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# TRENDS AND OPPORTUNITIES IN FUN SCIENCE LEARNING FOR EARLY CHILDHOOD: A BIBLIOMETRIC ANALYSIS (2014–2023)

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***Abstract:*** *This research aims to analyze research trends in fun science learning for early childhood, visualize existing research trends, and find novelty opportunities for future research based on analysis of research themes that have been carried out so far. This research uses bibliometric techniques using the Scopus database, conducted on 27 September 2024, with the keywords "fun science learning for early childhood." Data files from the Scopus database are downloaded in .csv and .ris formats and visualized using the VOSViewer application. The analysis was carried out over the last ten years, from 2014 to 2023, with 4.204 documents. Based on the results of the study, it was found that the research trend regarding science learning for early childhood has increased from year to year; apart from that, there are also four clusters in the VOSViewer visualization, and opportunities for novelty can be seen from several keywords including children development, childhood education, science learning, early childhood teacher, playful learning, pedagogical practice, early childhood education, and preschooler. These keywords are the findings of this research. Further research can use these keywords in research on fun science learning for early childhood to find greater possibilities for novelty.*

***Keywords:*** *Fun Science Learning, Early Childhood, Bibliometric, VOSViewer*

## A. Introduction

Early childhood education must consider aspects of developing personal habits and basic abilities. Developing personal habits includes spiritual attitudes, social attitudes, knowledge, and skills. Developing basic abilities includes religious and moral values, physical motor, cognitive, social-emotional, language, and art (Sadiah & Lestari, 2020). Education is important for early childhood because this period is essential for laying the foundation for developing children's various potentials and characters (Kasmiati, 2024). Increasing knowledge, skills, attitudes, and character formation in children depends on the things seen, obtained, and taught to children in this period (Kurnia, 2019).

Children always have a high curiosity. They have a natural tendency to explore nature. Early Childhood Children actively study their environment to understand the phenomena they observe and experience. Indirectly, they also build essential science process skills such as observing, classifying, and sorting. Children are natural scientists, not only because they are always curious and energetic but also because they have an instinct for simple experiments (Setiawan & Tatminingsih, 2013).

Introducing science to children does not mean introducing complicated formulas and concepts. Teaching science to children should be in a fun atmosphere, bringing children closer to nature and developing thinking and scientific process skills (Wijaya & Dewi, 2021).

Fun science learning will make children happy. Next, the child will ask why that is, what happened next, and others. Introducing science to children must be appropriate to their age and development stages. Most of early childhood is spent with parents, so parents or teachers need to spend a little time playing with their children. In that play situation, we can do simple and fun science experiments (Marsetyaningrum, 2018).

In principle, fun science learning is the ability to increase students' interest in studying science (Irwansyah et al., 2019). Fun in learning is an expression of students' emotions related to students' motivation to learn and their activeness in participating in the entire science learning series. Students' love of science can be shown by how students can be open and enthusiastic about learning science both inside and outside the classroom. Students

who enjoy learning science will have a more positive attitude than those who don't like science lessons. Students unhappy with science learning tend to be passive and lazy during the learning process (Sulistioning et al., 2020).

Not all science material can be introduced to young children. Generally, only material is light and close to everyday life. Science material or science activities that can be given to young children include recognizing movement, recognizing liquid objects, sinking and floating, recognizing scales or balances, playing with soap bubbles, mixing colors and substances, recognizing elastic objects, playing with air, playing with shadows, doing simple experiments, getting to know fire and burning, getting to know ice, playing with sand, playing with sounds, playing with magnets, and loving animals (Amalia et al., 2018).

