

Self-reflection and Concept Mapping as Self-regulated Learning Strategies for Learners in Online Open Distance E-learning: A Bibliometric Review from 2014-2024

Babawande E. Olawale^{1*} 

Mncedisi C. Maphalala² 

AFFILIATIONS

^{1&2}Department of Curriculum & Instructional Studies, Faculty of Education, University of South Africa, Pretoria, South Africa.

CORRESPONDENCE

Email: beolawale@outlook.com

EDITORIAL DATES

Received: 27 June 2025

Revised: 20 December 2025

Accepted: 23 January 2026

Published: 15 March 2026

Copyright:

© The Author(s) 2026.

Published by [ERRCDF Forum](#).

This is an open access article distributed under Creative Commons Attribution (CC BY 4.0) licence.



DOI: [10.38140/ijer-2026.vol8.1.11](https://doi.org/10.38140/ijer-2026.vol8.1.11)

Abstract: Self-regulated learning (SRL) is crucial in open and distance e-learning, but techniques like self-reflection and concept mapping face challenges. Research mainly focuses on face-to-face or blended settings, raising questions about SRL's effectiveness in digital environments. Thus, this article explores the literature trends of self-reflection and concept mapping as learning strategies for learners in online open distance e-learning (2014-2024), in a bid to fill the existing literature gap. The data collected from the Scopus database were subjected to bibliometric analysis using the BiblioShiny app. The analysis revealed that Hwang G. J., Järvelä S., Kinchin I. M., Li Y., and Malmberg J. are the most relevant authors, and countries such as Canada and the Netherlands have the highest number of publications within this study area. The word 'human' has the highest frequency, followed by 'male', 'female', and so on. Under the word cloud section, 'human' is the most prominent, followed by 'concept mapping'. Self-reflection has been very useful for learners' self-motivation, self-monitoring, and the development of their intellectual capital. Similarly, concept mapping is a highly creative learning strategy that simplifies complex thinking and transforms learning. Hence,

future research can be conducted on teachers' roles. Likewise, further studies can be carried out on other self-regulated learning strategies in the future.

Keywords: Self-reflection, concept mapping, self-regulated learning, distance learning.

1. Introduction

Allen and Seaman (2015) described online learning as a modality for lectures delivered virtually without physical meetings. It facilitates quick and easy lecture delivery, eliminating the need for physical interactions between teachers and learners. Online learning is essentially made possible through the deployment and engagement of ubiquitous technologies and gained significant popularity during the COVID-19 pandemic. Allen and Seaman (2015) argued that, in response to the pandemic, higher education institutions globally deployed an emergency remote method of teaching by engaging virtual methods of learning and teaching. Facilitators have shown readiness and determination to use technology to impart academic knowledge to learners (Allen & Seaman, 2015; Ucar & Ugurhan, 2023). Through online learning, open access to educational knowledge is available worldwide. Ucar and Ugurhan (2023) noted that the concept underpinning open access to education is the liberation of students from distance and time limitations, as well as the provision of flexible learning opportunities. Therefore, online learning removes the barriers of distance and the restriction of time through a model called online open distance e-learning. Information and communication technology facilities that rely on big data and the internet make open distance e-learning possible and accessible. Based on the significant role of online distance learning environments, learners are able to acquire specific skill sets and knowledge via internet-based asynchronous and synchronous applications using information and communication technologies (Ucar & Ugurhan, 2023).

How to cite this article:

Olawale, B. E., & Maphalala, M. C. (2026). Self-reflection and concept mapping as self-regulated learning strategies for learners in Online Open Distance e-Learning: A Bibliometric Review from 2014-2024. *Interdisciplinary Journal of Education Research*, 8(1), a11. <https://doi.org/10.38140/ijer-2026.vol8.1.11>

Since learning occurs without physical interaction between the learner and the teacher in open and distance e-learning, learners must ensure that they are sufficiently focused to maximise the benefits of the learning process through self-control and self-restriction. Diningrat et al. (2024) asserted that it is expected of learners to exhibit self-control and also employ self-reflection based on their self-reactions and judgments. Learners in the open and distance learning environment are expected to equip themselves with competent self-regulated learning skills to demonstrate the behaviour of independent learners, which is a relevant characteristic for open and distance learning (Corno, 2001). Given that it is important for individuals to be regulated and moderated in their various engagements, learners are therefore expected to show their willingness and readiness to exhibit self-control and self-regulation during online learning (Maphalala et al., 2021). According to Wei and Chou (2020), learners must demonstrate their willingness and readiness for online lectures to succeed in their various courses. Similarly, learners are expected to engage in online learning in an environment that they can easily adapt to and self-regulate as much as possible. However, Ucar and Ugurhan (2023) noted that the skillset of self-regulated learning can prevent an individual from adapting to other learning environments with different conditions. Nonetheless, Pintrich (2000) argued that learners are fundamentally active in setting their goals and determining the methods they use, which are based on the information available in the external environment and their own considerations.

Inzlicht et al. (2021) noted that the concept of self-regulation is an essential component of human functioning because it can assist in facilitating the successful achievement of human goals. Furthermore, Tekkol and Demirel (2018) asserted that the importance of self-regulated learning transcends educational achievements; it also supports lifelong learning. Historically, the concept of self-regulation in education is founded on both cognitive-behavioural and cognitive-developmental attributes (Mahoney & Thoresen, 1972; Asarnow, 1979). As such, learners use their discretion and volition to set goals based on their demands and choices (self-determination) as well as resolve action-based conflicts through a self-regulation mechanism (Odinokaya et al., 2019). Learners are expected to motivate themselves to self-regulate during open and distance e-learning, as no instructor or teacher will be present to caution and guide learners in maintaining appropriate focus. Thus, for a successful online learning programme, there must be clear control of the learning process, which underscores the concept of self-regulated learning (SRL) (Zimmerman, 2002).

Panadero (2017) opined that self-regulated learning (SRL) is a fundamental concept that aids in understanding the cognitive, emotional, and motivational phases of learning. In online and distance learning environments, learners are expected to possess high-level self-regulation skills that enable them to remain focused, manage their time effectively, and learn optimally (Shen, 2013; Ucar & Ugurhan, 2023). Turan et al. (2022) posited that self-regulated learning is essentially a process that is constructively and actively engaged, where learners are capable of setting targets and regulating their motivations, cognitions, and behavioural dispositions to achieve these targets. Self-regulated learning encompasses goal setting, methodologies, and effective monitoring, which involve seeking help, self-directed learning, managing the environment, and regulating one's efforts (Kesuma et al., 2020; Amiruddin et al., 2023). Thus, self-regulated learning is crucial for time management, ensuring that success is achieved in real time. According to Hidayatullah and Csikos (2023), self-regulated learning inherently involves monitoring procedures such as goal orientation, environmental structure, time management, task methods, seeking help, and individualised evaluation. Self-regulated learning mechanisms are essential for optimal engagement with e-learning platforms and programmes. Hence, self-regulated learning constitutes a vital skill set for supporting students' learning in an electronic learning environment (Huh & Reigeluth, 2018). This is because learners must evaluate themselves to ascertain that they have learned optimally through self-regulated learning, employing self-monitoring and self-reflection (Huh & Reigeluth, 2018; Amiruddin et al., 2023). Therefore, Pintrich (2000) argued that self-regulated learning comprises four components: 1) activation and planning; 2) control; 3) reflection and reaction; and 4) control. Furthermore, De Silva

(2020) adds that self-regulation consists of a combination of self-judgment, self-observation, and self-reaction.

