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RESEARCH TRENDS ON SELF-REGULATED LEARNING AND MATHEMATICS LITERACY: A BIBLIOMETRIC ANALYSIS

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Abstract

This study is intended to analyze research trends through a bibliometric analysis using VOSviewer software about self-regulated learning and mathematics literacy. This study used the bibliometric analysis method. The data collection was conducted using Publish or Perish, a manager reference application. The results found that from 2012 to 2016, the research trends on self-regulated learning and mathematics literacy fluctuated. Viewed from network visualization, the term self-regulated learning is not directly related to the term mathematics literacy. Thus, the relation between self-regulated learning and mathematics literacy can not be seen clearly. The conducted research mostly contains about self-regulated learning for academic achievement. These results can be concluded that the study on the relationship between self-regulated learning and mathematics learning is still limited. It means that research about it has a big opportunity to do in the future for giving the novelty of research.

Keywords: Bibliometric, Mathematics Literacy, Self-regulated learning, Trends, VOSviewer

1. Introduction

Mathematics literacy is one of the important skills mastered by students. Mathematics literacy is an individual's capacity to formulate, use, and interpret mathematics in various contexts. Through mathematics literacy, students can solve problems related to various contexts in life mathematically according to mathematical principles [1]. On the other hand, mathematical literacy is also closely related to other factors and abilities. For instance, students' mathematical literacy can be reviewed by considering the level of self-regulated learning. Self-regulated learning is the ability of students to set goals to increase knowledge, choose strategies that balance progress toward goals, determine the steps taken, and monitor the accumulated effects of their involvement [2]. Students with strong self-regulated learning skills showed the most adaptive results, both in terms of class engagement and math achievement [3].

Research trends especially in mathematics education have various changes in each era. Bibliometrics is a method for studying and analyzing many scientific data [4]. This method provides great benefits for computerized data processing and has been proven to increase the number of publications over the last few years [5]. Previous research using bibliometric analysis has been conducted especially about mathematics education, such as research about bibliometric analysis on mathematics education [6], bibliometric analysis about learning model and method of mathematics education [7], bibliometric analysis on learning media in mathematics [8], bibliometric analysis on technology in mathematics education [9], and bibliometric analysis on mathematical thinking [10-12]. However, the bibliometric review about self-regulated learning and mathematics literacy is still limited, especially in analyzing the research trends in the last ten years. Self-regulated learning and mathematics literacy have great demand. Therefore, the current study, study aims to analyze research trends through a bibliometric analysis using VOSviewer software about self-regulated learning and mathematics literacy. The novelties in this research are (i) this study analyzes the research trends on self-regulated learning and mathematics literacy through bibliometric analysis, (ii) this study investigates the relation between self-regulated learning and mathematics literacy, and (iii) this study finds the next future research.

2. Method

This study used the bibliometric analysis method. The publication article data were used to analyze the research trends on self-regulated learning and mathematics literacy. This current study followed several steps: framing the research question for the bibliometric analysis, collecting the data of research publication on self-regulated learning and mathematics literacy through the application of publish or perish, (3) arranging the bibliometric data for obtained publication data through the application of Microsoft Excel, doing computational mapping of bibliometric publication data through the application of VOSviewer, analyzing the results of the computational mapping, and interpreting the findings. The study was started to frame the research question *"What are the research trends on self-regulated learning and mathematics literacy from* 2012 *to* 2022?*"*. Next, the data from the published article were collected from Google Scholar. To collect these data, the researchers used the Publish or Perish software. Through this software, we search the publication data using the two keywords consisting of self-regulated learning and mathematics literacy. The articles used were published in the years 2012 to

2022. The data obtained from Publish or Perish software was exported into two types of files consisting of research information systems (.ris) and comma-separated value format (*.csv). Next, the CSV file was organized using Microsoft Excel and categorized based on the year of publication. The ris file was used to analyze the research trends using VOSviewer. The output file from VOSviewer and Microsoft excel was interpreted to describe the findings. Detailed information for the use of VOSviewer is explained elsewhere [13].

3. Results and Discussion

Based on the collected data in the google scholar database, 995 published articles were obtained using the keywords of self-regulated learning and mathematics literacy. The number of citations from all published articles in this research was 31.638, the number of citations per year was 3163.80 and the number of citations per paper was 31.67. The h-index of all articles was 86, while the g-index of all articles was 147. Table 1 shows some of the published articles data categorized by the 10 best articles based on the highest number of citations.

Table 1. Publication of self-regulated learning and mathematics literacy.

