Abstract

This research aims to analyze the content in a number of articles that research "seamless learning". 57 articles were collected using "publish or perish". Through the PRISMA screening protocol, 39 seamless learning articles were obtained that studied schooling and lectures. The results of the review show that the number of articles published online with the reputation of Scopus about seamless learning has been going on since 1996 until this year. The most research method used is quantitative, the sample most often used is university students, the number of authors who publish the most consists of one author, the country of origin of researchers who most dominantly research "seamless learning" is China. Through this analysis it is known that "seamless learning "which uses research respondents from kindergarten, secondary school and junior high school students is the latest research opportunity.

1. Introduction

Many researchers have conducted research on seamless learning at various levels of education, such as primary schools to universities. As research says, the involvement of elementary school students in experiencing variation allows the translation of theory into practice.(Voon, 2020) and research in elementary schools (Hamid, 2019; Seow, 2009; Song, 2018) to research at universities that most dominate (Buschlen, 2014; Dakir, 2021; Hambrock, 2023; Kahn, 1999; Kuh, 1996; Louhichi, 2021; Marín, 2016; Marks, 2002; Mykytiuk, 2022; Panke, 2017; Stefan, 2022; Uosaki, 2012; Wong, 2012; Yafie, 2020; Zhang, 2006). In the course of research, seamless learning (SL) is still a rather unknown concept in higher education. so many educators classify it under the same categories as mobile, blended, online or hybrid learning. (Hambrock, 2023).

Seamless learning as a learning model applies and offers seamless learning features because it can be accessed anywhere through digital learning resources, learning in various contexts, combined formal and informal learning guided by teachers, independent and collaborative learning, and transitions. between various learning activities can be an efficient teaching technique in higher education that has a positive effect on academic performance, motivation, learner's approach to learning and engagement (Mykytiuk, 2022). Learning designed to gain formal and informal experiences can equally contribute towards broadening the acquired knowledge and skills, enhancing user experience, and improving the learning outcomes (Stefan, 2022)

Seamless learning shows that improving learning outcomes can be achieved by combining various experiences (formal and informal, in the classroom and outside the classroom, face-to-face and virtual, academic and non-academic, guided and autonomous, individual and social) so that it appears whole or sustainable (Wong & Looi, 2011). Although this concept has been around for decades, it has taken hold more recently as an effort to bridge curricular and life experiences toward re-engaging students and becoming an effort to reach students who can reach educators. Achieving a truly seamless learning experience requires bridging strictly formal, learning content related to a subject matter, with more informal learning activities that involve collaboration with other students and educators, contextualizing learning, and moving beyond the boundaries between traditional class

(Wong & Looi, 2011). Seamless learning focuses on establishing continuity in learning and building a holistic learning experience. Combining formal and informal approaches and seeing students as a whole consisting of their entire mind, soul, body, talents, experience, and knowledge as supporting factors that characterize barrier-free learning that is associated with increased engagement and motivation, personal awareness, and behavior change (Hambrock, 2023).

Smartphones as part of technological innovation that can be used for learning are a suitable medium for implementing unlimited learning, considering their inherent ability to support learning anywhere and at any time. (Looi et al., 2009).

