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## Reflective Thinking: A Bibliometric Analysis of Four Decades of Research and Insights for Future Studies

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## Reflective Thinking: A Bibliometric Analysis of Four Decades of Research and Insights for Future Studies

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### Abstract

Reflective thinking (RT) is one of the higher-order thinking skills which have been of great importance to the researchers from a variety of disciplines for years. Although the significance of RT has been discussed in many studies and many different forms, there are no bibliometric studies conducted on this topic. This study aims to examine the current state and development of research in RT based on the data available in the Web of Science (WoS). To do this, a bibliometric approach was adopted to map the research literature on RT using the metadata from the WoS between 1986 and 2023 in terms of the distribution of the articles by year of publication and average citation status, the most productive journals publishing on RT and number of RT-related citations, the most cited RT articles and authors, top countries in which the articles about RT were cited most, the authors who have produced the most articles on RT, their publications and corresponding author(s)' countries, and the trend of words associated with RT in the articles. Our main contribution is the quantitative methodological design for examining the evolution of reflective thinking research, which is highly multidisciplinary and covers a large volume of publications. We believe that this study provides a comprehensive review of the studies on RT and provides interesting insights about the development of the field for future research.

### Introduction

Although it is hard to define “thinking” in a single form, it can be described as a cognitive activity or a mental process that involves understanding the events happening around us by using our brain and deciding how to respond or react to these phenomena. Of course, this general definition stands for everyday thinking. However, in this study, we focus on a form of thinking that exceeds everyday thought. In this sense, as Geertsen (2003) suggests, we undertake a kind of “thinking” which is a disciplined, systematic way of using the mind to confirm existing information or to search for new information using various degrees of abstraction which requires higher level of cognition.

There have been numerous studies conducted on “reflective thinking (RT)”, which is one of the higher-order

thinking skills in literature; however, there seems to be an inconclusive definition of it. The term dates back to John Dewey's work "How we think" in which he defines "reflective thinking" as an "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends" (Dewey, 1933, p.9). Schön (1987) argues that reflective thinking is a part of ordinary life as we always go through a thinking process while experiencing our daily activities. A similar stance by Ariany et al. (2023) is also discussed in that reflective thinking is necessary in our lives because the ability allows individuals to assess of what they have done to make an improvement, and, thus, it encourages them to become lifelong learners.

There is often a misconception that the word reflective thinking can be used instead of critical thinking (Geertsen, 2003). However, these words are not synonymous as reflective thinking places a greater emphasis on how individuals get involved in decision-making process, expressing their own opinions about what has happened and taking an action (Pham et al., 2020; Schön, 1987). Similarly, Mirzaei, Phang and Kashefi (2014) claim that the most important factor which separates the reflective thinking from critical thinking is that it presents an interpretation of a solution, deferring, translating, arrogating to the individual, comprehending the issues and making predictions for the future. On the other hand, Choy and San Oo (2012) claims that reflective thinking is thought to enhance critical thinking, and thus it should be considered a part of the critical thinking process specifically referring to the processes of analysing and making judgments about what has happened.

When it comes to the definition of "reflective thinking", it is also problematic to be able to define it in a single form. For example, Akpur (2020) states that reflective thinking is related to endeavours to rationalize matters, trying to establish connections among ideas and choosing the most suitable strategy to apply. Similarly, Salido and Dasari (2018) declares that reflective thinking can be considered one's ability to respond to matters by using prior knowledge and experiences, to make meaningful decisions when encountered with a problem or a challenging task. In educational context, according to Phan (2008), reflective thinking enhances meaningful learning and helps students and educators alike to develop specific skills that may assist them to be more vocal and critical. Similarly, Funny et al. (2019) claim that reflective thinking is about assessing what one should know, what they need to know, and how they bridge that gap between what is known and what should be known. Therefore, reflective thinking encourages individuals to think about a strategy and evaluate it for taking appropriate action in problem solving or handling a task (Gencel & Saracaloğlu, 2018). Similarly, Baron (1981) states that reflective thinking allows individuals to choose courses of action and to adopt true beliefs rather than false ones.

In the related literature, there also have been some studies which focus the process of reflective thinking. For example, Kholid et al. (2020) claim that reflective thinking begins with experiencing confusion and evaluation to find a solution to a problem, task or issue. Similarly, Başol and Evin Gencel (2013) point out reflective thinking process begins with the identification of the situation and continues as a cycle by listing what can be done about the situation, making future plans for the implementation and explaining what has been done to deal with that situation. In terms of the actions that should be taken in reflective thinking, Dewey (1933) suggests five logically distinct steps: (1) a felt difficulty, (2) its location and definition, (3) suggestion of possible solution, (4)

development by reasoning of the bearings of the suggestion, and (5) further observation and experiment leading to its acceptance or rejection; that is, the conclusion of belief or disbelief. Based on Dewey's steps, Baron (1981) proposes a general normative (prescriptive) model for reflective thinking and states five phases for it: (1) problem recognition, (2) enumeration of possibilities, (3) reasoning, (4) revision, and (5) evaluation. In summary, reflective thinking starts with the awareness of a problem or an issue and uncertainty about its solution, and the carries on with the formulation of ideas about a solution and the collection of evidence which may confirm or disconfirm some of the original ideas (Kitchener, 1984).

This study employs a bibliometric approach to map the research literature on reflective thinking using the metadata from the Web of Science (WoS) between 1986 and 2023. This research, which is the first study on reflective thinking conducted through bibliometric analysis, is significant in terms of its results and especially in terms of presenting a method based on analytical tools for future research on reflective thinking.