Therefore, it is crucial to conduct a bibliometric review of the scientific scholarly literature on self-regulated learning strategies, particularly self-reflection and concept mapping for learners in online open distance e-learning. Although various studies have been conducted in the past, for instance, Jegede et al. (1990) examined the effect of concept mapping on students' anxiety and achievement in biology. Romero et al. (2017) also studied meaningful learning through concept maps as a learning strategy. Furthermore, Shakoori et al. (2017) investigated the effect of the concept mapping strategy as a graphical tool on writing achievement among EFL learners. Additionally, Adiyiah et al. (2020) explored the impact of concept mapping on self-efficacy, thereby enhancing students' motivation and performance in biology. Moreover, Khiat and Vogel (2022) examined self-regulated learning management systems, while Faza and Lestari (2025) conducted a systematic review of technologies, strategies, challenges, and benefits in the context of self-regulated learning in the digital age. Recently, Arvatz (2025) focused on self-regulated learning and reflection as tools for teachers and students, among many others. These studies revealed that the ability of learners to establish objectives, track their progress, and evaluate their own learning processes is a hallmark of self-regulated learning (Khiat & Vogel, 2022; Arvatz, 2025; Faza & Lestari, 2025). The studies also indicate that, as a metacognitive process, self-reflection enables students to assess their knowledge and abilities, leading to greater engagement with the course content (Adiyiah et al., 2020; Khiat & Vogel, 2022). Concept mapping, on the other hand, aids students in efficiently organising and integrating information by providing a visual representation of knowledge (Romero et al., 2017; Shakoori et al., 2017).

Previous research on self-regulated learning strategies, particularly self-reflection and concept mapping, in online distance education has not been thoroughly scrutinised, resulting in a limited understanding of the field's framework and its influence. A bibliometric review of this nature fills this gap by employing quantitative methods to trace the history of publications, patterns of citations, trends in citations, and groups of related themes, thereby revealing the theoretical framework underpinning contemporary research. This approach not only emphasises the most relevant authors, university affiliations, and countries of origin of publications, but also uncovers unexplored domains and new research pathways overlooked by traditional reviews. Future research objectives, policy decisions, and understanding of the field's evolution can be significantly improved through bibliometric reviews, which provide a comprehensive overview of the literature's structure, trends, patterns, and impact. Thus, this study addresses the literature gap in reviews on self-regulated learning strategies, particularly self-reflection and concept mapping, for learners in online open distance e-learning from 2014 to 2024.

1.1 Conceptual framework

In the conceptual framework section of this study, the key concepts related to self-reflection, conceptual mapping as a learning strategy, and Boekaerts's Self-regulation Model were reviewed. Self-reflection is a critical process in which individuals examine their thoughts, actions, and beliefs to gain a deeper understanding of themselves and their learning processes. Conceptual mapping, on the other hand, involves visually representing relationships between concepts to enhance understanding and retention of information. Finally, Boekaerts's Self-regulation Model highlights the importance of individuals' ability to monitor, control, and adapt their learning strategies to achieve academic success. Understanding and incorporating these concepts into this study provides valuable insights into the processes and strategies that contribute to effective learning and academic achievement.

1.1.1 Learning self-reflection

Self-reflection essentially means introspection to check if actions were taken in conformity with set standards. Mezirow (2006) asserted that critical self-reflection involves an individual asking questions about their own assumptions, presuppositions, and trajectories. It is a mechanism that ensures an individual critique their choices, actions, and inactions to ascertain that they are on the path to success. Rather than solely relying on introspection, it may also involve having an honest discussion with another person to evaluate one's performance and progress. Frith (2012) noted that self-reflection creates a foundation for discussions between two or more people about perceptions, aiming to determine the level of progress.

Learning self-reflection signifies a form of self-evaluation and self-monitoring to assess whether the required level of learning progress is being made. Loon (2018) indicated that self-reflection, as a concept, encompasses both quantitative and qualitative profound self-monitoring engaged in learning processes and outputs, as well as the factors contributing to an individual's success or failure. It is important to note that both learners and teachers can engage in learning self-reflection. However, Sun et al. (2017) observed that the impacts of self-reflection strategies have mainly been studied from the learners' perspectives. Arvatz (2025) asserts that in line with the main guidelines of self-reflection learning, learners are expected to be consciously aware of what motivates them and to track their thoughts, emotions, and actions to facilitate continued learning. This is crucial as it helps learners sustain their learning and achieve optimal outcomes.

At the performance-reflection stage, learners typically seek feedback through self-reflection or from peers or teachers to ensure that learning objectives have been met (Khat & Vogel, 2022). The reflection mechanism can aid learners in focusing on their learning and regulating their learning activities (Fabriz et al., 2014). Furthermore, self-reflection allows teachers the opportunity to introspect and evaluate themselves, ensuring they are employing the right teaching techniques and imparting accurate knowledge to their students. Arvatz (2025) asserted that teachers specifically reflect on their roles in fostering learners' self-reflection learning, developing their own self-reflection learning, and enhancing their self-reflection teaching skill set simultaneously, which also contributes to learners' improvement. For both learners and teachers, self-reflection aids in refining and enhancing their respective skills and abilities. Thus, self-monitoring engagements are crucial when employed as formative rather than summative evaluations, as formative evaluation significantly impacts self-evaluation, particularly self-reflection (Sitzmann et al., 2010; Eva & Regehr, 2005).

1.1.2 Concept mapping as a learning strategy

Zvacek et al. (2012) noted that a concept map is a visual representation of knowledge organised by an individual into connected nodes. Romero et al. (2017) posited that a concept map is a graphical tool created in 1972 by Joseph D. Novak that shows information arranged hierarchically, as well as the connectivity of ideas. Shakoori et al. (2017) stated that a concept map is a graphical representation used to visualise relationships that exist among ideas. It can effectively help learners structure their thoughts in a relatable and visual way. Adiyiah et al. (2020) asserted that the procedures involved in constructing a concept map are valuable for assisting learners in developing a better understanding of how to connect various ideas. Notably, a concept map is a valuable self-reflective tool that has helped learners understand concepts better through visual representations. As a self-reflective tool, the concept map promotes profound learning, enhances retention, and aids learners in regulating their learning processes (Zvacek et al., 2012; Romero et al., 2017). According to Romero et al. (2017), some students have a better understanding of their lessons through graphical representations of ideas. For such students, a concept map could be one of the best techniques for learning. Mih and Mih (2011) posited that concept maps are instruments that facilitate evaluation and smooth learning through graphical organisation.

The advantages of engaging in a concept mapping strategy for enhancing learning are numerous. For instance, Rittle-Johnson and Star (2007) asserted that the benefits of knowledge processes through strategic learning are not necessarily linked to the advantages of conceptual mapping. Similarly, Schraw et al. (2006) noted that engaging with concept maps can promote self-regulated learning by 1) enhancing the development of cognitive procedures through the provision of new strategies for learners; 2) improving metacognitive processes by creating visual knowledge structures; and 3) boosting motivation through increased self-efficacy connected with prior knowledge activation. Jegede et al. (1990) observed that concept maps serve as tools to help students organise their cognitive templates into deeply interconnected settings. Ultimately, concept maps are very useful for learners, enabling them to better structure and coordinate their cognitive frameworks. Advocates for the use of concept mapping strategies agree that learners perform significantly better when they are aware of and can manage the cognitive processes associated with learning (Jegede et al., 1990). Thus, concept mapping can act as a motivational tool for students. For instance, Stevenson et al. (2017) argued that concept mapping could motivate learners more effectively and enhance their ability to self-regulate their learning processes. This is because using concept maps can help reduce anxiety in science classrooms, thereby facilitating improved learning outcomes in science subjects (Jegede et al., 1990; Stevenson et al., 2017).

According to Novak et al. (2005), learners who engage in concept mapping, a learning tool, embrace new knowledge that connects old ideas to new ones and serves as an anchor for cognitive structures. Thus, concept maps can be constructed either at the beginning or at the end of educational lessons. Shakoori et al. (2017) asserted that concept mapping is a pre-task planning procedure that involves drawing and connecting ideas. While Adiyiah et al. (2020) noted that concept maps are typically drawn at the end of an instructional period, the authors argued for continuous engagement throughout the learning process to better rearrange learners' concepts. Similarly, Stevenson et al. (2017) averred that it is more beneficial for learners and teachers to engage in concept mapping both at the start and at the end of the academic period. Thus, in a typical concept map, the most prominent words represent the concepts that are considered very important. Hence, Mih and Mih (2011) asserted that concept maps contain a hierarchical representation of concepts, where the most general concepts are situated in the upper portion of the map and the more specific concepts are located in the lower portion.