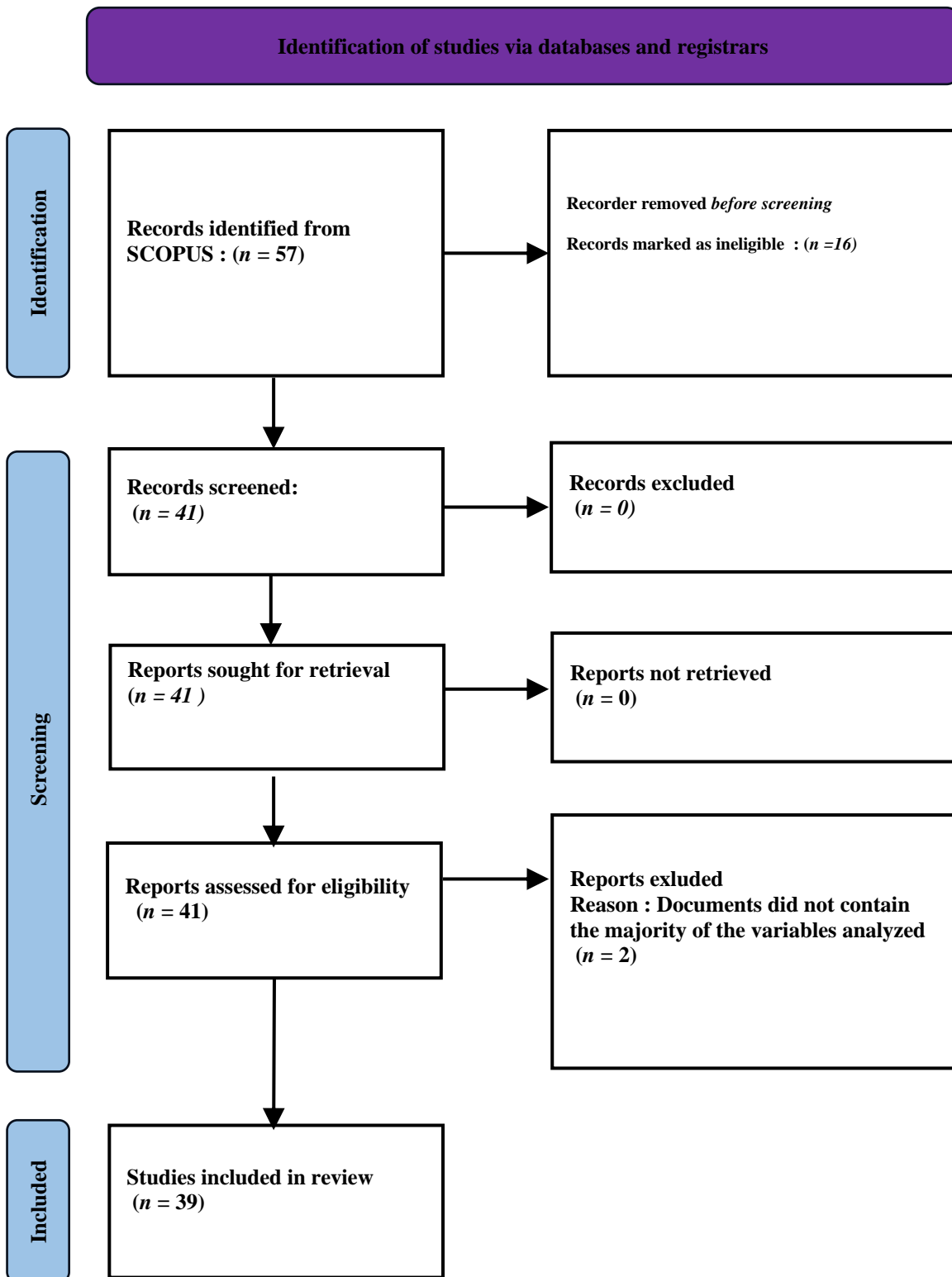## 2. Methodology
2.1. The Systematic Review Process

The method used to review the latest literature on seamless learning uses an adaptation method called PRISMA so that the literature review is carried out systematically. Review based on the title "seamless learning" and the keyword "learning" (see Table 1). Next, the researcher goes through the procedures or steps of the review process (identification, screening, feasibility), data, abstraction and analysis. This research literature review uses a popular database, namely Scopus, which is a highly reputable source consisting of tens of thousands of pieces of knowledge.

