



Harnessing the Power of Technology in Statistics Education: A Comprehensive Bibliometric Study

Edi Irawan¹, Rizky Rosjanuardi^{2,3,*}, Sufyani Prabawanto^{2,3}

¹ Study Program of Mathematics Education, Institut Agama Islam Negeri Ponorogo, Kabupaten Ponorogo, Jawa Timur 63471, Indonesia

² Study Program of Mathematics Education, Universitas Pendidikan Indonesia, Kota Bandung, Jawa Barat 40154, Indonesia

³ Indonesian DDR Development Center, Universitas Pendidikan Indonesia, Kota Bandung, Jawa Barat 40154, Indonesia

ABSTRACT

This study aims to conduct a bibliometric mapping of research articles on technology in statistics education. The articles under analysis are those published in English-language journals and indexed in the Scopus database. VOSviewer and Bibliometrix software were employed in the data analysis. The search yielded 59 relevant articles published since 1985, with a 1.84% annual growth rate, an average of 11.02 citations per document, and an average document age of 13.7 years. The publications involved 135 authors from 31 countries, with an average of 2.44 co-authors per document. The research findings revealed the formation of five clusters through networking visualization. Based on the thematic map using Bibliometrix, we identified that "higher education" and "R" are themes that have shown significant development and are crucial for shaping the technology field in statistics education. This bibliometric analysis provides ideas and references for selecting current, potential, and evolving research themes related to technology in statistics education.

Keywords:

Bibliometric analysis; Statistic education; Technology; VOSviewer

1. Introduction

The massive development of technology in all fields has significantly impacted the education and learning processes. Similarly, the presence of technology has also greatly influenced statistics education. There are at least two roles of technology in statistics education: technology to support the statistics learning process and technology to support statistical computation. Various emerging learning technology platforms can support the learning of statistics [1,2]. Many software applications for statistical computing have been created by developers, including R, Python, Microsoft Excel, SPSS, SAS, and Minitab [3-5].

Statistics is an essential discipline that plays a significant role in everyday life [6]. It is used extensively in education, governance, economics, healthcare, and politics. Statistics education has been critical in observing and comparing trends and the distribution of COVID-19 patients during the COVID-19 pandemic [7], while covid is one of the crucial issues [8-18]. Statistics education is required

* Corresponding author.

E-mail address: rizky@upi.edu

to prepare citizens for the twenty-first century [19]. As a result, statistics are critical and in great demand in many parts of life. However, in the field of research, it is still unknown whether the use of technology in statistics education is still in demand.

One of the methods to observe trends and potential themes related to the utilization of technology in statistics education is bibliometric analysis. Bibliometric analysis is a technique used to study various references in a research field based on research findings published in journals and other scientific articles [20,21]. By employing bibliometric analysis, emerging and potentially researchable themes for the future can be identified [22-25].

Numerous bibliometric analyses have been conducted in the field of education, including research on mathematics education [26-31], STEM education [32-35], ICT in mathematics education [36], computational thinking [37-42], integrating computational thinking in mathematics education [43,44], gamification in higher education [45], game-based learning in science and mathematics education [46], flipped classroom [47,48], professional development for science teachers [49], management education [50], TPACK [51], digital literacy in higher education [52], virtual reality and education [53], artificial intelligence in education research [54,55], metaverse in education [56], education and information technologies [57], and educational research [58,59]. However, a bibliometric analysis focusing on technology in statistics education has not been found, particularly one conducted on Scopus-indexed articles from 1985 to 2023. 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	[60]
2	Bibliometric Computational Mapping Analysis of Trend Metaverse in Education using VOSviewer	[61]
3	The Use of Information Technology and Lifestyle: An Evaluation of Digital Technology Intervention for Improving Physical Activity and Eating Behaviour	[62]
4	Strategies in language education to improve science student understanding during practicum in laboratory: Review and computational bibliometric analysis	[63]
5	How language and technology can improve student learning quality in engineering? definition, factors for enhancing students' comprehension, and computational bibliometric analysis	[64]
6	Mapping of nanotechnology research in animal science: Scientometric analysis	[65]
7	Scientific research trends of flooding stress in plant science and agriculture subject areas (1962-2021)	[66]
8	Introducing ASEAN Journal of Science and Engineering: A bibliometric analysis study	[67]
9	A bibliometric analysis of chemical engineering research using VOSviewer and its correlation with Covid-19 pandemic condition	[68]
10	A bibliometric analysis of materials research in Indonesian journal using VOSviewer	[69]
11	Bibliometric analysis of engineering research using VOSviewer indexed by google scholar	[70]
12	Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSviewer	[71]
13	Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis	[72]
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	[73]
15	Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research	[74]
16	Corn-cob-derived sulfonated magnetic solid catalyst synthesis as heterogeneous catalyst in the esterification of waste cooking oil and bibliometric analysis.	[75]
17	The compleat lextutor application tool for academic and technological lexical learning: Review and bibliometric approach.	[76]
18	A systematic review of blockchain in healthcare: frameworks, prototypes, and implementations	[77]

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|----|---|------|
| 19 | Computational bibliometric analysis of research on science and Islam with VOSviewer: Scopus database in 2012 to 2022. | [78] |
| 20 | Digital transformation in special needs education: Computational bibliometrics. | [79] |
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Hence, this research is conducted to perform a bibliometric analysis and mapping of articles related to technology in statistics education indexed by Scopus, utilizing Bibliometrix and VOSviewer software. This study's objective is to guide researchers in selecting current and potential research themes, particularly those associated with the utilization of technology in statistics education.

2. Methodology

The data utilized in this study were extracted from research publications available in Scopus-indexed journals. Scopus was selected as the primary database for five reasons: it offers pertinent and trustworthy information, boasts extensive coverage, incorporates all authors cited in the references, facilitates direct data retrieval, and allows for processing the output data in various bibliometric analysis software [80]. Methodologically, the research stages aligned with the four phases of bibliometric analysis as outlined by Naveen Donthu *et al.*, [81]. Detailed information regarding bibliometric is shown elsewhere [82,83].

The search was conducted on the Scopus database on June 29, 2023, using the following search query: (TITLE ("Statistics Education" OR "Teaching Statistics" OR "Learning Statistics" OR "Learn Statistics" OR "Teach Statistics")) AND TITLE-ABS-KEY (technology OR application OR programming)) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English")). This query indicated that the search was performed based on titles, abstracts, and keywords containing six terms: statistics education, learning statistics, teaching statistics, and technology, programming, or application. The search was limited to articles published in journals and written in English.

The data analysis was conducted using Bibliometrix software version 4.1.2 and VOSviewer version 1.6.18. Bibliometrix was used to obtain information about the development of related literature and thematic maps [84,85]. The utilization of VOSviewer facilitated the generation of three distinct renditions of publication mapping: network visualization, density visualization, and overlay visualization, which were premised on the network (co-citation) among extant items [86, 87]. In order to develop a bibliometric map, the keyword frequency threshold was established at a minimum of four occurrences. Consequently, 31 keywords which were deemed less pertinent, were expunged.

3. Results

3.1 Search Results for Publication Data

The search on the Scopus database yielded 59 articles on the utilization of technology in statistics education. These articles were published in journals and written in English. The obtained data consist of article metadata, including author names, titles, publication years, journal names, publishers, author affiliations, author affiliation countries, abstracts, keywords, citation counts, and various reference sources. Based on the data analysis using Bibliometrix software, general information about the generated data is presented in Table 2. The elements incorporated in the study encompass a broad range of minutiae, including but not limited to the duration of time under investigation, the origins of the data, the nature of the documentation, the yearly increase in frequency, the typical age of the texts, the average number of citations per document, the designated keywords of the author, the identities of the authors, the identity of the authors of solo-authored texts, the prevalence of

international authorship collaborations, the average number of co-authors per document, and the references cited.

Table 2 reveals that articles related to the utilization of technology in statistics education have been present since 1985, with an annual growth rate of 1.84%. 135 authors from 31 countries have contributed to studies on technology for statistics education. Among the 59 identified documents, the average age of the documents is 13.7 years, with an average of 11.02 citations per document and involving an average of 2.44 co-authors per document. There are 161 keywords and 1686 references used by the authors. The following data analysis involves the ranking of articles based on their citation count. A list of the top 20 article titles with the highest total citations, authors, publication year, and source is presented in Table 3.

Table 2
Main information of data collected

Aspect	Results
Timespan	1985:2023
Sources	38
Documents	59
Annual Growth Rate	1.84%
Document Average Age	13.7
Average citations per doc	11.02
Author's Keywords	161
Authors	135
Authors of single-authored docs	16
International co-authorships	8.475
Co-Authors per Doc	2.44
Corresponding Author's Countries	31
References	1686

Table 3 reveals that the article titled “The effect of challenge-based gamification on learning: An experiment in the context of statistics education”, authored by Legaki, N.Z. *et al.*, and published in the “International Journal of Human Computer Studies” in 2020 [88], is the most cited article, with 90 citations.

