# A SCIENTOMETRIC ANALYSIS OF ACADEMIC PERFORMANCE DEVELOPMENT: R BIBLIOSHINY

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**ABSTRACT**

The development of research in the field of education experiences exponential growth every year. This study aims to analyze the development of research on academic performance from 2010-2022. A total of 1906 articles indexed by the PubMed database were analyzed with a scientometric qualitative approach with bibliometric R bibliophily and VosViewer R tools. The results showed a significant development of research on the object of study of academic performance, especially in 2020-2022. From the analysis of several articles, this development was primarily influenced by the covid-19 pandemic. Some authors are categorized as productive writers on this theme, in most of them are from China. The potential for future research by looking at the research keywords of bibliometric analysis results in cluster 1, such as academic functioning, school performance, educational attainment, socioeconomic status, sleep duration, and parental education, is about increasing "student academic performance" which is supported by "school performance", "parental education" and "socioeconomic" families. This research helps compile study topics regarding academic performance and find novelty in subsequent research.

**Keywords:** Academic Performance, Scientometric Analysis, R Biblioshiny.

## INTRODUCTION

The development of research studies in education today is developing very quickly, considering that education is the most crucial part of human life to produce a superior civilization printed in the history of humanity's future (Azhari et al., 2022). Research in the field of education is divided into several sub-fields that are the focus of researchers' studies. However, the research aims to improve quality and provide the latest innovations integrated with technological and scientific developments. Research studies include curriculum studies, educational policies, educational psychology, learning media and other fields.

The object of study that is of much concern to researchers of which is academic performance, the efforts made by researchers in this study are to understand the factors that can affect the performance of academic performance (Khan et al., 2020; Waheed et al., 2020), this shows the importance of academic performance studies in producing products from superior education. His study combines academic performance with educational psychology, such as family support variables, learning motivation, self-regulated learning, and self-efficacy. The purpose of the study in academic performance is to improve and improve student achievement in the learning

process at school, which includes cognitive, affective and psychomotor assessment of students. However, some researchers reveal that academic performance is an academic performance resulting from exam results.

The more research on academic performance, researchers are increasingly discovering many new things, including academic performance being influenced by internal and external aspects (Helal et al., 2018). Some studies that examine academic performance include (Beltrán-Velasco et al., 2021), which examines the effects of perceptual, psychological and habitual factors on academic performance; the result of this study is that students who have high academic performance are characterized by a higher level of suitability and are supported by other health factors such as diet, exercise and body mass.

Research using scientometric analysis in academic performance studies has not been done. So, this is the first research in the field of education using scientometric analysis, especially in academic performance studies. Previous studies with the type of case study have shown promising results in finding research gaps and projections that will occur in the future so that they are appropriate when mapped using scientometric analysis.

The research conducted by (Shi & Qu, 2021a) analyzed the health of student psychology as a mediating variable to determine how students' cognitive abilities affect academic performance and abstract thinking ability. The results of his research show that students' cognitive abilities influence improving academic performance mediated by student psychological health. In addition, research conducted by the same researcher (Shi & Qu, 2021b) analyzing cognitive ability and self-control towards increasing academic performance, with the results of the study showing that cognitive ability correlates with increased academic performance and self-regulation plays a role in regulating the relationship between representational ability (RA), logical reasoning ability (LRA), thinking conversion ability (TCA) and holistic academic performance.

Research using scientometric analysis has shown promising results, as research conducted by (Wang & Shahzad, 2022) can provide analysis results regarding a summary of health literacy research (Li et al., 2022) in the field of occupational safety shows that there is a domain, firstly the safety climate focuses more on the development and validation of questionnaires and surveys in the context of specific organizations, while safety culture research has studies a more comprehensive discussion. Thus this research will be the first to visualize scientometric mapping of the development of educational studies on academic performance variables. It will help researchers find study topics in academic performance analysis for future research.

The purpose of this study is to trace the development of the topic of academic performance studies from 2010-2021 using the PubMed database. This will be the first research on the focus of academic performance studies using scientometric analysis using the R Biblioshiny application. This research will focus on the study of discussions on the development of academic performance research.

## METHOD

This study used a qualitative approach using scientometric analysis using the R tool (Aria & Cuccurullo, 2017) and VosViewer (van Eck & Waltman, 2010). Science mapping or scientometric is a spatial representation of how a scientific discipline and articles between authors are connected (Small, 1999). The data in this study was obtained from the dimensions.ai and PubMed databases using the search string keyword "Academic Performance" from 2010-2022. The scientometric analysis aims

to visually provide the results of an analysis of the development of an object of study of science. Scientometric using bibliometrics bibliophily R is more appropriately used in this study because it will produce research predictions through thematic evolution analysis by looking at the time slice in the emerging or declining themes section.

Research with scientometric analysis will be beneficial for the development of science. Researchers will get the results of recommendations regarding future research topics and predictions of developments regarding a study in the research object. In addition, researchers will avoid literature review bias and bias in research development (Rusliana et al., 2022). Scientometric research allows analysis based on co-citation and grouping documents in two dimensions with a geometric triangulation process (Small, 1994). The formulas for the bibliometric equations are as follows:

$$V(xi, \ldots, xn) = \sum i{<}j \ sij\|xi - xj\|2 \quad (1)$$

$$\frac{2}{n\,(n-1)} \sum i{<}j\|xi - xj\| = 1 \qquad (2)$$

## RESULTS AND DISCUSSION

The result of the scientometric analysis is to identify the results of research studies published in international journals with a digital object identifier (DOI) collected from the PubMed database. The documents analyzed from PubMed were 1906 documents, annual growth rate of 12.69%, authors 7727, authors of single-authored docs 65, co-authors per docs 4.74. The sections analyzed such as annual scientific production, three-field plot, most relevant sources, bradford's law, country collaboration map, lotka law, most frequent words, most global cited documents, most local cited authors, most relevant affiliations, most relevant sources, source dynamics, thematic evolution, trend topics and title word cloud, author impact, author production over time, author production over time documents.

