Self-Regulated Learning of University Students: A Bibliometric Review in Scopus

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Abstracts: A student's ability to structure, monitor and evaluate his or her own learning is known as self-regulated learning and is characterized as a process of self-reflection and action. The present study aimed to conduct a worldwide literature review in Scopus on self-regulated learning of university students during the period 2003-2023. It was a bibliometric analysis that defined the metrics of scientific production. The indicators were obtained from 615 documents chosen from the Scopus database using keywords in English ("self-regulated learning", "university students"). The results show that between 2017 and 2022 there was a spike in the number of papers published on the subject (51.5%). The highest scientific production rate is found in the United States (13.8%; n=105), and the highest publication rate in the Education University of Hong Kong (n=10). The journals Asia Pacific Education Researcher, Learning and Individual Differences and Sustainability Switzerland published 10 papers each, while the most cited journal was Computers and Education with 1061, with authors Liang, J.C. and Tsai, C.C., being the most cited (n=7 papers, 338 citations). From the studies analyzed, it is concluded that self-regulated learning in university students has increased in production, authorship and thematic diversity, with changes depending on the social, cognitive and academic development of the students, as well as the process in different educational environments and pedagogical practices.

Keywords: Self-Regulated Learning, University Education, Students, Scientific Production.

1. INTRODUCTION

In the context of a plan for university student development, which motivates the educational system to form capable citizens, it is important to reflect on how students learn and what processes should be built for quality learning, so that students can develop meaningful learning for life and the needs of today's labor market, taking development and sustainability seriously at a global level (Cerna & Silva, 2020; Larruzea-Urkixo & Cardeñoso, 2020).

Currently, professional development programs emphasize the importance of instilling in students the habits of mind that will help them become independent learners during their undergraduate years in university classrooms (Moreno, 2020). As Horta (2020) emphasizes, it is crucial that students have the opportunity to develop their abilities and autonomy to learn the content they will need in their professional and personal lives. The educational psychology sector has referred to this capacity as self-regulated learning (Serrano, 2020). Likewise, Flores and Lopez (2022) point out that, we now live in a world where self-regulated education is possible through digital media. Alternatively, Villatoro and De Benito (2021) argue that students are becoming increasingly tech-savvy as a result of increased exposure, and Rebaza and Deroncele (2022) assert that students can employ self-regulated learning to effectively manage and master digital resources.

In that vein, self-regulated learning and the development of good study habits are cornerstones of educational practice (García & Martín, 2021). Although regular study requires self-control, over time it becomes automatic and transforms the student's mindset (Román et al., 2020). Furthermore, Náñez et al. (2022) emphasize the need to assume academic responsibility and demonstrate dedication to learning as key components in the development of effective study habits. On the other hand, self-regulated learning is not something that people possess naturally, but it is something they can learn to develop due to the fact that everyone has access to the same educational

resources (Cárdenas & Castillo, 2021).

In addition, Gutiérrez (2021) mentions that self-regulated learning is the act of voluntarily supervising and directing one's own education through the use of metacognition, which includes the steps of preparation, participation and reflection on one's own education. This allows students to take ownership of their learning, which is crucial for their academic success and the development of their own knowledge (Diaz et al., 2023). Consequently, they need to be able to independently confirm their own academic progress. Both positive and negative outcomes contribute to learning; whether the student chooses to emulate the former, avoid the latter, or triumph over the latter, all three scenarios offer opportunities for growth (Fuentes et al., 2023).

On the other hand, humans are able to successfully adapt to a changing environment through the practice of self-regulated learning, which is an aspect of psychoeducational theory that works in conjunction with motivation and self-efficacy (Hendrie & Bastacini, 2020). According to Aguinaga and Palacios (2023), students who engage in self-regulated learning engage in a recursive process in which they monitor and evaluate their own learning, as well as analyze and modify their own methods to achieve academic success in light of their specific circumstances.