Table 3
Top 20 articles on using technology to study statistics

No	Document title	Authors	Source	Year	TC*	Ref.
1	The effect of challenge-based gamification on learning: an experiment in the context of statistics education	Legaki, N.Z. <i>et al.</i> ,	International Journal of Human Computer Studies, 144, 102496	2020	90	[88]
2	A meta-analysis examining the impact of computer-assisted instruction on postsecondary statistics education: 40 years of research	Larwin, K. and Larwin, D.	Journal of Research on Technology in Education, 43 (3)	2011	43	[89]
3	Teaching statistics theory through applications	Nolan, D. and Speed, T.P.	American Statistician, 53 (4)	1999	42	[90]
4	Instructional strategies and course design for teaching statistics online: perspectives from online students	Yang, D.	International Journal of STEM Education, 4 (1)	2017	39	[91]
5	Play it again: teaching statistics with monte carlo simulation	Sigal, M.J. and Philipchalmers, R.	Journal of Statistics Education, 24 (3)	2016	35	[92]

6	Teaching statistics online: A decade's review of the literature about what works	Mills, J.D. and Raju, D.	Journal of Statistics Education, 19 (2)	2011	35	[93]
7	The application of Simulation-Assisted Learning Statistics (SALS) for correcting misconceptions and improving understanding of correlation	Liu, T.C. <i>et al.</i> ,	Journal of Computer Assisted Learning, 26 (2)	2010	30	[94]
8	Multimedia for teaching statistics: Promises and pitfalls	Velleman, P.F. and Moore, D.S.	American Statistician, 50 (3)	1996	30	[95]
9	Statistics? You must be joking: The application and evaluation of humour when teaching statistics	Neumann, D.L. <i>et al.</i> ,	Journal of Statistics Education, 17 (2)	2009	28	[96]
10	An active learning approach to teaching statistics	Dolinsky, B.	Teaching of Psychology, 28 (1)	2001	28	[97]
11	Statistics education fin de siècle	Moore, D.S. <i>et al.</i> ,	American Statistician, 49 (3)	1995	28	[98]
12	Teaching statistics - despite its applications	Ridgway, J. <i>et al.</i> ,	Teaching Statistics, 29 (2)	2007	18	[99]
13	Learner-centred mathematics and statistics education using netbook tablet PCs	Loch, B. <i>et al.</i> ,	International Journal of Mathematical Education in Science and Technology, 42 (7)	2011	17	[100]
14	Teaching statistics to non-specialists	Simpson, J.M.	Statistics in Medicine, 14 (2)	1995	17	[101]
15	Teaching statistics with Excel 2007 and other spreadsheets	Nash, J.C.	Computational Statistics and Data Analysis, 52 (10)	2008	16	[102]
16	Teacher's corner a method for teaching statistics using a-dimensional geometry	Saville, D.J. and Wood, G.R.	American Statistician, 40 (3)	1986	15	[103]
17	The development and evaluation of a survey that makes use of student data to teach statistics	Neumann, D. <i>et al.</i> ,	Journal of Statistics Education, 18 (1)	2010	14	[104]
18	Teaching statistics at google-scale	Chamandy, N. <i>et al.</i> ,	American Statistician, 69 (4)	2015	11	[105]
19	Three empirical strategies for teaching statistics	Marson, S.M.	Journal of Teaching in Social Work, 27 (3-4)	2007	11	[106]
20	Preparing graduate students to teach statistics: introduction	Moore, D.S.	American Statistician, 59 (1)	2005	9	[107]

*TC = Total Citation

3.2 Publication Trends

Based on the identification results obtained from the Scopus database, Figure 1 presents the data about the number of publications associated with technology use in statistics education.

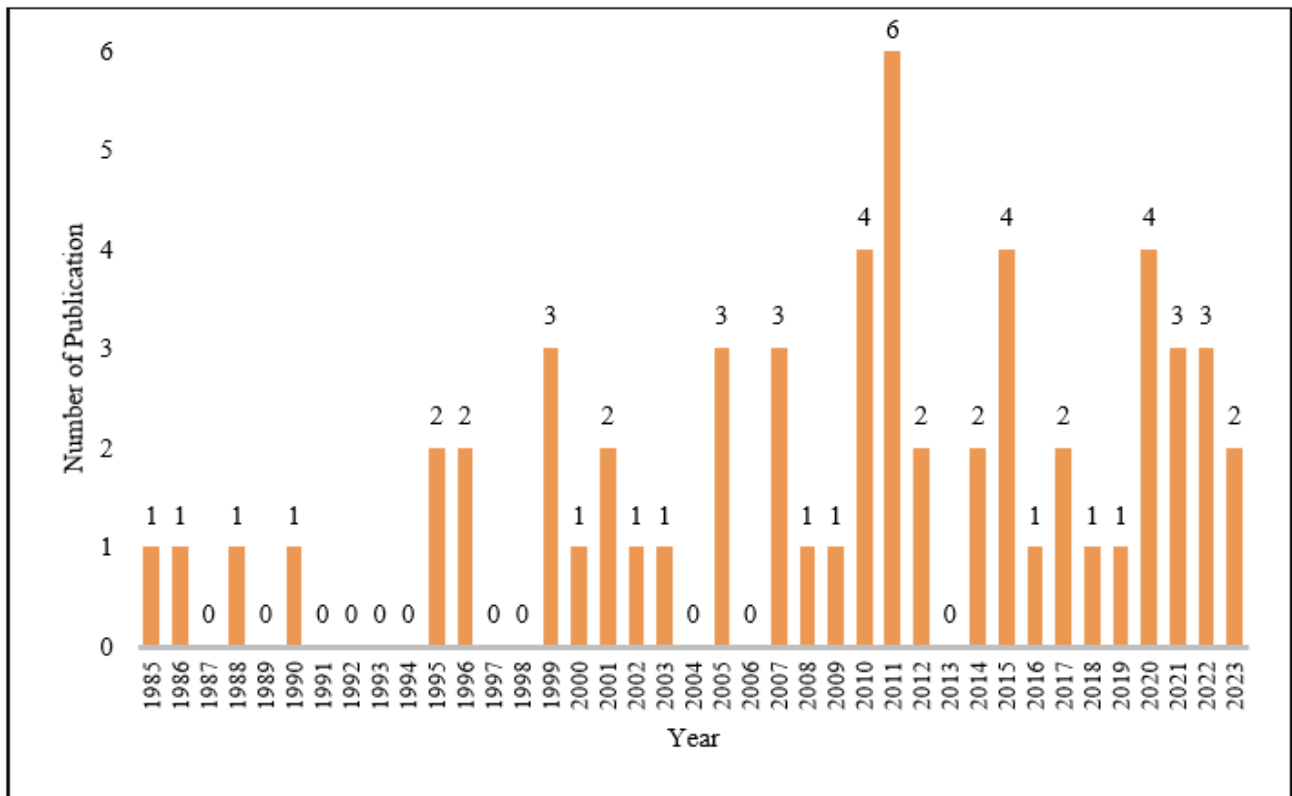


Fig. 1. Trend of publications on technology in statistics education

As presented in Figure 1, the number of publications on the utilization of technology in statistics education has experienced fluctuations over the years. The first publication started in 1985 with one article, followed by one article each in 1986, 1988, and 1990. Similarly, one article was published in 2000, 2002, 2003, 2008, 2009, 2016, 2018, and 2019. Two articles were published in 1995, 1996, 2001, 2012, 2014, 2017, and 2023. Three articles were published in 1999, 2005, 2007, 2021, and 2022. Four articles were published in 2010, 2015, and 2020. In 2011, we witnessed the most prolific publication of articles, totalling six. Nevertheless, there were specific years, namely 1987, 1989, 1991, 1992, 1993, 1994, 1997, 1998, 2004, 2006, and 2013, where no articles about technology implementation in statistics education were discovered.

3.3 Visualization of Terms using VOSviewer

Keywords that appeared at least four times were subjected to visualisation. Keyword identification with VOSviewer yielded 96 terms. However, further analysis revealed that 31 terms were not directly related to the utilization of technology in statistics education. Therefore, the visualization was performed on 65 relevant terms. This particular research incorporates various forms of visualization, namely network visualization (as shown in Figure 2), overlay visualization (as shown in Figure 3), and density visualization (as shown in Figure 4).

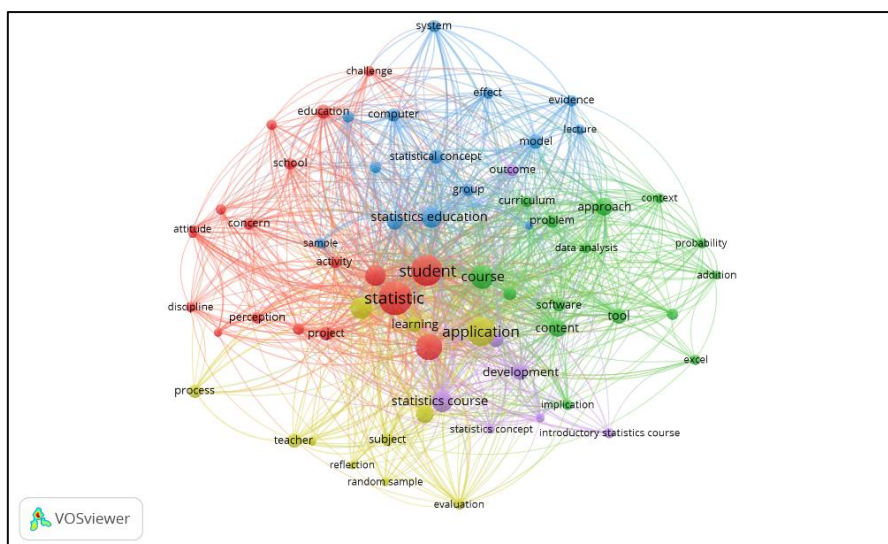


Fig. 2. Network visualization of technology in statistics education keyword

Figure 2 presents the network visualization of technology in statistics education keywords using VOSviewer. Based on Figure 2, it is evident that there are five clusters formed from the network visualization:

- i. Cluster 1, marked in red, comprises 18 items: activity, attitude, challenge, concern, discipline, education, experience, mathematics, negative attitude, perception, positive attitude, principle, project, school, statistic, student, teaching statistic, and technology.
- ii. Cluster 2, marked in green, consists of 15 items: addition, approach, content, context, course, curriculum, data analysis, excel, implication, introductory statistics, probability, problem, science, software, and tool.
- iii. Cluster 3, marked in blue, includes 14 items: computer, difficulty, effect, evidence, group, lecture, misconception, model, sample, statistical analysis, statistical concept, statistics education, system, and understanding.
- iv. Cluster 4, marked in yellow, comprises 11 items: application, data, evaluation, importance, learning, process, random sample, reflection, subject, teacher, and teaching.
- v. Cluster 5, marked in purple, consists of 7 items: case study, development, effectiveness, introductory statistics course, outcome, statistics concept, and statistics course.

Next, the results of overlay visualization of technology in statistics education keywords using VOSviewer are presented in Figure 3. Overlay visualization depicts the novelty of research based on the related terms [108].

