MAPPING THE LANDSCAPE OF SELF-REGULATED LEARNING: A BIBLIOMETRIC ANALYSIS AND VISUALIZATION OF RESEARCH TRENDS AND PATTERNS

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Abstract

Self-regulated learning (SRL) plays a crucial role in academic success and lifelong learning. This study aims to conduct a comprehensive bibliometric analysis of SRL research from 2015 to 2022, utilizing data from the Scopus and ProQuest databases. By analyzing 400 articles with tools such as VOSviewer and MS Excel, the study identifies key trends, influential authors, and prominent journals in the field. The results indicate a rising interest in SRL, with a significant increase in publications during 2016. E. Panadero emerged as the most cited author, while Frontiers in Psychology was identified as the leading journal. The study's co-occurrence analysis highlights core themes, including metacognition, motivation, and educational psychology, offering insights into the evolving landscape of SRL research. These findings underscore the importance of SRL in contemporary educational practices and suggest future research should explore the integration of SRL strategies in diverse educational settings and their impact on student outcomes.

Keywords: *Self-Regulated Learning, Bibliometric Analysis, Vosviewer, Publish or Perish*

Introduction:

The concept of self-regulation has garnered increasing recognition as a fundamental element in educational research, assuming a central role in various facets of human functioning, encompassing learning and academic achievement. Self-regulation is characterized as the degree to which learners actively participate in their learning processes, particularly in terms of metacognition, motivation, and behavior (Zimmerman, 1989). Literature supports the notion that self-regulated learners possess an awareness of their strengths and weaknesses. They establish specific objectives, track their progress through self-reflection, and consistently assess and adapt their learning strategies (Llacuna, 2022; Hawe, Lightfoot, & Dixon, 2019).

The 2020 National Education Policy (NEP) underscores the need to move away from rote learning and instead prioritize building a deep understanding of concepts and encouraging inquiry. It emphasizes the importance of fostering students' ability to regulate and assess their own learning, which is essential for preparing them to adapt to the ever-changing landscape of knowledge and careers (Nilson, 2013; Wallin & Adawi, 2018). Creating such learners requires more than just teaching skills; it involves guiding students on a transformative journey towards becoming intrinsically motivated and self-directed individuals (Iwamoto et al., 2017).

Despite the acknowledged significance of self-regulated learning (SRL), much of the current research is disjointed, often focusing on SRL's correlation with specific strategies or factors, such as teaching methods, motivation, and metacognition. While these studies do offer valuable insights, there is still a literature gap when it comes to a comprehensive, up-to-date overview of SRL research, particularly in identifying

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current trends, key contributors, and influential publications in the field.

To address this gap, this study conducts a bibliometric analysis of SRL research published between 2015 and 2022. Using VOSviewer and MS Excel, the study systematically examines the temporal distribution of publications, citation networks, and co-occurrence of keywords to map the landscape of SRL research. The findings will provide a clearer understanding of the evolving trends and hotspots within SRL, offering insights for future research and educational practices.

Objectives:

This study aims to offer a comprehensive overview of international research on self-regulated learning (SRL). The specific objectives are:

1. To analyze the annual publications on self-regulated learning (SRL) from 2015 to 2022, identifying trends and shifts in research activity over time.

2. To conduct a citation network analysis to identify the most frequently cited authors in the SRL domain and to investigate patterns of scientific collaboration among these authors.

3. To rank the top ten academic journals specializing in SRL research based on the number of citations received per year, providing insights into the most influential publication outlets in the field.

4. To perform a co-occurrence analysis of keywords to uncover research trends and emerging themes within SRL, thus mapping the intellectual structure of the field.