In this scenario, in higher education, the cognitive, executive, behavioral, motivational and environmental control dimensions of the student come into play as they assume greater responsibility for their own learning process and how they self-regulate to improve their academic skills and performance (Sanchez-Cotrina, 2023). Therefore, responsibility, discipline and dedication to studies are necessary for successful learning; as Jácome-León et al. (2023) point out, learning is a process of knowledge construction, and it is up to the student to determine how this process is carried out.

Now, due to the relevance of the topic at hand, it is imperative that the aspiring professional develops the initiative, dedication, and responsibility necessary to direct his or her own education for the rest of his or her existence, since success in any field depends on a relentless pursuit of knowledge (Valencia-Serrano, 2020; Zambrano-Álava et al., 2020). Furthermore, although study habits and self-regulated learning have been the subject of previous research, it has been found that university students still have room for improvement in terms of their academic performance (Sáez et al., 2023). Therefore, the absence of adequate study habits and metacognition of students is a problem that persists from previous eras and remains a concern today, as there are many students who lack the necessary skills to study effectively and self-regulate their own learning (Najarro, 2020).

Thus, bibliometrics, the study of quantifying information about documents and other forms of literature, helps researchers to monitor the development of scientific publications, draw conclusions about the importance of works and, most importantly, allocate resources effectively (Caló, 2022; Leyva et al., 2022). That is the logic behind their use in databases that document the history of science in order to present reliable details about the results and techniques of scientific research (Sanz, 2022). In this way, bibliometric indicators are developed to measure the results of metric analyses of scientific production in this area or in related disciplines (Mora et al., 2023).

In summary, as stated by Capote et al. (2023), the ability to self-regulate one's own learning is crucial. This means that the student must not only be motivated to learn new material but must also set his or her own learning objectives, create a study plan, carry it out, and critically evaluate his or her own progress (Caballero-Cantu et al., 2023). The purpose of education should be to teach students to learn how to learn, which is also known as self-regulated study or academic autonomy (Ninacuri et al., 2023).

Therefore, in order to adequately convey the academic community's opinion on the self-regulated learning of university students, the material should be classified and analyzed according to different bibliometric indicators such as: year of publication, country, subject area, type of document, source and authorship. Based on this premise, the study aims to conduct a worldwide literature analysis in Scopus on self-regulated learning of university students, during the period 2003-2023.

2. MATERIEL AND METHODS

The research literature on the topic of self-regulated learning of university students was analyzed using bibliometric methods. Similarly, bibliometrics helped researchers to obtain both qualitative and quantitative results (Salinas and Garcia, 2022). Also, due to its wide use and indexing of scientific production worldwide, the Scopus database was consulted for this search, which covered the years 2003 to 2023.

Moreover, Boolean terms comprising the following English words "self-regulated" AND "learning", "university" AND "students" (Zhong & Rohaya, 2022; Sulistiawati et al., 2023) were selected as part of the search strategy (based on abstract, title and keywords). Initially 675 documents were collected using this method. However, the collected data went through a series of filters before resulting in the final sample. This allowed a representative sample of 615 documents to be extracted for use as an analytical building block. In addition, the following were established as exclusion parameters: 1) papers published outside the study period (2003-2023), 2) duplicates of existing publications, 3) papers that do not directly address the research topic.

Using a set of bibliometric indicators, including year of publication, authorship, journal or source, country of origin of the document, author's institution, type of document and subject area, a bibliographic review was conducted of the 615 documents that were chosen for analysis (Florez-Fernandez & Aguilera-Egua, 2020).

Finally, when examining the data, descriptive statistics were used for each indicator. While VOSviewer V_1.6.19 was used to generate keyword co-occurrence and source density maps, Excel was used to gather and analyze the descriptive statistics for the large sample of documents.

3. RESULTS AND DISCUSSIONS

A total of 615 papers were selected between 2003 and 2023 focusing on self-regulated learning of university students. Figure 1 shows statistics on the number and distribution by year of publications on this topic worldwide and indexed in the Scopus database, during the last twenty years. Between 2017 and 2022, 317 scientific papers were produced, an annual growth of 51.5%. In addition, 88 papers were published in 2022, being the year with the highest scientific production during the study period.