1.1.3 Boekaerts's Self-regulation model

Boekaerts (1999) noted that learners are self-regulating intrinsically when they have a clear-cut target that does not require guidance or instructions from other people. This model is useful for learners who have learning targets that they perceive they can achieve on their own. Bylieva et al. (2021) noted that Boekaerts's self-regulation model separates self-regulation procedures into two sections, namely; 1) mastering learners' skillsets and 2) well-being where learners can easily switch. This model advocates that when learners have mastered appropriate skillsets, they can easily operationalise different techniques of self-regulation during instructional periods while also prioritising their well-being. Boekaerts (1999) posited that goal-directed regulations are focused on the achievement of certain learning aims, while self-directed regulations involve management of the individual's well-being and emotions while learning. Furthermore, Tinajero (2024) asserted that this model is inclusive of a personal self-regulatory pathway, which could range from coping paths to mastery paths, clearly showing learners' intentions to fully focus on the target, irrespective of prospective challenges or problems. Thus, this model ensures students are smart enough to moderate themselves appropriately so as to get the best out of learning.

Boekaerts (1997) asserted that the assumption of this educational framework anchors around; 1) the majority of the learners would achieve significant success with the activation and generation of cognitive methodologies that could create very good solutions within the set time of the teacher, 2)

that there will be spontaneous materialisation of transfers during practical periods, and 3) students will subsequently be independent of the control as well as lead of their teacher. Thus, Boekaerts's self-regulation model motivates learners to be cognitively smart and achieve greatly without the instructions and guidelines of their teachers. According to Tinajero (2024), this model involves the usage of various methodologies targeted at controlling motivational and affective reactions connected with the challenges associated with such learning tasks. As such, learners can take a cue from the challenges that they encountered while acquiring pertinent skillsets of self-regulation for a particular instructional lesson or period, for other periods. Boekaerts (1999) posited that students who have achieved significant successes could easily apply the methods and strategies that they have gained in one situation to another, and they could also modify and extend such strategies along the way.

2. Materials and Methods

Data for bibliometric analysis were harvested from Scopus. This study utilises a singular authoritative database (Scopus) to ensure uniformity, accessibility, and replication, as the amalgamation of different sources often results in duplication and metadata discrepancies. The selected database provides a solid foundation for bibliometric analysis within the specified scope, although its acknowledged limitations are well articulated. The data were searched using pertinent keywords that underscore the focus of this study. The pertinent keywords are "self-regulation", "concept mapping", "self-reflection", and "open distance e-learning". The search range extends from 2014 to 2024. Notably, the initial search revealed 3,829 documents. To enhance focus, the search was limited to article publications only, reducing the number of documents to 2,809. Furthermore, to achieve greater precision, the search subject areas were confined to computer science, arts and humanities, business, management, accounting, and multidisciplinary fields. This restriction was made because these disciplines closely align with the study's thematic focus, ensuring that the retrieved papers are conceptually relevant rather than peripheral outcomes derived from unrelated fields such as engineering or medical sciences. The final number of documents was therefore trimmed to 781. The breakdown of the search documents is also presented in the PRISMA chart below.

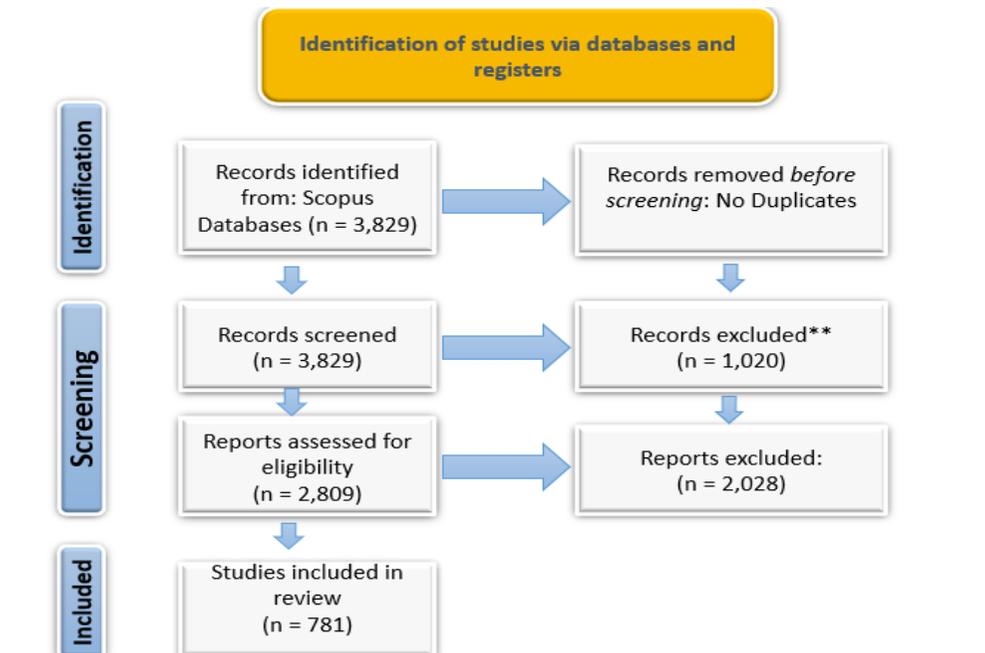


Figure 1: Prisma flow chart

In summary, the inclusion criteria established are as follows: all documents are article publications, the subject areas include computer science, arts and humanities, business, management, accounting, and multidisciplinary fields, and all documents were written in English. The 781 documents were analysed using bibliometric analysis, particularly with the aid of the Biblioshiny app in R Studio. The bibliometric analysis for this study was conducted using the “Biblioshiny” package in R Studio (Aria & Cuccurullo, 2017). Bibliometric analysis has been employed by various researchers in recent times, such as Hermala et al. (2024), Hu et al. (2025), Geng et al. (2025), and others.

The research questions for this study were:

- Q1: What was the information about the authors of publications from 2014–2024?
- Q2: What were the sources of the publications from 2014–2024?
- Q3: What were the trends of the documents from 2014–2024?

3. Presentation of Results

This section addresses three key research questions relating to self-reflection and concept mapping as self-regulated learning strategies for learners in Online Open Distance e-Learning in publications from the years 2014 to 2024. The first research question focuses on the information about the authors of these publications, seeking to understand the demographics, affiliations, and country-specific production of the research. The second research question delves into the sources of the publications during this time period, examining the types of journals and other platforms where the research was disseminated. Lastly, the third research question explores the trends of the documents published between 2014 and 2024, such as the topics, methodologies, and impact of the research. Hence, by answering these research questions, the study hopes to gain a comprehensive understanding of the landscape of scholarly publications over the past decade, shedding light on the key players, sources, and trends in the field. As such, the research questions are presented as shown below:

Q1: What was the information about the authors of publications from 2014–2024?

It is evident that Hwang G. J., Järvelä S. and Kinchin I. M., published seven (7) articles each, Li Y., and Malmberg J. published six (6) articles each, Gašević D., Li S., and Wang M. published five (5) articles each, and so on, as obvious in Figure 2.