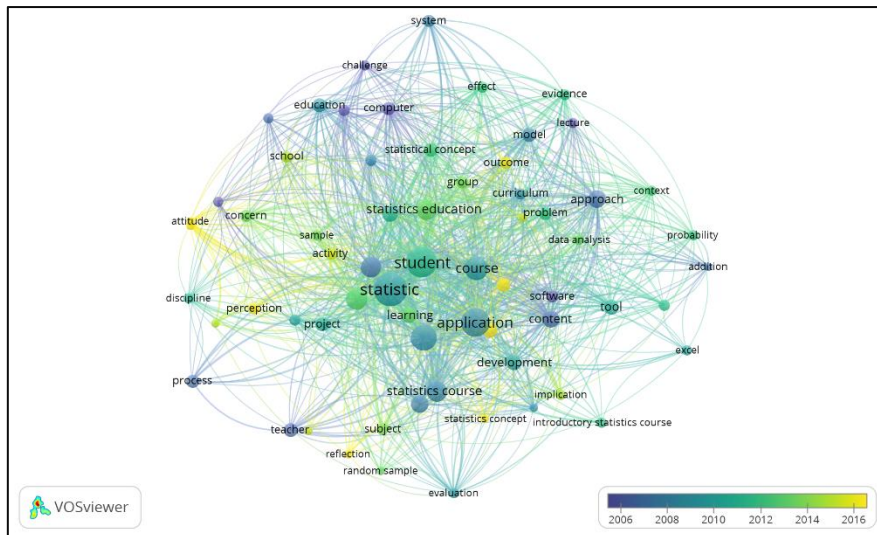


Fig. 3. Overlay visualization of technology in statistics education keyword

Figure 3 shows that attitude, perception, activity, outcome, reflection, and statistics concepts are relatively recent research themes. On the other hand, computer, teacher, challenge, lecture, software, content, and approach are relatively older themes, appearing around 2006. Next, the analysis of density keywords using VOSviewer provides density visualization of technology in statistics education keywords, as presented in Figure 4.

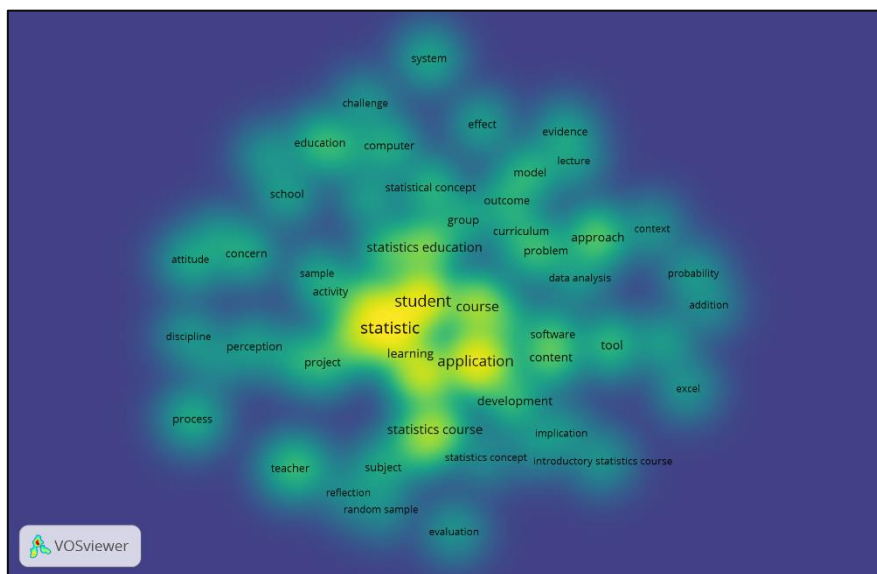


Fig. 4. Density visualization of technology in statistics education keyword

Figure 4 shows that statistics, student, application, learning, course, and statistics course are the terms with the highest density compared to other terms. On the other hand, other terms such as software, evaluation, attitude, context, and reflection have relatively lower densities.

3.3 Thematic Map of Technology in Statistics Education Keyword

The subsequent data analysis involves mapping the themes related to technology in statistics education using a thematic map using Bibliometrix software as presented in Figure 5. The categorization of themes on a thematic map is based on two parameters, namely density and

centrality. The resulting classification comprises four distinct categories: motor themes, niche themes, emerging or declining themes, and basic themes. Motor themes are situated in the top-right quadrant of the map and exhibit high levels of density and centrality. Niche themes, on the other hand, are located in the top-left quadrant and display high density but low centrality. Emerging or declining themes are found in the bottom-left quadrant and are characterized by low levels of both density and centrality. Finally, basic themes are situated in the bottom-right quadrant of the map and exhibit low density but high centrality.

Figure 5 shows the thematic map of various research on technology in statistics education. Several themes are distributed across the four quadrants as follows:

- i. The themes "higher education" and "R" are situated in the top-right quadrant, which represents motor themes. Therefore, "higher education" and "R" are essential and well-developed themes that significantly shape the technology field in statistics education.
- ii. The theme "active learning" is located in the top-left quadrant, representing niche themes. As a result, "active learning" is a theme that is well-developed internally but not considered crucial externally within the technology field in statistics education.
- iii. The theme "statistics education" is positioned in the bottom-left quadrant, which indicates emerging or declining themes. "Statistics education" is a weakly developed and marginal theme in the current context.
- iv. The theme "simulation" appears in the bottom-right quadrant, representing basic themes. "Simulation" is an important theme that serves as a foundation in the field but has not undergone significant development.

These findings provide valuable insights into the current state of research themes related to technology in statistics education and their relative significance and development within the field. This study gives information for further development as reported elsewhere regarding several subjects:

- i. mathematics [109-136]
- ii. biology [137-146]
- iii. physics [147-151]
- iv. chemistry [152-158]
- v. engineering [159-165]
- vi. technology [166-170].

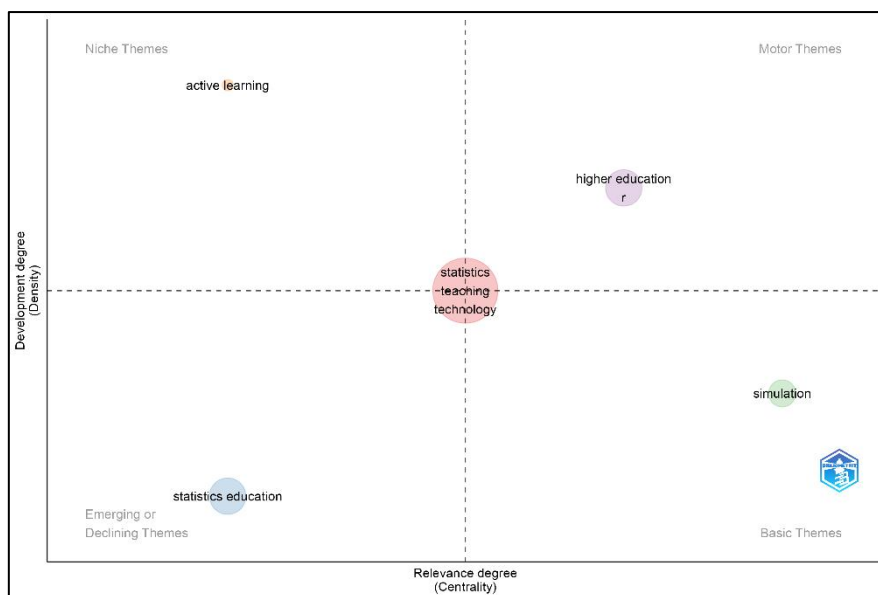


Fig. 5. Thematic map of technology in statistics education keyword

4. Conclusions

This study aims to expound upon the discoveries of a bibliometric analysis of articles about technology in statistics education. The scrutinized articles are those which have been published in journals written in the English language and indexed within the Scopus database. The database used in this research includes the article title, author names, author affiliations, journal name, publisher, abstract, keywords, and reference lists. Based on the search results, 59 relevant articles were identified and published since 1985, with an annual growth rate of 1.84%. The articles under consideration demonstrate an average of 11.02 citations per document and an average document age of 13.7 years. These publications were authored by a total of 135 individuals hailing from 31 distinct nations, with an average count of 2.44 co-authors per document. Five clusters were identified through network visualization of various terms derived from article keywords. Among these, "higher education" and "R" emerged as well-developed and significant themes in shaping the technology field in statistics education. This study suggests opportunities for future research in technology in statistics education. The findings provide valuable insights into the existing literature and potential directions for further exploration.

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References

- [1] Zhang, Ke, and Ayse Begum Aslan. "AI technologies for education: Recent research & future directions." *Computers and Education: Artificial Intelligence* 2 (2021): 100025. <https://doi.org/10.1016/j.caeai.2021.100025>
- [2] Hernández, Jonathan Bermúdez, Salim Chalela, Jackeline Valencia Arias, and Alejandro Valencia Arias. "Research trends in the study of ICT based learning communities: A bibliometric analysis." *Eurasia Journal of Mathematics, Science and Technology Education* 13, no. 5 (2017): 1539-1562. <https://doi.org/10.12973/eurasia.2017.00684a>
- [3] Ozgur, Ceyhun, Sanjeev Jha, and Madison Wallner. "R, Python, Excel, SPSS, SAS, and MINITAB in Banking Research." *AIMS International Journal of Management* 16, no. 1 (2022). <https://doi.org/10.26573/2021.16.1.4>
- [4] Ozgur, Ceyhun, David Booth, and Pervaiz Alam. "Analytics Software Languages for Problem Solving." *Engineering and Technology Quarterly Reviews* 2, no. 2 (2019).