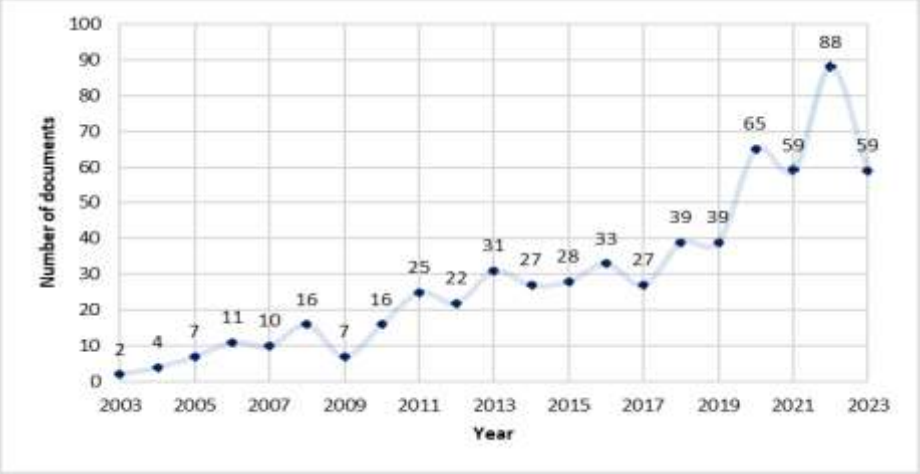

Figure 1. Papers published by year.

Table 2 illustrates the breakdown by country; 82 different nations are represented in the publications, with special attention to the countries that have contributed the most to the body of literature on this topic. The United States, Spain, and China are the top three contributing countries, with 13.8% (n=105), 8.1% (n=62), and 7.1% (n=54), respectively. In addition, about 93.8% of the papers are written in English, while only 5.5% are written in Spanish and 0.7% in Portuguese.

Table 1. Publication of papers by country.

N°	Country	Number of documents	%	N°	Country	Number of documents	%
1	United States	105	13.8%	18	Netherlands	11	1.4%
2	Spain	62	8.1%	19	South Africa	10	1.3%
3	China	54	7.1%	20	Chile	9	1.2%
4	Germany	39	5.1%	21	New Zealand	9	1.2%
5	Australia	34	4.5%	22	Portugal	9	1.2%
6	Taiwan	33	4.3%	23	Brazil	8	1.1%
7	Canada	29	3.8%	24	Argentina	7	0.9%
8	Malaysia	26	3.4%	25	Belgium	7	0.9%
9	Turkey	22	2.9%	26	Switzerland	7	0.9%
10	United Kingdom	21	2.8%	27	Austria	6	0.8%
11	Indonesia	20	2.6%	28	Colombia	6	0.8%
12	Hong Kong	19	2.5%	29	Israel	6	0.8%
13	Japan	19	2.5%	30	Italy	6	0.8%
14	South Korea	18	2.4%	31	Mexico	6	0.8%
15	Thailand	14	1.8%	32	Singapore	6	0.8%
16	Iran	12	1.6%	33	Undefined	110	14.5%
17	Finland	11	1.4%	**Total countries**		**82**	

This study used information from 144 journals as a source of data. The most important sources of these papers are shown in Table 2. It was found that: Asia Pacific Education Researcher, Learning and Individual Differences and Sustainability Switzerland journals published the highest number of papers (n=10 each), followed by Educational Psychology and Electronic Journal of Research in Educational Psychology. In addition to being in the top two quartiles of journals worldwide in terms of impact factor.

Table 2. Publication of documents by source or journal.

