

## BIBLIOMETRIC ANALYSIS OF STUDIES ON THE CONCEPT OF FINANCIAL LITERACY

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### BIBLIOMETRIC ANALYSIS OF STUDIES ON THE CONCEPT OF FINANCIAL LITERACY

#### ABSTRACT

**The purpose of the article.** This paper attempts to reveal the effect of the study by visually presenting the analysis of the studies on the concept of "financial literacy".

**Methodology.** Bibliometric analysis of the studies published in the Web of Science (WOS) database between 1991 and 2023 was analyzed with the VOSviewer (Version 1.6.9) package program. Since the title, content, and keyword of the concept of "financial literacy" were intended to be scanned in all languages and all publication types, 2,889 works were accessed and analyzed. The limitations of the study are that only the studies in WOS are analyzed. No data from Scopus and PubMed databases has been included. For future studies, research from the Scopus and PubMed databases should be added.

**Results of the research.** When the most frequently included keywords in the publications related to the concept of "financial literacy" have a relationship between them at least twice in the study, the keywords "financial literacy" with 825 repetitions in terms of 1841 total connection strength, "financial education" with 111 repetitions in terms of 315 total connection strength, "financial behavior" with 65 repetitions in terms of 217 total connection strength and "financial knowledge" with 71 repetitions in terms of 213 total connection power are seen. As a result of the analysis performed, it was determined that there were 2265 connection powers and 4069 total connection powers for a total of 36 clusters. When we look at the year-by-year distribution, the most works were published in 2022 with a maximum of 426 works. At least one work was published in 2004,

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2003, 1998, 1994 and 1991. Among the published studies, journal article 2,515, proceedings paper 280, early access 135, book chapters 101, review article 68, editorial material 29, correction 6, book 5, book review 3 were determined as works. When we look at the languages in which the published works are published, they are in English with a maximum of 2,814 works. At least two works are in French and Chinese. In order to determine the year-based stratification status of the published studies for country-based citations, it was noted that a country should have at least 1 study published and at least 1 citation obtained. As a result of the analysis, analysis was carried out on 78 observation units that were found to have a relationship between them, and it was determined that there were 14 clusters, 1065 connection power and 9417 total connection power. The countries with the most citations are the USA (11981 citations), the Netherlands (2445 citations) and England (1685 citations). In terms of the number of works, the ranking is the USA (197 publications), China (77 publications), India (73 publications), and Australia (70 publications). When the stratification status of the citation ties of the countries on a yearly basis is examined, it is seen that they are limited between 2017 and 2021.

**Keywords:** financial literacy, business, financial behavior, financial knowledge.

**JEL Class:** A12, A13, D14, G40.

## **INTRODUCTION**

Although this type of bibliometric analysis is used to examine the scientific productivity in a subject or research area, publication trends, the influence of authors and institutions, the citation of publications and similar characteristics, it is also used for many purposes such as evaluating academic research, identifying new research areas, and measuring the performance of researchers and institutions.

In this article, the connections and relationships between the studies subject to analysis will be discussed. The commonalities and differences of key concepts between the studies will be also analyzed, and how the related studies interact with each other on the basis of year-author-citation-institution-country will be emphasized.

In this study, since it is aimed at scanning the title, content and keyword of the concept of financial literacy in all languages and all publication types, the studies published in the Web of Science (WOS) database were examined by bibliometric analysis. This study is expected to be useful for businesses, policymakers, practitioners, the private sector, the public sector and academics working in the field in terms of revealing the place of financial literacy in the literature and identifying its gaps.

It is believed that by ensuring that the keywords in the most cited articles are noticed, the key words will be a guide for the researchers who will conduct research in this field in the future.

### **1. CONCEPTUAL FRAMEWORK**

#### **1.1. Some Concepts Associated with Financial Literacy**

##### **1.1.1. FINANCIAL LITERACY**

Financial literacy refers to the knowledge and skills necessary to make informed financial decisions. Budgeting involves understanding various financial concepts such as saving, investing, and managing personal finances. Financial literacy is important because it empowers individuals to make sound financial choices, avoid common pitfalls, and achieve their financial goals. However, financial literacy practices refer to the actions and strategies that individuals or organizations implement to promote and improve financial literacy. These practices may vary depending on the target audience, context, and goals, but are generally aimed at improving financial knowledge, skills, and behaviors.

Today, it is observed that financial literacy knowledge is insufficient to make the types of financial decisions required in both enterprises and other institutions

and organizations. Financial literacy helps people make informed financial decisions. Thus, individuals can better understand and comprehend the information about the operation of insurance and basic financial instruments, and they can act more comfortably while using them. In short, financial literacy improves financial well-being in life (Lusardi and Messy, 2023). Low levels of financial literacy increase consumer and financial market risks as increasingly complex financial instruments enter the market (Klapper and Lusardi, 2019). Because women face unique financial challenges, they need financial knowledge to build a financially secure future (Hasler and Lusardi, 2017).