Tabel 1. Metrics in the Review Systematic Process

Data Based	Metrics
Scopus	**Reference date:** 2024-11-12 12:41:31 +00700
	Publication years: 1996-2024
	Citation years: 28 (1996-2024)
	Papers: 57
	Citations: 1330
	Citations/year: 47.50 (acc1=34, acc2=23, acc5=9, acc10=5, acc20=2)
	Citations/paper: 23.33
	Citations/author: 1330.00
	Papers/author: 57.00
	Authors/paper: 1.00/1.0/1 (mean/median/mode)
	Age-weighted citation rate: 181.04 (sqrt=13.45), 181.04/author
	Hirsch h-index: 16 (a=5.20, m=0.57, 1119 cites=84.1% coverage)
	Egghe g-index: 36 (g/h=2.25, 1306 cites=98.2% coverage)
	PoP hI,norm: 16
	PoP hI,annual: 0.57
	Fassin hA-index: 6

2.2. Prisma Protocol

In the initial screening using Publish or Perish, there were 57 articles with titles relevant to the context of "seamless learning" and the keyword "learning". However, in the end, after going through the review process, 39 articles were selected from the systematic review process which will be analyzed to help achieve the research objectives. First, analysis involved reading the abstract of each article to highlight relevant main themes and subthemes. Then, an in-depth reading of each article was carried out to gather more detailed information related to the research objectives.
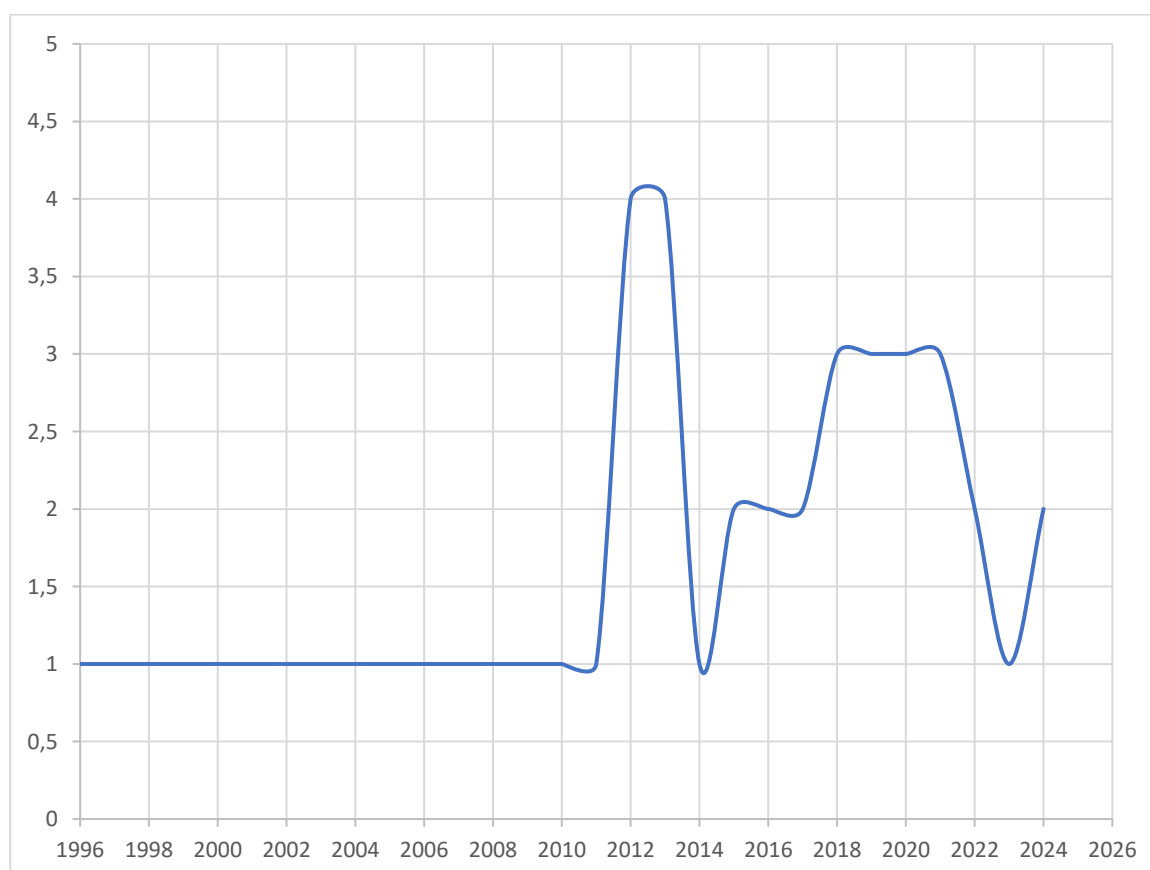
Identification of studies via databases and registrars