No	Authors	Title	Year	Cites
1	Mega et al.	What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement	2014	1175
2	Graham et al.	A meta-analysis of writing instruction for students in the elementary grades	2012	1053
3	Baran	A review of research on mobile learning in teacher education.	2014	652
4	Han et al.	How science, technology, engineering, and mathematics (STEM) project-based learning (PBL) affects high, middle, and low achievers differently	2015	621
5	Huang	Gender differences in academic self-efficacy: A meta-analysis	2013	612
6	English and Kitsantas	Supporting student self-regulated learning in problem-and project-based learning	2013	596
7	Cheung and Pomerantz	Why does parents' involvement enhance children's achievement? The role of parent-oriented motivation	2012	401
8	Soenens et al.	Psychologically controlling teaching: Examining outcomes, antecedents, and mediators.	2012	394
9	Ahmed et al.	Emotions, self-regulated learning, and achievement in mathematics: A growth curve analysis.	2013	370
10	Wong et al.	Supporting self-regulated learning in online learning environments and MOOCs: A systematic review.	2012	362

To obtain the research trends, the data from Google Scholar were categorized based on the year of publication. The research trends showed in Fig. 1. In 2012, 59 articles were published in journals sourced by Google Scholar. In 2013 and 2014, the number of publications had the same number, which was 73 articles. In 2015, there was a decrease in the publication from the previous year as many as 66 articles. In contrast to 2015, in 2016 there was an increase in the publication of as many as 78 articles. However, in the next year, the publications of articles decreased again, with as many as 71 articles in 2017. It meant that from 2012 to 2017, the published articles on self-regulated learning and mathematics literacy was fluctuating. From 2017 to 2019, research trends had increased constantly (sequentially 71, 93, 126 publications per year). However, the number of publications decreased again in 2020, with as many as 114 articles. In 2021, the publications had an increase from 114 articles to 133 articles. In 2022, the number of article publications was 109 articles. Based on the result data, it indicates that the research trends of self-regulated learning and mathematics literacy was fluctuating from 2012 to 2022.

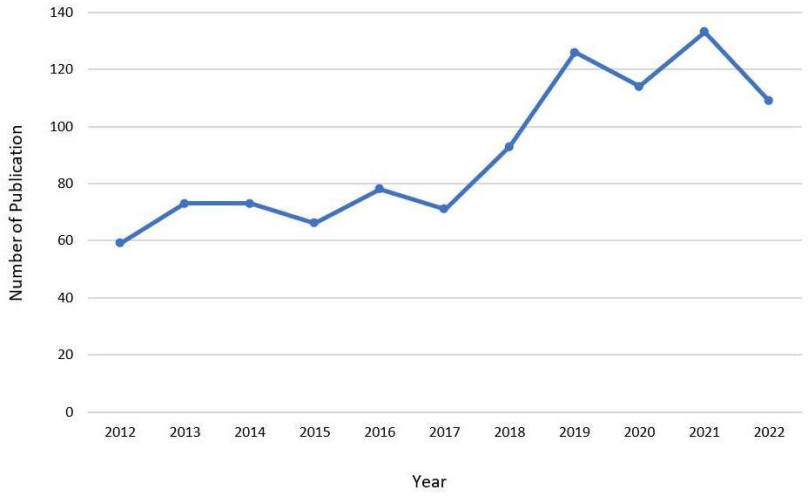

Fig. 1. Research trends on self-regulated learning and mathematics literacy.

Based on the results, 271 items were found through computational mapping and divided into 9 clusters shown in Fig. 2. Based on the categorized cluster, there was a relation of each term. The network visualization was shown in Figs. 3 and 4.

According to Fig. 3, the research on self-regulated learning and mathematics literacy was divided into 3 aspects consisted of self, study, and strategy. The term self was categorized in cluster 1 with 270 link total, 6371 total link strength, and 876 occurrences. The term of study was categorized in cluster 4 with 252 link total, 2051 total link strength, and 268 occurrences. The term of the strategy was categorized in cluster 8 with 240 link total, 1636 total link strength, and 214 occurrences. However, the term self-regulated learning and mathematics literacy are not included in those terms with the highest occurrences in the last ten years' publication.

Based on Fig. 4, mathematical literacy has a relation to the other terms. However, the term self-regulated learning is not directly connected to the term mathematics literacy. Thus, the relation between self-regulated learning and mathematics literacy can not be seen clearly. It means that the research published on the relationship between self-regulated learning and mathematics literacy is still limited to be researched.

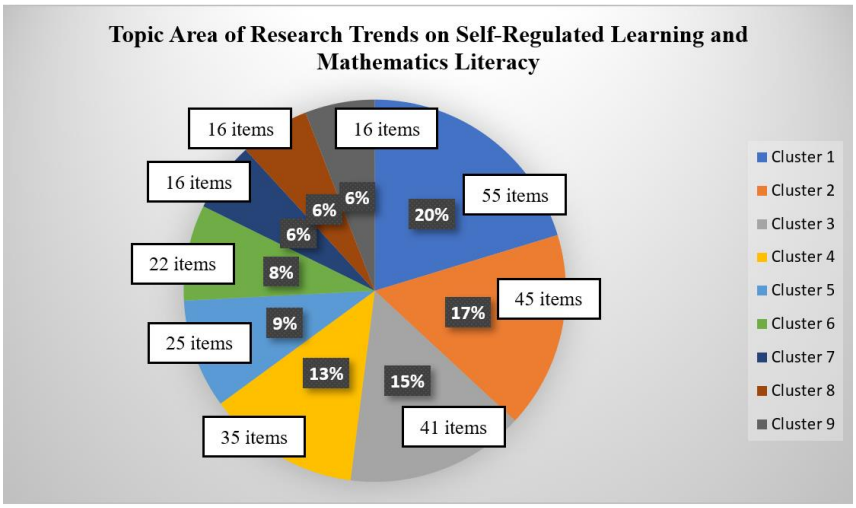

Fig. 2. Topic area of research trends on self-regulated learning and mathematics literacy keyword.