Methodology: The methodology employed in this study involves conducting a bibliometric analysis to systematically map the research landscape of self-regulated learning (SRL) from 2015 to 2022. The analysis is based on two distinct datasets obtained from the Scopus and ProQuest databases, each comprising 200 articles selected using the keyword "Self-Regulated Learning" to ensure a broad and representative sample of the field.
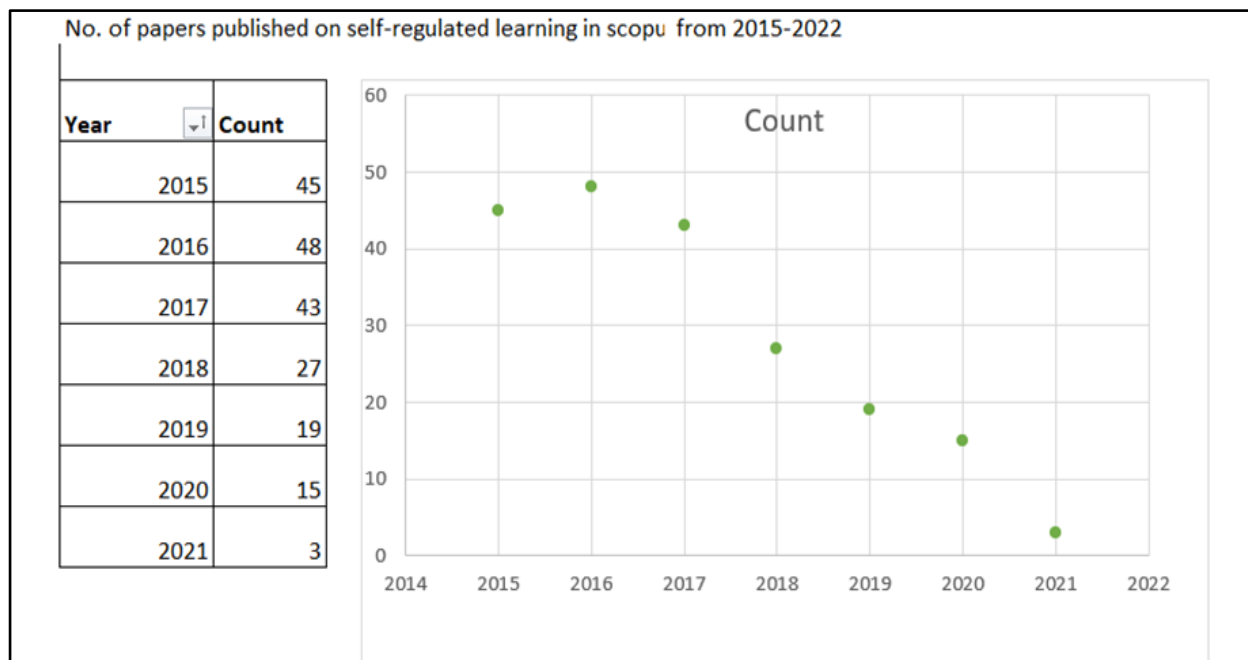
Data Collection:

The data were collected using the Publish or Perish software for Scopus, and a similar keyword search was conducted for ProQuest. The search was limited to articles published between January 2015 and August 2022. The final dataset includes a total of 400 articles, with 200 from each database.

Data Analysis:

- Temporal Distribution: MS Excel was used to analyze the temporal distribution of SRL publications to identify trends over the selected period.

- Citation Network Analysis: VOSviewer was utilized to conduct a citation network analysis, identifying the most influential authors and mapping their collaborative networks.

- Journal Ranking: The top ten journals publishing SRL research were ranked based on the number of citations per annum, obtained from the Scopus database.

- Co-occurrence Analysis: A co-occurrence analysis of keywords was performed using VOSviewer to visualize research trends and identify key themes and topics within SRL.

- Ethical Considerations: As this study is based on the analysis of published literature, no ethical approval or informed consent was required.

Analysis of the Distribution of Annual Publications on SRL: Figure 1 illustrates the research trends in self-regulated learning (SRL) as derived from Scopus data, analyzed using MS Excel. The data reveals a noticeable increase in the number of publications on SRL from 2015 to 2016, peaking in 2016. However, following this peak, a decline in publication activity is observed. This trend suggests a surge in interest and research output in SRL during the early years, followed by a subsequent decrease that may reflect changes in research focus or saturation in the field

Fig. 1. The distribution of annual publications on self-regulated learning

No. of papers published on self-regulated learning in scopu from 2015-2022

Year	Count
2015	45
2016	48
2017	43
2018	27
2019	19
2020	15
2021	3

Top-Cited Authors in Self-Regulated Learning:

Following Table 1 outlines the most frequently cited researchers in the area of self-regulated learning, based on data from the Scopus database. Notably, E. Panadero emerges as the most cited author. His influential work, "A Review of Self-Regulated Learning: Six Models and Four Directions for Research," published in 2017, has garnered 598 citations. The figure also presents the top 10 most cited authors and their seminal articles, underscoring their important contributions to the advancement and dissemination of SRL research.