### Country Collaboration Map

Fig.1 shows collaboration between authors in various countries in the world with the topic of academic performance studies. In general, the author conducts research on the topic jointly between countries. This can indicate that the characteristics of the problem and the uniqueness of the object of study in different countries are different.



Figure 1. Country Collaboration Map

### Annual Scientific Production

This analysis shows the development of research on academic performance from year to year, as can be seen in Fig.2 that the growth of research with academic performance studies has grown exponentially in 2021 to 841 articles. This is related

to the covid-19 outbreak event which caused all fields of human life to experience major changes, one of which is in the field of education which is carried out through distance learning (Al-Mawee et al., 2021).
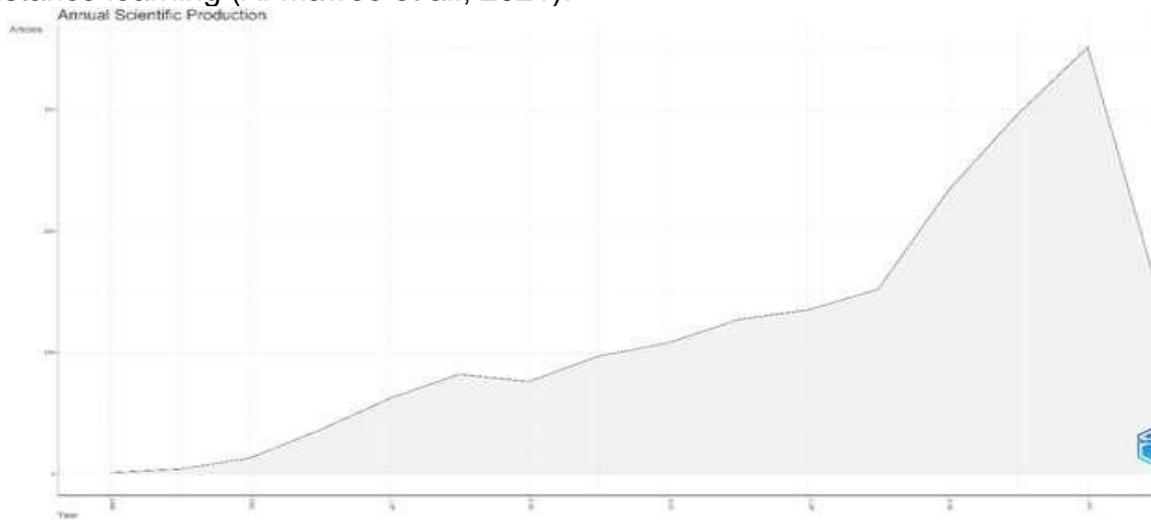


Figure 2. Annual Scientific Production

***Three Field Plot***

On Fig. 3 displays the relationship between journal-title and author, some sources show articles that are relevant to the topic of academic performance studies. In this analysis using a database from PubMed, there are 20 journals that publish many studies on the topic of academic performance, in addition to that there are 20 articles with different titles, but on average they conduct case study research studies involving students in high school and university. A total of 20 popular authors are also present in this analysis. Furthermore, the analysis of the Three Field Plot country-affiliation-authors in figure 3 using a database from PubMed, the results show that the authors who conducted many studies on academic performance were mostly carried out by western countries such as Canada, the United States, Spain, Australia, Netherlands and Germany and the rest were carried out by several countries from Asia such as Saudi Arabia.
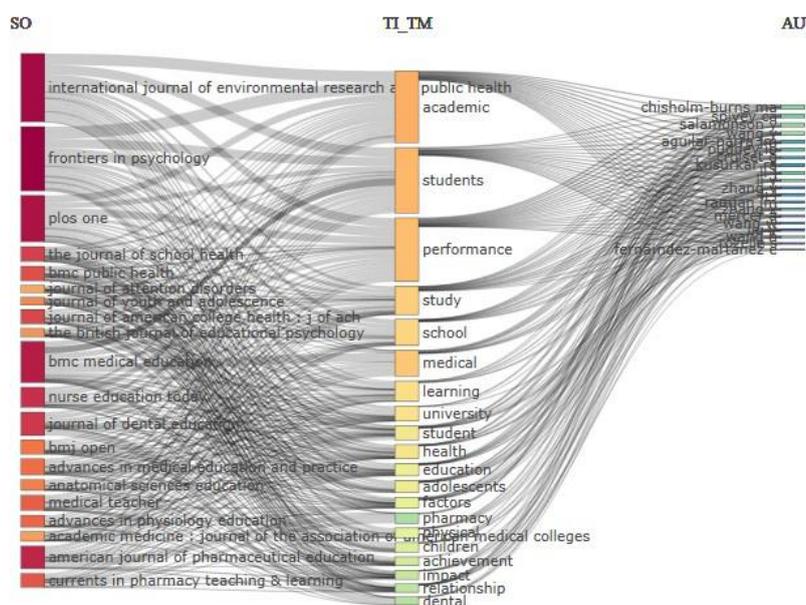