## **Method**

This study aims to examine the current state and development of research in RT based on the data available in the Web of Science (WoS). This study adopts bibliometric analysis of the research conducted on "reflective thinking". Bibliometrics basically aims to evaluate the scientific literature in a particular field, and it has wide applicability for all fields of science (Andrés, 2009). The term "bibliometrics" was first used by Pritchard in 1969 (Andrés, 2009). He defined the term as "the application of mathematics and statistical methods to books and other media of communication. It is the metrology of the information transfer process; its purpose is analysis and control of the process. In summary, bibliometrics is the scientific study of recorded discourse". Similarly, Aktoprak and Hursen (2022) state that bibliometrics deals with the statistical and quantitative analysis of certain characteristics of publications, such as the author(s), subjects, publication information, and cited sources. Apart from bibliometrics, there is a relatively similar term called "scientometrics" which is defined as the study of the quantitative aspects of science as a discipline or economic activity (Rousseau, Egghe & Guns, 2018; Sooryamoorthy, 2021; Szántó-Várnagy et al., 2014). Initially, scientometrics was restricted to the measurement of science communication, while bibliometrics was designed to deal with more general information processes (Andrés, 2009). However, at present, it can be said that the terms scientometrics and bibliometrics can be used in the same meaning.

## **Data Creation Process**

In this study, Clarivate's Web of Science (WoS) index was used as a data source. The literature on Reflective Thinking (RT) in WoS was mapped with a bibliometric approach. Mongeon and Paul-Hus (2016) stated that WoS and Elsevier's Scopus indexes are frequently used in bibliometric and scientometric studies. While obtaining the research literature data on RT from WoS, the following filtering steps in Figure 1 were followed. The data set created through the process in Figure 1 included 501 studies on RT. In this data set, publication year, the number of citations, the author(s), the institution/organization, the country, the journal, and the metadata of the cited sources, as well as the title, summary and keywords of the documents were included.

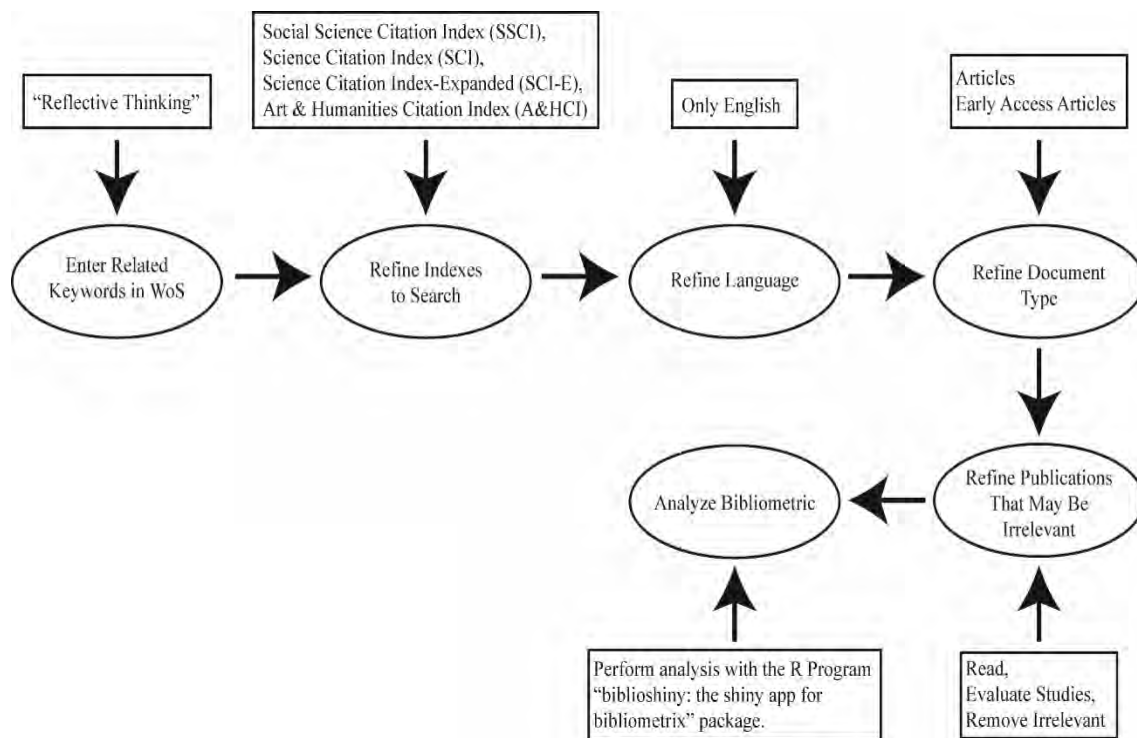


Figure 1. Data Creation Process

## Data Analysis

In this study, data analysis was conducted using a free software, R. The package that enables bibliometric analysis in the R program is the “bibliometrix” package developed by Aria and Cuccurullo (2017). Analyses were carried out using this package. By means of this software, the date ranges and number of the studies included in the study, the annual increasing trend of the studies, the number of authors, the international author collaboration status, the reference statistics used, the average of publications per year, the average amount of citations per research are described.

The prominent sources and the most cited sources in the research were determined. In terms of authors, the authors most relevant to RT, the most cited authors, the scientific publication production of these authors by years, the countries where the authors have conducted the research, and the most cited countries about RT were examined. In the context of the research document (article), the frequently used words in the documents, the word cloud, the frequency and trend of the keywords in the documents per year, the trend topics, the network showing the proximity or similarity in the words were analysed.

