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How Technology Can Change Educational Research? Definition, Factors for Improving Quality of Education and Computational Bibliometric Analysis

Dwi Fitria Al Husaeni [1], Dwi Novia Al Husaeni [1], Asep Bayu Dani Nandiyanto [2,], Mauhibur Rokhman[3], Saefuddin Chalim[3,4], Jiraporn Chano [5], Abdulkareem Sh. Mahdi Al Obaidi [6], Martin Roestamy [7]*

[1] Departemen Pendidikan Ilmu Komputer, Universitas Pendidikan Indonesia, Indonesia
[2] Departemen Kimia, Universitas Pendidikan Indonesia, Indonesia
[3] Universitas Achmad Chalim, Indonesia
[4] UIN Sunan Ampel Surabaya, Surabaya, Indonesia
[5] Faculty of Education, Mahasarakham University, Thailand
[6] School of Engineering, Taylor's University, Selangor, Malaysia
[7] Universitas Djuanda, Bogor, Indonesia
*Correspondence: E-mail: nandiyanto@upi.edu

ABSTRACT

This study explains all factors relating to the definition and current research trends in how technology can improve education. This study explains how strategies are developed to create and improve the quality of education, including communication, the input of technology (such as IT, ICT, AI, AR, etc.), curriculum and education level, and the relationship between social studies, humanities, science, and industry, as well as management and facilities. We demonstrated current technology using social media, for educators to implement it to improve the teaching and learning process. Bibliometric and theoretical analysis, based on the Google Scholar database from 2018-2023, was used. The search results found 988 articles with the keywords of "Education Technology" AND "Indonesia". Research on educational technology in Indonesia has increased every year. 113 terms were found based on network visualization, which was divided into 6 clusters. The “Indonesia” term appeared 596 times and the term “education technology” appeared 133 times. Co-authorship analysis found 2035 authors have contributed. Completing this research leads to the creation of future research, determining what next research subjects can appear, especially in the field of education.

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1. INTRODUCTION

Education is a process of learning knowledge, skills, and habits of a group of people which are passed on from one generation to the next through teaching, training, and research (Morbo, 2021; Yanri & Syahrani, 2021). Education is a conscious effort to create a teaching and learning atmosphere to develop the potential of students (Ammatulloh *et al*., 2022). Education functions to develop and shape the character, personality, and abilities of students inside and outside of school. In improving these abilities, it is necessary to have an interest in learning from the students themselves (Hashim *et al*., 2021; Fadillah & Maryanti, 2021; Putri *et al*., 2021; Kamila & Sakti, 2022; Ardiana *et al*., 2022; Nugroho *et al*., 2023; Wijaya *et al*., 2022; Riteshkarmaker, 2023; Ogundele *et al*., 2023; Nafilah & Sakti, 2022). There are various ways to increase students' interest in learning, one of which is by using technology during the teaching and learning process.

One of the important aspects of improving the quality of education is the existence of technology. Technology continues to develop, especially in this modern era of globalization. Developing technology can become a factor, considering the need for more sophisticated facilities, to expedite the learning process. Technology in the world of education is a medium to re-design the teaching and learning practice. One of the examples of the additional technology in this practice is in the preparation of learning sources. The use of technology is proven to increase students' interest in learning (Al Husaeni *et al*., 2022; Tatar & Robinson, 2003). Technology, at the same time, can interestingly present teaching material (Raja & Nagasubramani, 2018) and prevent students from feeling bored while attending lessons.

Many studies are available on examining the use of technology in education, one of which is research on the impact of modern technology in education (Raja & Nagasubramani, 2018; Ghory & Ghafory, 2021; Simuforosa, 2013), the use of technology as a learning medium (Friedman & Friedman, 2013; Al Husaeni *et al*., 2022; Albar *et al*., 2021; Issa *et al*., 2021), and the role of using computers and information technology in the education system (Dabas, 2018). Many previous studies to know research trends using bibliometric analysis in the field of education are available as shown in **Table 1**, relating to development and trends in the educational technology research focused in Indonesia. However, no detailed explanation of factors relating to what strategies are used for improving the quality of education.

Bibliometric is one of the effective methods for understanding current research trends and has been used for various fields (see **Table 2**). Based on our previous studies on bibliometrics (see **Table 3**), here, this research was conducted to analyze development and research trends in educational technology in Indonesia from 2018 to 2023 using bibliometric analysis. We added a review of the factors that can influence the quality of education. This research is expected to be a material consideration for readers to understand current conditions in the field of educational technology.

Table 1. Previous studies of bibliometric analysis in education.

No	Topic Discussion	Educational Contribution	Research Year	References
1.	The study provides a bibliometric analysis on the topic of the simple spectrophotometer by using the VOSviewer	simple spectrophotometer in STEM Education	2011-2021	Shidiq *et al.* (2021)
2.	This study combines mapping analysis with the VOSviewer application regarding special needs education	special needs education	2017-2021	Al Husaeni *et al.* (2023)

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Table 1 (Continue). Previous studies of bibliometric analysis in education.