Figure 3. Three Field Plot by Source-Title-Author

Fig. 4 shows several countries whose intensity of focus on studies on academic performance is shown by countries such as Saudi Arabia (King Saud University), Canada (University of Toronto), Australia (University of Melbourne), USA (Harvard Medical School), Spain (University of Granada), China (Sun Yat Sen University) and the Netherlands (Amsterdam University).
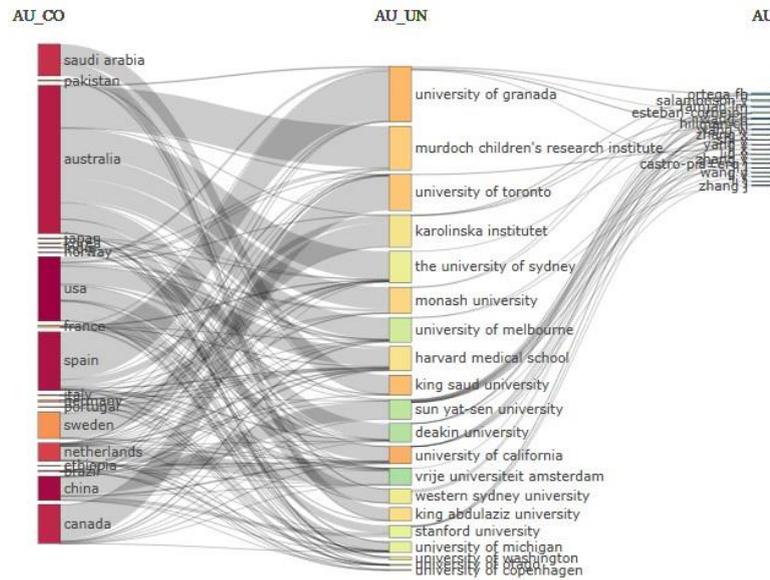


Figure 4. Three Field Plot by Country-Affiliation-Authors

On Fig. 5 shows the relationship between sources-authors-keywords, the biggest keyword produced in this analysis is regarding academic performance, the dominant author is Esteban-Cornejo I and the dominant source is Frontiers in psychology.
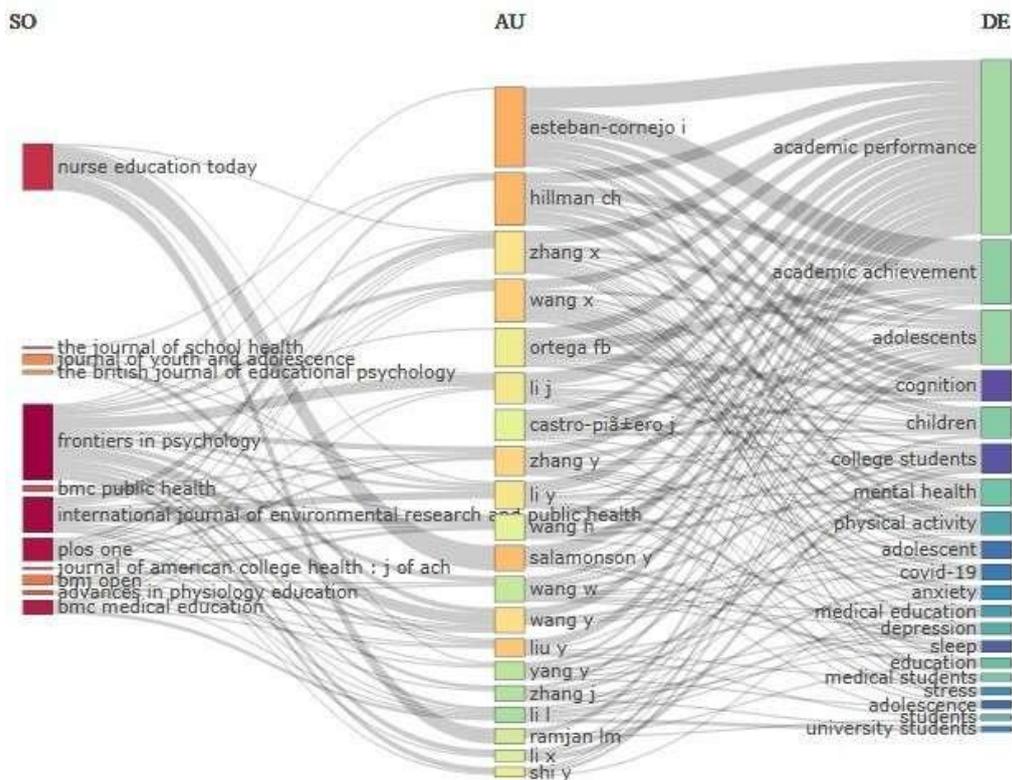


Figure 5. Three Field Plot by Sources-Authors-Keywords

**Most Relevant Source**

This analysis features some of the most relevant journals and publishes many research results with the theme of academic performance. There are 10 journals that publish a lot about the study of academic performance, in the first place are the journal Frontiers in Psychology (245 articles), the international journal of environmental research (218 articles), Plos One (187 articles), BMC Medical Education (113 articles), the American Journal of Pharmaceutical Education (75 articles), Nurse Education Today (71 articles), the Journal of Dental Education (62 articles), The journal of school health (53 articles), journal of american college health (48 articles), BMC public health (46 articles).
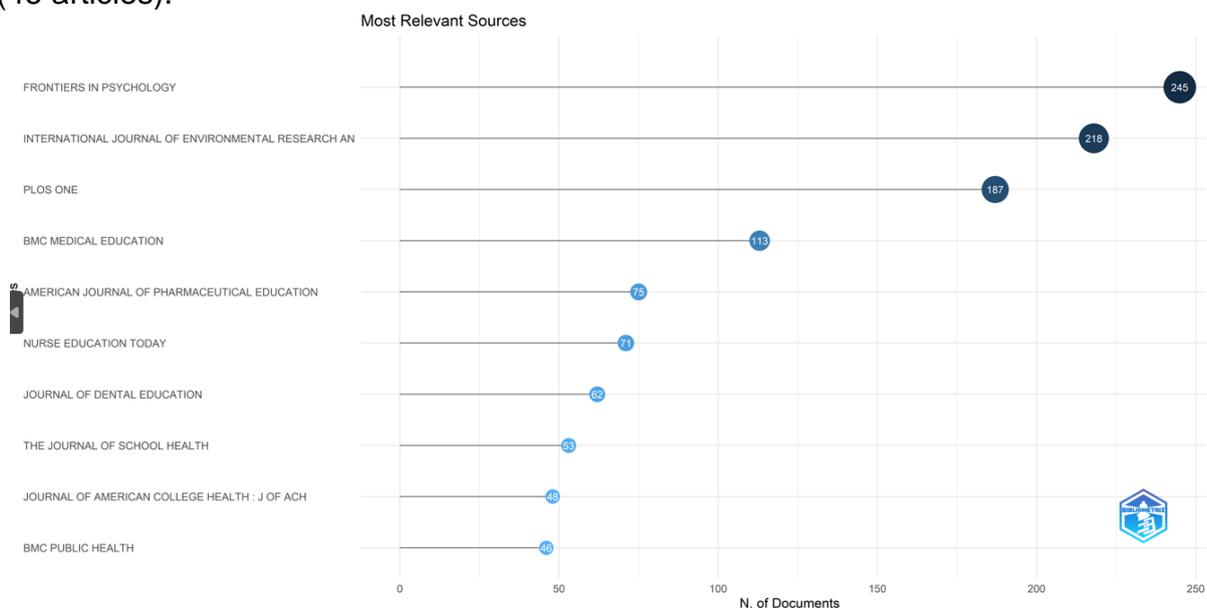


