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Science and Technology in Civic Education Learning: A Bibliometric Review of Recent Research

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ABSTRACT

This study is a bibliometric review aimed at analysing recent research on science and technology in civic education learning. Research data was obtained using the reference management application Publish or Perish from journals indexed by Google Scholar. A total of 181 articles relevant to the keywords "Civic Education Learning" AND "Science and Technology" were collected from 2018 to 2023. The VOSviewer application was then used to visualize and analyse the bibliometric data. The results of the study can provide insights into the contribution of science and technology to civic education learning. With a better understanding of the contribution of science and technology to civic education learning, educators and researchers can develop more effective strategies to prepare the younger generation to face the complex challenges of the current global era. This research can also help identify research gaps that need further investigation and guide future research on science and technology in civic education learning.

Keywords:

Bibliometric; civic education; education; science and technology

1. Introduction

Civic education has become an important aspect in shaping active, participatory, and responsible citizens [1-4]. In an era dominated by scientific and technological advancements, understanding how science and technology can contribute to civic education becomes increasingly relevant [5,6].

Recent studies have highlighted the importance of integrating science and technology in the context of civic education learning [7]. The dynamic changes in contemporary society that are becoming more technologically interconnected are what drive integration. Therefore, understanding science and the application of technology in education becomes crucial for educators, enabling students to become more skilled and adaptable to social and technological changes.

To comprehend the latest developments in the relationship between science, technology, and civic education learning, a bibliometric analysis is required. Bibliometric research provides deeper insights into trends and contributions in research. For instance, a bibliometric study by Nandiyanto & Al Husaeni [8] successfully mapped research developments in Indonesia. Using this approach, this

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study aims to analyse articles related to science and technology in civic education learning that have been published within a specific time frame. Detailed information for the bibliometric is shown in Table 1.

Table 1
 Previous studies on bibliometric

No	Title	Ref.
1	Involving Particle Technology in Computational Fluid Dynamics Research: A Bibliometric Analysis	[9]
2	Bibliometric Computational Mapping Analysis of Trend Metaverse in Education using VOSviewer	[10]
3	The Use of Information Technology and Lifestyle: An Evaluation of Digital Technology Intervention for Improving Physical Activity and Eating Behaviour	[11]
4	Strategies in language education to improve science student understanding during practicum in laboratory: Review and computational bibliometric analysis	[12]
5	How language and technology can improve student learning quality in engineering? definition, factors for enhancing students' comprehension, and computational bibliometric analysis	[13]
6	Mapping of nanotechnology research in animal science: Scientometric analysis	[14]
7	Scientific research trends of flooding stress in plant science and agriculture subject areas (1962-2021)	[15]
8	Introducing ASEAN Journal of Science and Engineering: A bibliometric analysis study	[16]
9	A bibliometric analysis of chemical engineering research using VOSviewer and its correlation with Covid-19 pandemic condition	[17]
10	A bibliometric analysis of materials research in Indonesian journal using VOSviewer	[18]
11	Bibliometric analysis of engineering research using VOSviewer indexed by google scholar	[19]
12	Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSviewer	[20]
13	Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis	[21]
14	Domestic waste (eggshells and banana peels particles) as sustainable and renewable resources for improving resin-based brakepad performance: Bibliometric literature review, techno-economic analysis, dual-sized reinforcing experiments, to comparison with commercial product	[22]
15	Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research	[23]
16	Corncob-derived sulfonated magnetic solid catalyst synthesis as heterogeneous catalyst in the esterification of waste cooking oil and bibliometric analysis	[24]
17	The compleat lextutor application tool for academic and technological lexical learning: Review and bibliometric approach	[25]
18	Use of blockchain technology for the exchange and secure transmission of medical images in the cloud: Systematic review with bibliometric analysis	[26]
19	Computational bibliometric analysis of research on science and Islam with VOSviewer: Scopus database in 2012 to 2022	[27]
20	Digital transformation in special needs education: Computational bibliometrics	[28]
21	Antiangiogenesis activity of Indonesian local black garlic (<i>Allium Sativum</i> 'Solo): Experiments and bibliometric analysis	[29]
22	Characteristics of tamarind seed biochar at different pyrolysis temperatures as waste management strategy: experiments and bibliometric analysis	[30]
23	The compleat lextutor application tool for academic and technological lexical learning: Review and bibliometric approach	[31]
24	Corncob-derived sulfonated magnetic solid catalyst synthesis as heterogeneous catalyst in the esterification of waste cooking oil and bibliometric analysis	[32]