## Results

### Distribution of the Articles about Reflective Thinking (RT) by Year of Publication and Average Citation Status

To map the literature on a certain research topic, field or a discipline, it can be a good indicator to examine the change in publications and the citation status by year. Between 1986 and 2023, 501 articles were determined on

reflective thinking in WoS. The publication trend of the articles by year can be seen in Figure 2.

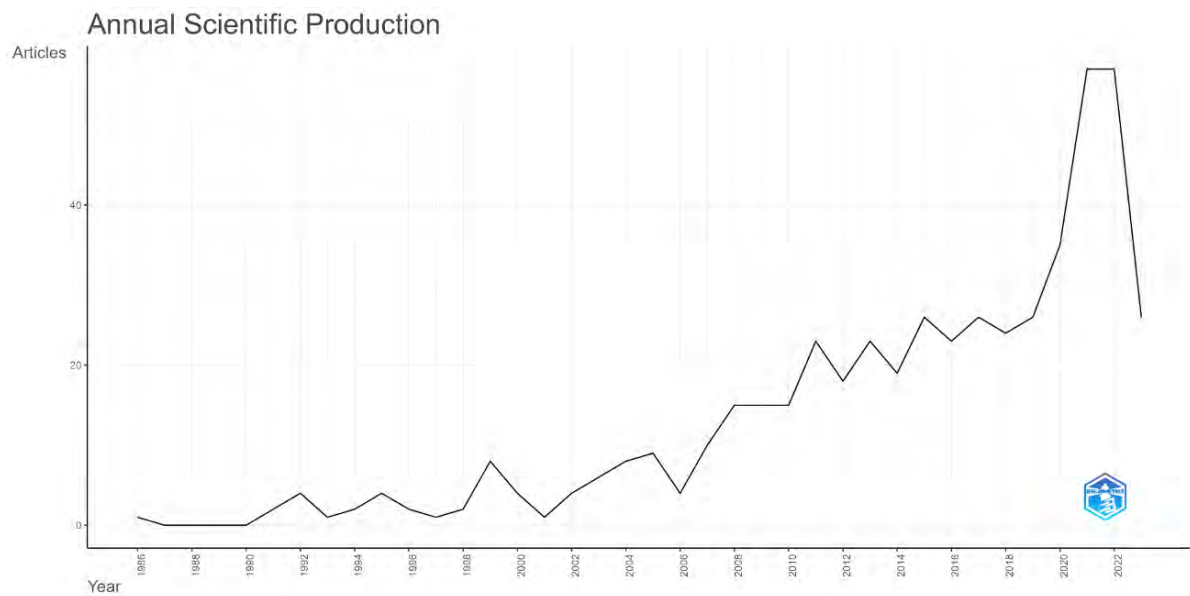


Figure 2. Article Publication Trend by Year

Although there are some slight fluctuations in RT articles from 1986 to 2006, it can be said that there is a production trend that is stable. It was determined that 63 articles were published between these years. As of 2006, a steady increase was seen until 2018. 237 articles were published in 2007-2018. There is a peak in the trend in RT articles published in 2020, 2021 and 2022. It was determined that 35 articles were published in 2020, 57 articles in 2021 and 57 articles in 2022. In June 2023, until this study was conducted, 26 articles were published. If the same trend continues, the number of articles produced in 2023 is likely to exceed 50. In addition, during these years, an average of 23.32 citations was received per article.

It was also found that the highest increase in citations to RT articles was in 1996 (average 196 citations) and 2002 (average 206.5 citations). Although it has not reached the peak points, other high citation years are 2004 (average 75.12 citations), 2005 (average 68.56 citations), 2008 (average 49.53 citations), 2010 (average 58.73 citations) and 2015 (average 28.12 citations). There has been a decrease in citations to RT articles in recent years.

Hernández-Torrano and Ibrayeva (2020) state that there is a typical developmental pattern of a discipline which occurs in four stages: (1) small number of researchers beginning to produce research exploring new ideas and theoretical frameworks, (2) a higher number of researchers generate an exponential increase in publications in a field, (3) a field maturation in which the number of publications stabilizes, and then declines when interest in the area reduces, and (4) other ideas are developed through new relations in the field. Research on RT seems to be currently between the 3rd and 4th stages of this developmental pattern. In addition, the rise of research on RT after 2018 may be due to the development of constructivist learning theories and the studies that seeks for its relationship with learning strategies and achievement. However, although the number of publications about RT have increased as of 2018, the number of citations that those publications received shows a trend of decline.

### Most Productive Journals Publishing on RT and Number of RT-Related Citations

501 articles on RT in WoS were published in 278 different journals. Among these, the most productive journals that published articles on RT and the number of citations related to RT are shown in Table 1.

Table 1. Most Productive Journals Publishing on RT and Number of RT-Related Citations

Journal	Document*	Citations
Computers & Education	15	351
Thinking Skills and Creativity	15	90
Sustainability	14	43
Frontiers in Psychology	11	72
Teaching and Teacher Education	9	297
Journal of Advanced Nursing	8	5
Educational Technology Research and Development	7	80
Education and Information Technologies	6	1
Eğitim ve Bilim-Education and Science	6	1
Instructional Science	6	73
Journal of Nursing Education	6	91
Nurse Education Today	6	125
British Journal of Educational Technology	5	91
Interactive Learning Environments	5	39
Journal of Educational Research	5	31
Judgment and Decision Making	5	98
Kuram ve Uygulamada Eğitim Bilimleri	5	9
Teachers and Teaching	5	7

*Note.* Table 1 shows the journals that have published 5 and more than 5 RT articles by June 2023.