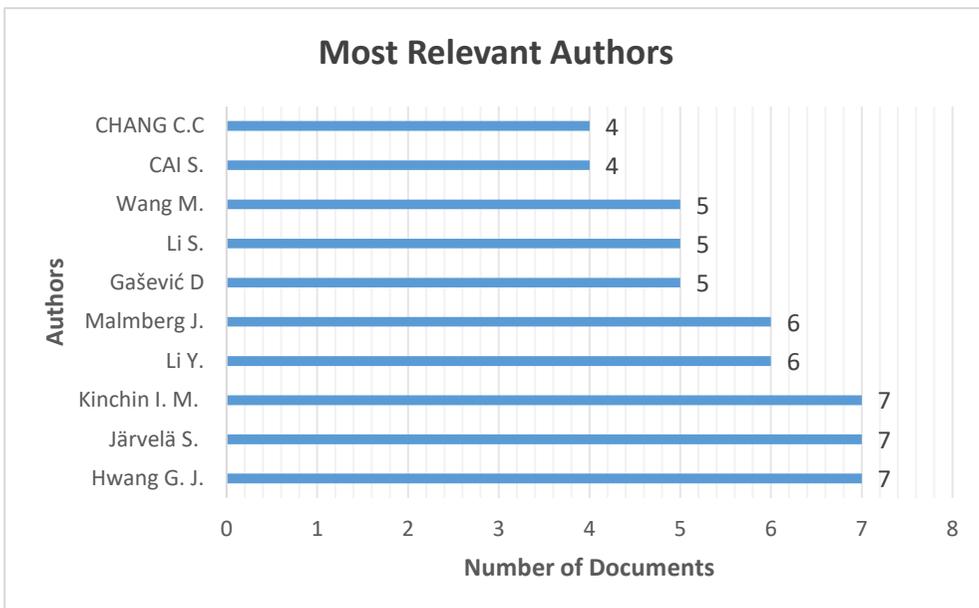


Figure 2: Most relevant authors

It is notable that the University of California has thirty-nine (39) published articles, the University of Oulu has twenty-seven (27) published articles, Central China Normal University has twenty-six (26) published articles, Monash University has twenty-two (22) published articles, and so on, as shown in Figure 3.

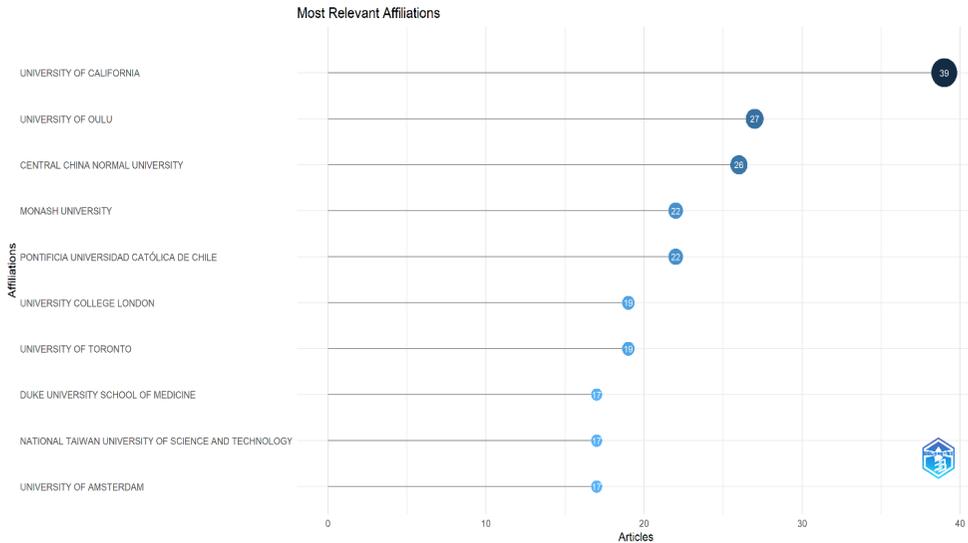


Figure 3: Most relevant affiliations

In Canada, five (5) articles were published in 2014, twenty-three (23) in 2015, twenty-five (25) in 2016, forty-four (44) in 2017, fifty (50) in 2018, fifty-five (55) in 2019, sixty (60) in 2020, and so on, while in the Netherlands, twelve articles were published in 2014, sixteen (16) were published in 2015, twenty-three (23) were published in 2016, and so on, as shown in Figures 4 and 5.

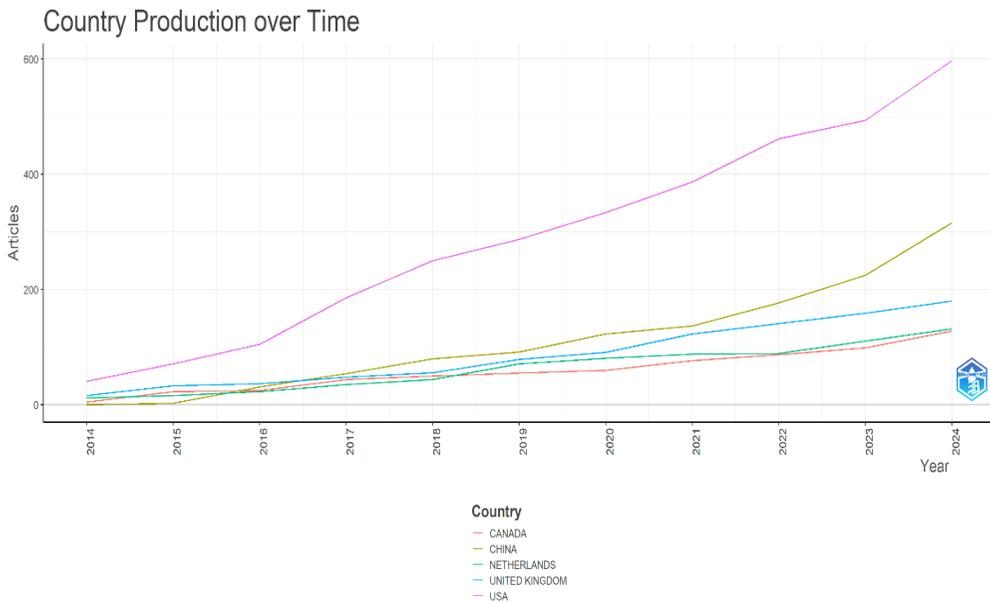


Figure 4: Country production over time

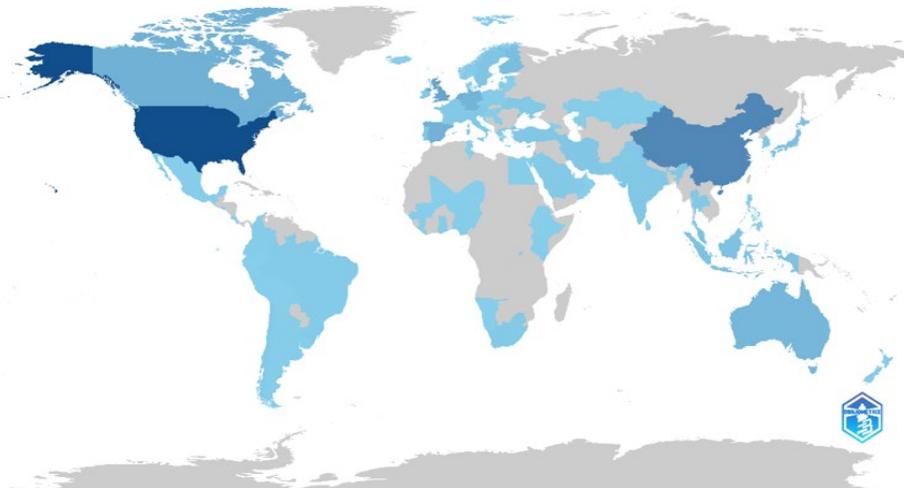


Figure 5: Country-specific production

Thus, while the first research question focuses on the information about the authors of these publications, seeking to understand the demographics, affiliations, and country-specific production of the research. The second research question below delves into the sources of the publications during this time period, examining the types of journals and other platforms where the research was disseminated.

Q2: What were the sources of the publications from 2014–2024?

The most relevant sources are PLOS ONE Journal with forty-one (41) articles, Evaluation and Program Planning with thirty-three (33) articles, Computers and Education with twenty-three (23) articles, and Computers in Human Behaviour with twenty-two (22) articles (Figure 6).