Source or Magazine	Number of documents	Source or Magazine	Number of documents	Source or Magazine	Number of documents
Asia Pacific Education Researcher	10	British Journal of Educational Technology	5	Journal of Educational Computing Research	4
Learning and Individual Differences	10	Computers in Human Behavior	5	Nurse Education Today	4
Sustainability Switzerland	10	European Journal of Educational Research	5	Psicothema	4
Educational Psychology	9	International Journal of Emerging Technologies in Learning	5	Revista Electrónica de Investigación Educativa	4
Electronic Journal of Research in Educational Psychology	9	International Journal of Engineering Education	5	Sage Open	4
Computers and Education	8	Learning and Instruction	5	Asian Efl Journal	3
Educational Technology Research and Development	7	Studies in Higher Education	5	Assessment and Evaluation in Higher Education	3
Frontiers in Education	7	Turkish Online Journal of Educational Technology	5	Australian Educational Researcher	3
Interactive Learning Environments	7	Australasian Journal of Educational Technology	4	Behaviour and Information Technology	3
British Journal of	6	Current Psychology	4	Contemporary	3

Educational Psychology				Educational Psychology	
Education Sciences	6	Education and Information Technologies	4	Eurasia Journal of Mathematics Science and Technology Education	3
Internet and Higher Education	6	International Journal of Learning	4	Undefined	189
System	6	Issues in Educational Research	4	**Total revistas**	**144**

A bibliographic clustering analysis was performed using the data from the sources chosen to categorize the different sets of published papers (Figure 2). This study reveals five distinct clusters, with the highest concentrations of citations made to Computers and Education (1061), the Internet and Higher Education (574), Learning and Individual Differences (395), System (158), and British Journal of Educational Psychology (127). In other words, examination of the bibliographic citations demonstrates a strong relationship between the primary sources and the most cited papers appearing in the same journals.

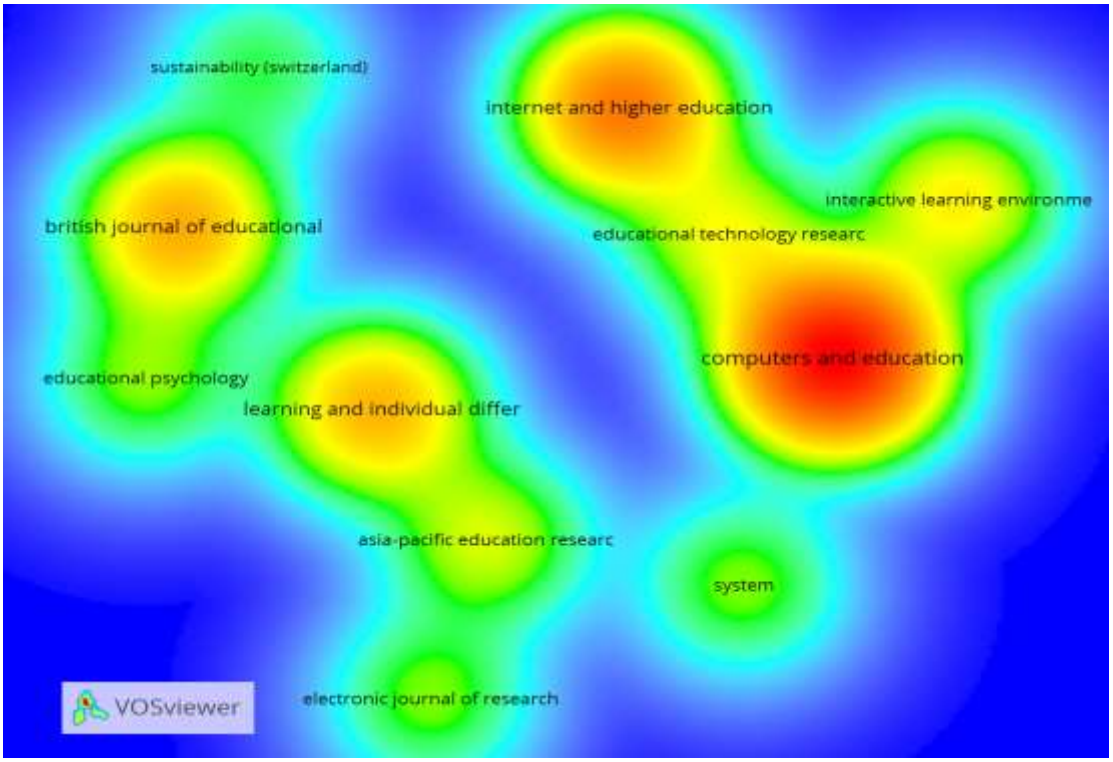

Figure 2. Source or journal clustering density map.