Identification	

Records identified from SCOPUS : (*n = 57*)

Recorder removed *before screening*

Records marked as ineligible : (*n =16*)

Records screened: (*n = 41*)

Records excluded (*n = 0*)

Reports sought for retrieval (*n = 41*)

Reports not retrieved (*n = 0*)

Reports assessed for eligibility (*n = 41*)

Reports exluded
Reason : Documents did not contain the majority of the variables analyzed (*n = 2*)

Studies included in review (*n = 39*)

Screening

Included

Picture 1. PRISMA Protocol

3. Result

3.1. Review Based on Publications per year

Research that produces international scientific publications from various countries continues to be encouraged. Apart from being important for increasing reputation at the international level, it is also a scientist's contribution to the development of science and technology. As an academic, a scientist is obliged to maintain the quality and increase the quantity of his research as a form of integrity to his profession.
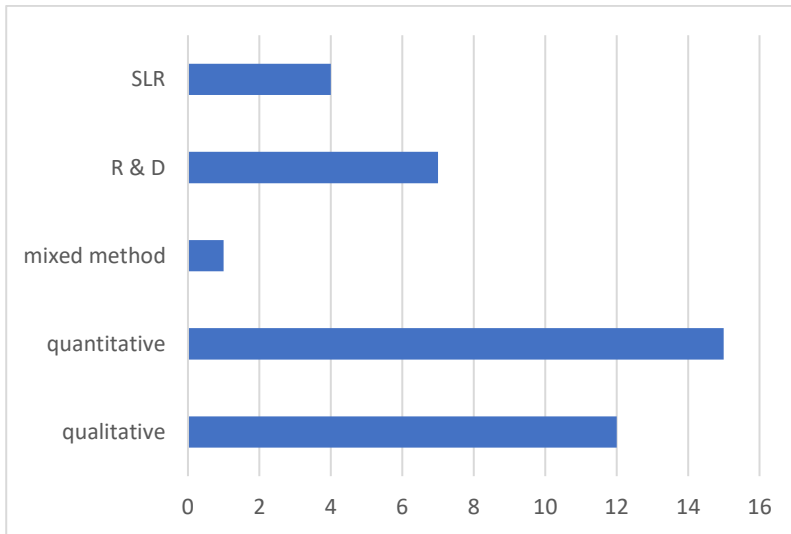

Picture 2. Review Based on Publication per Years

Publications regarding seamless learning seem to experience ups and downs. The graph shows that research was first published online in 1996(Kuh, 1996). Then it was continued by (Kahn, 1999) in 1999. There were no Scopus research articles published in the following year (1997, 1998).

The most seamless learning research articles were published by Scopus in 2012-2013. Then it decreased sharply in 2014. However, recently seamless learning research has started to increase again. This study only reports research articles indexed by Scopus and relevant to the field of education.