It can be said that the most productive journals which published articles on RT are (1) Computers & Education, (2) Thinking Skills and Creativity, (3) Sustainability, and (4) Frontiers in Psychology. It was determined that these four journals published 11% of the total publications on RT. Computers & Education started publication in 1976 and published its 203rd volume by June 2023. The impact factor of the journal by June 2023 is 11.1. It is a journal that “aims to increase knowledge and understanding of ways in which digital technology can enhance education, through the publication of high-quality research, which extends theory and practice.” Thinking Skills and Creativity was launched in 2006 and has published its 49th volume by June 2023. The impact factor of the journal by June 2023 is 3.6. The journal aims to identify and detail critical issues in the future of learning and teaching of creativity, as well as innovations in teaching for thinking.” Sustainability is a journal that started publication in 2009 and published its 15th volume by June 2023. The impact factor of the journal by June 2023 is 3.9. It is an international and interdisciplinary open access journal on the technical, environmental, cultural, economic and social sustainability of people, providing an advanced forum for studies related to sustainability and sustainable development. Frontiers in Psychology is a journal that started to publish articles in 2007. By 2023, the impact

factor of the journal is 4.2. It is “the largest journal in its field, publishing rigorously peer-reviewed research across the psychological sciences, from clinical research to cognitive science, from perception to consciousness, from imaging studies to human factors, and from animal cognition to social psychology”.

According to the above-mentioned findings, it can be said that RT research has been mostly published in journals related to digital technology in education, thinking skills, creativity, sustainability, and psychology. While Computers & Education, Thinking Skills and Creativity, Sustainability, and Frontiers in Psychology are the journals that publish the most RT research, the most cited journals are Computers & Education, Teaching and Teacher Education, and Nurse Education Today. Journals indexed in the WoS database were cited 26.752 times for the articles on RT. Computers & Education, Teaching and Teacher Education, and Nurse Education Today took on 3% of the total number of citations. The average number of citations per research document of 501 studies published on RT between 1986 and 2023 is 23.32. The annual growth rate in research articles published on RT is 9.2%.

### **Most cited Reflective Thinking (RT) Articles and Authors**

Another finding obtained from the search for RT articles in WoS is about the most cited articles and their authors. The most cited RT articles and their authors are shown in Table 2.

Table 2. Most Cited/Influential Articles about Reflective Thinking (RT) and Their Authors

Manuscript Title	Journal	Authors	Citations*
Defining reflection: Another look at John Dewey and reflective thinking	TCR	Rodgers (2002)	661
The influence of personality traits and demographic factors on social entrepreneurship start up intentions	JBE	Koe Hwee Nga & Shamuganathan (2010)	329
Reflective judgment: Theory and research on the development of epistemic assumptions through adulthood	EP	King & Kitchener (2004)	286
How does desktop virtual reality enhance learning outcomes? A structural equation modeling approach	CE	Lee et al. (2010).	267
The expert learner: Strategic, self-regulated, and reflective	IS	Ertmer & Newby (1996)	267
Assessing the level of student reflection from reflective journals	JAN	Wong et al. (1995)	213
Understanding and assessing preservice teachers' reflective thinking	TTE	Lee (2005)	205
Standards of best practice: Simulation standard VI: The debriefing process	CSN	Decker et al. (2013)	198
Tweeting for learning: A critical analysis of research on microblogging in education published in 2008–2011	BJET	Gao et al. (2012)	196



Manuscript Title	Journal	Authors	Citations*
A four-category scheme for coding and assessing the level of reflection in written work	AEHE	Kember et al. (2008)	183
Dual-process theories of reasoning: Contemporary issues and developmental applications	DR	Evans (2011)	178
Designing technology to support reflection	ETRD	Lin et al. (1999)	160
A new way of teaching programming skills to K-12 students: Code.org	CHB	Kalelioğlu (2015)	160
Organizational Learning: The ‘Third Way’	ML	Elkjaer (2004)	159
Theory and practice in health communication campaigns: A critical interrogation	HC	Dutta-Bergman (2009)	155
The effect of peer feedback for blogging on college students' reflective learning processes	IHE	Xie et al. (2008)	152
Demystifying reflection: A study of pedagogical strategies that encourage reflective journal writing	TCR	Spalding & Wilson (2002)	150

*Note.* Table 2 shows the articles that received more than 150 citations until June 2023. **TCR**: Teachers College Record; **JBE**: Journal of Business Ethics; **EP**: Educational Psychologist; **CE**: Computers & Education; **IS**: Instructional Science; **JAN**: Journal of Advanced Nursing; **TTE**: Teaching and Teacher Education; **CSN**: Clinical Simulation in Nursing; **BJET**: British Journal of Educational Technology; **AEHE**: Assessment & Evaluation in Higher Education; **DR**: Developmental Review; **ETRD**: Educational Technology Research and Development; **ML**: Management Learning; **CHB**: Computers in Human Behavior; **HC**: Health Communication; **IHE**: The Internet and Higher Education

Table 2 indicates the most cited articles on RT by the number of citations they received. When these articles are examined, it has been determined that they are related to the topics “reflection”, “reflective thinking”, “social entrepreneurship”, “reflective judgment”, “virtual reality enhance learning”, “self-regulated and reflective”, “learning”, “reasoning”, “designing technology”, “organizational learning”, “peer feedback”, and “students' reflective learning”. The most cited publications were published between 1995 and 2015. The journals in which these publications were published are mostly the journals which accept articles in the field of “education”. This finding is also in line with the literature in that reflective thinking, has been among the topics which have an increasing volume of research for years in many disciplines, particularly education (Ariany, Rosjanuardi & Juandi, 2023; Hong et al., 2023; Zach & Ophir, 2020).