When evaluated in the context of educational business, it is known that financial literacy is not at the desired level among high school students and that the new generation of adults does not have enough information when they face obstacles and change. Within the framework of the latest wave of the OECD Programme for International Student Assessment (PISA), around 20 percent of students in some G7 countries, such as Italy, are not at the basic level of proficiency in financial literacy. In other countries, such as Peru or Brazil, the rate is over 40% (OECD, 2020; Lusardi and Messy, 2023).

According to Kaiser et al. (2022), financial education programs have, on average, positive causal treatment effects on financial knowledge and sub-financial behaviors. In short, the implementation of national strategies that promote financial literacy, the design of financial education policies and school instructions is a situation that requires urgency for policymakers worldwide (Kaiser et al., 2022).

Improving financial literacy can have a positive impact on individuals, families, and communities. Better financial well-being can lead to increased savings, reduced debt, and improved financial security. It can also help individuals navigate complex financial products and services, make informed decisions about borrowing and investing, and plan long-term financial goals such as retirement or education.

According to Lusardi (2015), there are four innovative aspects of financial literacy that need to be addressed. First, financial literacy does not depend solely on knowledge and understanding, but also aims to support effective decision-making. The latter is not intended to influence a single behavior, such as reducing debt by increasing savings, but also to improve financial well-being. Third, financial literacy has implications not only for individuals but also for society. Fourth, financial literacy enables young people to participate in economic life (Lusardi, 2015; Lusardi and Messy, 2023).

TIAA Institute-GFLEC Personal Finance Index (P-Fin Index), an annual assessment of financial literacy among the U.S. adult population, now in its sixth year (Yakoboski et al., 2022)<sup>1</sup>.

The P-Fin Index survey also includes indicators of financial well-being, which allow the relationship between financial literacy and financial well-being to be examined (Yakoboski et al., 2022). In this context, comparative studies can be carried out by making a detailed analysis of country-based financial literacy information with the projects of different countries.

Financial literacy can be improved in a variety of ways, including through educational programs, workshops, online courses, and resources provided by financial institutions, government agencies, and nonprofits. These resources typically cover topics such as budgeting, saving, investing, debt management, credit scores, insurance, and retirement planning.

Recent research shows that people enter old age with more debt and little or no retirement plans (Mitchell and Lusardi, 2022). This process shows that many people are not financially prepared for retirement. Therefore, it is important for people to make retirement plans in order not to experience financial difficulties in the aging process. These plans may consist of different methods, such as saving, investing, or participating in retirement funds. Creating a retirement plan can also create a more promising future financially by helping people feel more secure in their old age. So by expanding their financial knowledge and skills, individuals can have more control over their financial lives and make informed decisions that align with their financial goals and values.

National strategies that promote financial literacy in businesses and the public need to be implemented, and financial education policies and school instructions need to be designed in this context. The impact of financial literacy programs, especially in the workplace on the participants of the program can help users with the ability to create a budget, learn how to rebuild savings, monitor their credit, manage debt, and use online technology to make financial decisions, for example (Lusardi et al., 2021).

### 1.1.2. FINANCIAL BEHAVIOR

Financial behavior refers to the way individuals manage their money, make financial decisions, and engage in financial activities. Budgeting encompasses a wide range of actions and choices related to personal finance, such as saving, investing, borrowing, and spending. According to a study by Dewi et al. (2020), it was aimed at determining the level of financial literacy of millennials and to

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<sup>1</sup> The TIAA Institute-GFLEC Personal Finance Index (P-Fin Index) measures knowledge and understanding that enable sound financial decision making and effective management of personal finances among U.S. adults (GFLEC, 2023).

examine the relationship between their financial knowledge, financial attitudes, financial skills and financial behavior. As a result of the research, significant relationships were found not only between financial attitude and financial management behavior, but also between financial skills and financial management behavior. However, it was concluded that there was no significant relationship between financial information and financial behavior (Dewi et al., 2020).

Understanding financial behavior is important because it can have a significant impact on an individual's financial well-being and outcomes. Financial behavior can be influenced by a variety of factors, including personal attitudes and beliefs about money, financial knowledge and literacy, cultural and social influences as well as economic conditions.