- [5] Possas, Arícia, Antonio Valero, and Fernando Pérez-Rodríguez. "New software solutions for microbiological food safety assessment and management." *Current Opinion in Food Science* 44 (2022): 100814. <https://doi.org/10.1016/j.cofs.2022.100814>
- [6] da Silva, Alexandre Sousa, Maria Tereza Serrano Barbosa, Luciane de Souza Velasque, Davi da Silveira Barroso Alves, and Marcos Nascimento Magalhães. "The COVID-19 epidemic in Brazil: how statistics education may contribute to unravel the reality behind the charts." *Educational Studies in Mathematics* 108, no. 1 (2021): 269-289. <https://doi.org/10.1007/s10649-021-10112-6>
- [7] Drew, David, Sam Behseta, and Cherie Ichinose. "An Urgent Plea for More Graduate Programs in Statistics Education." *Journal of Humanistic Mathematics* 12, no. 1 (2022). <https://doi.org/10.5642/jhummath.202201.32>
- [8] Machmud, Amir, and Asnul Dahar Bin Minghat. "The price dynamics of hand sanitizers for COVID-19 in Indonesia: Exponential and cobweb forms." *Indonesian Journal of Science and Technology* 5, no. 2 (2020): 176-184. <https://doi.org/10.17509/ijost.v5i2.24431>
- [9] Putra, Zulfan Adi, and Shahrul Azman Zainal Abidin. "Application of SEIR model in COVID-19 and the effect of lockdown on reducing the number of active cases." *Indonesian Journal of Science and Technology* 5, no. 2 (2020): 185-192. <https://doi.org/10.17509/ijost.v5i2.24432>
- [10] Anggraeni, Sri, Aulia Maulidina, Mauseni Wantika Dewi, Salma Rahmadiani, Yulian Putri Chandra Rizky, Zulfa Fathi Arinalhaq, Dian Usdiyana, Asep Bayu Dani Nandiyanto, and Abdulkareem Sh Mahdi Al-Obaidi. "The deployment of drones in sending drugs and patient blood samples COVID-19." *Indonesian Journal of Science and Technology* 5, no. 2 (2020): 193-200. <https://doi.org/10.17509/ijost.v5i2.24462>
- [11] Muhmmed, Mustapha Ismael, Aliaa Saadon Abdul-Razaq, and Saad Mukhlif Mahdi. "The Association between The Digestive System and Liver Injury in Covid-19 Patients." *ASEAN Journal of Agriculture and Food Engineering* 2, no. 1 (2023): 1-8.
- [12] Abd Latif, Nor Kamilah, and Abu Yazid Abu Bakar. "The Application of Multicultural Counseling to Help Mental Health Problems During the Covid-19 Pandemic in Malaysia." *ASEAN Journal of Community and Special Needs Education* 2, no. 2 (2023): 61-68.
- [13] Sultanto, Muhamad Anggi, Rafly Ikhsanudin Al Afghani, Salsa Dilla Meisya, Isma Afina Salsabila, Shofa Sofia Rohimat, and Mesa Rahmi Stephani. "Physical education online class for students with hearing impairment during covid-19 pandemic." *ASEAN Journal of Community and Special Needs Education* 2, no. 1 (2023): 17-26.
- [14] Awang, Suriana Che, and Abu Yazid Abu Bakar. "The Unemployment among Malaysian Youth during the Covid-19 Pandemic." *ASEAN Journal of Community Service and Education* 2, no. 1 (2023): 51-58.
- [15] Artawati, A., F. H. D. Handaya, and S. L. Marito. "Comparison analysis of the effectiveness of online and offline classes in following tax brevet training on anccounting students of universitas komputer Indonesia during the Covid-19 pandemi." *ASEAN Journal of Community Service and Education* 1, no. 1 (2022): 51-62.
- [16] Al Husaeni, Dwi Novia. "Bibliometric analysis of briquette research trends during the covid-19 pandemic." *ASEAN Journal for Science and Engineering in Materials* 1, no. 2 (2022): 99-106.
- [17] Dirgantari, Puspo Dewi, Yusuf Murtadlo Hidayat, Rury Nugraheni, and Mohd Halim Mahphoth. "Response to Covid-19 Pandemic in Indonesia Regarding Consumer Purchasing Patterns." *ASEAN Journal of Economic and Economic Education* 1, no. 2 (2022): 61-66.
- [18] Dastjerdi, Negin. "Factor Affecting the Acceptance of Online Learning by Primary School Teachers During the Covid-19 Pandemic: A Structural Study Using the unified theory of acceptance and use of technology (UTAUT) Model." *ASEAN Journal of Educational Research and Technology* 2, no. 3 (2023): 239-250.
- [19] Choo, Suzanne S. "Approaching twenty-first century education from a cosmopolitan perspective." *Journal of Curriculum Studies* 50, no. 2 (2018): 162-181. <https://doi.org/10.1080/00220272.2017.1313316>
- [20] Nandiyanto, Asep Bayu Dani, and Dwi Fitria Al Husaeni. "Bibliometric analysis of engineering research using vosviewer indexed by google scholar." *Journal of Engineering Science and Technology* 17, no. 2 (2022): 883-894.
- [21] Wu, Haiyang, Kunming Cheng, Qiang Guo, Weiguang Yang, Linjian Tong, Yulin Wang, and Zhiming Sun. "Mapping knowledge structure and themes trends of osteoporosis in rheumatoid arthritis: a bibliometric analysis." *Frontiers in Medicine* 8 (2021): 787228. <https://doi.org/10.3389/fmed.2021.787228>
- [22] Amiri, Amiri Mdoe, Bijay Prasad Kushwaha, and Rajkumar Singh. "Visualisation of global research trends and future research directions of digital marketing in small and medium enterprises using bibliometric analysis." *Journal of Small Business and Enterprise Development* 30, no. 3 (2023): 621-641. <https://doi.org/10.1108/JSBED-04-2022-0206>
- [23] Baker, H. Kent, Nitesh Pandey, Satish Kumar, and Arunima Haldar. "A bibliometric analysis of board diversity: Current status, development, and future research directions." *Journal of business research* 108 (2020): 232-246. <https://doi.org/10.1016/j.jbusres.2019.11.025>
- [24] Han, Runyue, Hugo KS Lam, Yuanzhu Zhan, Yichuan Wang, Yogesh K. Dwivedi, and Kim Hua Tan. "Artificial intelligence in business-to-business marketing: a bibliometric analysis of current research status, development and

- future directions." *Industrial Management & Data Systems* 121, no. 12 (2021): 2467-2497. <https://doi.org/10.1108/IMDS-05-2021-0300>
- [25] Khatib, Saleh FA, Dewi Fariha Abdullah, Ernie Hendrawaty, and Ahmed A. Elamer. "A bibliometric analysis of cash holdings literature: current status, development, and agenda for future research." *Management Review Quarterly* 72, no. 3 (2022): 707-744. <https://doi.org/10.1007/s11301-021-00213-0>
- [26] Phan, Tinh Thi, Thi Trinh Do, Thanh Hai Trinh, Trung Tran, Huu Tong Duong, Thi Phuong Thao Trinh, Bao Chau Do, and Tien-Trung Nguyen. "A Bibliometric Review on Realistic Mathematics Education in Scopus Database between 1972-2019." *European Journal of Educational Research* 11, no. 2 (2022): 1133-1149. <https://doi.org/10.12973/eu-er.11.2.1133>
- [27] Julius, Rafael, Muhammad Syawal Abd Halim, Normi Abdul Hadi, Azrul Nizam Alias, Muhammad Hafiz Mohd Khalid, Zulfadli Mahfodz, and Fariesha Farha Ramli. "Bibliometric analysis of research in mathematics education using Scopus database." *Eurasia Journal of Mathematics, Science and Technology Education* 17, no. 12 (2021). <https://doi.org/10.29333/ejmste/11329>
- [28] Cansiz Aktas, Meral. "Problem-Posing Research in Mathematics Education: A Bibliometric Analysis." *Journal of Pedagogical Research* 6, no. 4 (2022): 217-233. <https://doi.org/10.33902/JPR.202217414>
- [29] Hasumi, Toshiyuki, and Mei-Shiu Chiu. "Online mathematics education as bio-eco-techno process: bibliometric analysis using co-authorship and bibliographic coupling." *Scientometrics* 127, no. 8 (2022): 4631-4654. <https://doi.org/10.1007/s11192-022-04441-3>
- [30] Dede, Ercan, and Ercan Ozdemir. "Mapping and Performance Evaluation of Mathematics Education Research in Turkey: A Bibliometric Analysis from 2005 to 2021." *Journal of Pedagogical Research* 6, no. 4 (2022): 1-19. <https://doi.org/10.33902/JPR.202216829>
- [31] Safitri, Niken Dwi, Rani Darmayanti, Usmiyatun Usmiyatun, and Dewi Nurmalitasari. "21st century mathematics learning challenges: Bibliometric analysis of trends and best practices in shinta indexed scientific publications." *JEMS: Jurnal Edukasi Matematika Dan Sains* 11, no. 1 (2023): 136-152.
- [32] Phuong, Nguyen Lan, Nguyen Quang Linh, Trinh Thi Phuong Thao, Hong-Hanh Thi Pham, Nguyen Truong Giang, and Vu Thi Thuy. "Implementation of STEM education: A bibliometrics analysis from case study research in Scopus database." *Eurasia Journal of Mathematics, Science and Technology Education* 19, no. 6 (2023): em2278. <https://doi.org/10.29333/ejmste/13216>
- [33] Ha, Cao Thi, Trinh Thi Phuong Thao, Nguyen Tien Trung, Ngo Van Dinh, and Tran Trung. "A bibliometric review of research on STEM education in ASEAN: Science mapping the literature in Scopus database, 2000 to 2019." *Eurasia Journal of Mathematics, Science and Technology Education* 16, no. 10 (2020): em1889. <https://doi.org/10.29333/ejmste/8500>
- [34] Assefa, Shimelis G., and Abebe Rorissa. "A bibliometric mapping of the structure of STEM education using co-word analysis." *Journal of the American Society for Information Science and Technology* 64, no. 12 (2013): 2513-2536. <https://doi.org/10.1002/asi.22917>
- [35] Marín-Marín, José-Antonio, Antonio-José Moreno-Guerrero, Pablo Dúo-Terrón, and Jesús López-Belmonte. "STEAM in education: a bibliometric analysis of performance and co-words in Web of Science." *International Journal of STEM Education* 8, no. 1 (2021): 41. <https://doi.org/10.1186/s40594-021-00296-x>
- [36] Trinh Thi Phuong, Thao, Nam Nguyen Danh, Trinh Tuyet Thi Le, Thao Nguyen Phuong, Tuyen Nguyen Thi Thanh, and Cuong Le Minh. "Research on the application of ICT in Mathematics education: Bibliometric analysis of scientific bibliography from the Scopus database." *Cogent Education* 9, no. 1 (2022): 2084956. <https://doi.org/10.1080/2331186X.2022.2084956>
- [37] Su, Jiahong, and Weipeng Yang. "A systematic review of integrating computational thinking in early childhood education." *Computers and Education Open* 4 (2023): 100122. <https://doi.org/10.1016/j.caeo.2023.100122>
- [38] Chen, Hui E., Daner Sun, Ting-Chia Hsu, Yuqin Yang, and Jin Sun. "Visualising trends in computational thinking research from 2012 to 2021: A bibliometric analysis." *Thinking Skills and Creativity* 47 (2023): 101224. <https://doi.org/10.1016/j.tsc.2022.101224>
- [39] Kite, Vance, Soonhye Park, and Eric Wiebe. "The code-centric nature of computational thinking education: A review of trends and issues in computational thinking education research." *Sage Open* 11, no. 2 (2021): 21582440211016418. <https://doi.org/10.1177/21582440211016418>
- [40] Roig-Vila, Rosabel, and Víctor Moreno-Isac. "El pensamiento computacional en Educación. Análisis bibliométrico y temático." *Revista De Educación a Distancia (RED)* 20, no. 63 (2020). <https://doi.org/10.6018/red.402621>
- [41] Ilic, Ulas, Halil İbrahim Haseski, and Ufuk Tugtekin. "Publication trends over 10 years of computational thinking research." *Contemporary Educational Technology* 9, no. 2 (2018): 131-153. <https://doi.org/10.30935/cet.414798>
- [42] Tekdal, Mehmet. "Trends and development in research on computational thinking." *Education and Information Technologies* 26, no. 5 (2021): 6499-6529. <https://doi.org/10.1007/s10639-021-10617-w>