3.2. Review Based on Research Methods

Various research approaches and methods were carried out by researchers to obtain in-depth information. A seamless learning environment is an intelligent form of deep integration between the digital learning environment and the physical learning environment (Xin, 2018). So that several researchers are carrying out the development and construction of seamless learning spaces and platforms which is a new trend in mobile learning research and practice (Song, 2013; Sunandar, 2017; Xin, 2018). Research was also carried out by reviewing various documents from previous researchers as done (Hambrock, 2023; Mutahi, 2015; Otero, 2011; L.-H. Wong & Looi, 2011).
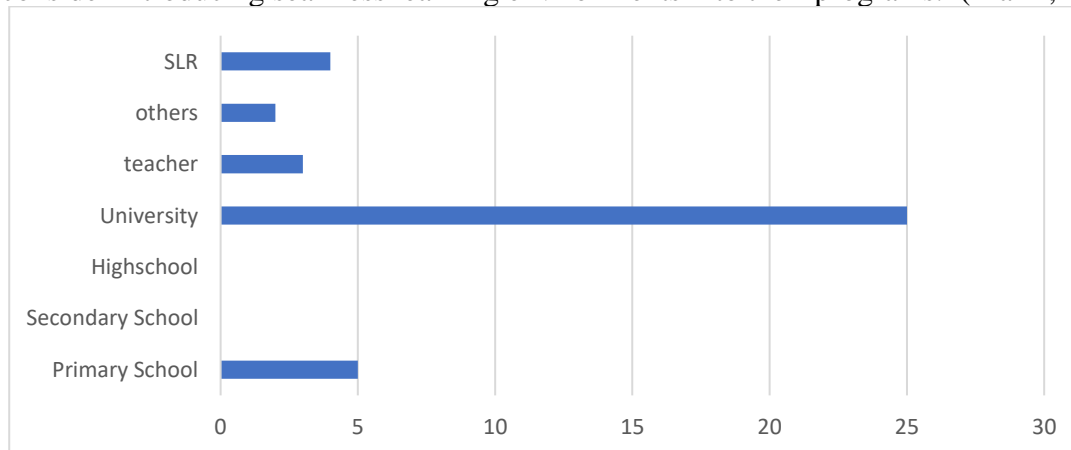
Picture 3. Review Based on Research Methodology

From the data above, qualitative research reached a total of 12 titles, dominated by the case study approach. Other approaches are exploratory, analytical, descriptive, and practical approaches. Then for quantitative methods there are 15 research titles with the approach most often used by researchers, namely experiment. Other approaches such as comparative studies and surveys are very few. Apart from these two methods, there were 7 research and development (R & D), 4 literature reviews, and one researcher who carried out mixed methods in his research.

3.3. Review Based on Research Sampling.

Utilizing a seamless learning environment that has the potential to support lifelong learning anytime and anywhere has become a reality. At this time, many educational institutions began to consider introducing seamless learning environments into their programs. (Marín, 2016).
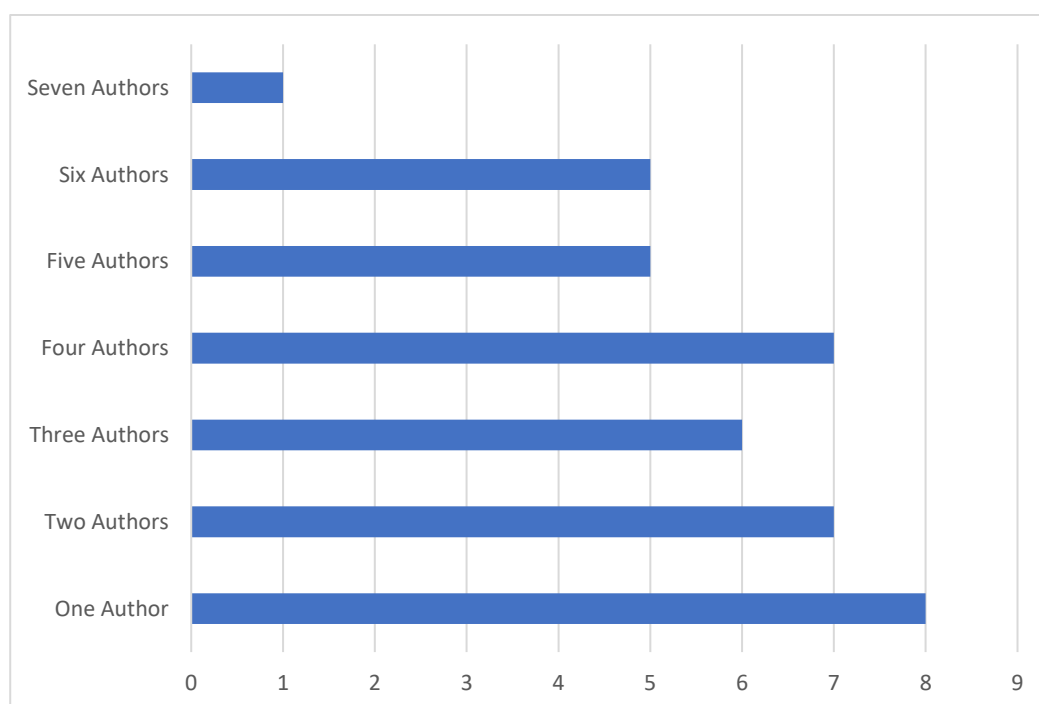