The goal of this study is to conduct a bibliometric analysis of Google Scholar-indexed articles on science and technology in civic education learning. The analysis was conducted using the Publish or Perish and VOSviewer applications. Through this research, it is expected to provide guidance for researchers in determining research themes related to science and technology in civic education learning. The findings and results of this study are expected to serve as a basis for researchers to

explore more specific and relevant topics regarding science and technology in the context of civic education.

2. Methodology

The data for this study was derived from journals indexed by Google Scholar. Google Scholar has been used in several previous bibliometric studies to collect research data [33,34]. To obtain research data, the reference management application Publish or Perish was employed. Publish or Perish allows for gathering research data from Google Scholar using relevant keywords [20,35]. After collecting the research data, bibliometric analysis was conducted using the VOSviewer application. VOSviewer is a software to visualize and analyse bibliometric data in the form of maps and networks. Data mapping using VOSviewer has been widely used in bibliometric research to identify trends, connections, and characteristics of scientific publications [36].

This study followed four stages, as outlined by Al Husaeni & Nandiyanto [23]: first, the collection of publication data using the Publish or Perish application; second, the processing of bibliometric data from the collected articles using Microsoft Excel; third, the application of bibliometric mapping analysis to the publication data using the VOSviewer application; and fourth, the analysis and interpretation of the results from the computational mapping analysis.

The bibliometric analysis in this research focused on the number of publications, the most productive authors, the most cited journals, and frequently used keywords. The article data was searched using the Publish or Perish application using the keywords “Science and Technology” AND “Civic Education Learning” to filter publications based on research needs. The articles used were published between 2018 and 2023. The collected article data was then exported into “.ris” and “.csv” file formats. The VOSviewer application was then used for network visualization, overlay visualization, and density visualization. In visualizing the data, keyword frequencies were set to be found at least three times, and less relevant keywords were removed. The bibliometric analysis of trends and contributions of science and technology in civic education learning will be further discussed below.

3. Results

3.1 Publication Data Search Results

Based on the data search through the Publish or Perish reference management application from the Google Scholar database, a total of 181 articles that met the research criteria were obtained. The data obtained consisted of article metadata, including author names, titles, years, journal names, publishers, citation counts, article links, and related URLs. Table 2 shows examples of some data used in the VOSviewer analysis in this study. The sample data taken consisted of the top 18 articles with the highest citation counts. The total citation count for all articles used in this research reached 644.