The 615 academic papers were the product of the teamwork of researchers from 160 different institutions. As can be seen in Figure 3, during the specified study period, the largest number of research papers on undergraduate self-regulated learning was published by the Education University of Hong Kong (n=10), followed by The University of Auckland and University of Granada with eight papers each. While the University of Oviedo, University of Almeria and National Taiwan University of Science and Technology published seven scientific papers respectively.

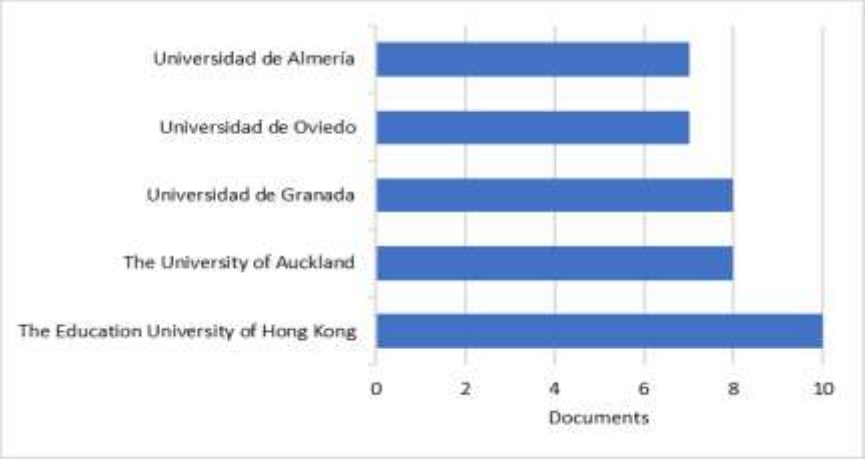

Figure 3. Papers published by institution.

A total of 155 authors from 160 different institutions contributed to the selected papers. According to Table 3, Liang, J.C. and Tsai, C.C. are the researchers with the most scientific publications (n=7 each). In addition, Sander, P. and Tsai, C.W. are shown to have five papers each.

Table 3. Papers published by author.

By author	Quantity	Total citations	By author	Quantity	Total citations
Liang, J.C.	7	338	Justicia, F.	4	101
Tsai, C.C.	7	338	Martínez-Vicente, J.M.	4	104
Sander, P.	5	74	Rosário, P.	4	192
Tsai, C.W.	5	58	Schwinger, M.	4	121
Balashov, E.	4	1	Teng, L.S.	4	309
Bellhäuser, H.	4	86	Theobald, M.	4	94
Broadbent, J.	4	93	Zhang, L.J.	4	254
Fries, S.	4	166	Ahuna, K.H.	3	33

Figure 4 presents the authors who have received the most citations on the topic of self-regulated learning in university students. Topping the list are Liang, J.C. and Tsai, C.C., who have received a total of 338 citations each. They are followed by Teng, L.S., who has received a total of 309 citations. Meanwhile, Zhang, L.J. ranks third with a total of 254 citations. Finally, Rosário, P. ranks fourth with 192 citations.