Picture 4. Review Based on Research Sampling

From the document review, many researchers prefer students from universities. It could be because researchers view college students as having traits of character – e.g. adaptability, ambitiousness, proactivity, optimism and engagement, industrialism, persistence, independence, conscientiousness, self-confidence, considerateness, inquisitiveness, ability to concentrate. This character really supports the continuity of seamless learning(Dobeš et al., 2015). The data presented in picture 3 contains a

sample of 25 college student articles. The sample of elementary school students shows a number that is far from college students, namely 5 studies. But this is better than students from kindergartens, secondary schools and high schools who have not been researched based on articles published online with the reputation of Scopus. It should be emphasized that the 4 systematic literature review research methods do not use samples or research respondents.

3.4. Review Based on Number of Research Authors

In the 17th century, many scientists kept new discoveries secret so that others could not claim the results as their own. In line with the discovery of digital technology via the internet network, various research results can be published online and searched by other researchers. From this arrangement emerged the modern scientific journal and the practice of peer review.
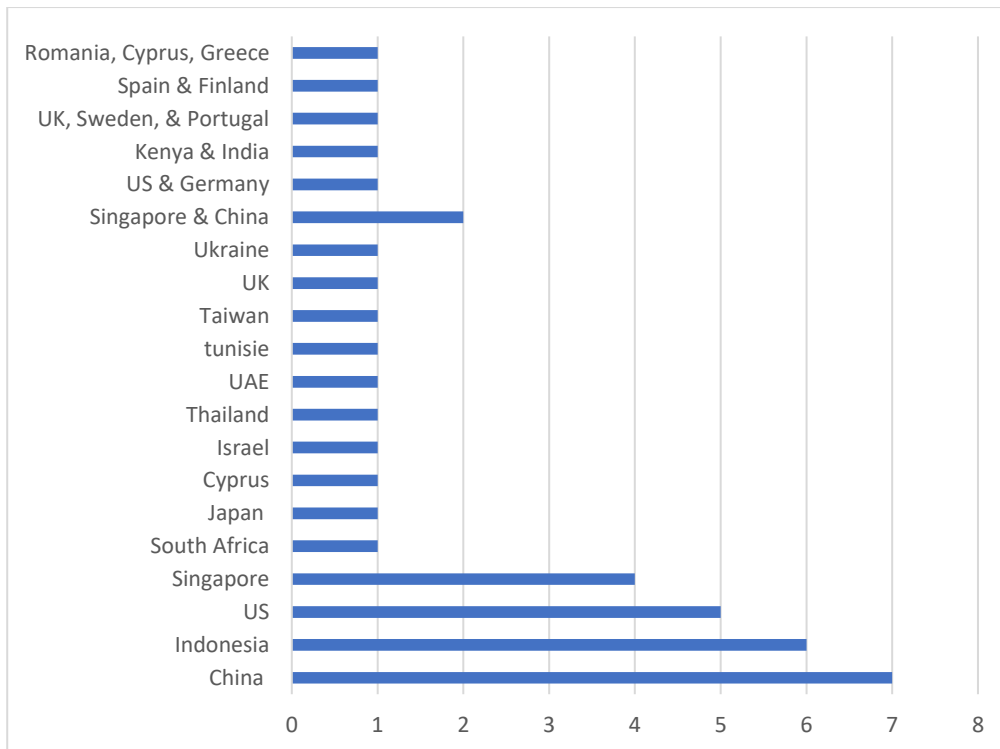