### Top countries in Which the Articles about Reflective Thinking (RT) were Cited Most

Another finding obtained as a result of the search for reflective thinking articles in WoS is about the top countries where the most cited publications on RT research belong to. Top countries in which the articles about RT were cited are shown in Figure 3. The USA is the leading country in which RT articles were most cited. Other countries which have high citation ranks in RT articles include China, United Kingdom, Australia, Turkey, Canada, Malaysia, Finland, Fiji, Netherlands, and Hong Kong. There are several reasons to explain why the USA is leading the research on RT. First, the term reflective thinking has its roots in the United States by John Dewey and advances in the early stages of the field were linked to the contributions of American philosophers such as Donald

Alan Schön, who was a professor at one of the leading universities in the world (Massachusetts Institute of Technology).

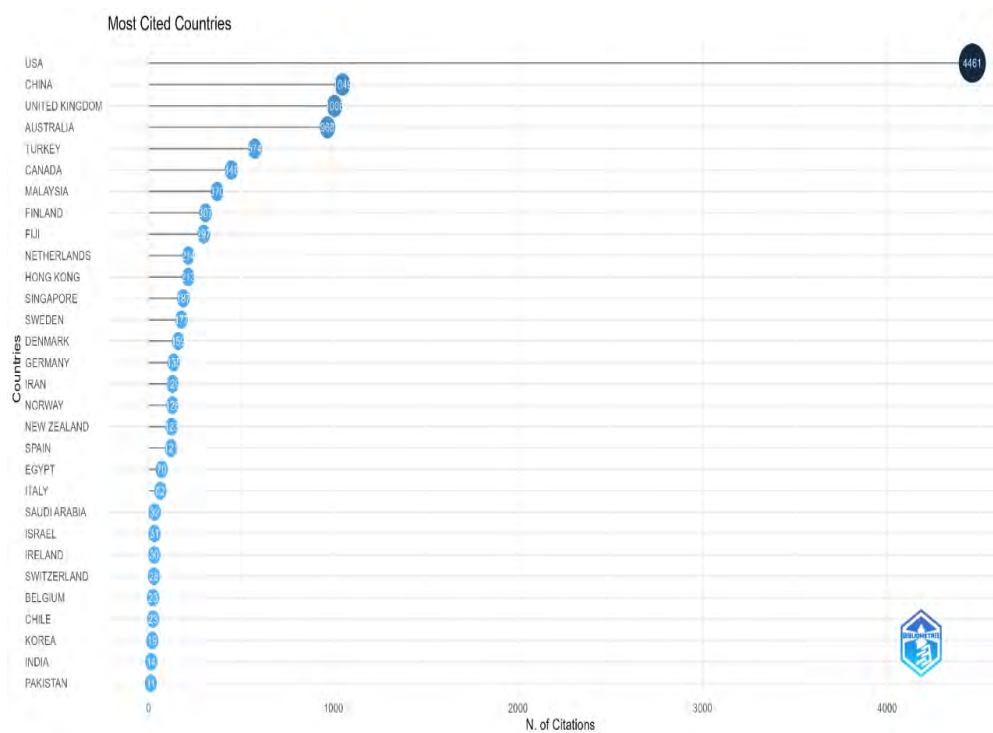


Figure 3. Top Countries Ranked by Number of Citations about the RT Articles

### The Authors Who Have Produced the Most Articles on Reflective Thinking (RT), Their Publications and Corresponding Author(s)' Countries

The authors who produced the most publications on the subject of RT in WoS were determined. These authors are shown in Figure 4.