Science for early childhood is a science that targets early childhood and how to understand science from a child's perspective. The fundamental competencies children must have in science are recognizing various simple concepts related to their daily lives. Such as changes that occur in multiple colors when mixed, the condition of objects put into water, or trying to distinguish various tastes, smells, or sounds. Children are trained to recognize multiple symptoms of objects or events using their five senses. The more the senses are involved in learning, the more children understand what is being learned and gain new knowledge from their senses with various objects around them. The learning experiences that children gain through observing, imitating, or experimenting simply in their environment repeatedly will affect the child's entire potential and intelligence (Izzuddin, 2019a).

Early childhood teachers have an essential role in science education (Nurkholisoh, 2020). Teachers should provide learning activities that enable children to discover simple facts and concepts for themselves (Izzuddin, 2019b). However, teachers' lack of knowledge in science makes science less interesting for children. Many preschool teachers report limited science knowledge, which is a particular concern, especially as teachers are required to teach science that is fun for early childhood.

Apart from teachers, parents also have an essential role in introducing and teaching science to children. This is because parents are the first teachers of children. Children need special

treatment and attention. Many examples show that parents and society do not understand children's development and tend to impose their will on them (Fazat Azizah et al., 2020). Parents' attention to their children's learning activities greatly influences their children's interest in learning wherever they are, at home or school (Arum Sekar Sari, 2021).

This research aims to analyze research trends in fun science learning for early childhood, visualize existing research trends, and find novel opportunities for future research based on analysis of research themes that have been carried out so far. This will allow future research to be directed at areas with minimal research, increasing the chance of finding a novelty.

## B. Method

This research uses bibliometric techniques (Deta et al., 2021; Noor & Asriyadin, 2023; Noor & Prasetyo, 2022; Suprapto, Kholiq, et al., 2021). Bibliometric analysis is a popular and rigorous method for exploring and analyzing large volumes of scientific data (Donthu et al., 2021). Conducting bibliometric research involves five steps: determining keywords, starting a search, refining the search, compiling initial data statistics, and data analysis (Hidayatullaah et al., 2021; Suprapto, Sukarmin, et al., 2021).

1) Research process and metadata collection

Data was obtained from the Scopus database on 27 September 2024 using the keyword "fun science learning for early childhood" to obtain 5.873 documents. The analysis stage will then be carried out for the last ten years of data, starting from 2014 to 2023, with 4.204 documents. More detailed information will be presented in Figure 1.

2) Data Analysis

VOSViewer and Microsoft Excel were used to present the bibliometric analysis. The VOSViewer application has various features that can visualize in-depth bibliometric analysis. Scopus files in .csv and .ris format are uploaded into the VOSViewer application (Mokhtari, 2019). Furthermore, Excel and .jpg files were downloaded and used for data analysis. Next, a visual presentation is obtained from the results of the VOSViewer

application. VOSviewer software can display images or graphics (Maz-Machado et al., 2022).

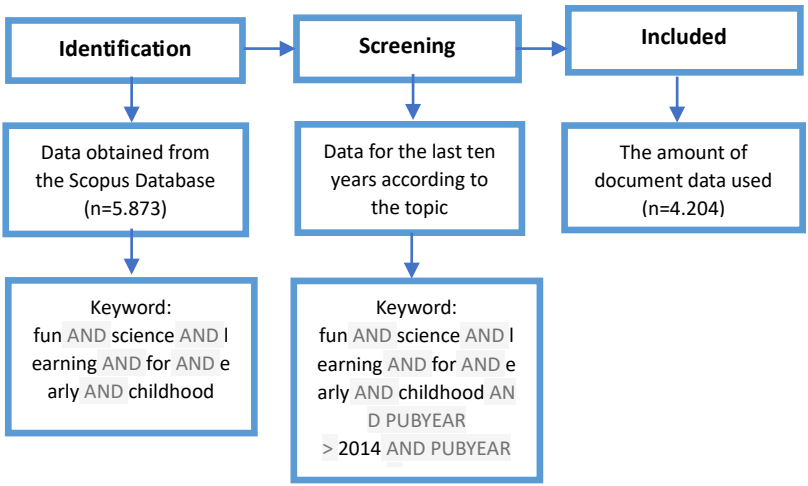


**Figure 1**. Research Process and Metadata Collection
Source: (Suprapto et al., 2024) adapted

## C. Result and Discussion

1) Distribution of fun science learning for early childhood documents every year

Figure 2 shows the number of documents produced yearly over the last ten years, obtained from the Scopus database. The number of documents appears to have increased from 2014 to 2023, with the most significant increase between 2020 and 2021.