Figure 6. Most Relevant Source

## Most Local Cited Sources

On Fig. 7 shows the 10 journals that are most cited by journals that are in the data base and listed in the references. In the first order, it shows that the journal Computers and Education is the most cited journal (2413 times cited), the next is the medical teacher journal (1682 times cited), the anatomical sciences education journal (1606 times cited), the nurse education today journal (1465 times cited), medical education (1456 times cited), the BMC medical education journal (379 times cited), the academic medicine journal (25 times cited), journal of educational psychology (21 times cited), journal of frontiers in psychology (19 times cited), and journal of human behaviour (12 times cited).
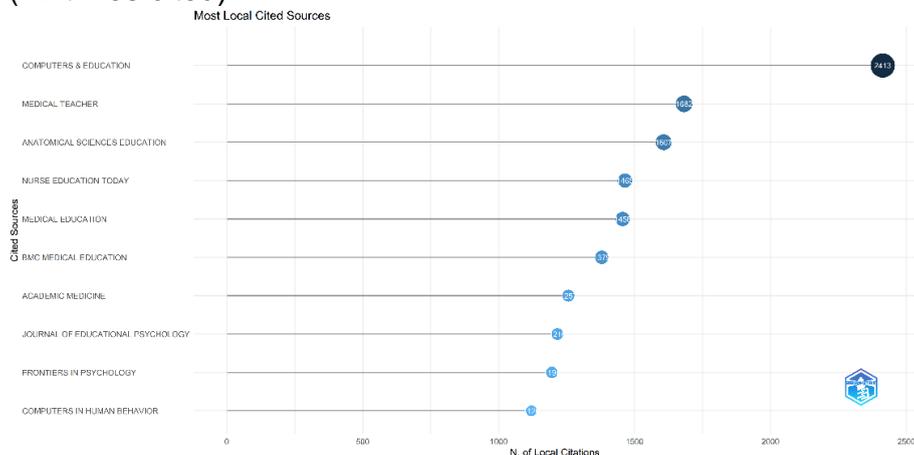


Figure 7. Most Local Cited Sources

### *Most Relevant Authors*

On Fig. 8 shows the author with the most articles in the PubMed dataset that analyzes academic performance, this calculation uses N of documents. The first-place writers are Wang Y (15 articles), Salamonson Y (13 articles), Chisolm-Burns MA (10 articles), Li Y (10 articles), Spivey CA (10 articles), Li J (9 articles), Puddey IB (9 articles), Wang H (9 articles), Zang X (9 articles), and Aguilar Parra JM (8 articles).
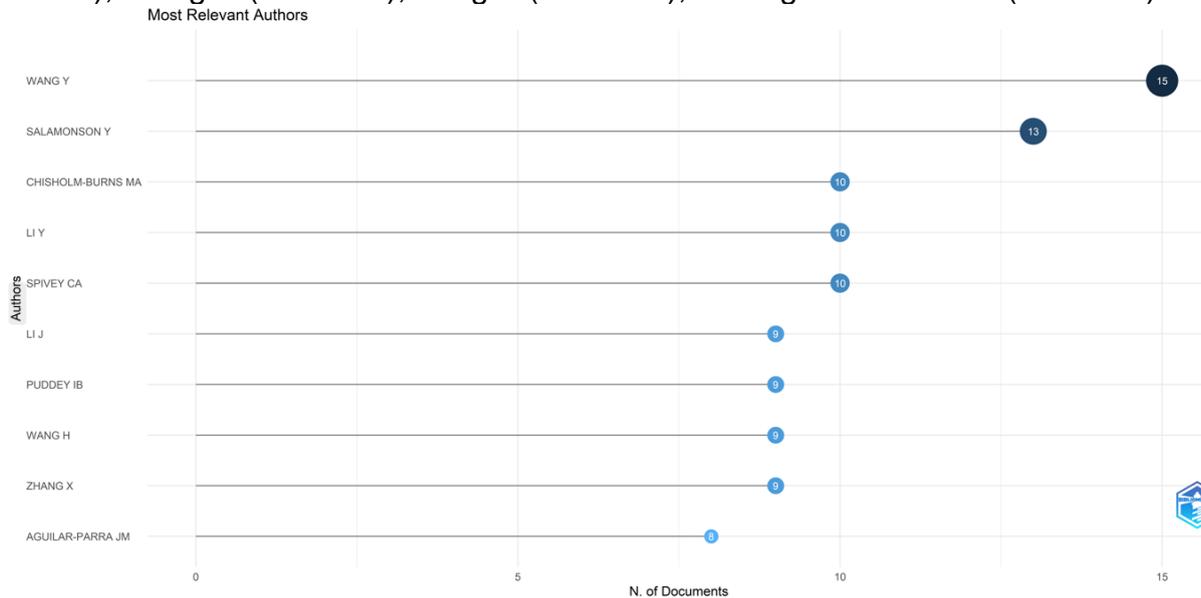