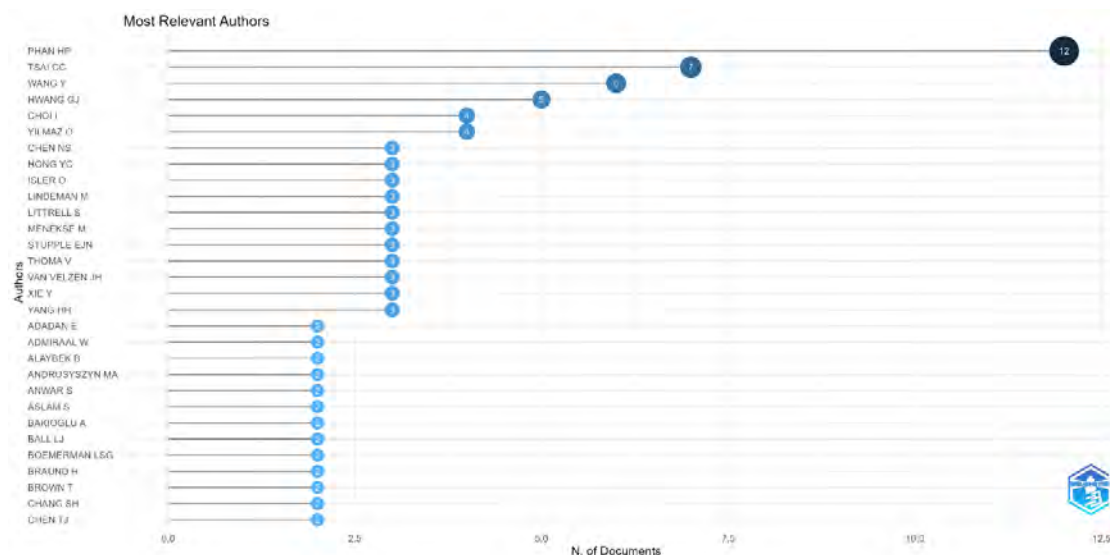


Figure 4. The Authors with the Highest Number of Publications about RT

The author with the highest number of articles on reflective thinking is Huy P. Phan, a professor in the Department of Educational Psychology, Teaching and Learning (Education) at the University of New England: Armidale, and he has produced 12 publications on reflective thinking. Chin-Chung Tsai, a professor at the National Taiwan Normal University: Taipei, Program of Learning Sciences & Institute for Research Excellence in Learning Sciences, is another author who has a high number of publications on reflective thinking. Ying Wang takes the third place with 6 publications. Gwo-Jen Hwang is ranked 4th with 5 publications, followed by Ikseon Choi and Onurcan Yılmaz with 4 publications each. It has been determined that the researchers who have the highest number articles about RT are mostly from the Far East. The articles of the first two researchers who published the most are shown in Table 3.

Table 3. The Authors with the Highest Number of articles about RT and their Publications

Manuscript Title	Journal	Authors*	Citations
Reflective thinking, effort, persistence, disorganization, and academic performance: A mediational approach	EJREP	Phan (2009)	8
Exploring students' reflective thinking practice, deep processing strategies, effort, and achievement goal orientations	EP	Phan (2009)	70
Predicting change in epistemological beliefs, reflective thinking and learning styles: A longitudinal study	BJEP	Phan (2008)	60
An examination of reflective thinking, learning approaches, and self-efficacy beliefs at the university of the South Pacific: A path analysis approach	EP	Phan (2007)	67
Self-efficacy, reflection, and achievement: A short-term longitudinal examination	JER	Phan (2014)	19
Unifying different theories of learning: theoretical framework and empirical evidence	EP	Phan (2008)	38
Expectancy-value and cognitive process outcomes in mathematics learning: a structural equation analysis	HERD	Phan (2014)	8
Examination of student learning approaches, reflective thinking, and epistemological beliefs: A latent variables approach	EJREP	Phan (2006)	32
Deep processing strategies and critical thinking: Developmental trajectories using latent growth analyses	JER	Phan (2011)	23
Critical thinking as a self-regulatory process component in teaching and learning	P	Phan (2010)	34
Relations between goals, self-efficacy, critical thinking and deep processing strategies: a path analysis	EP	Phan (2009)	65
Amalgamation of future time orientation, epistemological beliefs, achievement goals and study strategies: Empirical evidence established	BJEP	Phan (2009)	62
Preferences toward the constructivist internet-based learning environments among high school students in Taiwan	CHB	Chuang & Tsai (2005)	48
Exploring high school students' and teachers' preferences toward the	ES	Lee & Tsai	27

Manuscript Title	Journal	Authors*	Citations
constructivist internet-based learning environments in Taiwan		(2005)	
Cognitive-metacognitive and content-technical aspects of constructivist internet-based learning environments: a LISREL analysis	CE	Wen et al. (2004)	37
Preferences toward internet-based learning environments: High school students' perspectives for science learning	ETS	Tsai (2005)	22
Self-directed learning readiness, internet self-efficacy and preferences towards constructivist internet-based learning environments among higher-aged adults	JCAL	Chu & Tsai (2009)	66
The preferences toward constructivist internet-based learning environments among university students in Taiwan	CHB	Tsai (2008)	52
Exploring high school students' views regarding the nature of scientific theory: A study in Taiwan	APER	Wen et al. (2010)	9

*Note.* Table 3 shows the works of only two authors with the highest number of publications about RT by June 2023. **EJREP**: Electronic Journal of Research in Educational Psychology; **EP**: Educational Psychology; **BJEP**: British Journal of Educational Psychology; **JER**: Journal of Educational Research; **HERD**: Higher Education Research & Development; **P**: Psicothema; **CHB**: Computers in Human Behavior; **ES**: Educational Studies; **CE**: Computers & Education; **ETS**: Educational Technology & Society; **JCAL**: Journal of Computer Assisted Learning; **APER**: The Asia-Pacific Education Researcher

In the studies of researchers who have the highest number of articles on RT, it is found that the RT is mostly paired with the topics such “academic performance, deep processing strategies, achievement goal orientations, learning styles, learning approaches, self-efficacy beliefs, cognitive process outcomes, epistemological beliefs, critical thinking, self-regulatory process, study strategies, constructivist internet-based learning environments, cognitive metacognition, self-directed learning readiness, mathematics, and science learning. The graph of the countries of the corresponding authors who have articles on RT is shown in Figure 5.