- [43] Irawan, Edi, and Tatang Herman. "Trends in research on interconnection of mathematics and computational thinking." In *AIP Conference Proceedings*, vol. 2805, no. 1. AIP Publishing, 2023. <https://doi.org/10.1063/5.0148018>
- [44] Irawan, Edi, Rizky Rosjanuardi, and Sufyani Prabawanto. "Research trends of computational thinking in mathematics learning: A bibliometric analysis from 2009 to 2023." *Eurasia Journal of Mathematics, Science and Technology Education* 20, no. 3 (2024): em2417. <https://doi.org/10.29333/ejmste/14343>
- [45] Irwanto, Irwanto, Dwi Wahyudiati, Anip Dwi Saputro, and Sigit Dwi Laksana. "Research trends and applications of gamification in higher education: A bibliometric analysis spanning 2013–2022." *International Journal of Emerging Technologies in Learning (IJET)* 18, no. 5 (2023): 19-41. <https://doi.org/10.3991/ijet.v18i05.37021>
- [46] Chen, Pei-Ying, Gwo-Jen Hwang, Ssu-Yin Yeh, Yi-Ting Chen, Ting-Wei Chen, and Chih-Hsuan Chien. "Three decades of game-based learning in science and mathematics education: an integrated bibliometric analysis and systematic review." *Journal of Computers in Education* (2021): 1-22.
- [47] Limaymanta, Cesar, Ludgarda Apaza-Tapia, Elizabeth Vidal, and Orlando Gregorio-Chaviano. "Flipped classroom in higher education: A bibliometric analysis and proposal of a framework for its implementation." *International Journal of Emerging Technologies in Learning (IJET)* 16, no. 9 (2021): 133-149. <https://doi.org/10.3991/ijet.v16i09.21267>
- [48] Yang, Lie, Tiantian Sun, and Yanli Liu. "A bibliometric investigation of flipped classroom research during 2000-2015." *International Journal of Emerging Technologies in Learning (IJET)* 12, no. 06 (2017): 178-186. <https://doi.org/10.3991/ijet.v12i06.7095>
- [49] Pham, Huong Thi, Tu Cam Vu, Lam Tung Nguyen, Ngoc-Thuy Thi Vu, Thang Chien Nguyen, Hong-Hanh Thi Pham, Lien Phuong Lai, Hong-Chi Thi Le, and Chi Hai Ngo. "Professional development for science teachers: A bibliometric analysis from 2001 to 2021." *Eurasia Journal of Mathematics, Science and Technology Education* 19, no. 5 (2023): em2260.
- [50] Ng, Davy Tsz Kit, Anthony Chun Hin Ching, and Sau Wai Law. "Online learning in management education amid the pandemic: A bibliometric and content analysis." *The International Journal of Management Education* 21, no. 2 (2023): 100796. <https://doi.org/10.1016/j.ijme.2023.100796>
- [51] Zou, Di, Xinyi Huang, Lucas Kohnke, Xieling Chen, Gary Cheng, and Haoran Xie. "A bibliometric analysis of the trends and research topics of empirical research on TPACK." *Education and Information Technologies* 27, no. 8 (2022): 10585-10609. <https://doi.org/10.1007/s10639-022-10991-z>
- [52] Wang, Gang, and Jing He. "A bibliometric analysis on research trends of digital literacy in higher education from 2012 to 2021." *International Journal of Emerging Technologies in Learning (IJET)* 17, no. 16 (2022): 43-58. <https://doi.org/10.3991/ijet.v17i16.31377>
- [53] Rojas-Sánchez, Mario A., Pedro R. Palos-Sánchez, and José A. Folgado-Fernández. "Systematic literature review and bibliometric analysis on virtual reality and education." *Education and Information Technologies* 28, no. 1 (2023): 155-192. <https://doi.org/10.1007/s10639-022-11167-5>
- [54] Hwang, Gwo-Jen, and Yun-Fang Tu. "Roles and research trends of artificial intelligence in mathematics education: A bibliometric mapping analysis and systematic review." *Mathematics* 9, no. 6 (2021): 584. <https://doi.org/10.3390/math9060584>
- [55] Prahani, Binar, Iqbal Rizki, Budi Jatmiko, Nadi Suprpto, and Amelia Tan. "Artificial intelligence in education research during the last ten years: A review and bibliometric study." *International Journal of Emerging Technologies in Learning (IJET)* 17, no. 8 (2022): 169-188. <https://doi.org/10.3991/ijet.v17i08.29833>
- [56] Tlili, Ahmed, Ronghuai Huang, Boulus Shehata, Dejian Liu, Jialu Zhao, Ahmed Hosny Saleh Metwally, Huanhuan Wang *et al.*, "Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis." *Smart Learning Environments* 9, no. 1 (2022): 1-31. <https://doi.org/10.1186/s40561-022-00205-x>
- [57] Ozyurt, Ozcan, and Ahmet Ayaz. "Twenty-five years of education and information technologies: Insights from a topic modeling based bibliometric analysis." *Education and Information Technologies* 27, no. 8 (2022): 11025-11054. <https://doi.org/10.1007/s10639-022-11071-y>
- [58] Al Husaeni, Dwi Fitria, Asep Bayu Dani Nandiyanto, and Rina Maryanti. "Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research." *Indonesian Journal of Teaching in Science* 3, no. 1 (2023): 1-8. <https://doi.org/10.17509/ijotis.v3i1.43182>
- [59] Huang, Cui, Chao Yang, Shutao Wang, Wei Wu, Jun Su, and Chuying Liang. "Evolution of topics in education research: A systematic review using bibliometric analysis." *Educational Review* 72, no. 3 (2020): 281-297. <https://doi.org/10.1080/00131911.2019.1566212>
- [60] Nandiyanto, Asep Bayu Dani, Risti Ragadhita, and Muhammad Aziz. "Involving particle technology in computational fluid dynamics research: A bibliometric analysis." *CFD Letters* 15, no. 11 (2023): 92-109. <https://doi.org/10.37934/cfdl.15.11.92109>