Figure 8. Most Relevant Authors

Table 1. Most Local Cited Authors

| Authors | Articles | Articles Fractionalized |
|---|---|---|
| WANG Y | 15 | 3.89 |
| SALAMONSON Y | 13 | 2.47 |
| CHISHOLM-BURNS MA | 10 | 2.15 |
| LI Y | 10 | 2.22 |
| SPIVEY CA | 10 | 2.15 |
| LI J | 9 | 2.13 |
| PUDDEY IB | 9 | 2.82 |
| WANG H | 9 | 1.50 |
| ZHANG X | 9 | 1.59 |
| AGUILAR-PARRA JM | 8 | 1.30 |

### *Top-Authors' Production over Time*

Some authors are popular in the field of education, especially the object of study of academic performance in Fig. 9 can be used as the main reference for researchers in the field of education. This position can still change from each year this is determined by the productivity of researchers. On Fig. 9 Author Wang Y is a fairly prolific writer where in 2012 Wang Y has started writing about academic performance studies consistently until 2022 and is followed by Salamonson Y, Chrisholm-Burns MA, Li Y, Spivey CA, Li J, Puddey IB, Wang H, Zhang X, and Aguilar Parra JM. Each author has a different starting point for writing, but there are only a few who are able to be consistent in producing the results of analytical studies on academic performance.

Round circles with different levels of contrast indicate the level of citations in the document, the darker the circle, the more the document is cited and the larger the circle shows the quantity of the author's article.
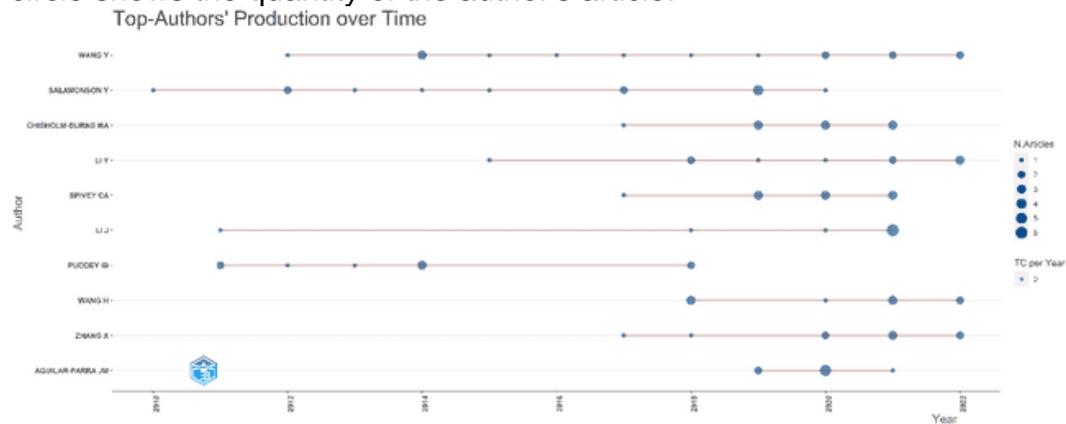


Figure 9. Authors Production Over Time

**Bradford Laws**

This analysis sorts and categorizes journal titles based on the highest number of articles. On Fig. The 10 journals with the highest level of article production with academic performance publications are Frontiers in Psychology (245 articles), International journal of Environmental Research and Public Health (218 articles) and Plos one (187 articles). Furthermore, in Bradford Laws divides journals into several zones, it is based on the calculation of journals that are in core sources which are divided into three. On the Table. 2 journals of frontiers in psychology, international journal of environmental research and public health, and Plose one are one-third of the journals included in the zone 1 category as shown in the table. 2.



Figure 10. Bradford Laws

Table 2. Bradford Laws

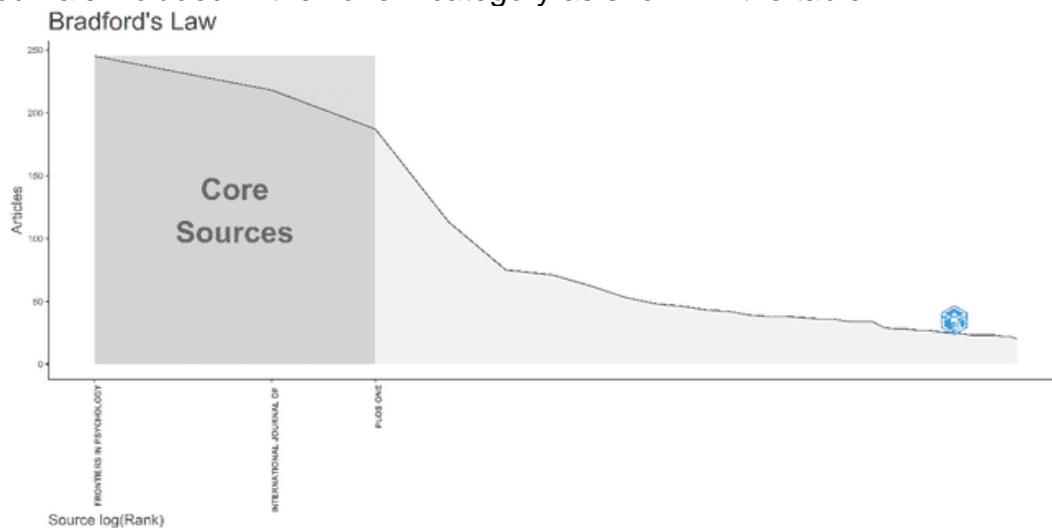| SO | Rank | Freq | cumFreq | Zone |
|---|---|---|---|---|
| FRONTIERS IN PSYCHOLOGY | 1 | 245 | 245 | Zone 1 |
| INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH | 2 | 218 | 463 | Zone 1 |
| PLOS ONE | 3 | 187 | 650 | Zone 1 |
| BMC MEDICAL EDUCATION | 4 | 113 | 763 | Zone 2 |
| AMERICAN JOURNAL OF PHARMACEUTICAL EDUCATION | 5 | 75 | 838 | Zone 2 |
| NURSE EDUCATION TODAY | 6 | 71 | 909 | Zone 2 |
| JOURNAL OF DENTAL EDUCATION | 7 | 62 | 971 | Zone 2 |
| THE JOURNAL OF SCHOOL HEALTH | 8 | 53 | 1024 | Zone 2 |
| JOURNAL OF AMERICAN COLLEGE HEALTH : J OF ACH | 9 | 48 | 1072 | Zone 2 |
| BMC PUBLIC HEALTH | 10 | 46 | 1118 | Zone 2 |