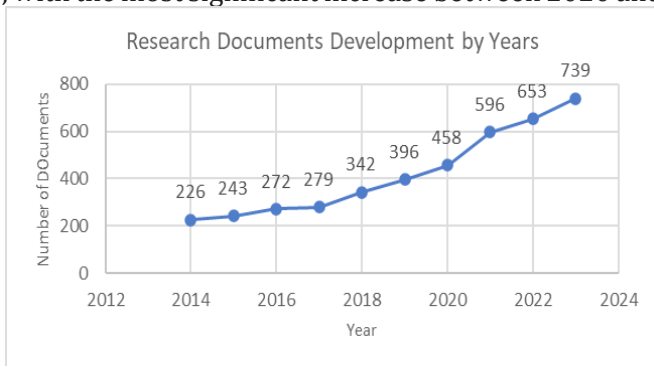


**Figure 2**. Research Documents Development by Years

The increased research on fun science learning for early children from year to year is excellent news for developing science teaching for early childhood. Our understanding of science learning in early childhood has increased exponentially, and today, we have a strong, experiential knowledge of science for children (O'Connor et al., 2021).

2) The number of documents based on source type

The distribution of documents can be seen based on the source type of documents in Figure 3. Based on the figures, it appears that the most common source of fun science learning for early childhood documents is carried out using journals with a total of 2.745 documents. However, there is at least 1 document in the trade journal. It can be realized that online journals through the open journal system have developed very rapidly. Apart from that, author rankings can be seen from article documents published in journals of international reputation. The following is the distribution of papers based on source type.

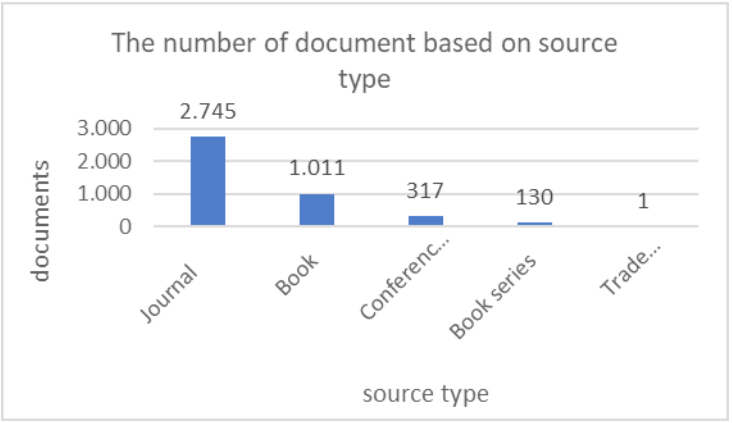


**Figure 3**. The Number of Documents Based on Source Type

In Figure 3, the most significant number of documents is in journal form. Online journals or journals in electronic format are an alternative that journal managers can utilize. Besides the effectiveness of journal administration and management, most online journal platforms are open-source and free. One widely used and quite reliable online journal platform is OJS (Open Journal System) (Handoko, 2016).

3) The authorship pattern and prolific author of the document

The data presented in this research is limited to the five authors who have done the most work. Research on fun science learning for early childhood is dominated by Hirsh-Pasek, Kathy (6701837427), affiliated with The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, 20036, DC, United States, with a total of 21 documents. Meanwhile, the researcher with the fifth highest number of documents is Lapidow, Elizabeth (57194171013), affiliated with the Department of Psychology, University of Waterloo, Waterloo, ON, Canada, with 9 documents. The top Author in Researching Fun Science Learning for Early Childhood can be seen in Figure 4.