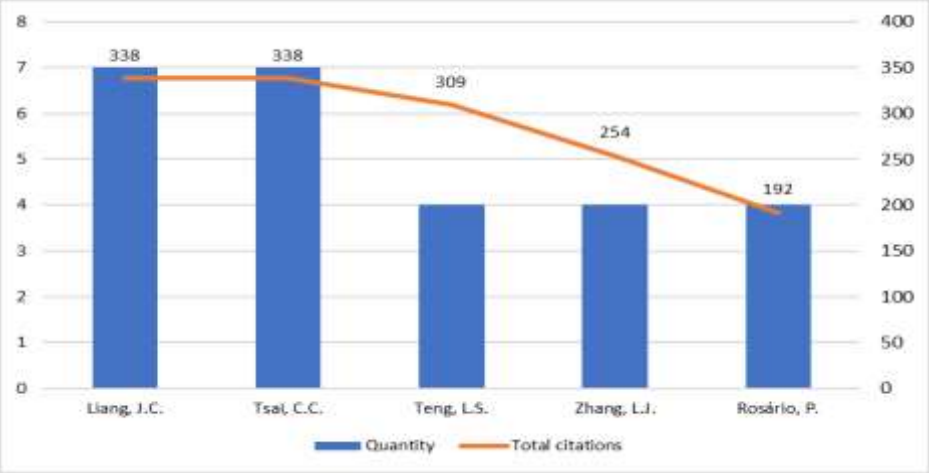

Figure 4. Most cited papers by author.

All papers published throughout the study period (2003-2023) dealing with undergraduate self-regulated learning are listed in Table 4, which is broken down by subject area and type of publication. From the data, it can be deduced that social sciences, psychology and computer science account for 72% of all published bibliographic papers out of a total of 23 subject categories.

Table 4. Publication of documents by thematic area and type.

By area	**Quantity**	**%**
Social Sciences	519	49%
Psychology	126	12%
Computer Science	117	11%
Arts and Humanities	90	9%
Engineering	38	4%
Medicine	30	3%
Business, Management and Accounting	26	2%
Health Professions	18	2%
Environmental Science	14	1%
Decision Sciences	14	1%
Other areas	61	6%
Total	**1053**	**100%**
By type	**Quantity**	**%**
Article	566	92%
Book Chapter	45	7%
Book	4	1%
Total	**615**	**100%**

Likewise, the percentage of scientific production generated by discipline is also represented in Figure 5: social sciences contribute 49%, psychology 12% and informatics 11%. On the other hand, when the production is broken down by type of document, it can be seen that scientific articles constitute the vast majority (92%) of the production, followed by book chapters (7%) and books (1%).

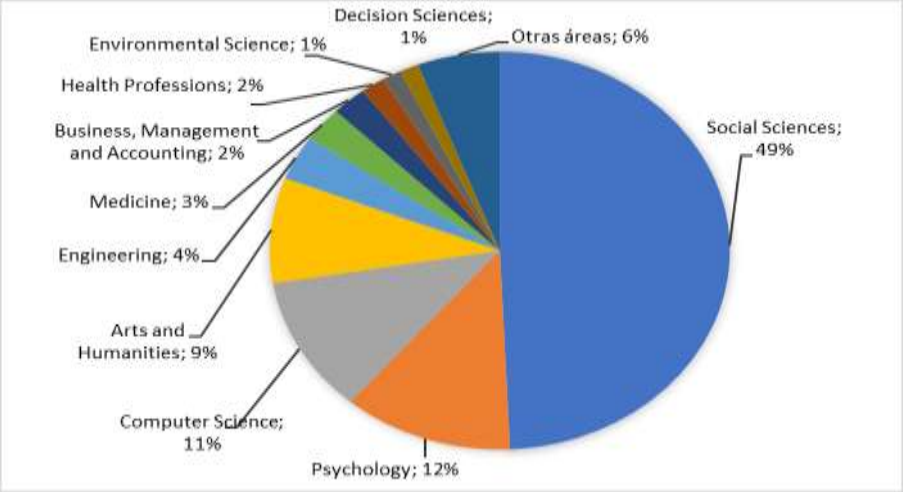

Figure 5. Publication of documents by subject area.