***Lotka Law***

Shows the frequency of distribution of the author's scientific productivity. On the table. 3 shows that there are 6929 authors who wrote one article document, 628 authors who wrote two article documents, 155 authors who wrote three article documents and so on. However, few authors have articles above 5 article documents. In lotka law, the author with the most documents is a prolific writer and can be used as the main reference source which can be seen from the impact factor.



The Frequency Distribution of Scientific Productivity
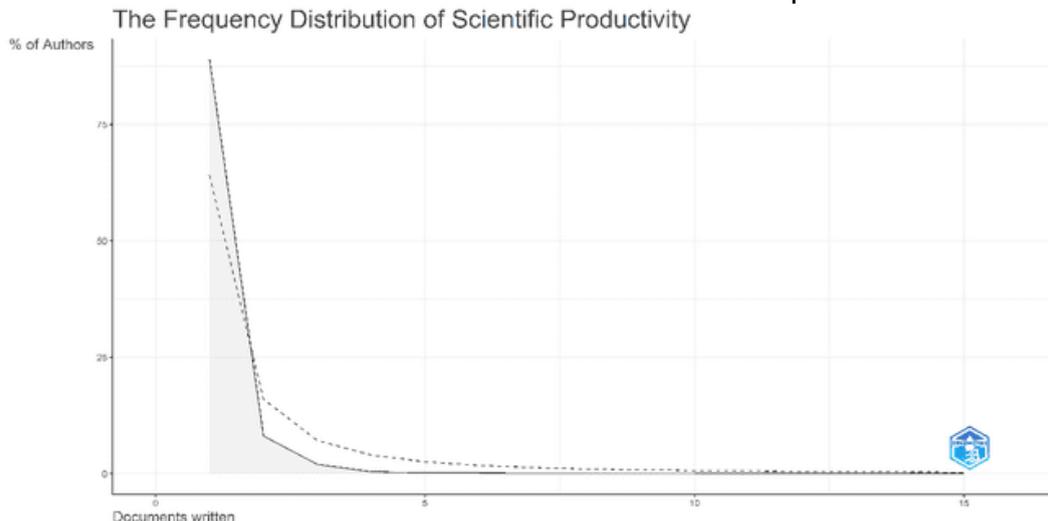
Figure 11. Lotka Law

Table 3. Lotka Law

| Documents written | N. of Authors | Proportion of Authors |
|---|---|---|
| 1 | 6929 | 0.89 |
| 2 | 628 | 0.081 |
| 3 | 155 | 0.02 |
| 4 | 31 | 0.004 |
| 5 | 12 | 0.002 |
| 6 | 11 | 0.001 |

| Documents written | N. of Authors | Proportion of Authors |
|---|---|---|
| 7 | 7 | 0.001 |
| 8 | 7 | 0.001 |
| 9 | 4 | 0.001 |
| 10 | 3 | 0 |

On Fig. 12 shows 20 topics summarized in the past 10 years, by looking at the term frequency which is classified into four frequencies (100, 200, 300, 400) it can understand the focus of educational studies every year. Research on the topic of academic performance studies began around 2017 and began to experience exponential growth around 2019 to 2020, this is estimated to be due to the impact of covid-19 and other factors that cause academic performance studies to increase.
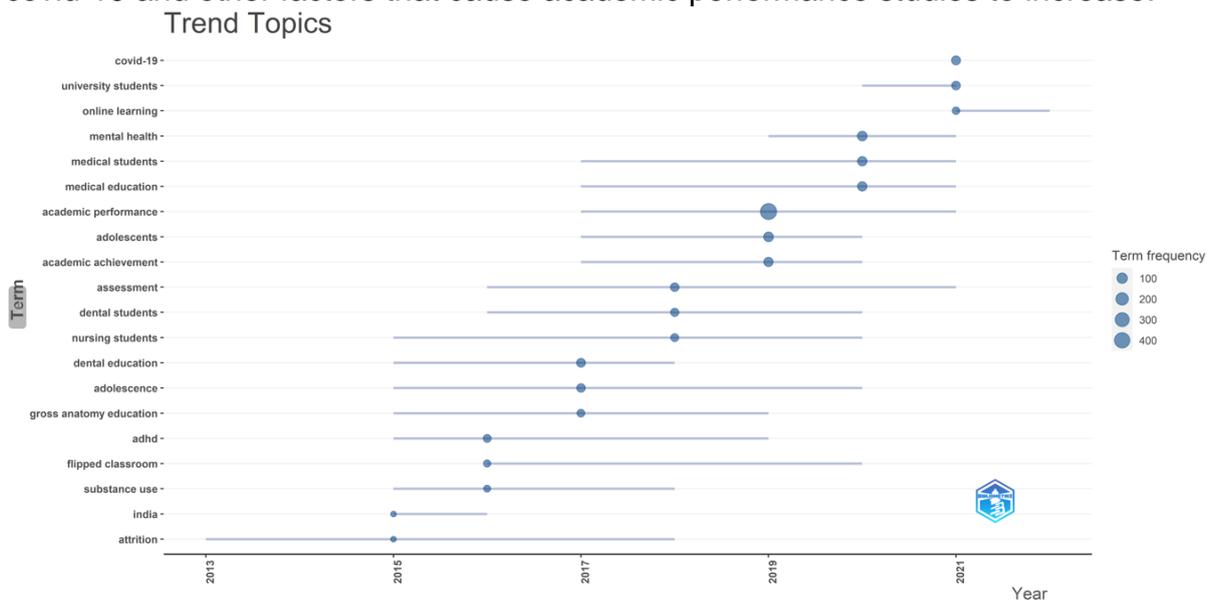