Table 1: Top cited authors on self-regulated learning

	Authors	Top 10 most cited authors From scopus Database	Year	Source	Cites
		Title			
1	E. Panadero	A review of self-regulated learning: Six models and four directions for research	2017	Frontiers in Psychology	598
2	J. Broadbent	Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review	2015	Internet and Higher Educatio	597
3	D. Gašević	Let's not forget: Learning analytics are about learning	2015	TechTrends	444
4	R.F. Kizilcec	Self-regulated learning strategies predict learner behavior and goal attainment in Massive Open Online Courses	2017	Computers and Education	399
5	D. Gašević	Learning analytics should not promote one size fits all: The effects of instructional conditions in predicting academic success	2016	Internet and Higher Educatio	350
6	C. Lai	A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course	2016	Computers and Education	340
7	A. Littlejohn	Learning in MOOCs: Motivations and self-regulated learning in MOOCs	2016	Internet and Higher Educatio	326
8	K.A. Ericsson	Acquisition and maintenance of medical expertise: A perspective from the expert-performance approach with deliberate practice	2015	Academic Medicine	268
9	J. Broadbent	Comparing online and blended learner's self-regulated learning strategies and academic performance	2017	Internet and Higher Educatio	252
10	D. Cook	Motivation to learn: an overview of contemporary theories	2016	Medical Education	244

Prominent journals in research on self-regulated learning:

Table 2 Prominent Journals in Self-Regulated Learning Research

Year	Source	DOI	CitesPerYear	Cites Per Author
2017	Frontiers in Psychology	10.3389/fpsyg.2017.00422	119.6	598
2015	Internet and Higher Education	10.1016/j.iheduc.2015.04.007	85.29	597
2017	Computers and Education	10.1016/j.compedu.2016.10.001	79.8	399
2015	TechTrends	10.1007/s11528-014-0822-x	63.43	444
2018	Higher Education	10.1007/s10734-017-0220-3	60.25	241
2016	Internet and Higher Education	10.1016/j.iheduc.2015.10.002	58.33	350
2021	Zeitschrift fur Erziehungswissenschaft	10.1007/s11618-021-01002-x	57	57
2016	Computers and Education	10.1016/j.compedu.2016.05.006	56.67	340
2021	Personality and Individual Differences	10.1016/j.paid.2021.110673	56	56
2019	International Journal of Human-Computer Interaction	10.1080/10447318.2018.1543084	54.67	164

Top 10 journals as per no. of citatioins per year afterSelf-Regulated learning keyword search from scopus dabase

Table 2 presents the top ten academic journals that have published the most cited research on self-regulated learning (SRL), based on citation data from the Scopus database. Among these, Frontiers in Psychology emerges as the leading journal, distinguished by the highest number of citations per year. This indicates the journal's pivotal role in disseminating influential SRL research and suggests its prominence as a preferred publication outlet for scholars in the field.

The ranking of these journals provides valuable insights into the dissemination and impact of SRL research. It highlights the academic platforms where SRL studies are most frequently published and cited,

offering a guide for researchers seeking high-impact venues for their work. Additionally, the dominance of certain journals reflects their focus on educational psychology and learning sciences, areas closely aligned with SRL.

. **Co-authorship analysis:**

Figures 4A and 4B present the results of the co-authorship analysis conducted on the Scopus and datasets. Co-authorship analysis is a valuable tool for understanding the collaborative networks within a research field, as it highlights the intellectual connections and partnerships that contribute to the development of the domain.

Create Map   ✕

Verify selected authors

Selected	Author	Documents ⌄	Total link strength
☑	panadero, e	13	5
☑	broadbent, j	8	5
☑	callan, gl	8	4
☑	winne, ph	8	1
☑	greene, ja	8	0
☑	wolters, ca	8	0
☑	baars, m	7	4
☑	cleary, tj	7	4
☑	azevedo, r	6	1
☑	paas, f	5	4
☑	ben-eliyahu, a	5	0
☑	fan, y	5	0
☑	janssen, j	5	0

Fig 4A Selected authors (Scopus Data)

The co-authorship analysis examines the interactions between researchers in a research area. Because co-authorship is a formal form of intellectual collaboration between scientists (Donthu N. et al. 2021; Cisneros et al., 2018; Acedo et al., 2006.), co-authorship was established with Vosviewer for Scopus data and ProQuest data verified. where the setting for the maximum number of documents is 3 documents per author. The total strength of co-authorship is calculated with other authors. The authors with the greatest overall link strength were selected.