No	Topic Discussion	Educational Contribution	Research Year	References
3.	development of mechanical engineering education research through a bibliometric approach to computational mapping analysis	mechanical engineering education	2012-2021	Al Husaeni and Nandiyanto (2022)
4.	This study combines the mapping results to conduct a special education bibliometric chemistry study	chemistry and special needs education	2017-2021	Bilad (2022)
5.	mapping analysis for researching bibliometric techniques in vocational schools.	vocational school	2017-2021	Al Husaeni and Nandiyanto (2023a)
6.	Mapping analysis for researching bibliometric techniques in high schools	high school	2017-2021	Al Husaeni and Nandiyanto (2023b)
7.	This study describes the development of research in the field of teaching engineering with VOSviewer.	teaching science engineering	2012-2021	Nordin (2022)
8.	This study analyzes the scope of techno-economic education research through a bibliometric evaluation approach	Techno-Economic Education	2017-2022	Ragadhita and Nandiyanto (2022)
9.	This study conducted a bibliometric analysis of chemical engineering special needs by combining mapping results.	chemical engineering and special needs education	2018-2022	Wirzal and Putra (2022)

Table 2. Previous studies of bibliometric analysis.

No	Title	Topic Discussion	Ref
1	Dental suction aerosol: Bibliometric analysis.	Through the use of VOSViewer's distribution of bibliometrics maps and research trends, this study demonstrates how dental aerosol suction developed.	Ramadhan *et al*. (2022)
2	A bibliometric analysis of covid-19 research using VOSviewer.	Using bibliometric methodology, this study examines the evolution of research throughout the Covid-19 era.	Hamidah *et al*. (2020)
3	The concise latest report on the advantages and disadvantages of pure biodiesel (B100) on engine performance: Literature review and bibliometric analysis	The pros and cons of using pure biodiesel on engine performance are discussed in this study's literature review.	Setiyo *et al*. (2021)
4	A bibliometric analysis of management bioenergy research using vosviewer application	This paper examines the advancements and trends in the study of bioenergy management.	Soegoto *et al*. (2022)
5	Oil palm empty fruit bunch waste pretreatment with benzotriazolium-based ionic liquids for cellulose conversion to glucose: Experiments with computational bibliometric analysis	This study used bibliometric analysis and VOSviewer to examine how benzotriazole ionic salt liquid was used to dissolve empty palm oil fruit bunches.	Mudzakir *et al*. (2022)
6	Biomass-based supercapacitors electrodes for electrical energy storage systems activated using chemical activation method: A literature review and bibliometric analysis.	This study explores the potential of biomass-based carbon as an electrode for a supercapacitor that can transfer current with extreme efficiency in energy storage devices.	Hamidah *et al*. (2023)

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Table 2 (Continue). Previous studies of bibliometric analysis.

No	Title	Topic Discussion	Ref
7	Management information systems: bibliometric analysis and its effect on decision making.	The information regarding the impact of decision-making is discussed in this study.	Santoso *et al.* (2022)
8	Bibliometric analysis of nano metal-organic frameworks synthesis research in medical science using VOSviewer	In this study, mapping analysis utilizing the VOSviewer program is combined with bibliometric analysis of nFs for medical science.	Shidiq (2023)
9	Past, current and future trends of salicylic acid and its derivatives: A bibliometric review of papers from the Scopus database published from 2000 to 2021.	This study examines scientometric research on the organizational development and future of SA and its derivatives.	Ruzmetov and Ibragimov (2023)
10	Correlation between process engineering and special needs from bibliometric analysis perspectives.	The integration of mapping analysis utilizing the VOSviewer program is covered in this study.	Nordin (2022)
11	Bibliometric analysis for understanding the correlation between chemistry and special needs education using VOSviewer indexed by Google.	In this work, the usage of VOSviewer in conjunction with mapping analysis is addressed.	Bilad (2022)
12	Computing bibliometric analysis with mapping visualization using VOSviewer on “pharmacy” and “special needs” research data in 2017-2021.	This study examines the use of mapping visualization in research on specialized needs and pharmaceutical subjects within the next five years (2017–2021).	Sudrajat (2023)
13	Nutritional research mapping for endurance sports: A bibliometric analysis.	The research mapping in the area of nutrition for endurance sports is covered in this paper.	Firdaus *et al.* (2023)
14	Bibliometric and visualized analysis of scientific publications on geotechnics fields.	Through the use of bibliometric distribution maps and the VOSviewer program, this study examined the growth of geotechnical engineering-related research.	Mulyawati & Ramadhan (2021)
15	A bibliometric analysis of computational mapping on publishing teaching science engineering using VOSviewer application and correlation.	In this study, new breakthroughs in scientific education and engineering research are described.	Nordin (2022)
16	What is the correlation between chemical engineering and special needs education from the perspective of bibliometric analysis using VOSviewer indexed by google scholar?	By integrating mapping analysis and the VOSviewer program, this study examines "Special Needs of Chemical Engineering".	Wirzal *et al.* (2022)
17	Counseling guidance in science education: Definition, literature review, and bibliometric analysis.	Using a literature review and bibliometric analysis, this study explores the subject of guidance and counseling in science education.	Solehudin *et al.* (2023)
18	Phytochemical profile and biological activities of ethylacetate extract of peanut (Arachis hypogaea L.) stems: In-vitro and in-silico studies with bibliometric analysis.	In-vitro and in-silico analyses of the chemical composition and pharmacological activity of A.hypogaea stems were conducted in this work.	Sahidin *et al.* (2023)