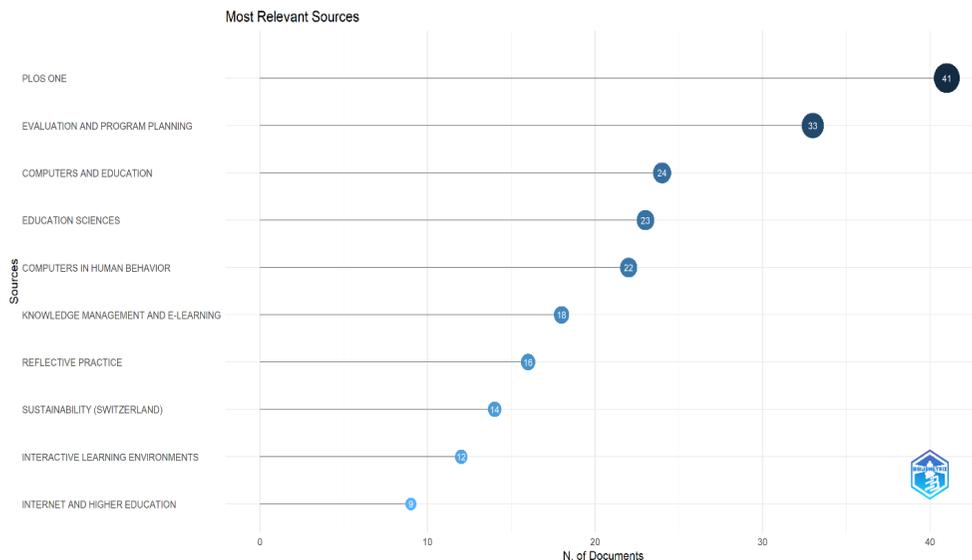


Figure 6: Most relevant sources

In terms of ranking of the sources according to Bradford's Law, in descending order, the rank is as follows: PLOS ONE, Evaluation and Program Planning, Computers and Education, Education Sciences, Computers in Human Behaviour, and so on (Figure 7).

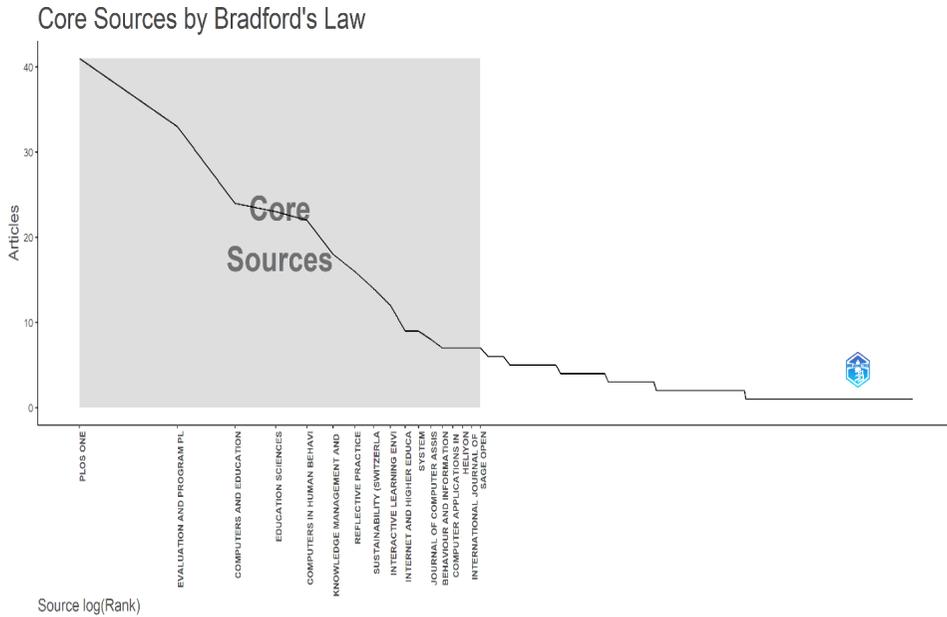


Figure 7: Core sources by Bradford’s law

While the second research question delves into the sources of the publications between 2014 and 2024, examining the types of journals and other platforms where the research was disseminated, the third research question explores the trends of the documents published between 2014 and 2024. This includes topics, methodologies, and the impact of the research, as shown below.

Q3: What were the trends of the documents from 2014–2024?

Figure 8 shows that Parsa S., 2014 is the most cited article with a total citation of two hundred and twenty-eight (228), followed by Bai B., 2023 with a total of two hundred and sixteen (216) citations, Chen Y. L., 2020, with a total of one hundred and eighty-eight (188) citations, Lehmann T., 2014, with a total of one hundred and eighty (180) citations and so on.

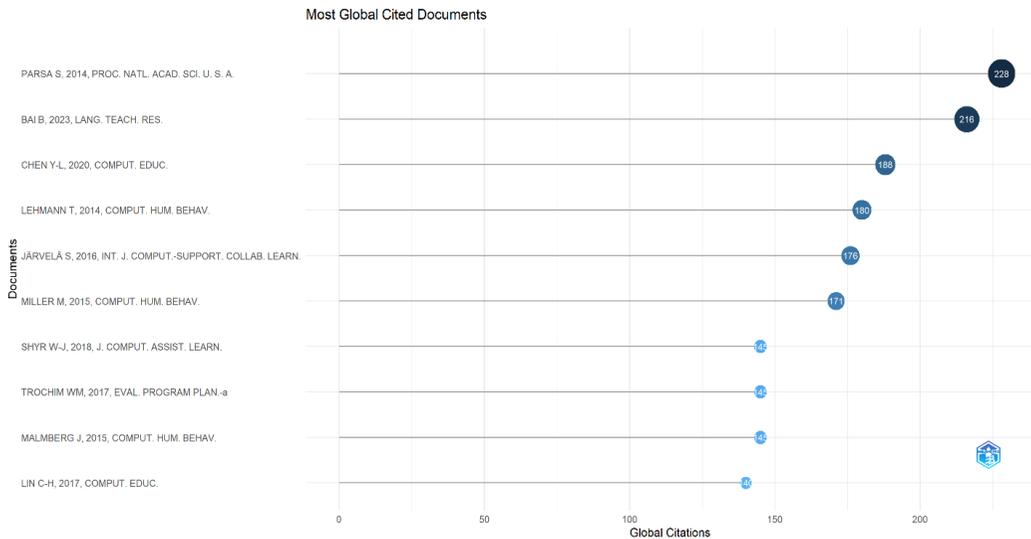


Figure 8: Most global cited documents

Words' frequency over time shows that in 2014, 'human' occurred sixteen (16) times, 'concept' occurred eighteen (18) times, 'male' occurred ten (10) times, 'female' occurred ten (10) times, and so on. In 2024, 'human' occurred one hundred and eighty-one (181) times, 'concept' occurred one hundred and thirty-six (136) times, 'male' occurred one hundred and thirty-six (136) times, 'female' occurred one hundred and thirty-three (133) times, and so on (Figure 9).

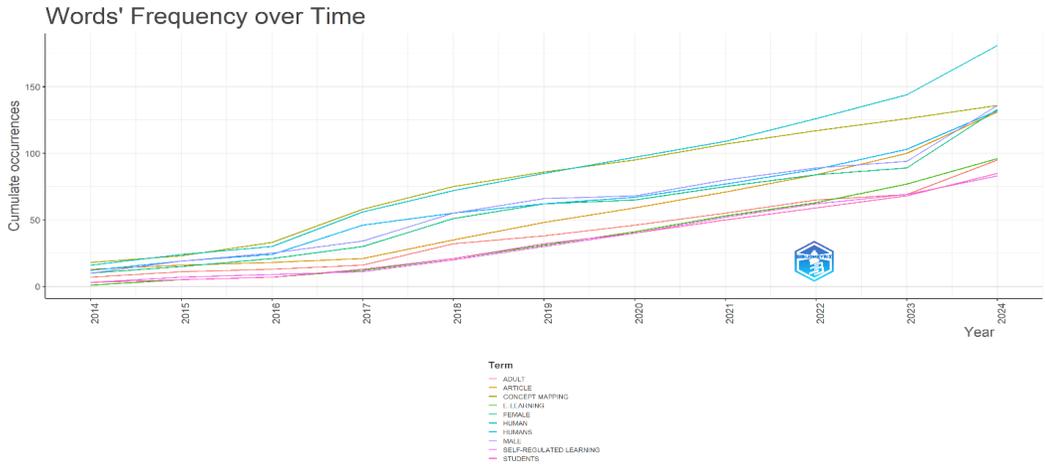


Figure 9: Word's frequency over time

Figure 10 and Figure 11 show word clouds that indicate that the word 'human' is the prominent word in all of the articles reviewed, with a frequency of one hundred and eighty-one (181) and a percentage value of 7%, followed by 'concept mapping' and 'male', each with a frequency of one hundred and thirty-six (136) and percentage values of 6% each. 'Humans' has a frequency of one hundred and thirty (130) and a percentage value of 5%, 'article' has a frequency of one hundred and thirty-one (131) and a percentage value of 5%, 'e-learning' has a frequency of ninety-six (96) and a percentage value of 4%, and so on.