Figure 4A contains a co-authorship analysis of Scopus data. Selected authors who meet the threshold are listed. Thirteen authors who met the threshold were selected from the Scopus data. Figure 4B shows eight of the thirteen authors and their network diagrams. It shows that out of thirteen selected authors, eight authors have found a relationship in the sense of co-authorship. Panedero e. and Broadbent J., these two authors have the greatest bond strength and relationship in terms of co-authorship.
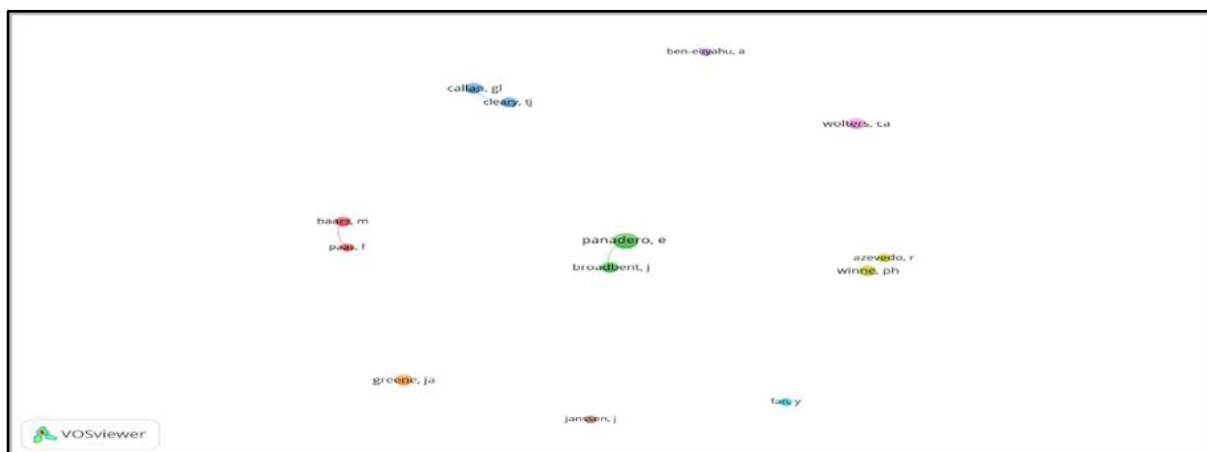

Fig. 4B Co-authorship Network Visualization

Figure 4B visualizes the co-authorship network of these selected authors. The network diagram reveals clusters of authors who frequently collaborate, reflecting distinct sub-communities within the field of SRL.

Co-occurrence analysis of SRL research:

In the context of a Co-occurrence analysis focusing on self-regulated learning (SRL) research, a network visualization was executed utilizing VOS viewer to examine co-occurrence patterns within ProQuest data. The unit of analysis was specified as keywords, and the relatedness of items was ascertained based on the frequency of their co-occurrence in documents. A minimum keyword count setting of five keywords was enforced, resulting in 95 keywords meeting the specified threshold after purging repeated instances.

The resulting network visualization, as delineated in Fig. 5, portrays keyword co-occurrence as interconnected lines, with node size indicating the frequency of co-occurrence in documents: larger nodes correlated to a higher frequency of co-occurrence.