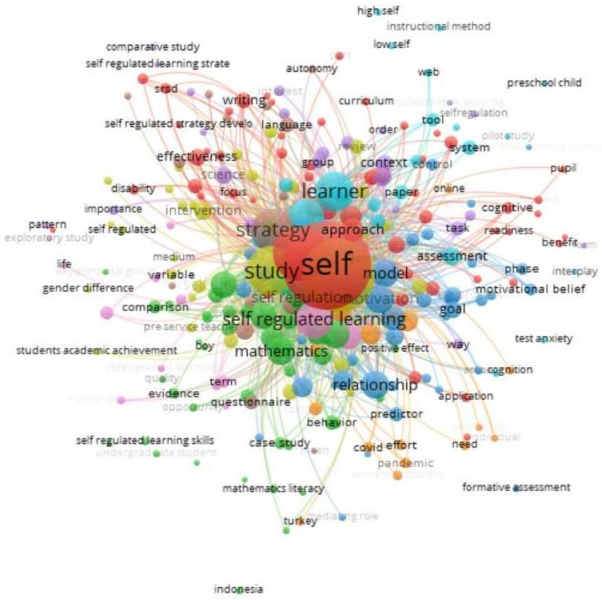

Fig. 3. Network visualization of self-regulated learning and mathematics literacy keyword.

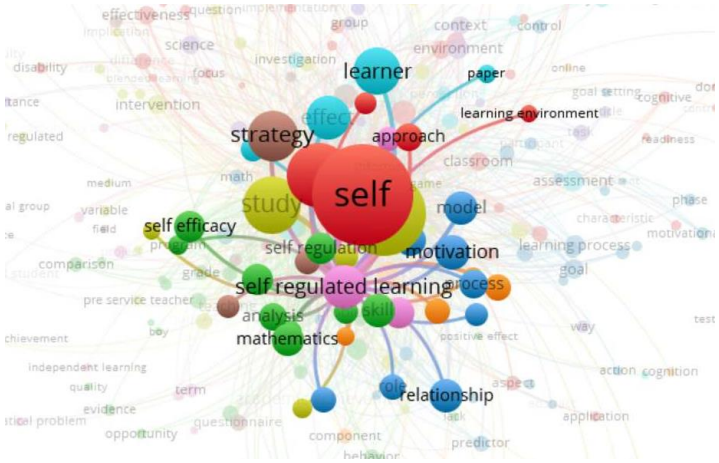

Fig. 4. Network visualization of the relation between self-regulated learning and mathematics literacy.

The best ten articles based on the number of citations mostly contain self-regulated learning for academic achievement. These findings indicate that research about self-regulated learning in learning achievement has a big focus on research trends from 2012 to 2022. These findings are supported by the previous research that there are positively correlated between self-efficacy, self-regulation of learning, and academic achievements [14]. The positive emotional changes are systematically associated with changes in self-regulation and learning achievement in mathematics learning [15].

The next term which has a big occurrence is the term of study. The term of study is related to the cognitive aspect of learning. This term is mostly related to mathematics, academic achievement, mathematics literacy, self-regulation, self-regulated learning, and others. Integrating form of the cognitive and affective aspects of mathematics teaching and learning is an important thing [16]. Students who set goals actively, monitor learning intentionally, use strategies effectively, and respond adaptively to feedback not only achieve mastery more quickly but are also more motivated to sustain the effort to learn [17].

The other term which has a big occurrence is the term strategy. The term of study is related to the learning process. This term is mostly related to mathematics, academic achievement, mathematics literacy, self-regulation, self-regulated learning, and others. Early behavioral self-regulation is related to growth in academic achievement [18]. Students with higher self-regulation showed significantly different learning outcomes when learning with different approaches, whereas there were no significant differences between students with lower self-regulation with different learning approaches [19].

Although the term mathematics literacy is not visible in the ten highest number of citations and network visualization, the previous research allows analyzing the relation between self-regulated learning and mathematics literacy. Self-regulated learning is the most powerful contributor to academic achievement [3]. The previous research shows that the results of students' mathematical literacy in each category have different indicators of completeness seen from self-regulated learning [20, 21].

Therefore, the result of the study can be concluded that the study on the relationship between self-regulated learning and mathematics learning is still limited.

4. Conclusions

The research trends on self-regulated learning and mathematics literacy were fluctuating from 2012 to 2022. The number of article publications was experiencing changes each year. Based on the network visualization, the term self-regulated learning is not directly related to the term mathematics literacy, so the relation between self-regulated learning and mathematics literacy can not be seen clearly. This result can be concluded that the study on the relationship between self-regulated learning and mathematics learning is still limited. Research on this topic has a big opportunity to do in the future for giving the novelty of research.

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