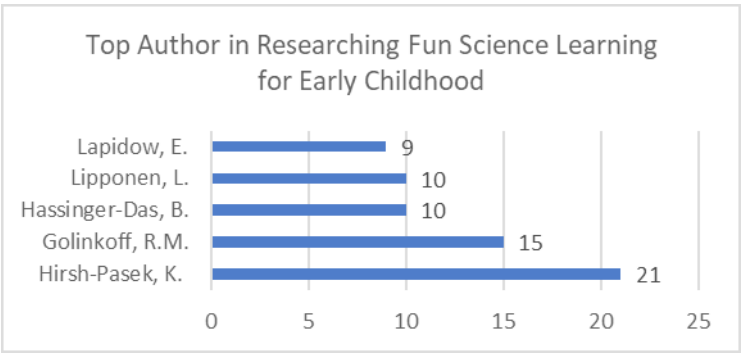


**Figure 4**. Top Author in Researching Fun Science Learning for Early Childhood

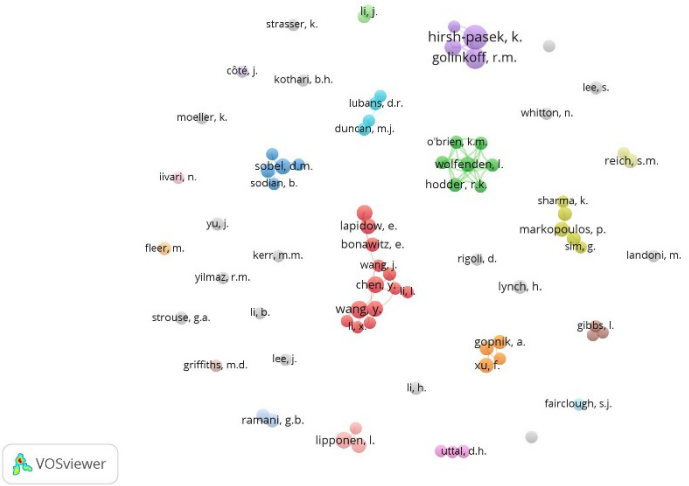


**Figure 5**. Network Visualization of Co-authorship

4) The Number of documents based on affiliation

The University of Toronto appears as the affiliate with the highest number of documents, amounting to 50. Table 1 shows the ten author affiliations with the most significant number of documents. Table 1 shows that the affiliation in the last ten is Temple University, with 30 documents. Apart from these affiliations, table 2 shows the number of documents from affiliated authors from Indonesia. Even though it is not in the top ten, the number of documents produced by affiliates from Indonesia is something to be proud of, and productivity must be increased.

**Table 1**. The Number of Documents by Affiliation

| No | Affiliation | Documents |
|---|---|---|
| 1 | University of Toronto | 50 |
| 2 | University College London | 35 |
| 3 | University of Michigan, Ann Arbor | 35 |
| 4 | University of Melbourne | 33 |
| 5 | Deakin University | 32 |
| 6 | Helsingin Yliopisto | 30 |
| 7 | The University of British Columbia | 30 |
| 8 | The University of Newcastle, Australia | 30 |
| 9 | The University of Sydney | 30 |
| 10 | Temple University | 30 |

**Table 2**. The Number of Documents by Affiliation from Indonesia

| No | Affiliation | Documents |
|---|---|---|
| 1 | Universitas Negeri Jakarta | 16 |
| 2 | Universitas Negeri Yogyakarta | 14 |
| 3 | Universitas Negeri Semarang | 10 |

5) The percentage of documents based on language

English is the dominant language used in the documents; 4.144 documents, or 99% of the documents, are written in English. Meanwhile, other languages used, although not significantly, are Spanish, French, Portuguese, and Turkish. The percentage of language usage can be seen in Figure 6.