Figure 10: Word cloud

effective management of students' time. Competent self-regulated learning attributes include self-learning, internal motivation, setting personal learning targets, and persistence (Schunk & Greene, 2018; Berigel & Cetin, 2019).

In terms of publication sources, PLOS ONE leads with 41 article publications among others. PLOS ONE provides broad visibility and lower barriers for developing researchers, fostering global engagement. However, subscription-based journals often have paywalls, limiting access for resource-constrained scholars and perpetuating disparities in knowledge dissemination. Hu et al. (2025) asserted that these journals have a clear capacity to shape research trajectories, facilitate interdisciplinarity, and disseminate results.

The article by Parsa S. in 2014 is the most cited, followed by Bai B. in 2023, among others. Estévez et al. (2025) noted that an analysis of highly cited publications could provide direction regarding the most important sections that have endeared many scholars to these articles. These articles must have addressed topical intellectual trajectories of self-regulated learning mechanisms for open and distance e-learning. A very high citation figure of 440 for Han H.'s article indicates impressive quality and that it has tackled various important issues in the research area (Berigel & Cetin, 2019; Estévez et al., 2025).

The scholarly contributions of the authors of these articles must have served as a rallying point for other authors, hence the high number of citations. The articles have examined pertinent technological inventions and developments with respect to self-regulated learning mechanisms for open and distance e-learning. The results further show that the word 'human' has the highest frequency. This underscores the fact that 'human beings' are at the centre of the self-regulated learning mechanism for open and distance e-learning. The self-regulated learning mechanism is meant to be adopted and operationalised by human beings, hence the reason 'human' appears most frequently. This is corroborated by the fact that the next set of words with high frequency are 'male' and 'female', indicating that it is either a male or a female who will engage in a self-regulated learning mechanism. Under the word cloud section, 'human' is the prominent word, followed by 'concept mapping'. It is notable that concept mapping, as a self-regulatory strategy, has received immense attention in contemporary times.

However, the articles produced by the authors reveal a clear and in-depth probe into the concepts of self-reflection and concept mapping as strategies for self-regulated learning, as evident in Table 1.

Table 1: Concepts and summary of findings of corresponding scholars

Concept	Authors	Summary
Self-reflection	Wang et al. (2020), Joksimovic et al. (2019), Li et al. (2023), Loon (2018)	All the components of self-reflection have significantly enhanced individual intellectual capital. Self-reflection levels are characterised by various linguistic properties that connect with underlying cognitive strategies. Deep reflection leads to more precise targets. Self-reflection is important for self-motivation and self-monitoring.
Concept mapping	Cheng et al. (2024), Liu et al. (2023), Aguiar et al. (2019), Chang et al. (2022), Romero et al. (2017)	Concept mapping enhances learning achievement because it enhances creative thinking and collaboration. Significant enhancement of learning achievements, discernment of information, and self-efficacy. Developed dialogues of complex thinking that led to prospective gains of consensus maps. Teachers engaged concept maps as an educational design tool, a collaborative tool and an individual mind tool. Students were taught the creation of concept maps, and it transformed their learning.

It is evident from the summary of the results in the table above that self-reflection is very important for understanding embedded cognitive concepts, boosting self-motivation, and ensuring self-monitoring (Loon, 2018; Joksimovic et al., 2019; Wang et al., 2020; Li et al., 2023). Similarly, the table reveals that concept mapping is a highly creative learning strategy that simplifies complex thinking and transforms learning (Romero et al., 2017; Aguiar et al., 2019; Chang et al., 2022; Liu et al., 2023; Cheng et al., 2024). Learning environments may be filled with a significant amount of information; hence, students must engage in self-regulation to understand what is expected of them in real time. The volume of information in a location determines the strategy employed to manage such data for optimal utilisation (Romero et al., 2017; Chang et al., 2022). Self-reflection as a strategy is also very important for teachers, just as it is for learners. Juma (2024) noted that self-reflection is vital for the professional growth of teachers, serving as an excellent strategy for continual development and improvement.

For learners to achieve significant learning in an e-learning environment, they must be able to control their surroundings through self-reflection and concept mapping. Ucar and Ugurhan (2023) noted that to succeed in open and distance learning, students must be able to manage learning processes. Learners are expected to self-regulate their time in online environments and prioritise learning targets (Bylieva et al., 2021). Therefore, learners should be strategic in their approach to acquire metacognitive knowledge that will enable them to better understand, examine, and monitor concepts and knowledge associated with their learning domains (Boekaerts, 1997). Ultimately, each of these strategies has its respective advantages that could enhance comprehension of open and distance e-learning instructional materials. In contemporary times, online learning has become more prevalent than ever; thus, there is a critical need to promote learners' self-regulated learning skillsets (Hadwin et al., 2022; Hadas et al., 2023).

5. Conclusions and Recommendations

This study explored the bibliometric analysis of self-regulated learning through self-reflection and concept mapping in an online and distance e-learning environment from 2014 to 2024. It is evident that a significant number of articles have been published by outstanding scholars regarding self-reflection and concept mapping as learning strategies. The most relevant authors are Hwang G. J., Järvelä S., Kinchin I. M., Li Y., and Malmberg J. There has been a continual increase in the number of publications from 2014 to 2024. Canada and the Netherlands have the highest numbers of publications. The word 'human' appears most frequently, followed by 'male', 'female', and others. In the word cloud section, 'human' is the most prominent word, followed by 'concept mapping'.

The literature reviewed indicates that self-reflection has been very beneficial for learners' self-motivation, self-monitoring, and the development of learners' individual intellectual capital. Similarly, concept mapping is a creative learning strategy that simplifies complex thinking and transforms learning. This study has shown that learners in open and distance e-learning can rely on self-reflection and concept mapping as self-regulated learning strategies to achieve optimal learning outcomes. Learners can easily monitor and evaluate themselves through self-reflection, as well as graphically represent instructional materials with the aid of concept mapping. With these strategies, students can fully concentrate on learning without the need for teachers or instructors to monitor them. Likewise, teachers can track the learning trajectories of students through concept mapping. Therefore, different institutions implementing open and distance e-learning can encourage their students to optimise learning using these self-regulated learning strategies.

Different forms of reviews also have their corresponding limitations. It is noteworthy that only article publications were considered for this study; other forms of publications, such as book chapters and textbooks, may yield different results. It was challenging to trace the articles of some authors identified in the analysis. Furthermore, this study primarily focused on learning strategies based on

the trajectories and positions of learners. Hence, future research could examine the positions of teachers. Likewise, research can be conducted on other self-regulated learning strategies in the future.

6. Declarations

Author Contributions: Conceptualisation (B.E.O. & M.C.M.); Literature review (B.E.O. & M.C.M.); methodology (B.E.O.); software (B.E.O.); validation (M.C.M. & B.E.O.); formal analysis (B.E.O. & M.C.M.); investigation (B.E.O. & M.C.M.); data curation (B.E.O. & M.C.M.) drafting and preparation (B.E.O. & M.C.M.); review and editing (M.C.M. & B.E.O.); supervision (M.C.M.); project administration (B.E.O.); funding acquisition (N/A). All authors have read and approved the published version of the article.

Funding: This research did not receive any external funding.

Acknowledgements: During the preparation of this manuscript, the author(s) used the BiblioShiny App for analysing scholarly publications and their impact comprehensively. The authors have reviewed and edited the output and take full responsibility for the content of this publication.

Conflicts of Interest: The author(s) declare no conflict of interest.

Data Availability: This review is based entirely on publicly available data and information sourced from peer-reviewed articles, reports, and other academic publications cited in the manuscript. No new primary data were generated or analysed during this study. Readers may refer to the cited sources for detailed information.