The data presented in Figure 6 were obtained by filtering the keywords that appear more than four times in the title, keywords and abstract of the analyzed documents. Depending on the degree of connectivity estimated by VOSviewer between each keyword, each color is assigned to a different set of words.

- Green cluster. "self-regulated learning" (n=283 occurrences), refers to a group of related words including: blended learning, university students, online learning, e-learning, students, learning systems, learning analytics, computer-assisted instruction, collaborative learning, teaching, educational computing.

- Red cluster. "learning" (n=74 occurrences), clusters the following words: student, controlled study, self-concept, universities, psychology, performance, self-efficacy, adult, learning environment, college students, academic performance, university, academic self-efficacy.

- Blue cluster. "Higher education" (n=59 occurrences), is associated with the words: self-regulation, feedback, motivation, self-efficacy, learning strategies, academic performance, self-assessment, metacognition.

The clustering reveals that the most used terms are relevant to the object of the research.

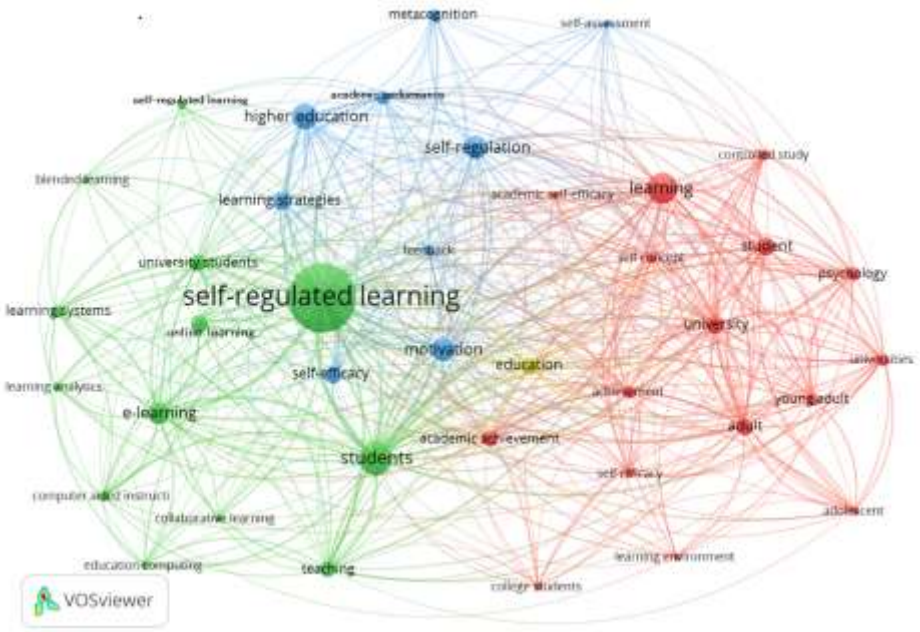

Figure 6. Map of keyword co-occurrence.

The results indicate a growing interest and activity in the upward trend of scientific production on self-regulated learning of university students, during the period from 2017 to 2022 and, in particular, the years 2020, 2021, 2022 and 2023 (n=271; 44.1%), with the highest total number of publications for production in the chosen study period. According to Sáez-Delgado et al. (2022), they state that in recent years the number of academic articles published on this topic has increased. This is because students' capacity for self-regulated learning is increasingly recognized as a critical factor in their final academic performance (Ernst et al., 2022). Thus, the importance of learning to self-regulate to meet the challenges of higher education is established in research literature (Heirweg et al., 2019; Zambrano-Matamala et al., 2020). Likewise, research on self-regulated learning illustrates the ability of students to take charge of their education and design effective methods to advance their education (Terry & Tucto, 2021; Ramos-Galarza et al., 2020).