Remarkably, the prominent keyword "self-regulated learning" demonstrates strong connections to terms such as self-regulation, students, learning, metacognition, motivation, and psychology. Each item is denoted by a label and a circle, with the size of the label and circle acting as an indicator of the item's prominence. Additionally, the employment of colors is utilized to differentiate individual articles, with each article circle displayed in the corresponding color. To avoid label overlap, only a subset of all labels is displayed by default.
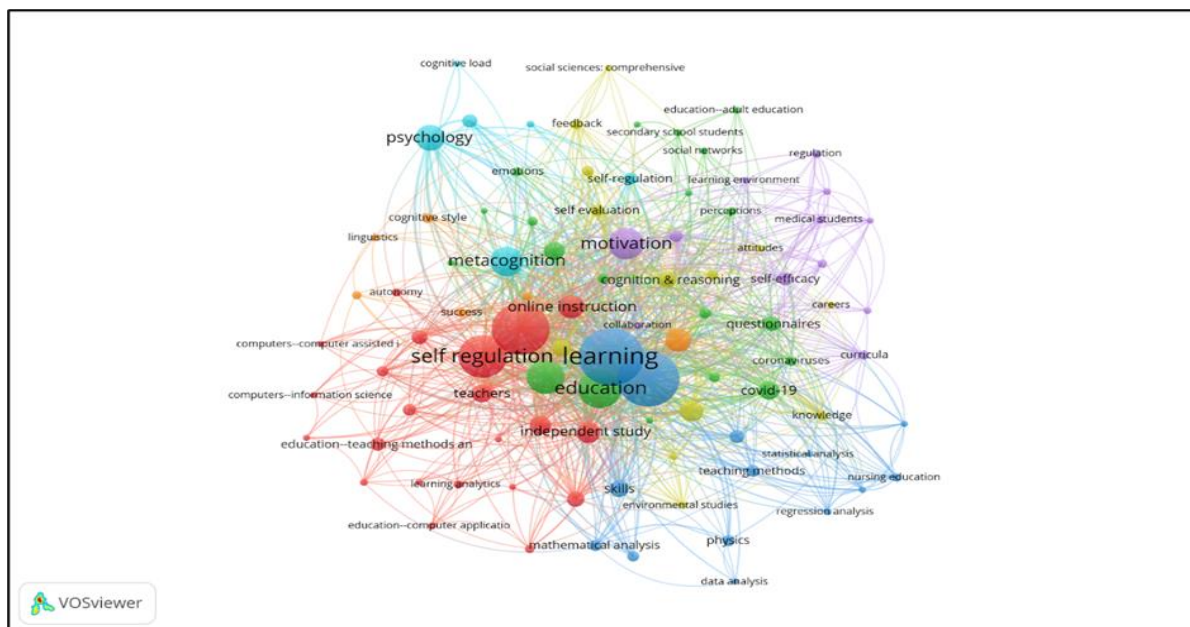
Fig. 5 Network visualization of self-regulated learning research

As outlined by Moral-Muñoz et al. (2020), the density visualization of Co-occurrence analysis of self-regulated learning (SRL) research serves as a valuable tool for obtaining a comprehensive understanding of the structural composition of a given map, while also highlighting key focal points within the map. The depicted density visualization in Figure 6 reveals the identification of seven significant keywords, namely self-regulated learning, self-regulation, learning, education, metacognition, motivation, and psychology, which are pivotal in shaping the current research landscape.
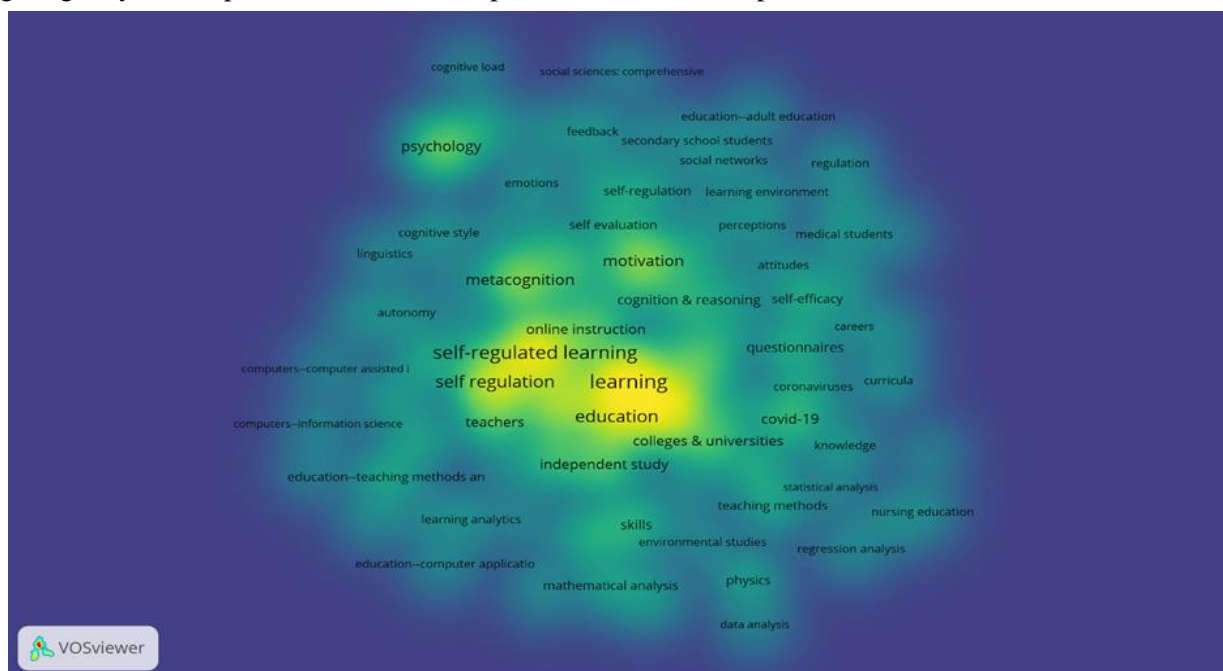