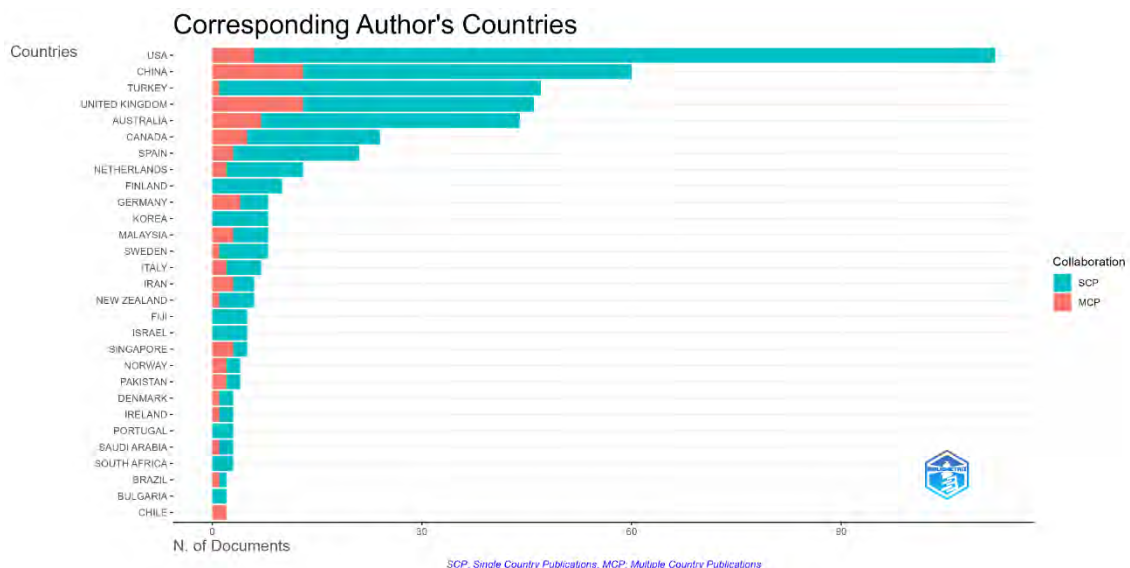


Figure 5. The Countries of the Corresponding Authors Who Have Articles on RT

When the countries of the corresponding authors who have articles about RT and the most RT article production rates according to these countries are examined, The USA is the leading country, followed by China, Turkey, United Kingdom, Australia, Canada, Spain, Netherlands, Finland, Germany, Korea, Malaysia, Sweden, Italy, Iran, New Zealand, Fiji, Israel.

### Trend of Words Associated with Reflective Thinking (RT) in the Articles

A co-occurrence analysis of keywords in the abstract, and keyword list of the publications in the dataset was conducted to reveal the general themes or word groups on reflective thinking. The results are shown in Figure 6. In Figure 6, the colour intensity and font size of terms related to reflective thinking are proportional to the frequency or significance of these terms within the analysed papers. Higher colour intensity and larger font size indicate stronger associations or more frequent occurrences of these terms.



Figure 6. The Co-Occurrence of the Words Associated with RT in the Articles

As can be seen from Figure 7, the word “reflective thinking” in the articles is mostly used with the words "education", "students", "performance", "knowledge", "perceptions", "motivations", "skills", "thinking", "model", "achievement", "attitudes", "reflective thinking", "strategies", "teachers", "level", "technology", "beliefs", "cognitive reflections", "impact", "individual differences", "science", "framework", "reflection", "gender", "judgment", "decision-making", "classroom", "experience", "feedback", "inquiry", "experiences" and "stress". The popularity or trend of these words was also examined by year. The results are shown in Figure 7.

In 2005-2010, the words "anxiety", "South-Pacific", "epistemological beliefs", "achievement goals" and "gender" were frequently used in articles about reflective thinking. In publications between 2011 and 2015, the word trend is "anxiety", "achievement goals", "construction", "gender", "tool", "outcomes", "student-teachers", "university", "nurse", "student". The words "reflective thinking", "model", "educations", "beliefs", "motivations", "knowledge", "perceptions", "performance" and "strategies". Word trend in the articles on reflective thinking in 2016-2020 is "anxiety", "gender", "outcomes", "student-teachers", "university", "student", "reflective thinking", "model", "education", "decision-making", "beliefs", "motivation", "knowledge", "perceptions", "performance", "stress",

"feedback", "individual differences", "strategies", "teachers", "skills", "bias", "achievement" and "experiences". The word trend in the articles after 2020 is "gender", "reflective thinking", "model", "motivation", "knowledge", "perceptions", "performance", "stress", "feedback", "individual differences", "strategies". The words "teachers", "skills", "bias", "cognitive reflection", "achievement" and "experiences". The use of words as a network and word proximity is shown in Figure 8.