Table 2
 Publication data on science and technology in civic education learning

No	Authors	Title	Year	Cites	Ref.
1	Rachmadtullah <i>et al.</i> ,	Development of computer-based interactive multimedia: study on learning in elementary education	2018	158	[37]
2	Septiani <i>et al.</i> ,	Development of Interactive Multimedia Learning Courseware to Strengthen Students' Character.	2020	58	[38]
3	Rahayu and Sukardi	The development of E-modules project-based learning for students of computer and basic networks at vocational school	2020	50	[39]
4	Putra and Afrilia	Systematic literature review: penggunaan kahoot pada pembelajaran matematika	2020	43	[40]
5	Holbert <i>et al.</i> ,	Afrofuturism as critical constructionist design: Building futures from the past and present	2020	39	[41]
6	Irawatie <i>et al.</i> ,	Education learning development of character education-based state defense	2019	36	[42]
7	Abdulkarim <i>et al.</i> ,	Developing civicpedia as a civic education E-learning media to improve students' information literacy	2018	31	[43]
8	Budiarto <i>et al.</i> ,	Student's View of Using Digital Learning Media in Classroom Activities: A Case of Public Senior High School in Cirebon, Indonesia	2020	29	[44]
9	Casmana <i>et al.</i> ,	Global citizenship: preparing the younger generation to possess pro-environment behaviour, mutual assistance and tolerance awareness through school engagement	2021	28	[45]
10	Karliani <i>et al.</i> ,	Indonesian civic engagement among college students	2019	22	[46]
11	Pratiwi and Wuryandani	Effect of problem-based learning (PBL) models on motivation and learning outcomes in learning civic education	2020	21	[47]
12	Uzunboylu <i>et al.</i> ,	The Views of the Teacher Candidates on the Use of Kahoot as A Gaming Tool.	2020	18	[48]
13	Sartono <i>et al.</i> ,	Interactive Multimedia Based on Indonesian Cultural Diversity in Civics Learning in Elementary Schools.	2022	16	[49]
14	Tetep and Arista	Students' Perception towards Kahoot Learning Media and Its Influence towards Students' Motivation in Learning Social Studies and Civic Education amid Pandemic in SMKN 9 Garut	2022	15	[50]
15	Asrial <i>et al.</i> ,	Implementation of web-based character assessment on students' character outcomes: A review on perception and gender	2023	15	[51]
16	Stahl and Literat	# GenZ on TikTok: the collective online self-Portrait of the social media generation	2022	15	[52]
17	Tohri <i>et al.</i> ,	The Urgency of Sasak Local Wisdom-Based Character Education for Elementary School in East Lombok, Indonesia.	2022	14	[53]
18	Suyanto <i>et al.</i> ,	The study perception of social sciences and law faculty students for hoax in social media	2018	13	[54]

3.2 Trends in Research on Science and Technology in Civic Education Learning

Table 3 displays the development of research on science and technology in civic education learning published in Google Scholar-indexed journals. The data in Table 3 indicates a total of 181 research articles in the field of science and technology in civic education learning published between 2018 and 2023. In 2018, there were 13 articles published. The number of articles increased to 19 in 2019, 25 in 2020, 46 in 2021, 52 in 2022, and 26 in 2023. From the data, it can be observed that research on science and technology in civic education learning was relatively less studied in the period from 2018 to 2020. However, there has been a significant increase in research on this topic in the past three years, namely in 2021, 2022, and 2023, as clearly seen in Figure 1.

Table 3

Development of research on science and technology in civic education learning

Years	Total
2018	13
2019	19
2020	25
2021	46
2022	52
2023	26

Figure 1 displays the development of research in the field of chemical engineering education over the past 10 years, from 2012 to 2021. Based on Figure 1, it can be noted that research on science and technology in civic education learning was relatively less studied in the period from 2018 to 2020. However, there has been a significant increase and development in research on this topic from 2021 to 2023.

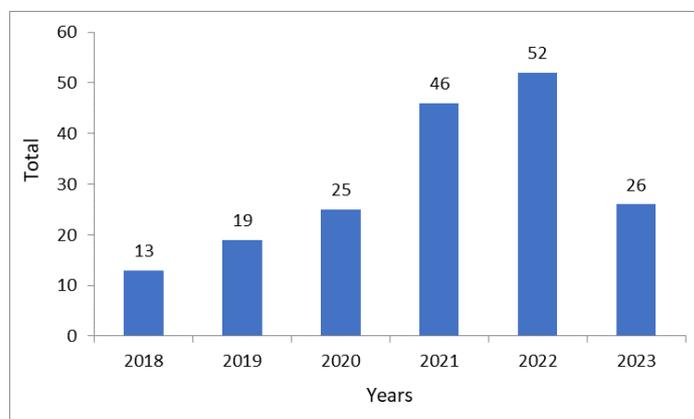


Fig. 1. Level of development of research on science and technology in civic education learning