- [61] Muktiarni, M., Nur Indri Rahayu, Affero Ismail, and Amalia Kusuma Wardani. "Bibliometric computational mapping analysis of trend metaverse in education using vosviewer." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 32, no. 2 (2023): 95-106. <https://doi.org/10.37934/araset.32.2.95106>
- [62] Rahayu, Nur Indri, Adang Suherman, and M. Muktiarni. "The use of information technology and lifestyle: An evaluation of digital technology intervention for improving physical activity and eating behavior." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 32, no. 1 (2023): 303-314. <https://doi.org/10.37934/araset.32.1.303314>
- [63] Fauziah, Siti Pupu, Irman Suherman, Mega Febriani Sya, Martin Roestamy, Amirullah Abduh, and Asep Bayu Dani Nandiyanto. "Strategies in language education to improve science student understanding during practicum in laboratory: Review and computational bibliometric analysis." *International Journal of Language Education* 5, no. 4 (2021).
- [64] Al Husaeni, D. F., D. N. Al Husaeni, R. Ragadhita, M. R. Bilad, A. S. M. Al-Obaidi, A. Abduh, and A. B. D. Nandiyanto. "How language and technology can improve student learning quality in engineering? Definition, factors for enhancing students comprehension, and computational bibliometric analysis." *International Journal of Language Education* 6, no. 4 (2022): 445-476. <https://doi.org/10.26858/ijole.v6i4.53587>
- [65] Kumar, Kuty. "Mapping of nanotechnology research in animal science: Scientometric analysis." *Kumar (2021) Mapping of Nanotechnology Research in Animal Science: Scientometric Analysis. ASEAN Journal of Science and Engineering* 1, no. 2 (2021): 111-126. <https://doi.org/10.17509/ajse.v1i2.35092>
- [66] Nurrahma, Arinal Haq Izzawati, Hana Haruna Putri, and Ray March Syahadat. "Scientific research trends of flooding stress in plant science and agriculture subject areas (1962-2021)." *ASEAN Journal of Science and Engineering* 3, no. 2 (2023): 163-178. <https://doi.org/10.17509/ajse.v3i2.46148>
- [67] Nandiyanto, Asep Bayu Dani, Dwi Novia Al Husaeni, and Dwi Fitria Al Husaeni. "Introducing ASEAN journal of science and engineering: A bibliometric analysis study." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 31, no. 3 (2023): 173-190.
- [68] Nandiyanto, Asep Bayu Dani, D. N. Al Husaeni, and D. F. Al Husaeni. "A bibliometric analysis of chemical engineering research using vosviewer and its correlation with covid-19 pandemic condition." *Journal of Engineering Science and Technology* 16, no. 6 (2021): 4414-4422.
- [69] Nandiyanto, Asep Bayu Dani, and Dwi Fitria Al Husaeni. "A bibliometric analysis of materials research in Indonesian journal using VOSviewer." *Journal of Engineering Research* (2021).
- [70] Nandiyanto, Asep Bayu Dani, and Dwi Fitria Al Husaeni. "Bibliometric analysis of engineering research using vosviewer indexed by google scholar." *Journal of Engineering Science and Technology* 17, no. 2 (2022): 883-894.
- [71] Al Husaeni, Dwi Fitria, and Asep Bayu Dani Nandiyanto. "Bibliometric computational mapping analysis of publications on mechanical engineering education using vosviewer." *Journal of Engineering Science and Technology* 17, no. 2 (2022): 1135-1149.
- [72] Nandiyanto, A. B. D., R. Ragadhita, D. N. Al Husaeni, and W. C. Nugraha. "Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis." *Moroccan Journal of Chemistry* 11, no. 1 (2023): 11-1.
- [73] Nandiyanto, Asep Bayu Dani, Risti Ragadhita, Meli Fiandini, Dwi Fitria Al Husaeni, Dwi Novia Al Husaeni, and Farid Fadhillah. "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..." *Communications in Science and Technology* 7, no. 1 (2022): 50-61. <https://doi.org/10.21924/cst.7.1.2022.757>
- [74] Al Husaeni, Dwi Fitria, Asep Bayu Dani Nandiyanto, and Rina Maryanti. "Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research." *Indonesian Journal of Teaching in Science* 3, no. 1 (2023): 1-8. <https://doi.org/10.17509/ijotis.v3i1.43182>
- [75] Mardina, Primata, Hesti Wijayanti, Rinna Juwita, Meilana Dharma Putra, Iryanti Fatyasari Nata, Rowina Lestari, Muhammad Faqih Al-Amin, Regi Abizar Suciagi, Oktefani Kusuma Rawei, and Liza Lestari. "Corn-cob-derived sulfonated magnetic solid catalyst synthesis as heterogeneous catalyst in the esterification of waste cooking oil and bibliometric analysis." *Indonesian Journal of Science and Technology* 9, no. 1 (2024): 109-124. <https://doi.org/10.17509/ijost.v9i1.64219>
- [76] Abduh, Amirullah, Ade Mulianah, Besse Darmawati, Fairul Zabadi, Umar Sidik, Wuri Handoko, Karta Jayadi, and Rosmaladewi Rosmaladewi. "The complete lextutor application tool for academic and technological lexical learning: Review and bibliometric approach." *Indonesian Journal of Science and Technology* 8, no. 3 (2023): 539-560. <https://doi.org/10.17509/ijost.v8i3.63539>
- [77] Chukwu, Emeka, and Lalit Garg. "A systematic review of blockchain in healthcare: frameworks, prototypes, and implementations." *Ieee Access* 8 (2020): 21196-21214. <https://doi.org/10.1109/ACCESS.2020.2969881>

- [78] Al Husaeni, Dwi Fitria, and Dwi Novia Al Husaeni. "Computational bibliometric analysis of research on science and Islam with VOSviewer: Scopus database in 2012 to 2022." *ASEAN Journal of Religion, Education, and Society* 1, no. 1 (2022): 39-48.
- [79] Al Husaeni, Dwi Fitria, and W. Wahyudin. "Digital transformation in special needs education: Computational bibliometrics." *ASEAN Journal of Community and Special Needs Education* 2, no. 2 (2023): 97-110.
- [80] Gao, Yanjun, Su Luan Wong, Mas Nida Md. Khambari, and Nooreen Noordin. "A bibliometric analysis of online faculty professional development in higher education." *Research and Practice in Technology Enhanced Learning* 17, no. 1 (2022): 17. <https://doi.org/10.1186/s41039-022-00196-w>
- [81] Donthu, Naveen, Satish Kumar, Debmalya Mukherjee, Nitesh Pandey, and Weng Marc Lim. "How to conduct a bibliometric analysis: An overview and guidelines." *Journal of business research* 133 (2021): 285-296. <https://doi.org/10.1016/j.jbusres.2021.04.070>
- [82] Azizah, Nissa Nur, Rina Maryanti, and Asep Bayu Dani Nandiyanto. "How to search and manage references with a specific referencing style using google scholar: From step-by-step processing for users to the practical examples in the referencing education." *Indonesian Journal of Multidisciplinary Research* 1, no. 2 (2021): 267-294. <https://doi.org/10.17509/ijomr.v1i2.37694>
- [83] Al Husaeni, Dwi Fitria, and Asep Bayu Dani Nandiyanto. "Bibliometric using Vosviewer with Publish or Perish (using google scholar data): From step-by-step processing for users to the practical examples in the analysis of digital learning articles in pre and post Covid-19 pandemic." *ASEAN Journal of Science and Engineering* 2, no. 1 (2022): 19-46. <https://doi.org/10.17509/ajse.v2i1.37368>
- [84] Aria, Massimo, and Corrado Cuccurullo. "bibliometrix: An R-tool for comprehensive science mapping analysis." *Journal of informetrics* 11, no. 4 (2017): 959-975. <https://doi.org/10.1016/j.joi.2017.08.007>
- [85] Shamsuddin, Jamaltul Nizam, Christopher Gan, and Dao Le Trang Anh. "Bibliometric Analysis of InsurTech." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 30, no. 2 (2023): 103-132. <https://doi.org/10.37934/araset.30.2.103132>
- [86] Perianes-Rodriguez, Antonio, Ludo Waltman, and Nees Jan Van Eck. "Constructing bibliometric networks: A comparison between full and fractional counting." *Journal of informetrics* 10, no. 4 (2016): 1178-1195. <https://doi.org/10.1016/j.joi.2016.10.006>
- [87] Nandiyanto, Asep Bayu Dani, Dwi Fitria Al Husaeni, and Dwi Novia Al Husaeni. "Social impact and internationalization of "Indonesian journal of science and technology" the best journal in Indonesia: A bibliometric analysis." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 32, no. 2 (2023): 42-59. <https://doi.org/10.37934/araset.32.2.4259>
- [88] Legaki, Nikoletta-Zampeta, Nannan Xi, Juho Hamari, Kostas Karpouzis, and Vassilios Assimakopoulos. "The effect of challenge-based gamification on learning: An experiment in the context of statistics education." *International journal of human-computer studies* 144 (2020): 102496. <https://doi.org/10.1016/j.ijhcs.2020.102496>
- [89] Larwin, Karen, and David Larwin. "A meta-analysis examining the impact of computer-assisted instruction on postsecondary statistics education: 40 years of research." *Journal of Research on Technology in Education* 43, no. 3 (2011): 253-278. <https://doi.org/10.1080/15391523.2011.10782572>
- [90] Nolan, Deborah, and T. P. Speed. "Teaching statistics theory through applications." *The American Statistician* 53, no. 4 (1999): 370-375. <https://doi.org/10.1080/00031305.1999.10474492>
- [91] Yang, Dazhi. "Instructional strategies and course design for teaching statistics online: perspectives from online students." *International Journal of STEM education* 4 (2017): 1-15. <https://doi.org/10.1186/s40594-017-0096-x>
- [92] Sigal, Matthew J., and R. Philip Chalmers. "Play it again: Teaching statistics with Monte Carlo simulation." *Journal of Statistics Education* 24, no. 3 (2016): 136-156. <https://doi.org/10.1080/10691898.2016.1246953>
- [93] Mills, Jamie D., and Dheeraj Raju. "Teaching statistics online: A decade's review of the literature about what works." *Journal of Statistics Education* 19, no. 2 (2011). <https://doi.org/10.1080/10691898.2011.11889613>
- [94] Liu, T-C., Y-C. Lin, and Kinshuk. "The application of Simulation-Assisted Learning Statistics (SALS) for correcting misconceptions and improving understanding of correlation." *Journal of computer assisted learning* 26, no. 2 (2010): 143-158. <https://doi.org/10.1111/j.1365-2729.2009.00330.x>
- [95] Velleman, Paul F., and David S. Moore. "Multimedia for teaching statistics: Promises and pitfalls." *The American Statistician* 50, no. 3 (1996): 217-225. <https://doi.org/10.1080/00031305.1996.10474383>
- [96] Neumann, David L., Michelle Hood, and Michelle M. Neumann. "Statistics? You must be joking: The application and evaluation of humor when teaching statistics." *Journal of Statistics Education* 17, no. 2 (2009). <https://doi.org/10.1080/10691898.2009.11889525>
- [97] Dolinsky, Beverly. "An active learning approach to teaching statistics." *Teaching of Psychology* (2001).
- [98] Moore, David S., George W. Cobb, Joan Garfield, and William Q. Meeker. "Statistics education fin de siecle." *The American Statistician* 49, no. 3 (1995): 250-260. <https://doi.org/10.1080/00031305.1995.10476159>