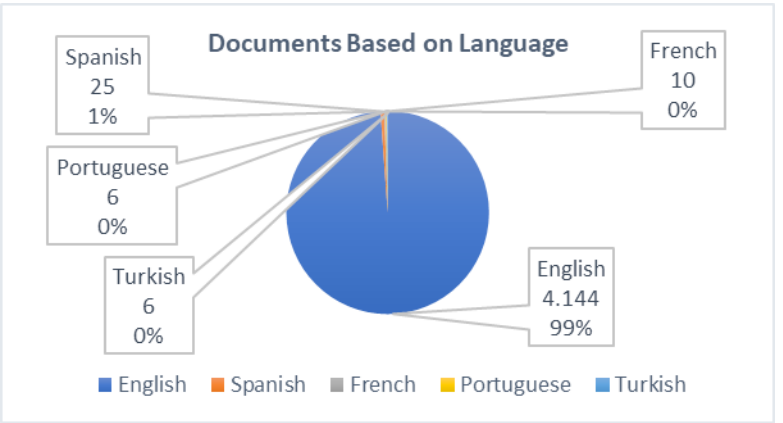


**Figure 6.** The Number of Documents by Affiliation

6) Countries' distribution of documents during 2014-2023

The country that contributed the most to producing documents about fun science learning for early childhood was the United States, which had a total of 1.294 documents. Apart from that, Indonesia also has a significant role by producing 174 documents and is ranked fifth globally. Apart from that, Germany is in tenth place with 123 documents. A visualization of the country-based document distribution map can be seen in Figure 7. Meanwhile, the total number of documents produced by each of the top ten most contributing countries can be seen in Table 3.

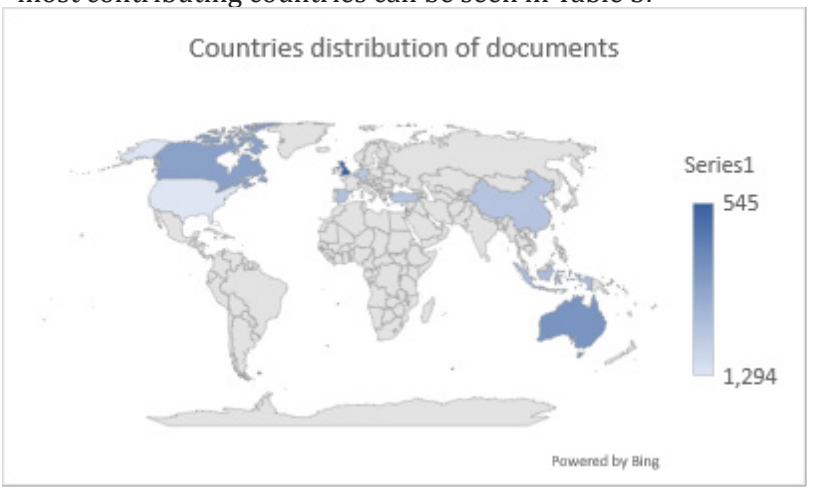


**Figure 7.** Visualization of Countries Contributing Documents

**Table 3**. Countries distribution of documents during 2014-2023

| No | Countries | Documents |
|---|---|---|
| 1 | United States | 1.294 |
| 2 | United Kingdom | 545 |
| 3 | Australia | 340 |
| 4 | Canada | 288 |
| 5 | Indonesia | 174 |
| 6 | Undefined | 158 |
| 7 | Spain | 150 |
| 8 | China | 142 |
| 9 | Turkey | 140 |
| 10 | Germany | 123 |

7) Network overlay visualization of research

Researchers visualized research trends on this topic consisting of 4,204 documents analyzed in the last ten years. The efforts made by researchers are to find novelty in research in this domain. Figure 8 visualizes the whole picture from research on fun science learning for early childhood. Researchers worldwide produced four clusters indicated with red, green, blue, and yellow).