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Table 3. Our works in bibliometric analysis.

No	Title	Topic Discussion	Ref
1.	A bibliometric analysis of materials research in Indonesian journal using VOSviewer	In this study, the research developments in the field of materials are discussed.	Nandiyanto & AL Husaeni (2021)
2.	Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis	The use of mercury in gold mining is covered in this paper.	Nandiyanto *et al.* (2023)
3.	Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research.	The bibliometric analysis of papers that are indexed by Google Scholar is examined in the context of education in this work.	Al Husaeni *et al.* (2023)
4.	Bibliometric analysis of special needs education keyword using VOSviewer indexed by google scholar	A special education-related bibliometric study of Google Scholar-indexed works is included in this work.	Al Husaeni *et al.* (2023)
5.	Sustainable development goals (SDGs) in science education: Definition, literature review, and bibliometric analysis.	This study investigates the reasons and patterns of research on sustainable development goals.	Maryanti *et al.* (2022)
6.	A bibliometric analysis of chemical engineering research using VOSviewer and its correlation with covid-19 pandemic condition.	This study investigates the reasons for and trends in the development of research on sustainable development goals.	Nandiyanto *et al.* (2021)
7.	Computational bibliometric analysis of research on science and Islam with VOSviewer: Scopus database in 2012 to 2022.	This study examines the evolution of research in the disciplines of science and Islam using information from Scopus-indexed article data.	Al Husaeni & Al Husaeni (2022)
8.	Resin matrix composition on the performance of brake pads made from durian seeds: From computational bibliometric literature analysis to experiment.	The impact of resin matrix composition on brake pad performance is discussed through bibliometric analysis in this article.	Nandiyanto *et al.* (2022)
9.	Bibliometric Analysis of Briquette Research Trends During the Covid-19 Pandemic.	This study investigates briquette research patterns during the Covid-19 outbreak.	Al Husaeni (2022)
10	Computational Bibliometric Analysis on Publication of Techno-Economic Education.	This study use bibliometric analysis to examine the evolution of publications in the field of techno-economic education.	Ragadhita & Nandiyanto (2022)
11	How bibliographic dataset portrays decreasing number of scientific publications from Indonesia	Using bibliographic records, this study analyzes how to describe the fall in the number of scientific publications in Indonesia.	Nandiyanto *et al.* (2020)

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Table 3 (Continue). Our works in bibliometric analysis in Education Research.

No	Title	Topic Discussion	Ref
12	Research trends from the Scopus database using keyword water hyacinth and ecosystem: A bibliometric literature review	This study looks at the Scopus database for research trends on water hyacinths and ecosystems.	Nandiyanto *et al.* (2024)
13	Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar	Bibliometric analysis is used in this study to examine research connected to senior high school.	Al Husaeni & Nandiyanto (2023)
14	How to calculate bibliometric using VOSviewer with Publish or Perish (using Scopus data): Science education keywords	This research looks at how to assess bibliometrics with VOSviewer and the Publish or Perish program.	Al Husaeni & Al Husaeni (2023)
15	Bibliometric analysis for understanding "science education" for "student with special needs" using VOSviewer	This study looks into bibliometric analysis in the context of science education and students with special needs.	Nursaniah & Nandiyanto (2023)
16	Bibliometric analysis of research development in sports science with vosviewer.	This research looks at the evolution of sports science research.	Al Husaeni (2023)
17	Bibliometric analysis of engineering research using Vosviewer indexed by google scholar	This study investigates the evolution of research on technical themes using VOSviewer and data from Google Scholar-indexed articles.	Nandiyanto & Al Husaeni (2022)
18	Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSviewer	This study looks into the advancement of research in the subject of engineering education.	Al Husaeni & Nandiyanto (2022)
19	Introducing ASEAN Journal of Science and Engineering: A Bibliometric Analysis Study	This study examines and validates the influence and success of the ASEAN Journal of Science and Engineering in internationalization.	Nandiyanto *et al.* (2023a)
20	Introducing ASEAN Journal of Science and Engineering Education: A Bibliometric Analysis Study for Understanding Internationalization	This study examines and validates the impact and globalization of the ASEAN Journal of Science and Engineering Education.	Al Husaeni *et al.* (2022)