3.3 Visualization of Research Topics on Science and Technology in Civic Education Learning using VOSviewer

Computational mapping was performed on the collected article data using the VOSviewer analysis tool. Through this computational mapping, a total of 66 items related to research on science and technology in civic education learning were identified. The results of the computational mapping showed the division of the mapping data into 7 distinct clusters. Each cluster encompasses articles that are closely related to the research topic. The 7 clusters are as follows:

- i. Cluster 1 consists of 13 items and is marked in red. The 13 items are 21st century, ability, addition, characteristic, community, country, internet, mastery, project, project citizen, project citizen model, role, teaching.
- ii. Cluster 2 consists of 12 items and is marked in green. The 12 items are android, civic, educational science, interactive multimedia, interactive multimedum, international, international journal, medium, mobile application, need, teaching material, utilization.
- iii. Cluster 3 consists of 10 items and is marked in blue. The 10 items are achievement, application, effect, evaluation, higher education, online learning, research, social media, use, video.

- iv. Cluster 4 consists of 9 items and is marked in yellow. The 9 items are advance, assessment, basis, benefit, human, life, perception, progress, web.
- v. Cluster 5 consists of 9 items and is marked in purple. The 9 items are change, citizen, covid, creativity, information, pandemic, person, rapid progress, today.
- vi. Cluster 6 consists of 7 items and is marked in sky blue. The 7 items are demand, effectiveness, Indonesia, innovation, line, principle, technology development.
- vii. Cluster 7 consists of 6 items and is marked in orange. The 6 items are accordance, character education, character formation, civic education learning, formation, int.

In each cluster, the interrelationships between different terms are visually depicted. Within each cluster, the terms are labelled and represented by coloured circles. The size of the circle for each term varies depending on the frequency of its occurrence in the titles and abstracts of the articles. The more frequently a term appears, the larger its label circle size. The visualization of the mapping analysed in this study consists of three main parts: network visualization (see Figure 2), overlay visualization (see Figure 3), and density visualization (see Figure 4). Each visualization part provides a different overview of the relationships between the terms in this research. By utilizing these three visualization parts, this study can offer a more comprehensive and detailed understanding of the interconnections between the terms in the mapping of research on science and technology in civic education learning.

This study gives information for further development as reported elsewhere regarding several subjects:

- i. Mathematics [55-83]
- ii. Biology [84-93]
- iii. Physics [94-98]
- iv. Chemistry [99-106]
- v. Engineering [107-117]

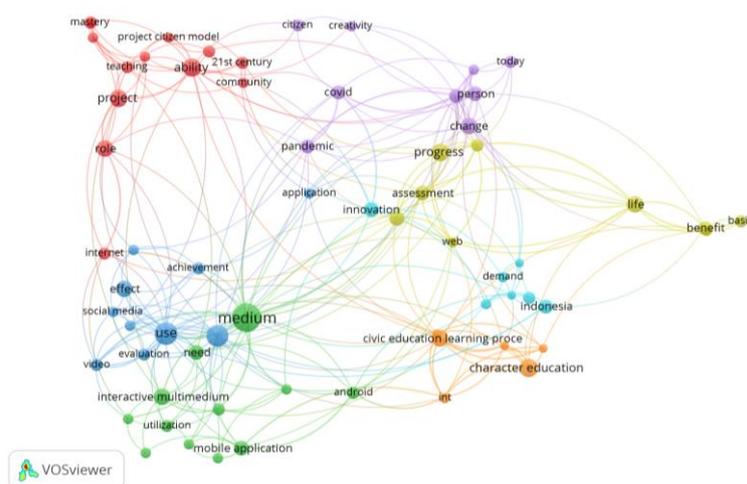


Fig. 2. Network Visualization of research on science and technology in civic education learning

receiving more attention and becoming a trend in civic education research. The bibliometric analysis and VOSviewer mapping provide valuable insights into understanding the development and direction of research in this field. Further research is expected to focus on the development of innovative teaching methods and strategies, exploring the impact of using cutting-edge technologies such as virtual reality (VR) in civic education learning.

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