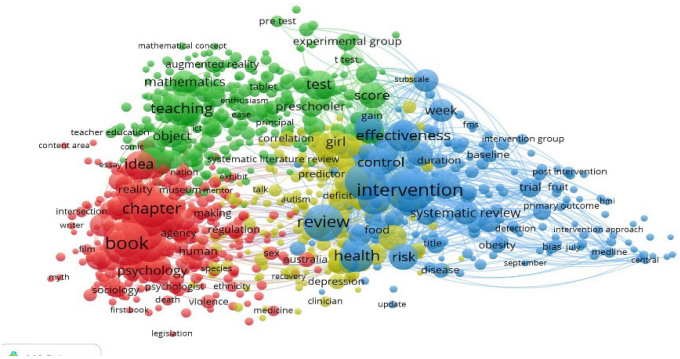


**Figure 8.** Network Overlay Visualization of Research

The four clusters have a total of 1.103-word items, presented on the VOSviewer display when processing. The RIS data has been obtained from the Scopus database with the keyword fun science learning for early childhood. Cluster 1 is visualized in red with a total of 358 items. Cluster 2 is visualized in green with a total of

340 items. Cluster 3 is visualized in blue with a total of 217 items. Cluster 4 is visualized in yellow with a total of 188 items.

There is a dominant word in each cluster. This shows that this word is widespread and often used in research with the keyword "fun science learning for early childhood." In cluster 1, there are several dominant words: book, chapter, idea, psychology, and reader. The following displays the most dominant word in cluster 1, Book, and its relationship with other words in the VOSviewer display.

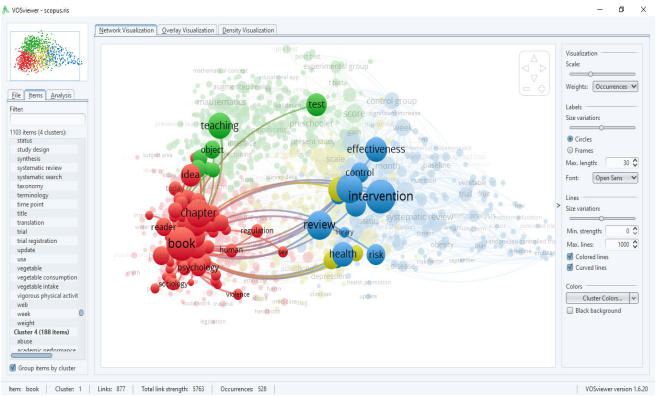


**Figure 9.** The Relationship between Dominant Words in the Red Cluster and Other Words

In cluster 2, several dominant words can be seen: teaching, test, preschooler, mathematics, and score. The following displays the most dominant word in cluster 2, Teaching, and its relationship with other words in the VOSviewer display.

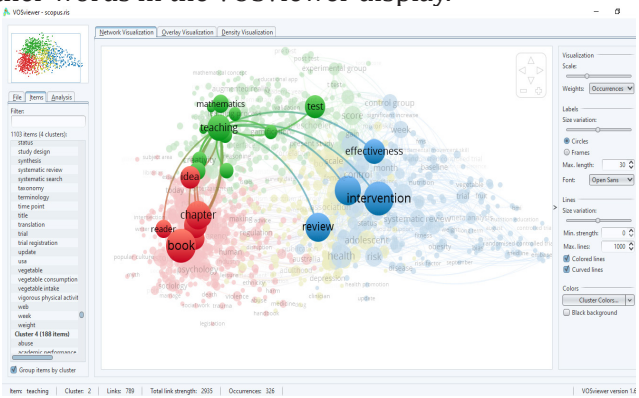


**Figure 10.** The Relationship between Dominant Words in the Green Cluster and Other Words

In cluster 3, several dominant words can be seen: intervention, review, systematic review, effectiveness, and control group. The following displays the most dominant word in cluster 3, Intervention, and its relationship with other words on the VOSviewer display.