References

- Adiyah, M., Mutangana, D., & Ameyaw, Y. (2020). Concept mapping impact on self-efficacy for enhancing students' motivation and performance in biology. *African Journal of Educational Studies in Mathematics and Sciences*, 16(1), 73–84. <https://doi.org/10.4314/ajesms.v16i1.6>
- Allen, I. E., & Seaman, J. (2015). *Grade level: Tracking online education in the United States*. Babson Survey Research Group and Quahog Research Group, LLC.
- Amiruddin, A., Baharuddin, F. R., Takbir, T., Setialaksana, W., & Hasim, M. (2023). Pedagogy-andragogy continuum with cybergogy to promote self-regulated learning: A structural equation model approach. *European Journal of Educational Research*, 12(2), 811–824. <https://doi.org/10.12973/eu-jer.12.2.811>
- Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959–975. <https://doi.org/10.1016/j.joi.2017.08.007>
- Arvatz, A., Peretz, R., & Dori, Y. (2025). Self-regulated learning and reflection: A tool for teachers and students. *Metacognition and Learning*, 20(15), 1–24. <https://doi.org/10.1007/s11409-025-09415-3>
- Asarnow, J.R., & Meichenbaum, D. (1979). Verbal rehearsal and serial recall: The mediational training of kindergarten children. *Child Development*, 50(4), 1173–1177. <https://doi.org/10.2307/1129345>
- Berigel, M., & Cetin, I. (2019). Açık ve uzaktan öğretimde öğretene ve öğrenen roller [The roles of instructors and learners in open and distance education]. In E. Tekinarslan & M. D. Gurer (Eds.), *Açık ve Uzaktan Öğrenme içinde* (pp. 125–144). Pegem Akademi Yayıncılık. <https://doi.org/10.14527/9786052412411.07>
- Boekaerts, M. (1997). Self-regulated learning: A new concept embraced by researchers, policy makers, educators. *Learning and Instruction*, 7(2), 161–186. [https://doi.org/10.1016/S0959-4752\(96\)00015-1](https://doi.org/10.1016/S0959-4752(96)00015-1)
- Boekaerts, M. (1999). Self-regulated learning: Where we are today. *International Journal of Educational Research*, 31(6), 445–457. [https://doi.org/10.1016/S0883-0355\(99\)00014-2](https://doi.org/10.1016/S0883-0355(99)00014-2)
- Bylieva, D., Hong, J. C., Lobatyuk, V., & Nam, T. (2021). Self-regulation in E-learning environment. *Education Sciences*, 11(785), 1–23. <https://doi.org/10.3390/educsci11120785>

- Chang, C., Hwang, G., & Tu, Y. (2022). Concept mapping in technology-supported K-12 education: A systematic review of selected SSCI publications from 2001–2020. *Journal of Educational Computing Research*, 60(7), 1–10. <https://doi.org/10.1177/073563312111073798>
- Cheng, S., Hwang, G., & Chen, P. (2024). Facilitating creativity, collaboration, and computational thinking in group website design: A concept mapping-based mobile flipped learning approach. *International Journal of Mobile Learning and Organization*, 18(2), 1–10. <https://doi.org/10.1504/IJMLO.2024.137613>
- Cho, M. H., & Shen, D. (2013). Self-regulation in online learning. *Distance Education*, 34(3), 290–301. <https://doi.org/10.1080/01587919.2013.835770>
- Corno, L. (2001). Volitional aspects of self-regulated learning. In B. Zimmerman & D. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (2nd ed., pp. 191–225). Mahwah, NJ: Erlbaum.
- De Silva, D. (2020). Developing self-regulated learning skills in university students studying in the open and distance learning environment using the KWL method. *Journal of Learning for Development*, 7(2), 204–217. <https://doi.org/10.56059/jl4d.v7i2.389>
- Diningrat, S., Marin, V., & Bachri, B. (2024). Students' self-regulated learning strategies in the online flipped classroom. *Journal of Educators Online*, 21(3), 1–16. <https://doi.org/10.9743/JEO.2024.21.3.4>
- Estévez, R., Quijada-Maldonado, E., Romero, J., & Abejón, R. (2025). Additive Manufacturing and Chemical Engineering: Looking for synergies from a bibliometric study. *Applied Sciences*, 15(6), 2962. <https://doi.org/10.3390/app15062962>
- Eva, K., & Regehr, G. (2005). Self-assessment in the health professions: A reformulation and research agenda. *Academic Medicine*, 80(1), S46–S54. <https://doi.org/10.1097/00001888-200510001-00015>
- Fabriz, S., Dignath-van Ewijk, C., Poarch, G., & Büttner, G. (2014). Fostering self-monitoring of university students by means of a standardized learning journal: A longitudinal study with process analyses. *European Journal of Psychology of Education*, 29(1), 239–255. <https://doi.org/10.1007/s10212-013-0196-z>
- Faza, A., & Lestari, I. (2025). Self-regulated learning in the digital age: A systematic review of strategies, technologies, benefits, and challenges. *International Review of Research in Open and Distributed Learning*, 26(2), 24–58. <https://doi.org/10.19173/irrodl.v26i2.8119>
- Frith, C. D. (2012). The role of metacognition in human social interactions. *Philosophical Transactions: Biological Sciences*, 367(1), 2213–2223. <https://doi.org/10.1098/rstb.2012.0123>
- Geng, D. C., Harshaw, H. W., Gaston, C., Wu, W., & Wang, G. (2025). Tourism management in national parks: Development, aspects, and conceptual framework. *Forests*, 16(6), 970. <https://doi.org/10.3390/f16060970>
- Hadas, B., Herscovitz, O., & Dori, Y. J. (2023). Analysis of online assignments designed by chemistry teachers based on their knowledge and self-regulation. *Chemistry Teacher International*, 5(2), 189–201. <https://doi.org/10.1515/cti-2022-0037>
- Hadwin, A. F., Sukhawathanakul, P., Rostampour, R., & Bahena-Olivares, L. M. (2022). Do self-regulated learning practices and intervention mitigate the impact of academic challenges and COVID-19 distress on academic performance during online learning? *Frontiers in Psychology*, 13, 813529. <https://doi.org/10.3389/fpsyg.2022.813529>
- Heleta, S., & Mzileni, P. (2024). Bibliometric coloniality in South Africa: Critical review of the indexes of accredited journals. *Education As Change*, 28(July), 26 pages. <https://doi.org/10.25159/1947-9417/16020>
- Hermala, I., Sunitiyoso, Y., & Sudrajad, O. Y. (2024). Green financing using Islamic finance instruments in Indonesia: A bibliometrics and literature review. *International Journal of Energy Economics and Policy*, 15(1), 239–248. <https://doi.org/10.32479/ijeeep.17208>

- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *EDUCAUSE Review*. <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Hidayatullah, A., & Csikos, C. (2023). Association between psychological need satisfaction and online self-regulated learning. *Asia Pacific Education Review*, 1(1), 1-11. <https://doi.org/10.1007/s12564-023-09910-9>
- Hu, Y., Hong, T., Zhou, S., Wang, Y., Ye, Q., Sheng, S., Wang, S., He, C., He, H., & Xu, M. (2025). Bibliometric analysis of coating protection from 2015 to 2025. *Coatings*, 15(6), 686. <https://doi.org/10.3390/coatings15060686>
- Huh, Y., & Reigeluth, C. M. (2018). Online K-12 teachers' perceptions and practices of supporting self-regulated learning. *Journal of Educational Computing Research*, 55(8), 1129-1153. <https://doi.org/10.1177/0735633117699231>
- Inzlicht, M., Werner, K., Briskin, J., & Roberts, B. (2021). Integrating models of self-regulation. *Annual Review of Psychology*, 72(1), 319-345. <https://doi.org/10.1146/annurev-psych-061020-105721>
- Jegede, O., Alaiyemola, F., & Okebukola, P. (1990). The effect of concept mapping on students' anxiety and achievement in biology. *Journal of Research in Science Teaching*, 27(10), 951-960. <https://doi.org/10.1002/tea.3660271004>
- Joksimovic, S., Dowell, N., Gasevic, D., Mirriahi, N., Dawson, S., & Graesser, A. (2019). Linguistic characteristics of reflective states in video annotations under different instructional conditions. *Computers in Human Behavior*, 96, 211-222. <https://doi.org/10.1016/j.chb.2018.03.003>
- Juma, A. (2024). Self-reflection in teaching: A comprehensive guide to empowering educators and enhancing student learning. *International Journal of Science and Research Archive*, 12(01), 2835-2844. <https://doi.org/10.30574/ijrsra.2024.12.1.1113>
- Kesuma, A. T., Harun, Z., Putranta, H., & Kistoro, H. C. A. (2020). Evaluation of the self-regulated learning model in high schools: A systematic literature review. *Universal Journal of Educational Research*, 8(10), 4792-4806. <https://doi.org/10.13189/ujer.2020.081051>
- Khiat, H., & Vogel, S. (2022). A self-regulated learning management system: Enhancing performance, motivation, and reflection in learning. *Journal of University Teaching & Learning Practice*, 19(2), 43-59. <https://doi.org/10.53761/1.19.2.4>
- Liu, C. C., Wang, D., Hwang, G. J., Tu, Y. F., Li, N. Y., & Wang, Y. (2023). Improving information discernment skills through a concept mapping-based information evaluating framework in a gamified learning context. *Interactive Learning Environments*, 32(9), 4766-4788. <https://doi.org/10.1080/10494820.2023.2205900>
- Loon, M. (2018). Self-Assessment and Self-Reflection to Measure and Improve Self-Regulated Learning in the Workplace. in: McGrath S., Mulder M., Papier J., Stuart R.(eds) *Handbook of Vocational Education and Training: Developments in the changing world of work* (pp. 2-28). https://www.researchgate.net/publication/328215125_Self-Assessment_and_Self-Reflection_to_Measure_and_Improve_Self-Regulated_Learning_in_the_Workplace
- Mahoney, M., & Thoresen, C. (1972). Behavioral self-control: Power to the person. *Educational Research*, 1972(1), 5-7. <https://doi.org/10.3102/0013189X001010005>
- Maphalala, M. C., Mkhlasibe, R. G., & Mncube, D. W. (2021). Online learning as a catalyst for self-directed learning in universities during the COVID-19 pandemic. *Research in Social Sciences and Technology*, 6(2), 233-248. <https://doi.org/10.46303/ressat.2021.25>
- Mezirow, J. (2006). An overview of transformative learning. In P. Sutherland & J. Crowther (Eds.), *Lifelong learning: Concepts and contexts* (pp. 24-38). Routledge.
- Mih, C., & Mih, V. (2011). Conceptual maps as mediators of self-regulated learning. *Procedia Social and Behavioral Sciences*, 29, 390-395. <https://doi.org/10.1016/j.sbspro.2011.11.254>

- Novak, J.D., Mintzes, J., & Wandersee, J. (2005). Learning, teaching, and assessment: A human constructivist perspective. In J. Mintzes, J. Wandersee, & J. Novak (Eds.), *Assessing science understanding: A human constructivist view* (pp. 1-13). Elsevier Academic Press. <https://doi.org/10.1016/B978-012498365-6/50003-2>
- Odinokaya, M., Krepkaia, T., Karpovich, I., & Ivanova, T. (2019). Self-regulation as a basic element of the professional culture of engineers. *Education Sciences*, 9, 200. <https://doi.org/10.3390/educsci9030200>
- Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology*, 8(1), 422. <https://doi.org/10.3389/fpsyg.2017.00422>
- Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451-502). Academic Press. <https://doi.org/10.1016/B978-012109890-2/50043-3>
- Rittle-Johnson, B., & Star, J. R. (2007). Does comparing solution methods facilitate conceptual and procedural knowledge? An experimental study on learning to solve equations. *Journal of Educational Psychology*, 99(3), 561. <https://doi.org/10.1037/0022-0663.99.3.561>
- Romero, C., Cazorla, M., & Buzon, O. (2017). Meaningful learning using concept maps: A learning strategy. *Journal of Technology and Science Education*, 7(3), 313-332. <https://doi.org/10.3926/jotse.276>
- Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education*, 36(1-2), 111-139. <https://doi.org/10.1007/s11165-005-3917-8>
- Schunk, D. H., & Greene, J. A. (Eds.). (2018). Historical, contemporary, and future perspectives on self-regulated learning and performance. In D.H. Schunk, & J.A. Greene, (Eds.), *Handbook of self-regulation of learning and performance* (pp. 1-15). Routledge. <https://doi.org/10.4324/9781315697048-1>
- Shakoori, M., Kadivar, P., & Sarami, R. (2017). The effect of concept mapping strategy as a graphical tool in writing achievement among EFL learners. *International Journal of Information and Education Technology*, 7(5), 357-360. <https://doi.org/10.18178/ijiet.2017.7.5.894>
- Sitzmann, T., Ely, K., Brown, K., & Bauer, K. (2010). Self-assessment of knowledge: A cognitive learning or affective measure? *Academy of Management Learning & Education*, 9(1), 169-191. <https://doi.org/10.5465/amle.9.2.zqr169>
- Stevenson, M., Hartmeyer, R., & Bentsen, P. (2017). Systematically reviewing the potential of concept mapping technologies to promote self-regulated learning in primary and secondary science education. *Educational Research Review*, 21(1), 1-16. <http://dx.doi.org/10.1016/j.edurev.2017.02.002>
- Sun, J. C., Wu, Y., & Lee, W. (2017). The effect of the flipped classroom approach to Open Course Ware instruction on students' self-regulation. *British Journal of Educational Technology*, 48(3), 713-729. <https://doi.org/10.1111/bjet.12444>
- Tekkol, A., & Demirel, M. (2018). An investigation of self-directed learning skills of undergraduate students. *Frontiers in Psychology*, 9, 2324. <https://doi.org/10.3389/fpsyg.2018.02324>
- Tinajero, C., Mayo, M., Villar, E., & Martínez-López, Z. (2024). Classic and modern models of self-regulated learning: Integrative and componential analysis. *Frontiers in Psychology*, 15, 1-14. <https://doi.org/10.3389/fpsyg.2024.1307574>
- Turan, Z., Kucuk, S., & Karabey, S. C. (2022). The university students' self-regulated effort, flexibility and satisfaction in distance education. *International Journal of Educational Technology in Higher Education*, 19(35), 1-14. <https://doi.org/10.1186/s41239-022-00342-w>
- Ucar, H., & Ugurhan, Y. (2023). The role of e-learning readiness on self-regulation in open and distance learning. *Turkish Online Journal of Distance Education-TOJDE*, 24(4), 146-159. <https://doi.org/10.17718/tojde.1231705>

- Wang, Z., Cai, S., Liu, M., Liu, D., & Meng, L. (2020). The effects of self-reflection on individual intellectual capital. *Journal of Intellectual Capital*, 1-18. <https://doi.org/10.1108/JIC-03-2019-0043>
- Wei, H.C., & Chou, C. (2020). Online learning performance and satisfaction: Do perceptions and readiness matter? *Distance Education*, 41(1), 48-69. <https://doi.org/10.1080/01587919.2020.1724768>
- Zhang, Z., Zhao, Y., Huang, X., Qi, C., & Zhao, G. (2025). Bibliometric analysis of classroom engagement: A review based on Web of Science database. *Behavioral Sciences*, 15(6), 737. <https://doi.org/10.3390/bs15060737>
- Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, 41(2), 64-70. https://doi.org/10.1207/s15430421tip4102_3
- Zvacek, S., Restivo, M., & Chouzal, M. (2012). Concept mapping for higher-order thinking. Special focus paper on 'talking about teaching', IGIP Annual Conference, 1-10. <https://doi.org/10.3991/ijep.v3iS1.2401>

Disclaimer: The views, perspectives, information, and data contained within all publications are exclusively those of the respective author(s) and contributor(s) and do not represent or reflect the positions of ERRCD Forum and/or its editor(s). ERRCD Forum and its editor(s) expressly disclaim responsibility for any damages to persons or property arising from any ideas, methods, instructions, or products referenced in the content.