- [99] Ridgway, Jim, James Nicholson, and Sean McCusker. "Teaching statistics—Despite its applications." *Teaching Statistics* 29, no. 2 (2007): 44-48. <https://doi.org/10.1111/j.1467-9639.2007.00276.x>
- [100] Loch, Birgit, Linda Galligan, Carola Hobohm, and Christine McDonald. "Learner-centred mathematics and statistics education using netbook tablet PCs." *International Journal of Mathematical Education in Science and Technology* 42, no. 7 (2011): 939-949. <https://doi.org/10.1080/0020739X.2011.611910>
- [101] Simpson, Judy M. "Teaching statistics to non-specialists." *Statistics in medicine* 14, no. 2 (1995): 199-208. <https://doi.org/10.1002/sim.4780140210>
- [102] Nash, John C. "Teaching statistics with Excel 2007 and other spreadsheets." *Computational Statistics & Data Analysis* 52, no. 10 (2008): 4602-4606. <https://doi.org/10.1016/j.csda.2008.03.008>
- [103] Saville, D. J., and G. R. Wood. "A method for teaching statistics using N-dimensional geometry." *The American Statistician* 40, no. 3 (1986): 205-214. <https://doi.org/10.1080/00031305.1986.10475394>
- [104] Neumann, David L., Michelle M. Neumann, and Michelle Hood. "The development and evaluation of a survey that makes use of student data to teach statistics." *Journal of Statistics Education* 18, no. 1 (2010). <https://doi.org/10.1080/10691898.2010.11889478>
- [105] Chamandy, Nicholas, Omkar Muralidharan, and Stefan Wager. "Teaching statistics at Google-scale." *The American Statistician* 69, no. 4 (2015): 283-291. <https://doi.org/10.1080/00031305.2015.1089790>
- [106] Marson, Stephen M. "Three empirical strategies for teaching statistics." *Journal of Teaching in Social Work* 27, no. 3-4 (2007): 199-213. https://doi.org/10.1300/J067v27n03_13
- [107] Moore, David S. "Preparing graduate students to teach statistics: Introduction." *The American Statistician* 59, no. 1 (2005): 1-3. <https://doi.org/10.1198/000313005X20745>
- [108] Al Husaeni, Dwi Fitria, and Asep Bayu Dani Nandiyanto. "Bibliometric computational mapping analysis of publications on mechanical engineering education using vosviewer." *Journal of Engineering Science and Technology* 17, no. 2 (2022): 1135-1149.
- [109] Dallyono, Ruswan, Didi Sukyadi, and Lukman Hakim. "A mathematical model of the cognitive semantics of the English preposition on." *Indonesian Journal of Science and Technology* 5, no. 1 (2020): 133-153. <https://doi.org/10.17509/ijost.v5i1.22774>
- [110] Hashim, Suhaizal, Alias Masek, Bismi Nurnazatul Shima Mohd Mahthir, Ana Haziqah A. Rashid, and Danakorn Nincarean. "Association of interest, attitude and learning habit in mathematics learning towards enhancing students' achievement." *Indonesian Journal of Science and Technology* 6, no. 1 (2021): 113-122. <https://doi.org/10.17509/ijost.v6i1.31526>
- [111] Akinoso, Sabainah Oyebola. "Motivation and ICT in secondary school mathematics using unified theory of acceptance and use of technology model." *Indonesian Journal of Educational Research and Technology* 3, no. 1 (2023): 79-90. <https://doi.org/10.17509/ijert.v3i1.47183>
- [112] Radiamoda, Arsad A. "Difficulties encountered by the students in learning mathematics." *Indonesian Journal of Educational Research and Technology* 4, no. 1 (2024): 63-70.
- [113] Husnah, Annisa Ul, Muhammad Alif Hidayat, and Miftahul Jannah. "The journey of a math: As a mathematics learning innovation." *Indonesian Journal of Multidisciplinary Research* 1, no. 1 (2021): 129-136. <https://doi.org/10.17509/ijomr.v1i1.33814>
- [114] Marasabessy, Rosida. "Study of mathematical reasoning ability for mathematics learning in schools: A literature review." *Indonesian Journal of Teaching in Science* 1, no. 2 (2021): 79-90. <https://doi.org/10.17509/ijotis.v1i2.37950>
- [115] Maryati, Wahyuni Eka, Endah Retnowati, and Ng Khar Thoe. "Learning mathematics formulas by listening and reading worked examples." *Indonesian Journal of Teaching in Science* 2, no. 1 (2022): 61-74. <https://doi.org/10.17509/ijotis.v2i1.45801>
- [116] Ogunjimi, Mayowa Olurotimi, and Taofeek Akolade Gbadeyanka. "Effect of guided inquiry and explicit-instructional strategies on lower basic students' academic performance in mathematics." *Indonesian Journal of Teaching in Science* 3, no. 1 (2023): 23-32. <https://doi.org/10.17509/ijotis.v3i1.54191>
- [117] Obafemi, K. E., U. T. Saadu, A. Adesokan, O. Yahaya, J. T. Sulaimon, T. O. Obafemi, and F. M. Yakubu. "Self-efficacy as a correlate of pupils' academic achievement in mathematics." *Indonesian Journal of Teaching in Science* 3, no. 2 (2023): 113-120. <https://doi.org/10.17509/ijotis.v3i2.59775>
- [118] Mitrayana, M., and Elah Nurlaelah. "Computational thinking in mathematics learning: Systematic literature review." *Indonesian Journal of Teaching in Science* 3, no. 2 (2023): 133-142. <https://doi.org/10.17509/ijotis.v3i2.60179>
- [119] Camenda, Datu Yuri, Cybelle Angela Gaba, Nazirev Lacord, Dania Natango, Alecshane Pabl, and Hassanal Abusam. "How difficult is 1+ 1? A phenomenological study of high school students struggling in mathematics." *ASEAN Journal of Science and Engineering Education* 1, no. 2 (2021): 111-116. <https://doi.org/10.17509/ajsee.v1i2.33403>

- [120] Omolafe, Eyiemi Veronica. "Primary educators experts' validation of the developed mathematics mobile application to enhance the teaching of mathematics in Nigeria primary schools." *ASEAN Journal of Science and Engineering Education* 1, no. 3 (2021): 157-166. <https://doi.org/10.17509/ajsee.v1i3.38505>
- [121] Serra, Elmer JR P., Nikko Jay R. Senope, and Charls M. Lariosa. "Potholes in the implementation of printed module in mathematics and feedbacks of learners in Lambayong national high school during covid-19 pandemic." *ASEAN Journal of Science and Engineering Education* 1, no. 3 (2021): 177-182. <https://doi.org/10.17509/ajsee.v1i3.40897>
- [122] Wijaya, Hanna, Rina Maryanti, Verra Wulandary, and Asep Rudi Irawan. "Numerical minimum competence assessment for increasing students' interest in mathematics." *ASEAN Journal of Science and Engineering Education* 2, no. 3 (2022): 183-192.
- [123] Awofala, Adeneye Olarewaju A. "Examining sources of mathematics self-efficacy beliefs of senior secondary school students." *ASEAN Journal of Science and Engineering Education* 3, no. 3 (2023): 229-244.
- [124] Awofala, Adeneye Olarewaju A., Oladiran S. Olabiya, Omolabake T. Ojo, Adenike J. Oladipo, Alfred O. Fatade, and Uchenna N. Udeani. "Personal and contextual factors as correlates of entrepreneurial intentions among pre-service science, technology, and mathematics teachers." *ASEAN Journal of Science and Engineering Education* 3, no. 3 (2023): 265-278.
- [125] Obafemi, Kayode Ezecheal, Ayodele Fajonyomi, and Eniola Keji Ola-Alani. "Effect of reversed jigsaw instructional strategy on pupils academic achievement in mathematics." *ASEAN Journal of Science and Engineering Education* 3, no. 3 (2023): 297-304.
- [126] Awofala, Adeneye Olarewaju A., Sabainah O. Akinoso, Comfort O. Adeniyi, Sufiyanu H. Jega, Alfred O. Fatade, and Abayomi A. Arigbabu. "Primary teachers' mathematics anxiety and mathematics teaching anxiety as predictors of students' performance in mathematics." *ASEAN Journal of Science and Engineering Education* 4, no. 1 (2024): 9-24.
- [127] Obafemi, K. E. "Enhancing pupils' academic performance in mathematics using brainstorming instructional strategy." *ASEAN Journal of Science and Engineering Education* 4, no. 2 (2024): 99-106.
- [128] Maryanti, Rina. "Assessment of mathematical abilities of students with intellectual disabilities during the COVID-19 pandemic." *Indonesian Journal of Community and Special Needs Education* 1, no. 2 (2021): 47-52. <https://doi.org/10.17509/ijcsne.v1i2.33402>
- [129] San Jose, Maria Tricia N. "Factors that affect the performance of selected high school students from the third district of Albay in International Mathematics Competitions." *ASEAN Journal for Science Education* 1, no. 1 (2022): 9-16.
- [130] Dermawan, Rian, M. Muktiarni, and Jonah Mupita. "Efforts to increase the interest of junior high school students in mathematics lessons using the tik tok learning tool." *ASEAN Journal for Science Education* 1, no. 2 (2022): 81-88.
- [131] Lagcao, Yvrin Gabriel D., Jean Paul Andrei D. Dechavez, Daven John G. Goleng, Alyssa Khate E. Lamzon, Khalid Yasper M. Tangkli, and Welard Jay C. Vicera. "Math readiness and its Effect on the online academic performance of science, technology, engineering, and mathematics students." *ASEAN Journal for Science Education* 2, no. 1 (2023): 33-38.
- [132] Awofala, Adeneye Olarewaju A., and Afolabi Oladayo Olaniyi. "Assessing teachers' formative evaluation strategy as related to senior secondary school students' achievement in mathematics." *ASEAN Journal for Science Education* 2, no. 2 (2023): 77-86.
- [133] Obafemi, K. E., U. T. Saadu, O. Yahaya, T. O. Obafemi, and F. M. Yakubu. "Exploration of the effect of scaffolding instructional strategy on pupils' academic performance in mathematics." *ASEAN Journal for Science Education* 2, no. 2 (2023): 121-128.
- [134] Awofala, Adeneye Olarewaju A., and Felicia OO Agbolade. "Effect of peer-tutoring strategy on senior secondary school students' achievement in mathematics." *ASEAN Journal for Science Education* 3, no. 1 (2023): 1-12.
- [135] Padmore, Edward Abanie, and Clement Ayarebilla Ali. "Exploring effective differentiated instruction in the teaching and learning of mathematics." *ASEAN Journal for Science Education* 3, no. 1 (2024): 41-54.
- [136] Irawan, Edi, Rizky Rosjanuardi, and Sufyani Prabawanto. "Advancing Computational Thinking in Mathematics Education: a Systematic Review of Indonesian Research Landscape." *JTAM (Jurnal Teori dan Aplikasi Matematika)* 8, no. 1 (2024): 176-194. <https://doi.org/10.31764/jtam.v8i1.17516>
- [137] Lasisi, Adekola Kamil, Abdulhafis Adeyinka Hassan, and Habibat Bolanle Abdulkareem. "Impact of single parenting on academic performance of junior secondary school students in mathematics." *ASEAN Journal for Science Education* 3, no. 2 (2024): 129-138.
- [138] Glorifica, Ivonne. "Media analysis of biology teaching book grade xii: A study based on science literacy category." *Indonesian Journal of Educational Research and Technology* 1, no. 1 (2021): 17-22. <https://doi.org/10.17509/ijert.v1i1.32659>
- [139] Olumorin, Charles Olabode, Ebenezer Omolafe Babalola, Gboyega Ayodeji Aladesusi, Ahmed Idris Issa, and Eyiemi Veronica Omolafe. "Experts' validation of the developed 3-dimensional automated model of the human heart to teach a biology concept in Ilorin, Nigeria." *Indonesian Journal of Multidisciplinary Research* 1, no. 2 (2021): 299-308. <https://doi.org/10.17509/ijomr.v1i2.37840>