Picture 5. Review based on Number of Research Authors

Scientists who conduct research on seamless learning mostly do it alone without collaborating with other researchers. As in the data above which shows the number of articles as many as 8 article titles. Not much different, researchers with two authors and four authors were found in 7 articles each. The collaboration of three authors was found in 6 article titles, five and six authors was found in 5 research articles, and the collaboration of seven authors was only in 1 article.

3.5. Review Based on Author's Country of Origin

Researchers from various countries will usually carry out research collaboration as a form of partnership between two or more parties who work together to achieve common research goals. This review show that the most collaborations were carried out with partners from the same country.

Picture 6. Review based on Author's Coutry of Origin

There are 8 research titles that the researchers wrote themselves and of course did not collaborate with colleagues across countries, they were from the US with two articles, Indonesia, Singapore, China, England, Cyprus and South Africa. Meanwhile, the research was conducted by two researchers from two countries, namely Singapore and China (Song, 2018; Wong, 2012), United State and Germany(Panke, 2017), Kenya and India(Mutahi, 2015), Spain and Finland(Marín, 2016), and collaboration of researchers from three different countries, namely the United Kingdom, Sweden, and Portugal (Otero, 2011) dan Romania, Cyprus, and Greece(Stefan, 2022)

4. Discussion

Various research approaches and methods were carried out by researchers to obtain in-depth information. Seamless learning environments are an intelligent form of deep integration between digital learning environments and physical learning environments (Xin, 2018). So that several researchers are carrying out the development and construction of seamless learning spaces and platforms which is a new trend in mobile learning research and practice(Song, 2013; Sunandar, 2017; Xin, 2018). Research was also carried out by reviewing various documents from previous researchers as was done by Otero (Hambrock, 2023; Mutahi, 2015; Otero, 2011; Wong & Looi, 2011).

The first seamless learning research published online was research from (Kuh, 1996) with the title "Guiding Principles for Creating Seamless Learning Environments for Undergraduates". Since then, the quantity of research has increased until it reached its peak in 2012-2013. The seamless learning research trend declined sharply in 2014 and then increased again the following year.

Many researchers from various countries contributed to share their thoughts on seamless learning. China is the country where research publications appear most frequently, followed by Indonesia, the United States, and Singapore. The highest number of authors collaborating on one article title was two authors and four authors were found on seven articles each. Researchers who were single authors were found in eight articles.

The most research method used is quantitative with an experimental approach. However, it is not much different from qualitative research methods. Some even carry out R&D and literature studies. This study also gathered information that most researchers collected data on university students and elementary school students took second place.

Researchers have found that the application of technology through teaching practices is still much more limited than expected due to personal factors, institutional interests, and technology that influence teachers' decisions to integrate technology (Louhichi, 2021). There is still very little research on seamless learning that utilizes technology such as smartphones by offering a new concept, namely mobile seamless learning, and could be an opportunity for the future.

5. Future Research

The findings of this systematic review can be used as a guide for other researchers to conduct a more in-depth study regarding the application of seamless learning as a method in learning, especially for levels of education that have not been reached by previous researchers. Smooth learning in middle and high schools can be considered a priority. The use of digital learning technology is also recommended so that continuous, limitless learning can be realized.

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