In Australia, buy-and-pay now (BNPL) is a thriving payment innovation. Regulators and consumer groups have expressed concern about the financial risks posed by BNPL. Because BNPL is not regulated in the context of consumer credit law, financial regulators and consumer groups have recommended that BNPL users adopt many responsible financial behaviors for their financial well-being. Survey results of BNPL users show a link between many of the proposed financially responsible behaviors and financial well-being, and that the financial behavior of young users (under 25) puts them at serious risk of reduced financial well-being (Powell et al., 2023).

Research in the field of behavioral finance shows that individuals may not always be able to make rational and optimal financial decisions. Behavioral biases, emotions, and cognitive limitations can lead to irrational financial behaviors, such as excessive risk-taking, overspending, or poor investment choices. Korkmaz et al. (2021) investigated the relationship between risk preference and risk behavior using the Chinese Household Finance Survey (CHFS). The results showed that there was a discrepancy between risk preference and risky behavior; in addition, financial literacy affects this discrepancy. In other words, financial literacy increases risk-taking behavior while increasing inconsistency in risk-averse people and decreasing it in risk-seekers.

Improving financial behavior often involves developing financial literacy and skills, as well as addressing behavioral biases and emotions. Financial education and awareness programs can help individuals make better financial decisions by providing them with the information and tools to manage their money effectively.

Financial institutions and policymakers also play a role in shaping financial behavior by designing products and services that promote responsible financial behavior and by providing consumer protections and regulations.

### 1.1.3. FINANCIAL KNOWLEDGE

Financial knowledge refers to the understanding and awareness of various financial concepts, principles and practices. It includes information on topics such as budgeting, saving, investing, debt management, insurance, tax, and retirement planning. Having financial knowledge is important because it allows individuals to make informed decisions about their money and financial well-being. It helps individuals understand how to effectively manage their income, expenses, and assets. With financial knowledge, individuals can make better choices about saving for the future, investing wisely, and avoiding financial pitfalls.

The age of the knowledge economy, the importance of financial information services is obvious. The more developed the economy, the higher the need for the quality of financial information services. The quality of financial information services is based on financial information innovation, and financial information innovation should focus on the measures and contents of financial information services (Yuxia, 2010).

Meressa (2023) explored the relationship between entrepreneurial financial literacy, access to credit, and the sustainability of small businesses in Ethiopia. The study used cross-sectional data collected from 293 small business owners and managers through a survey in 2022. The results showed that entrepreneurial financial literacy benefits the sustainability of small businesses.

Skica et al. (2022) analyzed the relationship between financial knowledge and a new business entry. For this, the authors used data from the Global Entrepreneurship Monitor (GEM), specifically the Adult Population Survey (APS) Global National Level Data. The results show that financial literacy is significantly positively correlated with the proportion of total early-stage entrepreneurial activity within the technology sector and negatively correlated with business discontinuance due to problems in getting finance. Furthermore, it is significantly negatively correlated with early-stage entrepreneurial motives to build a high income and earn a living because jobs are scarce (i.e., necessity-driven entrepreneurship).

Financial knowledge can be gained through a variety of means, including formal education, self-study, workshops, online courses, and resources provided by financial institutions and organizations. It is important to constantly update and expand financial information to keep up with changing economic conditions, financial products and regulations.

Research has shown that individuals with higher levels of financial knowledge tend to make better financial decisions (Cwynar et al., 2020), have higher savings rates, and achieve greater financial security (Białowolski et al., 2022). Financial information can also help individuals protect themselves from

fraud, make informed choices about financial products and services, and effectively plan for long-term financial goals.

## **2. METHOD**

### **2.1. Aim of the Research**

The Web of Science (WOS) aims to conduct a bibliometric analysis of the title, content and keyword of the "financial literacy" title, content and keyword published in the range of 1991–2023 in all languages and all publication types, as well as in the finance and business categories. It will be visually presented in the context of conceptual relationships in the scientific literature, author, number of citations, country, institution and keyword analysis and will conduct studies on the subject in the future. It is widely believed that it will contribute to researchers' work.

### **2.2. Hypotheses of the Study**

The analysis of studies on the concept of "financial literacy" through a bibliometric approach using the Web of Science (WOS) database between 1991 and 2023, as presented in this study, aims to provide a comprehensive visual representation of the evolving landscape in financial literacy research. Our study hypothesizes the following:

- H<sub>1</sub>: It is assumed that the most commonly used keyword is "financial literacy".
- H<sub>2</sub>: It is assumed that there is an increase in financial literacy publications in the context of temporal evolution.
- H<sub>3</sub>: It is assumed that English-language journal articles predominate.
- H<sub>4</sub>: The United States is assumed to have the highest number of citations.
- H<sub>5</sub>: It is assumed that the citation links between the years show limited stratification.
- H<sub>6</sub>: It is assumed that the call for the inclusion of Scopus and PubMed databases in future research will provide a more comprehensive understanding of financial literacy research.