- [140] Babalola, Ebenezer Omolafe. "Design and development of 3-dimensional model of human circulatory system to teach a concept of biology in senior secondary schools." *Indonesian Journal of Teaching in Science* 2, no. 1 (2022): 17-28. <https://doi.org/10.17509/ijotis.v2i1.39006>
- [141] Olumorin, Charles Olabode, Ebenezer Omolafe Babalola, and Desire Adunola Ayoola. "Design and development of human excretory system model to teach a biology concept in Ilorin, Nigeria." *Indonesian Journal of Teaching in Science* 2, no. 2 (2022): 107-116. <https://doi.org/10.17509/ijotis.v2i2.45782>
- [142] Hofifah, Siti Nur, and S. Sumiati. "The effectiveness of the practicum video guide on distance learning in improving biology learning outcomes in enzyme content." *Indonesian Journal of Teaching in Science* 3, no. 2 (2023): 201-212. <https://doi.org/10.17509/ijotis.v3i2.62905>
- [143] Alhassan, Najmuddeen, Amina Alhassan, and Akazi Frances Chioma. "Examining the role of biology teachers' beliefs, motivations, and self-reported practices in constructing curves for biology class." *Indonesian Journal of Teaching in Science* 4, no. 1 (2024): 11-26.
- [144] Tipmontiane, Krittin, and P. John Williams. "The integration of the engineering design process in biology-related STEM activity: A review of Thai secondary education." *ASEAN Journal of Science and Engineering Education* 2, no. 1 (2022): 1-10. <https://doi.org/10.17509/ajsee.v2i1.35097>
- [145] Abdussemiu, Ahmad. "Problems of teaching practical biology in senior secondary schools." *ASEAN Journal of Science and Engineering Education* 2, no. 3 (2022): 199-206.
- [146] Babalola, Ebenezer Omolafe, Desire Adunola Ayoola, and Eyiemi Veronica Omolafe. "Analysis of experts' opinion on the human excretory system model for teaching biology in Nigeria." *ASEAN Journal of Science and Engineering Education* 3, no. 1 (2023): 19-26.
- [147] Ala, N. A., A. O. Onojah, A. M. Ishyaku, and S. B. Adamu. "Development of an animation package in biology for teaching vertebrate, anatomy, and physiology." *ASEAN Journal for Science Education* 1, no. 2 (2022): 117-130.
- [148] Susilowati, Nisfullail Indah, Winny Liliawati, and Dadi Rusdiana. "Science process skills test instruments in the new Indonesian curriculum (merdeka): Physics subject in renewable energy topic." *Indonesian Journal of Teaching in Science* 3, no. 2 (2023): 121-132. <https://doi.org/10.17509/ijotis.v3i2.60112>
- [149] Lestari, Dwi Ayu, I. R. Suwarma, and Endi Suhendi. "Feasibility analysis of the development of STEM-based physics e-book with self-regulated learning on global warming topics." *Indonesian Journal of Teaching in Science* 4, no. 1 (2024): 1-10.
- [150] Abosede, Peter Joy, Samuel A. Onasanya, and Okonkwo Clementina Ngozi. "Students self-assessment of demonstration-based flipped classroom on senior secondary school students' performance in physics." *Indonesian Journal of Teaching in Science* 4, no. 1 (2024): 27-40.
- [151] Azizah, Elza Varih, Asep Bayu Dani Nandiyanto, Tedi Kurniawan, and Muhammad Roil Bilad. "The effectiveness of using a virtual laboratory in distance learning on the measurement materials of the natural sciences of physics for junior high school students." *ASEAN Journal of Science and Engineering Education* 2, no. 3 (2022): 207-214.
- [152] Ibrahim, Abdulwaheed Opeyemi. "Impact of blended learning method on secondary school physics students' achievement and retention in Lokoja, Nigeria." *ASEAN Journal for Science Education* 2, no. 2 (2023): 57-66.
- [153] Francis, Torpev Terver, and Salaudeen Jaleel Baba. "Effect of concept mapping teaching approach on students' academic performance in chemistry in senior secondary schools." *Indonesian Journal of Educational Research and Technology* 3, no. 1 (2023): 69-78. <https://doi.org/10.17509/ijert.v3i1.46145>
- [154] Putri, Silmi Ridwan, Siti Nur Hofifah, Gabriela Chelvina Santiuly Girsang, and Asep Bayu Dani Nandiyanto. "How to identify misconception using certainty of response index (CRI): A study case of mathematical chemistry subject by experimental demonstration of adsorption." *Indonesian Journal of Multidisciplinary Research* 2, no. 1 (2022): 143-158. <https://doi.org/10.17509/ijomr.v2i1.38738>
- [155] Wirzal, Mohd Dzul Hakim, and Nur Syakinah Abd Halim. "Short play approach for analytical chemistry class." *ASEAN Journal of Science and Engineering Education* 2, no. 2 (2022): 163-168. <https://doi.org/10.17509/ajsee.v2i2.42762>
- [156] Barke, Hans-Dieter, and Joline Büchter. "Laboratory jargon and misconceptions in Chemistry—an empirical study." *ASEAN Journal of Science and Engineering Education* 3, no. 1 (2023): 65-70.
- [157] Sombria, Khezel Jean F., Diane L. Celestial, Clea Grace M. Jalagat, and Anamarie G. Valdez. "Online learning through google classroom: Effects on students critical thinking skills in chemistry." *ASEAN Journal of Science and Engineering Education* 3, no. 2 (2023): 193-210.
- [158] Swafiyah, Bawa, Binta Asabe Muhammad, and Abdullahi Zaharaddeen Yamusa. "Effect of conceptual change instructional strategy on chemistry students' performance in acids and bases concepts." *ASEAN Journal for Science Education* 2, no. 1 (2023): 47-54.
- [159] Bilad, Muhammad Roil. "Bibliometric analysis for understanding the correlation between chemistry and special needs education using vosviewer indexed by google." *ASEAN Journal of Community and Special Needs Education* 1, no. 2 (2022): 61-68.

- [160] Sambudi, Nonni Soraya, and Raihan Mahirah Ramli. "Integrated project as innovative assessment to enhance learning experience in thermodynamics class." *ASEAN Journal of Science and Engineering Education* 1, no. 3 (2021): 167-176. <https://doi.org/10.17509/ajsee.v1i3.40896>
- [161] Haritha, K. "Exploring historical seismic events through secondary data analysis: Implications for understanding submarine earthquakes in marine geophysics for educational purposes." *Indonesian Journal of Multidisciplinary Research* 3, no. 2 (2023): 349-370.
- [162] Bilad, Muhammad Roil, and Saiful Prayogi. "Portfolio workbook as an effective method for student-centered learning of chemical engineering principles." *ASEAN Journal of Science and Engineering Education* 1, no. 1 (2021): 31-36. <https://doi.org/10.17509/ajsee.v1i1.32404>
- [163] Andika, Riezqa, and Zulfan Adi Putra. "Teaching programming to chemical engineering students." *ASEAN Journal of Science and Engineering Education* 2, no. 1 (2022): 51-60. <https://doi.org/10.17509/ajsee.v2i1.36935>
- [164] Samsuri, Shafirah. "Teaching chemical engineering thermodynamics using substituted blended learning techniques." *ASEAN Journal of Science and Engineering Education* 4, no. 2 (2024): 143-162.
- [165] Wirzal, Mohd Dzul Hakim, and Zulfan Adi Putra. "What is the correlation between chemical engineering and special needs education from the perspective of bibliometric analysis using vosviewer indexed by google scholar." *Indonesian Journal of Community and Special Needs Education* 2, no. 2 (2022): 103-110. <https://doi.org/10.17509/ijcsne.v2i2.44581>
- [166] Irawan, Edi, Yaya Sukjaya Kusumah, and Veni Saputri. "Pengembangan Multimedia Interaktif Menggunakan Scratch: Solusi Pembelajaran Di Era Society 5.0." *AKSIOMA: Jurnal Program Studi Pendidikan Matematika* 12, no. 1 (2023): 36. <https://doi.org/10.24127/ajpm.v12i1.6226>
- [167] Hashim, Mohd Ekram Al Hafis, and Noraini Ramli. "Interactive AR Textbook Application for 3M Orang Asli Students in Primary School." *Semarak International Journal of Innovation in Learning and Education* 2, no. 1 (2024): 1-24.
- [168] Jaafar, Nurulaini, Siti Rohani Mohd Nor, Siti Mariam Norrulashikin, Nur Arina Bazilah Kamisan, and Ahmad Qushairi Mohamad. "Increase students' understanding of mathematics learning using the technology-based learning." *International Journal of Advanced Research in Future Ready Learning and Education* 28, no. 1 (2022): 24-29.
- [169] Mohamed, Rosmawati, Mohd Zaid Mamat, and Anuar Ab Razak. "Using GeoGebra with Van Hiele's Model in Geometry Classroom: An Experience with Prospective Teacher." *Semarak International Journal of STEM Education* 1, no. 1 (2024): 1-19.
- [170] Roslan, Nur Widad, Normaliza Abd Rahim, Nur Maisarah Roslan, and Siti Nur Aliaa Roslan. "Students' presupposition towards incooperating AI (Artificial Intelligence) technology in virtual and face-to-face classes." *International Journal of Advanced Research in Future Ready Learning and Education* 27, no. 1 (2022): 16-19.