Fig 6 Density visualization of Co-occurrence analysis

Cluster Network Visualization of SRL:

The Cluster Network Visualization of SRL research in Figure 7 depicts six identified clusters of self-regulated learning research. Data from ProQuest is downloaded in RIS format and analyzed using VOSviewer software.
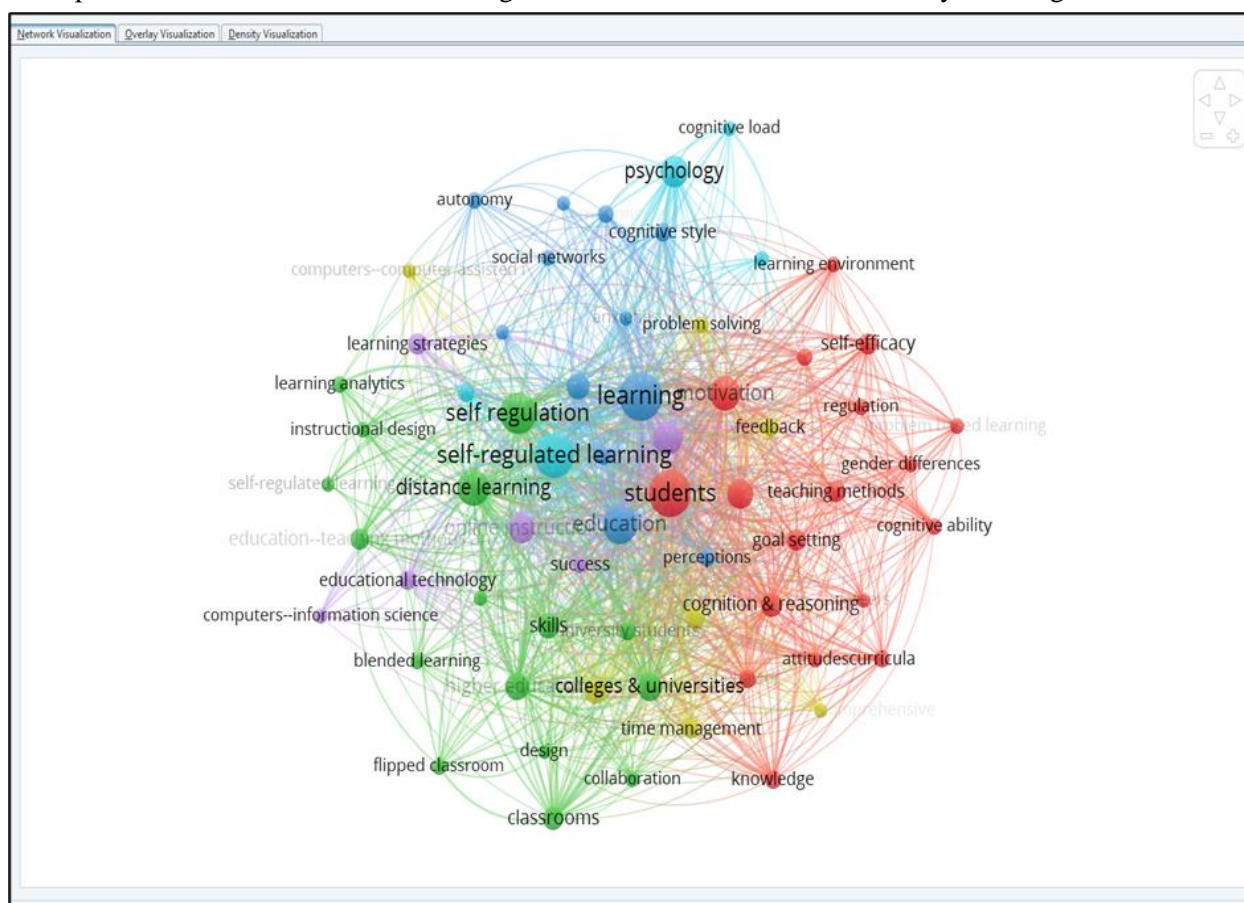