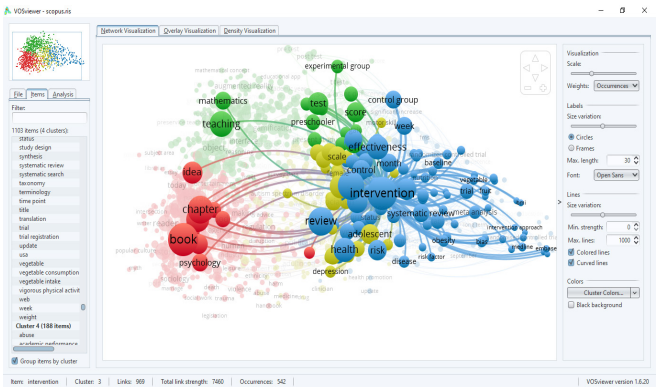


**Figure 11.** The Relationship between Dominant Words in the Blue Cluster and Other Words

In cluster 4, several dominant words can be seen: adolescent, scale, association, difference, and correlation. The following displays the most dominant word in cluster 4, Adolescent, and its relationship with other words on the VOSviewer display.

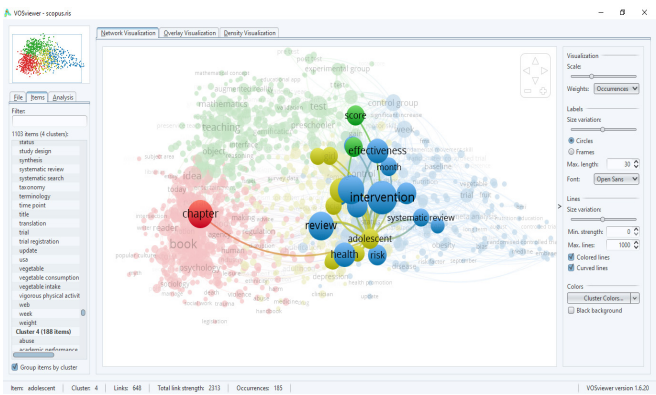


**Figure 12.** The Relationship between Dominant Words in the Yellow Cluster and Other Words

8) Find novelty in fun science learning for early childhood research

Based on the display in VOSViewer, we can see and determine the opportunity for great novelty when we find words with small circles and little connection with other words on the theme of fun science learning for early childhood. The following are words relevant to the theme of fun science learning for early childhood found in the VOSViewer visualization display.

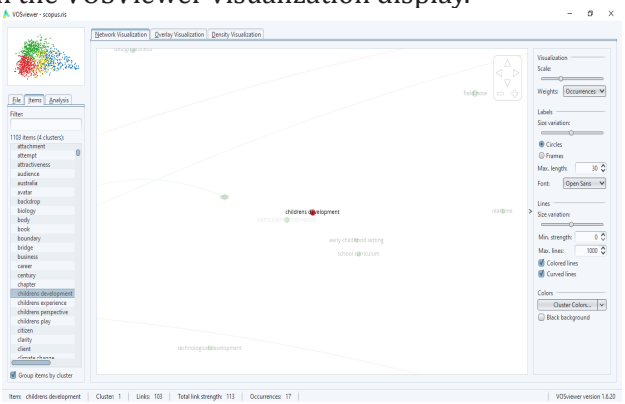

**Figure 13.** Keywords that have a chance of being discovered by Novelty

The word children development has no connection with other words.