### **2.3. Data and Analytics**

In this study, thanks to the visual analysis features of recognizing new research in scientific fields, identifying gaps in the literature and creating a roadmap for future research was possible, the VOSviewer (Version 1.6.9) package program (Van Eck and Waltman, 2009; Yurdakul and Bozdoğan, 2022).



Since it is very important to select appropriate data sources in terms of reliability and quality of research, the WOS database was used in this study because it is a comprehensive database of scientific literature. The obtained data was evaluated in the context of author-citation number, country-institution and keyword analysis.

Table 1. Year-based distribution of published works

Year	Number of published works	Year	Number of published works	Year	Number of published works
2023	242	2013	73	2003	1
2022	426	2012	79	2002	2
2021	419	2011	50	2001	2
2020	389	2010	26	1999	2
2019	317	2009	28	1998	1
2018	224	2008	12	1997	2
2017	175	2007	7	1994	1
2016	154	2006	4	1991	1
2015	136	2005	5		
2014	110	2004	1		

Source: Authors' own elaboration.

Having analyzed the year-by-year distribution, it can be noted that the most works were published in 2022 with a maximum of 426 works. At least one work was published in 2004, 2003, 1998, 1994 and 1991.

### 3. FINDINGS

#### 3.1. Co-authorship of Authors

In the context of the co-authorship analysis of the authors, the network map is presented in Figure 1, provided that at least one publication and at least one citation criteria are met in order to identify the most linked authors.

As a result of the analysis carried out among the authors with the most connections between them, it was found that there were 26 clusters and 321 connections and 488 total connection strengths. The most cited authors is Annamaria Lusardi with 6541 citations. The author has published 35 works and has a total link power of 56. It is followed by Olivia S. Mitchell with 3958 citations. The author has 34 published works and 37 total connection strengths. These two authors who have published the most studies are also the ones with the highest total connection power.

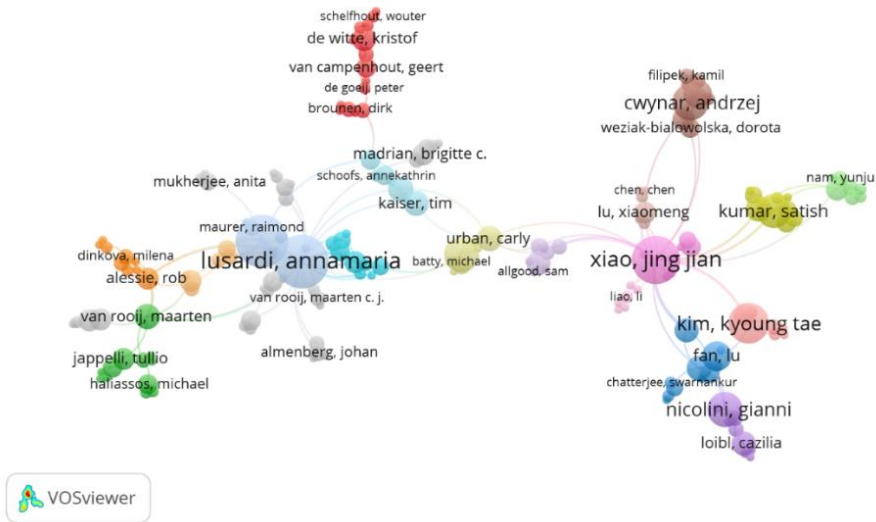


Figure 1. Co-Author Connects Demonstrating Collaboration Between  
Source: Authors' own elaboration.

### 3.2. Citation of Authors

In order to determine the citation networks, at least one publication and at least one citation criterion were met in the context of author citation analysis, and a year-based stratification status was determined. As a result of the analysis, 1553 units were found to be connected; with 48 clusters, it was determined that there was a connection power of 26225 and a total connection power of 37379. The most cited authors is Annamaria Lusardi with 6541 citations. It is followed by Olivia S. Mitchell, with 3958 citations and Rob J. Alessie with 910 citations. These three most-cited authors are also the ones with the highest total link power. When the citation links of the authors are examined on a yearly basis, it is seen that they are limited between 2014 and 2022.