Figure 12. Trend Topics

### Thematic Map

In thematic map analysis, there is an X line (centrality) meaning that the more to the right the sub-study on academic performance, the more influential it is on the field studied, while, the Y axis (density) means that the more upwards the more articles that examine the sub-study of academic performance. On the bottom left there are two possibilities, the first possibility is declining meaning that the topic of study on academic performance is declining or emerging means that the topic of study on academic performance is on the rise. On Fig. 13 studies on academic performance were heavily influenced by covid-19 with the conduct of distance learning. On the lower right side, it shows that if the study topic is getting to the bottom right, the topic is widely cited and has a fairly high influence. In making decisions for research development or finding novelty in research, you can choose a position that is bottom left because the article is new or trending.
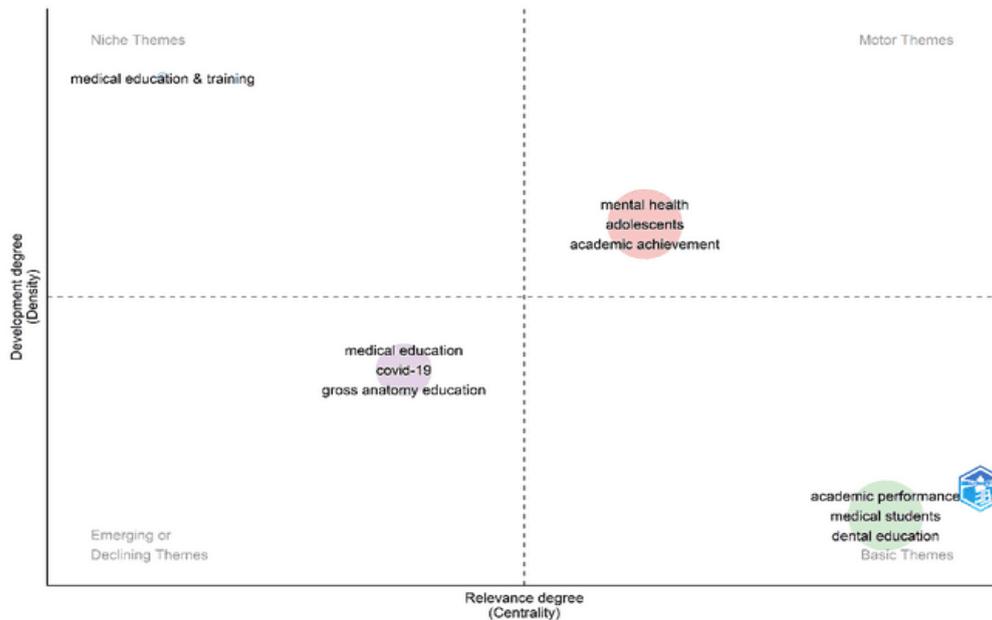
Figure 13. Thematic Map

On Fig. 14 using bibliometric analysis shows that the potential for future research, one of the focuses is on teaching methods. This has been proven by the conditions during the Covid-19 pandemic experiencing changes in learning methods using distance learning. On the table. 4 shows the division of clusters on the topic of research studies and future research potential.

Table 4. Thematic_Map_Clusters

| Cluster | Callon Centrality | Callon Density | Rank Centrality | Rank Density | Cluster Frequency |
|---|---|---|---|---|---|
| medical education | 0.014001217 | 1.787271142 | 1 | 1 | 161 |
| academic achievement | 0.076638558 | 2.415977163 | 2 | 2 | 1012 |
| academic performance | 0.122595729 | 2.693401844 | 4 | 4 | 3210 |
| medical students | 0.085659678 | 2.598878923 | 3 | 3 | 1161 |
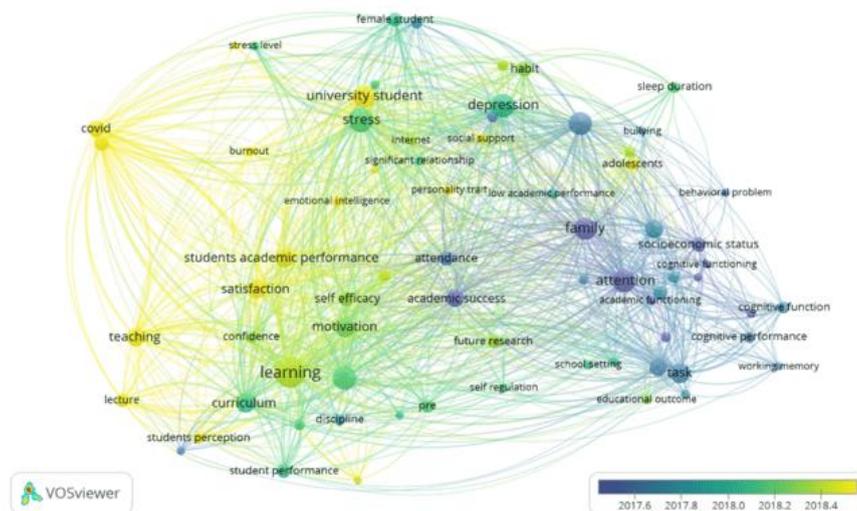