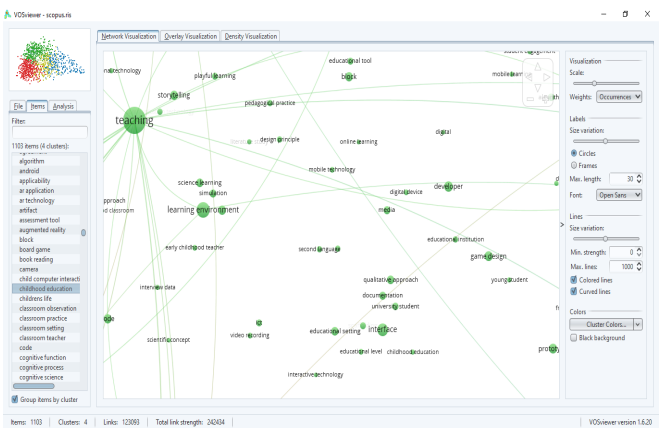

**Figure 14.** Keywords that have a chance of being discovered by Novelty

The words childhood education, science learning, early childhood teacher, playful learning, and pedagogical practice seem small and have no connection with any words.

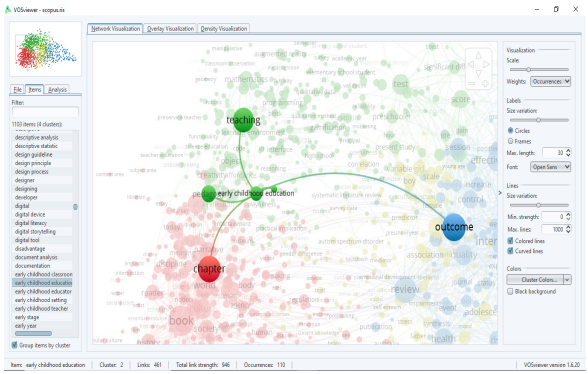


**Figure 15.** Keywords that have a chance of being discovered by Novelty

The word early childhood education is related to the words teaching, outcome, chapter, and pedagogy.

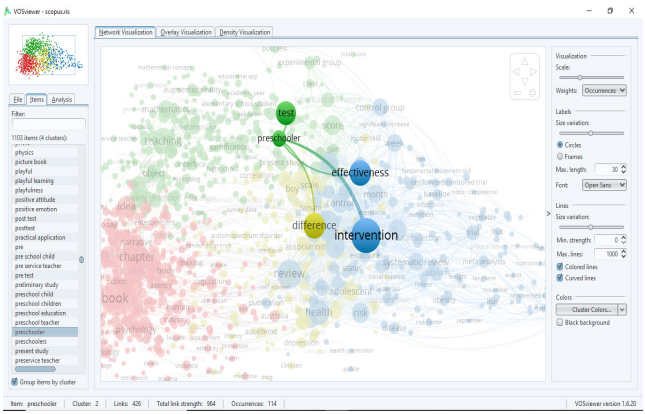


**Figure 16.** Keywords that have a chance of being discovered by Novelty

The word 'Preschooler' is related to test, effectiveness, intervention, and difference.

Based on the relationship between each word, some words are small and have little or no connection with other words. This indicates that very few researchers still use these keywords in research on fun science learning for early childhood. So, the

opportunity to discover novelty from these words is enormous.

## D. Conclusion

Based on the research results, it can be found that the research trend regarding science learning for early childhood has increased from year to year. There are 226 documents in 2014, 243 documents in 2015, 272 documents in 2016, 279 documents in 2017, 342 documents in 2018, 396 documents in 2019, 458 documents in 2020, 596 documents in 2021, 653 documents in 2022, and 739 documents in 2023. Apart from that, there are also four clusters in the VOSViewer visualization: the most dominant word in cluster 1, namely Book; the most dominant word in cluster 2, namely Teaching; the most dominant word in cluster 3, namely Intervention; and the most dominant word in cluster 4, namely adolescent. The opportunities for novelty can be seen from several keywords that look minor, not dominant, and not related to other words in the VOSViewer visualization, including children development, childhood education, science learning, early childhood teacher, playful learning, pedagogical practice, early childhood education, and preschooler. These keywords are the findings of this research. Further research can use these keywords in research on fun science learning for early childhood to find greater possibilities for novelty.

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