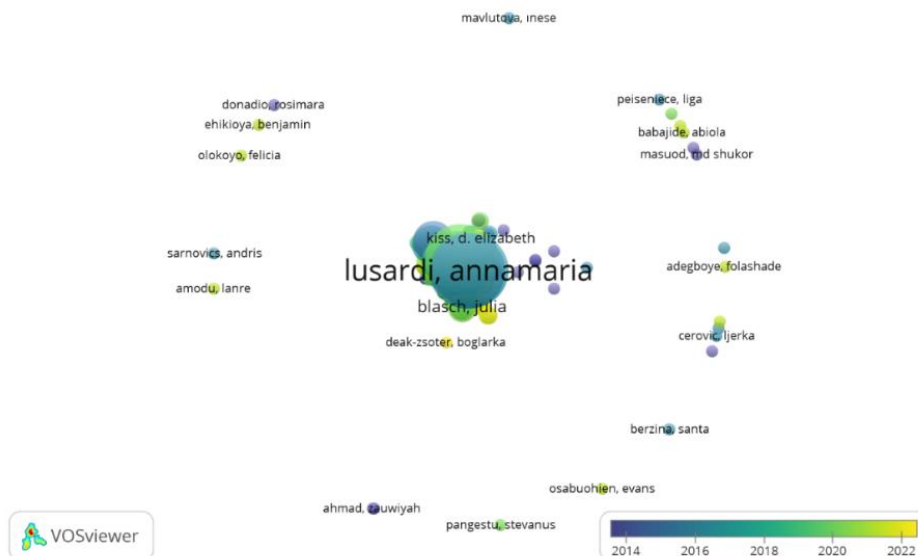


Figure 2. Status of authors' attribution links by year

Source: Authors' own elaboration.

### 3.3. Citation of Countries

In order to determine the year-based stratification status of the published studies for country-based citations, it was noted that a country should have at least one study published and at least one citation obtained. As a result of the analysis, it was carried out on 78 observation units that were found to have a relationship between them, and it was determined that there were 14 clusters, 1065 connection power and 9417 total connection power. The countries with the most citations are the USA (11981 citations), the Netherlands (2445 citations) and England (1685 citations). In terms of the number of works, the ranking is USA (197 publications), China (77 publications), India (73 publications), and Australia (70 publications). When the stratification status of the citation ties of the countries on a yearly basis is examined, it is seen that they are limited between 2017 and 2021.

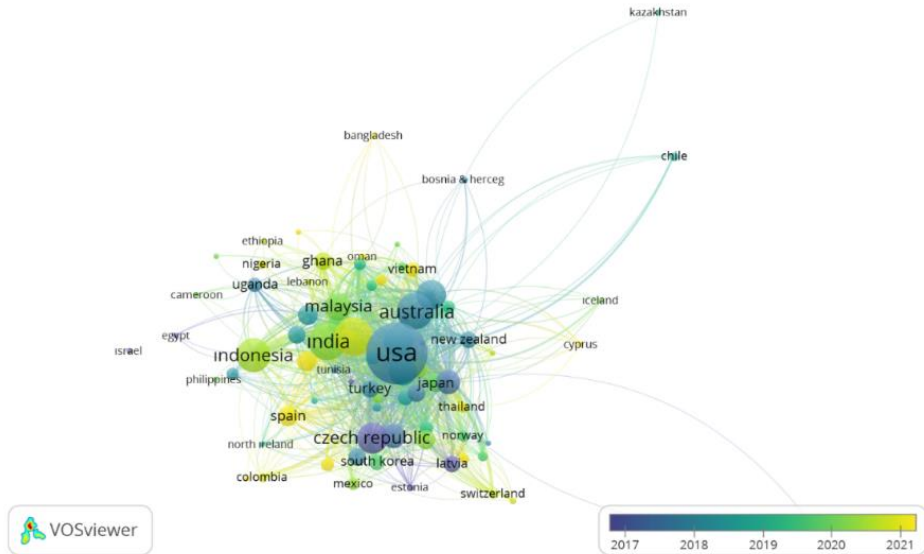


Figure 3. Stratification of countries' attribution connects by year

Source: Authors' own elaboration.

### 3.4. Citation of Organizations

In order to determine the stratification status of the bibliometric match ties of the institutions on a yearly basis, it was determined that there were 33 clusters, 16197 connection power and 23954 total connection power as a result of the analysis with 888 units that were found to have a relationship, provided that one institution had published at least one study and had at least one citation. Such pairings can be important to show how widely accepted the topic or work is and how deep the work on it has become. These institutions included: George Washington University (20) works, the University of Pennsylvania (13) works, and the University of Groningen and the University of Western Australia (12 works).

The most cited studies are George Washington University (4055 citations), the University of Pennsylvania (4001 citations), Dartmouth College (2467 citations) and the University of Groningen (1787 citations). The institutions with the most total connection power are the University of Washington in Georgia (2664 total connection strength), the University of Pennsylvania (2298 total connection strength), Dartmouth College (1380 total connection strength), and the University of Groningen (1157 total connection strength). When the bibliographic

match ties of the institutions are examined on a yearly basis, it is determined that they are limited between 2016 and 2022.