Figure 14. Overlay Visualization

Thematic evolution is the result of visualization of Bibliometric analysis using biblioshiny R which explains the development of research studies every period (Hernandez-Cruz, 2021). In this analysis, it uses a weight index inclusion index weighted by word-occurrences and a clustering algorithm using walktrap. Thematic evolution displays the development of the previous object of study (on the left side) and the current development (on the right side), based on the results of this analysis shows that there have been significant developments on the topic of academic performance studies in 2020-2022 which are divided into several aspects such as academic performance, critical thinking, GPA, flipped classroom, mental health, covid-19, student engagement, assessment and covid-19. The results of the data analysis are found in Fig. 15 as follows:
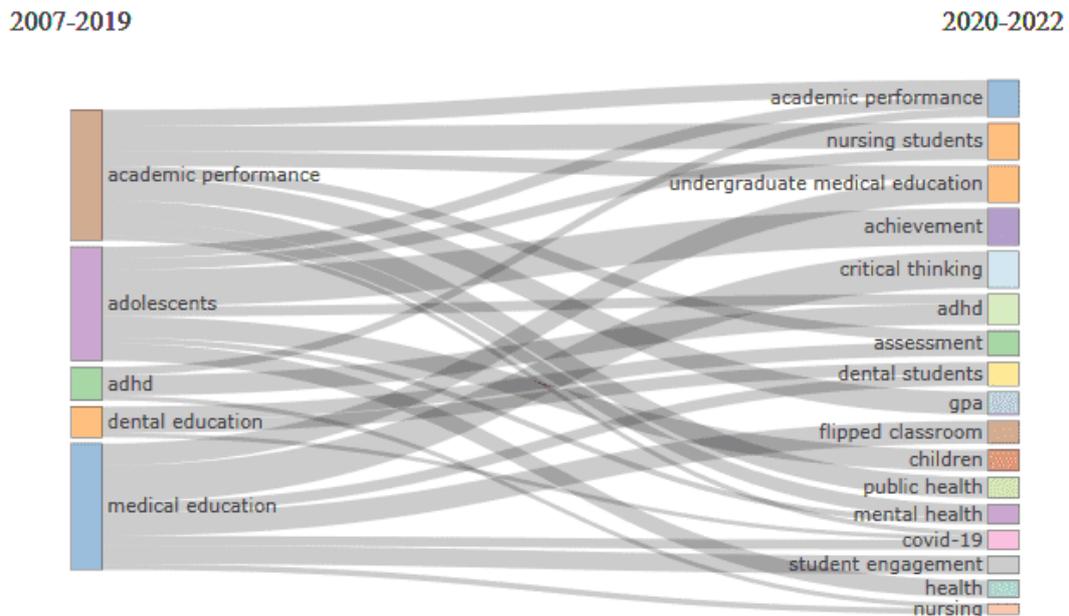


Figure 15. Thematic Evolution

Based on the results of interpretation using bibliometric analysis, there are at least several developments in studies on academic performance, including:

Table. 5 Development of academic performance studies 2010-2022

| Main Streams of Literature | Sub-Streams of Literature | Topic/Relevance Methods |
| --- | --- | --- |
| | Academic Functioning | Quantitative, Qualitative, Mix |
| | Academic skill | Quantitative, Qualitative, Mix |
| Educational Policy | School performance | Quantitative, Qualitative, Mix |
| | Educational outcome | Quantitative, Qualitative, Mix |
| | Educational attainment | Quantitative, Qualitative, Mix |
| | School environment | Quantitative, Qualitative, Mix |
| | Cognitive ability | Quantitative, Qualitative, Mix |
| Educational Psychology | Cognitive development | Quantitative, Qualitative, Mix |
| | Cognitive function | Quantitative, Qualitative, Mix |
| | Cognitive performance | Quantitative, Qualitative, Mix |
| | Attention | Quantitative, Qualitative, Mix |
| | Parental education | Quantitative, Qualitative, Mix |
| Student Environment | Bullying | Quantitative, Qualitative, Mix |
| | Socioeconomic status | Quantitative, Qualitative, Mix |
| | Sleep duration | Quantitative, Qualitative, Mix |
| | | |

On the table. 5 shows that there are three fields of study that contribute to the development of academic performance studies, the three fields of study are educational policy, educational psychology and student environment.

**Word Growth and Title Word Cloud**

Research with the keyword academic performance has developed from every year. By looking at Fig. 14 shows that research with academic performance studies began around 2009 and continues to experience exponential developments and the peak of the most research articles occurred in 2021. This shows that researchers' attention to the field of education is quite high, this is related to the efforts of researchers to improve the quality of global education and support the SDGS program.



Figure 14. Word Growth and Title Word Cloud

**CONCLUSION**

This study analyzed pubmed data base with the object of study regarding academic performance, as many as 1906 articles were analyzed and found that some of the focuses of studies in contemporary times were on educational policy, educational psychology and student environment. The authors who have consistently written about this study are Wang Y, Salamonson Y, Chrisholm-Burns MA, Li Y, Spivey CA, Li J, Puddey IB, Wang H, Zhang X, and Aguilar Parra JM and in general the authors are from China. Furthermore, based on the trend topic analysis, it shows that the biggest study is about academic performance and furthermore, there are the latest research trends in 2021 such as Covid-19 and mental health. The results of this study found several opportunities for research in the field of education in the future, by looking at several potential topics that develop in 2020-2022, namely regarding academic performance, achievement, critical thinking, assessment, GPA, flipped classroom, student engagement, and mental health.

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