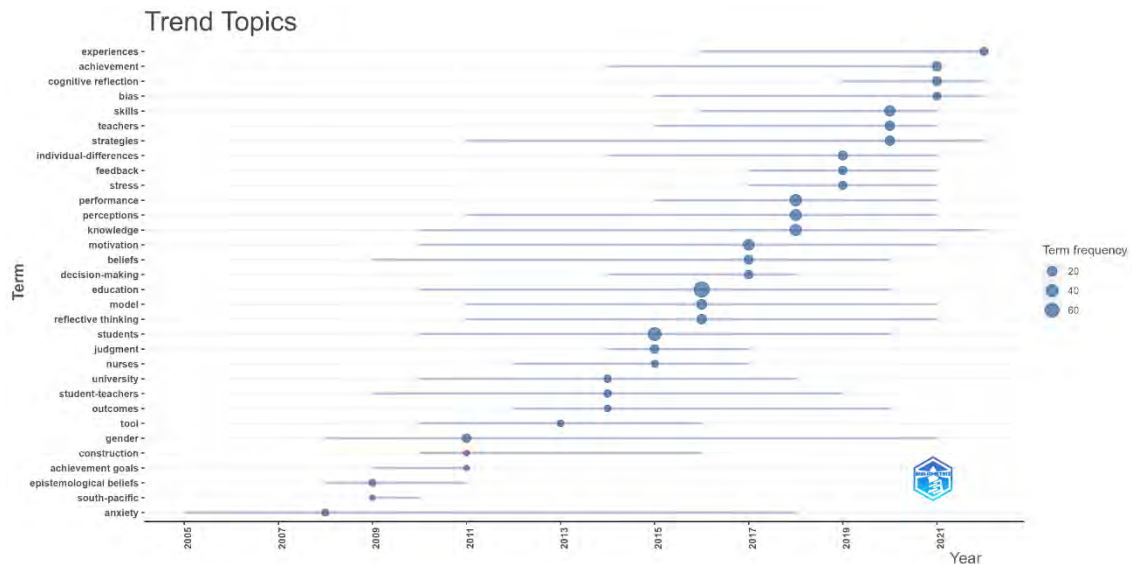


Figure 7. The Trend of the Words used within the Articles about RT

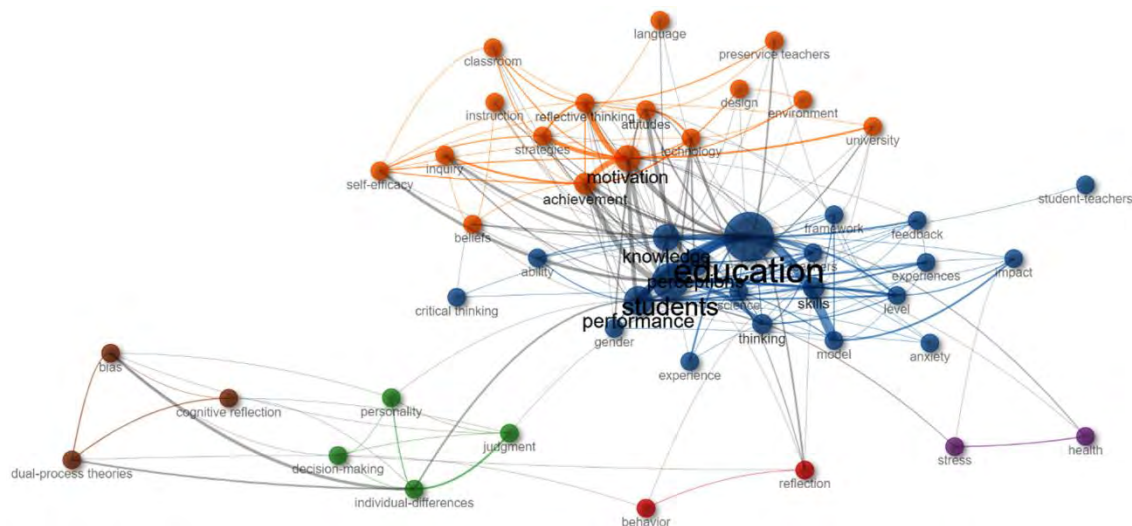


Figure 8. Word Network in the Articles about RT

The word "education" formed the first group in the word network "knowledge, students, perceptions, performance, gender, science, thinking, experience, skills, feedback, ability, critical thinking". The word "motivation" formed the second group in the word network "achievement, technology, strategies, attitudes, reflective thinking, instruction, design, environment, inquiry, language, classroom, preservice teachers, self-efficacy, classroom, university". The words "personality", "judgment", "individual differences" and "decision-making" formed a group on the outer periphery as well as the words "bias", "dual process theories", and "cognitive reflection". The words

"behaviour" and "reflections" formed another group on the outer periphery. The words "stress" and "health" formed the last group on the outer periphery. These findings suggest that RT has a broad concept ranging from education, motivation, and various psychological factors. Firstly, the centrality of "education" within the network underscores its foundational role in shaping students' knowledge, perceptions, and performance. Education serves as the cornerstone upon which other elements such as skills, feedback, and critical thinking are built. On the other hand, "motivation" emerges as a key driver of achievement, intertwined with factors like technology, instructional strategies, and attitudes, which highlights the importance of fostering a motivating environment in educational settings, to enhance learning outcomes. In addition, words like "personality," "judgment," and "individual differences" form a distinct cluster on the periphery, suggesting their significance in understanding how individuals' unique traits and decision-making processes influence their learning experiences. Additionally, the terms like "bias," "dual process theories," and "cognitive reflection" reflects the deeper exploration of cognitive mechanisms and biases that shape educational practices and outcomes. Furthermore, the grouping of "behaviour" and "reflections" on the outer periphery hints at the interplay between actions and self-awareness in the learning process, emphasizing the importance of metacognition and self-reflection. Lastly, the inclusion of "stress" and "health" in the outermost group underscores the recognition of the holistic nature of education, acknowledging the impact of mental and physical well-being on learning and academic performance. These interrelationships can inform the development of more effective teaching strategies and educational interventions aimed at maximizing students' potential and well-being.

## **Conclusion**

This study aims to examine the current state and development of research in reflective thinking (RT) based on the data available in the Web of Science (WoS). The results show that reflective thinking research is still an emergent field of study when the article publication trend by year is considered, especially after 2018. In addition, it can be concluded from analysis of the co-occurrence of the words associated with RT in the articles that researchers in this field have investigated a wide range of topics and topics that can be grouped into two broad categories: "education" and "motivation". When we consider these categories, we believe that the field of reflective thinking studies will continue to remain a developing area of research in the future. However, the results also indicate that the research about reflective thinking is limited to those journals which mostly publish articles about digital technology in education, thinking skills, creativity, sustainability, and psychology. The number of journals that publish articles about reflective thinking should be increased as the field has been given of great importance in educational contexts. Another finding was that the USA is the leading country in which RT articles were most cited and which has the highest production rates.

As no studies can be without limitations, the findings of this bibliometric study are limited in scope as the search only considers the findings of research in the WoS database. In other words, it does not include the findings of the literature by using alternative databases such as Scopus, ERIC, PsyInfo, PubMed, etc. Another limitation is that this study does not include other types of publication such as books, book chapters or conference proceedings. Despite these limitations, we believe that this study provides a comprehensive review of the literature on reflective thinking and provides interesting insights about the development of the field for future research.

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