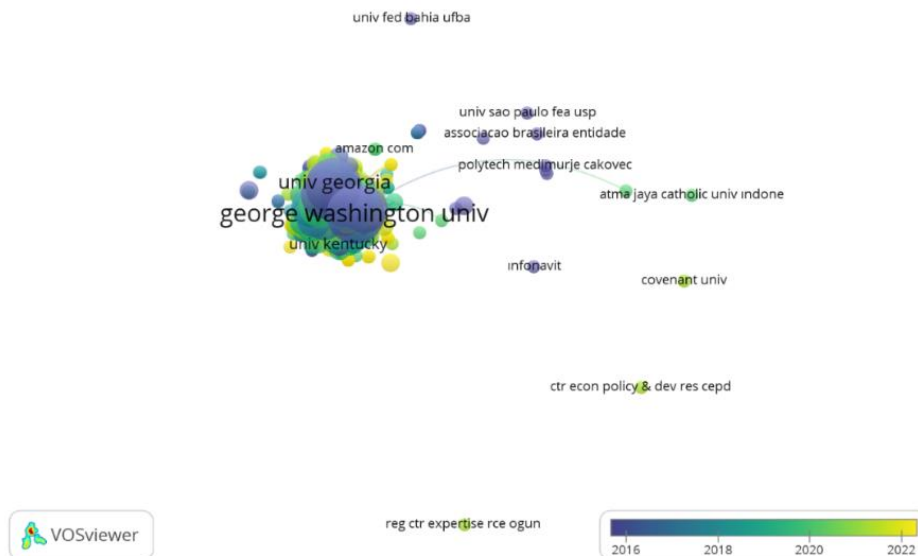


Figure 4. Stratification of bibliographic match connections of institutions by year

Source: Authors' own elaboration.

### 3.5. Co-occurrence of All Keywords

When the most frequently included keywords in the publications related to the concept of "financial literacy", have a relationship between them at least twice in the study, the keywords "financial literacy" with 825 repetitions in terms of 1841 total connection strength, "financial education" with 111 repetitions in terms of 315 total connection strength, "financial behavior" with 65 repetitions in terms of 217 total connection strength and "financial knowledge" with 71 repetitions in terms of 213 total connection power are seen. As a result of the analysis performed, it was determined that there were 2265 connection powers and 4069 total connection powers for a total of 36 clusters.

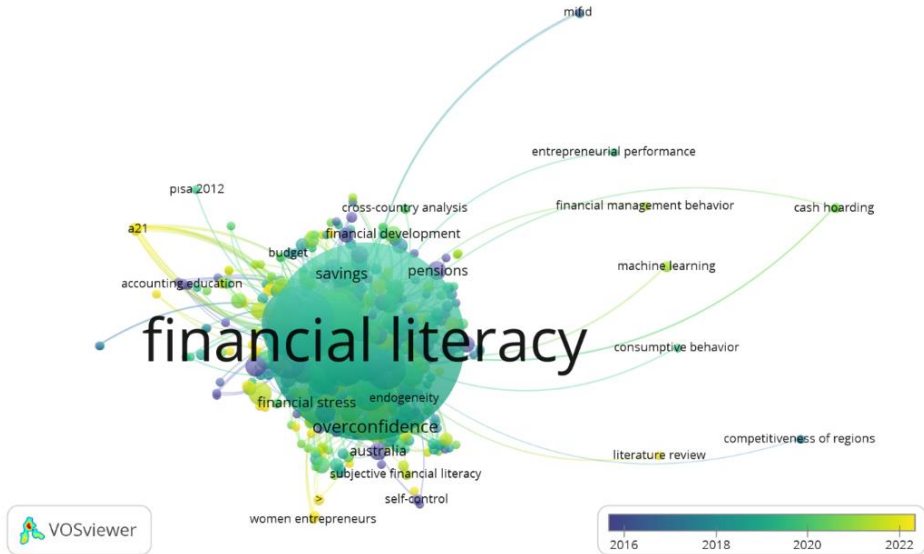


Figure 5. Layering of the most frequently used keyword links over the years

Source: Authors' own elaboration.

### 3.6. Bibliographic Coupling of Authors

In the study, it was concluded that the authors who published at least one work and had the condition of having one citation at the same time had seven clusters, 102651 connections and 744498 total connection power in the context of bibliographic match analysis. The author with the most bibliographic matches is Annamaria Lusardi with 6541 citations and a total link strength of 42112.