Moreover, compared to other universities, The Education University of Hong Kong has produced ten scientific papers. As for the countries of origin, the United States accounts for the largest share (13.8%; n=105) of the world production in this field; moreover, the vast majority of papers (93.8%) published on this topic were written in English. Liang, J.C. and Tsai, C.C. were the most cited (n=338 each) and most published authors (each with seven papers). In addition, it was noted that among the most published sources were present: Asia Pacific Education Researcher, Learning and Individual Differences and Sustainability Switzerland (n=10 each). In terms of citations, however, the Computers and Education papers, were the best performers (1061 citations).

According to Cerna and Silva (2020), they argue that international cooperation is essential to achieve academic promotion. Consequently, the study on the field of self-regulation as a whole has grown (Jansen et al., 2019). In that sense, there is a wide range of interpretations of the construct self-regulation of learning, each of which is linked to a certain theoretical framework (Inzunza et al., 2020; Loeffler et al., 2019). Thus, the growing importance of lifelong learning in our society has aroused the interest of researchers and practitioners in self-regulated learning; so has the proliferation of informal learning contexts that require the development of such skills (Aranda et al., 2022; Serrano, 2020). Consequently, the role of the university is to instill in its students the desire to learn continuously and to cultivate self-directed learning (Moreno et al., 2021). This is due to the fact that students' ability to learn independently of their teachers' guidance has been shown to have a significant impact on their academic performance (Martínez & Medina, 2019).

Likewise, the keywords around self-regulated learning of university students in the selected research papers point to an interdisciplinary approach in the fields of engineering, arts and humanities, business, management and

accounting, among others. However, the majority of the papers in this research (72%) come from the fields of social sciences, psychology and computer science. Also, there is a high percentage (92%) of papers produced that were scientific articles. Also, the most used keyword in this study is "self-regulated learning"; however, other key words such as "learning" and "higher education" are not too far from what was explored by the authors. Consequently, the co-occurrence network provides a visual representation, in the form of clusters, of the fundamental ideas shared by all relevant publications and disciplines.

On the other hand, higher education students' learning processes are increasingly complex and intrinsically require a higher level of motivation (Marcelo & Rijo, 2019; Zambrano-Álava et al., 2020). A crucial aspect of self-regulated learning is the ability to manage one's own thinking, the mental part of self-regulation known as metacognition, which is based on the deliberate management of thinking (Quiroz et al., 2023). In general, when talking about learning, the term self-regulation processes refer to the ways in which a learner employs internal techniques to exert influence over his or her own cognitive, affective and motivational states in order to obtain the desired results (Alomá et al., 2022; Demuner-Flores et al., 2023).

CONCLUSIONS

In accordance with the objective of the study, bibliometric analysis of literature indexed in Scopus from 2003 to 2023 worldwide revealed a significant increase in studies focused on undergraduate self-regulated learning between 2016 and 2022 (51.5%, or n=317). Furthermore, out of a total of 82 countries of scientific output, 13.8% (n=105 publications) of published papers, can be attributed to the United States.

Asia Pacific Education Researcher and Learning and Individual Differences, on the other hand, represent the sources with the highest number of published papers of any journal (n=10). Likewise, The Education University of Hong Kong has contributed a total of ten academic publications to this field. In addition, Liang, J.C. and Tsai, C.C. are the authors with the most scientific publications on self-regulated learning of university students (n=7 each), being also the most referenced (338 citations). Also, it was observed that most of the selected works were scientific articles (92%), distributed in the main areas of knowledge: social sciences (49%), psychology (12%) and computer science (11%). In addition, a keyword analysis performed with the VOSviewer program revealed that the most frequent term was "self-regulated learning", with 283 occurrences.

From the analysis of the 615 documents comprising the study sample, it is affirmed that the crucial characteristic of self-regulated learning is the student's use of initiative, persistence and adaptability in the course of his or her research. In that sense, self-regulated learning is the sequential process of three stages: anticipation, inspection of execution and self-reflection. Finally, it is concluded that self-regulated learning in university students has grown in recent years, not only in terms of production and authorship, but also in terms of thematic diversity, which tends to change in parallel with the social, cognitive and scholastic development of students and the inclusion of this process to different educational situations and pedagogical approaches.

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