Fig. 7 Cluster network visualization

In Fig. 7 two main clusters have been identified. Cluster 1 (red) is associated with components of SLR that are integrated and/or identified as cognitive and affective products, such as self-regulation, cognitive ability, cognitive load, cognitive style, educational psychology, self-efficacy, goal setting, regulation, perception, cognition, motivation, learning environment, attitude, and knowledge concerning scientific issues in the literature and the real world.

Cluster 2 (green) is related to methods, instructional strategies, and instructional environments, such as blended learning, flipped classrooms, educational technology, computer-assisted instruction, and instructional design used in self-regulated learning

research. Recommendations for future research related to online learning (integrated technology) based on self-regulated learning are also identified in this cluster. This cluster also highlights collaborations, colleges, students, and colleges as keywords that indicate the topic and subject matter of self-regulated learning research, with colleges often being used as research topics and objects.

Other clusters include autonomy, psychology, cognitive load, social networks, problem-solving, data analysis, medical sciences, nursing education, regression analysis, and teaching methods related to self-regulated learning research methods. Notably, significant research has been conducted in the medical

sciences and nursing education. Two small yellow clusters are overlapped, mostly serving as subsets of the main clusters.

Discussion:

This bibliometric paper provides a comprehensive and visual overview of the topic of self-regulated learning. This study analyzes 400 valid articles on self-directed learning in the Scopus and ProQuest databases from the years 2015 to 2022 (Aug. 2022). Since 2015, the publication of articles in SLR has increased sharply until 2016. In 2016, the highest number of articles was published on SLR. After 2016, the number of release graphics decreases. Self-regulated learning is an important acquired skill identified by (Russell et al. 2022). Despite recommendations and widespread agreement on the importance of self-regulation for learning, not all educators integrate support for self-regulated learning into their classrooms (Russell et al., 2020; Van Eekelen et al., 2005). Future recommendation is that more research should be done on this topic. There is a need to examine the teaching practices, beliefs and experiences of educators in promoting learners' self-regulated learning (Russell et al., 2020)., It becomes clear that most authors tend to enjoy working with few collaborators leading to main author groups.

When analyzing the most cited author, the most cited author is E. Pandero whose article A review of self-regulated learning: Six models and four directions for research was published in 2017 and cited 598 times. Second, the researcher identified good journals that published SLR research from the Scopus database. Frontiers in Psychology was found as the top journal by the maximum number of citations per year. In terms of co-occurrence analysis, the term self-regulated learning is the leading keyword and has stronger connections to self-regulation, students, learning, metacognition, motivation, and psychology.

Limitations and Future directions:

- There are several limitations in this bibliometric paper. The data is limited to articles collected solely from the Scopus and ProQuest databases. Consequently, data from other international databases such as EBSCO and ERIC are not included.

- The keyword search for this bibliometric analysis was restricted to 400 articles. Future research could expand the search scope to include titles, abstracts, and keywords, thereby encompassing a broader range of related articles.

- It is important to acknowledge that the VOSviewer software, while widely utilized in bibliometric studies, has certain limitations. To improve data analysis, it would be advantageous to integrate VOSviewer with other software and techniques.

- The findings of this study suggest that within the realm of self-regulated learning, the majority of authors tend to collaborate with a small circle of peers, leading to restricted connections among the principal researchers. Future scholars may want to explore the possibility of teaming up with a broader range of co-authors to enhance connectivity. In summary, the analysis results appear stable and reliable and are minimally affected by subjective experience.

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