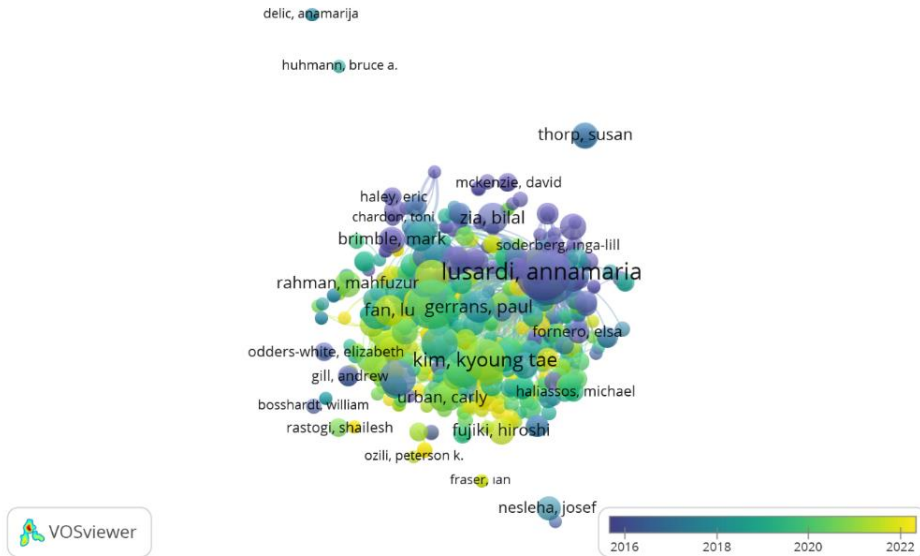


Figure 7. Bibliographic matching links of authors

Source: Authors' own elaboration.

### 3.7. Co- authorship of Organizations

With a total of 33 connection strengths, the most cited institution was determined to be George Washington University (4055 citations). With a total link strength of 23, it is the University of Groningen (1787 citations).

As a result of the analysis carried out by selecting the minimum number of citations as 1, a total of 27 clusters and 611 connection powers and 666 total connection powers were reached. Looking at the stratification status of the ties between the institutions of the co-authors on a yearly basis, it was determined that they were limited between 2014 and 2022.

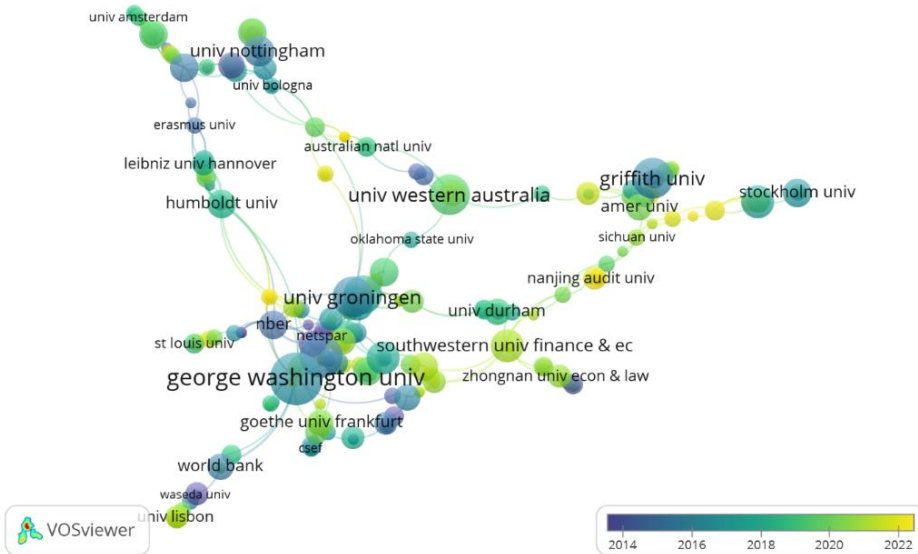


Figure 8. Stratification of Connects Between Co-Authors' Institutions by year  
 Source: Authors' own elaboration.

### 3.8. Evaluation of Hypotheses

Table 2. Realization/nonrealization of hypotheses

Hypotheses	Provided	Not Provided
H <sub>1</sub> : It is assumed that the most commonly used keyword is "financial literacy".	X	
H <sub>2</sub> : It is assumed that there is an increase in financial literacy publications in the context of temporal evolution.	X	
H <sub>3</sub> : It is assumed that English-language journal articles predominate.	X	
H <sub>4</sub> : The United States is assumed to have the highest citations.	X	
H <sub>5</sub> : It is assumed that the citation links between the years show limited stratification.	X	
H <sub>6</sub> : It is assumed that the call for the inclusion of Scopus and PubMed databases in future research will provide a more comprehensive understanding of financial literacy research.	X	

Source: Authors' own elaboration.



H<sub>1</sub>: The interconnectedness and frequency of keywords such as "financial literacy," "financial education," "financial behavior," and "financial knowledge" in the bibliometric analysis suggest a dynamic evolution of research trends, indicating a growing emphasis on the interplay between these concepts.

H<sub>2</sub>: The observed surge in financial literacy publications, peaking in 2022 with sporadic publications in earlier years, implies a changing landscape influenced by global economic dynamics, leading to increased awareness and interest in the field.

H<sub>3</sub>: The dominance of English-language journal articles underscores a potential language bias, and the prevalence of traditional scholarly channels suggests a need for future research diversification in terms of both publication types and languages.

H<sub>4</sub>: The high citation counts for the United States, the Netherlands, and England indicate their leadership in shaping the financial literacy discourse, while the ranking of countries based on publications and citations underscores the global nature of financial literacy research contributions.

H<sub>5</sub>: The limited stratification of citation ties between 2017 and 2021 suggests a concentrated period of influential financial literacy research, possibly linked to significant policy changes, educational initiatives, or economic events during that timeframe.

H<sub>6</sub>: Acknowledging limitations in using only the Web of Science database, the call for future research to include Scopus and PubMed databases is hypothesized to provide a more comprehensive understanding of financial literacy research, capturing a broader spectrum of studies for a holistic analysis of the field.

## CONCLUSIONS

This study conducted on August 1, 2023, aims to reveal the effect of the study by visually presenting the analysis of the studies on the concept of "financial literacy". Bibliometric analysis of the studies published in the Web of Science (WOS) database between 1991 and 2023 was analyzed with the VOSviewer (Version 1.6.9) package program. Since the title, content and keyword of the concept of "financial literacy" were intended to be scanned in all languages and all publication types, 2,889 works were accessed and analyzed.

When the most frequently included keywords in the publications related to the concept of "financial literacy", which have a relationship between them at least twice in the study, the keywords "financial literacy" with 825 repetitions in terms of 1841 total connection strength, "financial education" with 111 repetitions in terms of 315 total connection strength, "financial behavior" with 65 repetitions in terms of 217 total connection strength and "financial knowledge" with 71

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When we look at the year-by-year distribution, the most works were published in 2022 with a maximum of 426 works. At least one work was published in 2004, 2003, 1998, 1994 and 1991.

Among the published studies, journal article 2,515, proceedings paper 280, early access 135, book chapters 101, review article 68, editorial material 29, correction 6, book 5, book review 3 were determined as works.

The authors with the most publications were Olivia S. Mitchell (36 works), Annamaria Lusardi (34 works), Jing Jian Xiao (29 works), Kyoung Tae Kim (20 works), Gianni Nicolini (17 works), Andrzej Cwynar (16 works), and J. Michael Collins (15 works). When we look at the languages in which the published works are published, they are in English with a maximum of 2,814 works. At least two works are in French and Chinese.

As a result of the analysis carried out among the authors with the most connections between them, it was determined that there were 321 connections and 488 total connection strengths united in 26 clusters. The most cited authors is Annamaria Lusardi with 6541 citations. The author has published 35 works and has a total link power of 56. It is followed by Olivia S. Mitchell, with 3958 citations. The author has 34 published works and 37 total connection strengths. These two authors who have published the most studies are also the ones with the highest total connection power.

In order to determine the citation networks, at least one publication and at least one citation criterion were met in the context of author citation analysis, and year-based stratification status was determined. As a result of the analysis, 1553 units were found to be connected; with 48 clusters, it was determined that there was a connection power of 26225 and a total connection power of 37379. The most cited authors is Annamaria Lusardi with 6541 citations. It is followed by Olivia S. Mitchell, with 3958 citations and Rob J. Alessie with 910 citations. These three most-cited authors are also the ones with the highest total link power. When the citation links of the authors are examined on a yearly basis, it is seen that they are limited between 2014 and 2022.

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In the study, it was concluded that the authors who published at least one work and had the condition of having one citation at the same time had seven clusters, 102651 connections and 744498 total connection power in the context of bibliographic match analysis. The author with the most bibliographic matches among the authors is Annamaria Lusardi, with 6541 citations and a total link strength of 42112.

With a total of 33 connection strengths, the most cited institution was determined to be George Washington University (4055 citations). With a total link strength of 23, it is the University of Groningen (1787 citations).

As a result of the analysis carried out by selecting the minimum number of citations as one, a total of 27 clusters and 611 connection powers and 666 total connection powers were reached. Looking at the stratification status of the ties between the institutions of the co-authors on a yearly basis, it was determined that they were limited between 2014 and 2022.

## **CONFLICT STATEMENT**

The author declares that there is no conflict of interest.

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