2. METHODS

In this study, we took all bibliographical data from articles that had been published from 2019 to 2023 and indexed by Google Scholar. Data collection uses the Publish or Perish reference manager application (which was accessed on August 21, 2023). Publish or Perish result data will then be saved in two formats, namely *.ris (for data mapping using the VOSviewer application), and *.csv (for data processing in Ms.Excel). After data capture, we use the VOSviewer application as a data visualization tool that generates a network from pre-processed data sets, to build a scientometric network that outlines productivity. The terms "Education", "Research", "Technology", and "Indonesia" are used as keywords for data search. Further explanation regarding the steps of the bibliometric analysis research carried out is shown in **Figure 1**.

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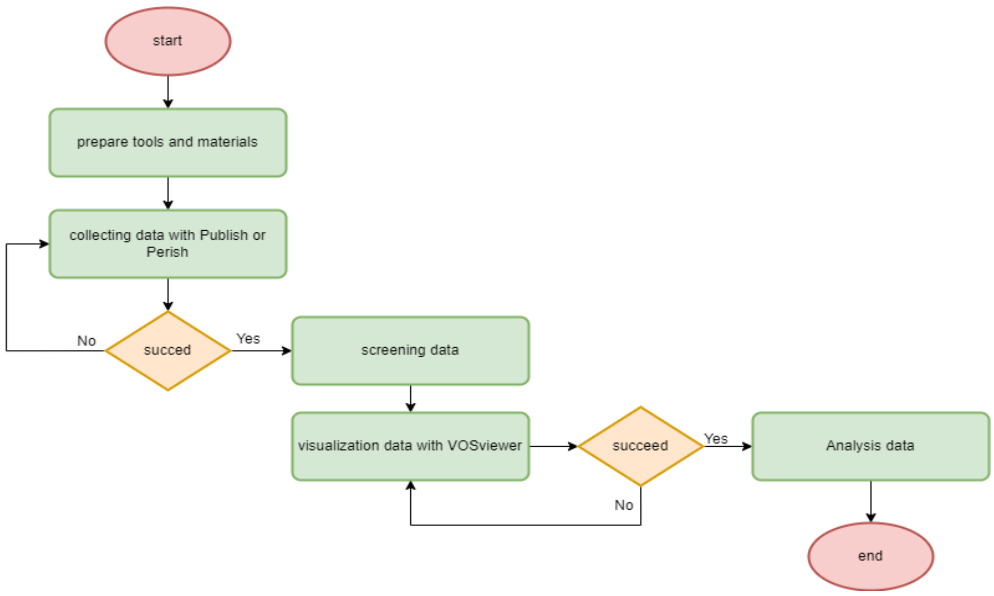

Figure 1. Flowchart of bibliometric analysis steps.

2.1. Prepare Tools and Materials

The first step that must be taken in conducting a bibliometric analysis is to prepare the tools and materials to be used. Several applications need to be prepared, namely the Microsoft Excel application which is used for analysis and screening of search result data, the Publish or Perish (PoP) application which is used for searching and collecting article data based on keywords, and finally the VOSviewer application which is used for visualization and mapping. search result data.

2.2. Harvesting Data

At this stage, we collect data for publication trend analysis regarding the keywords used. At this stage, published research documents (articles) related to the topics "Education", "Research", "Technology", and "Indonesia" are collected using the Publish or Perish application. Research documents were collected using the keywords "'Education Technology' AND 'Indonesia'". The article data taken is the data of articles published in the last five years, namely from 2019 to 2023.

2.3. Screening Data

Research documents collected during the data harvesting stage cannot be analyzed directly. As a result, data filtering is required. At this stage, data screening is carried out by taking into account the year of publication. Articles whose year of publication is missing are included. In addition, only journal articles were used in this study. Therefore, articles that are not sourced from journals will be deleted at this data screening stage. After screening the data, 996 articles were obtained which could be processed in this study, there were 988 articles. Some articles are not used because their metadata is incomplete.

2.4. Visualization Data

Data that has been saved in the format (*.ris) is then uploaded to the VOSviewer application to get data visualization. The terms in the VOSviewer network mapping visualization are filtered at this stage. The source database is used to map the article data.

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There are three types of visualization used in this study, namely network visualization, overlay visualization, and density visualization.

2.5. Analysis Data

At this stage, the data that has been visualized is analyzed in such a way that the results are obtained which will be explained in the "results and discussion" section. Microsoft Excel is used to simplify the process of data analysis.

3. RESULTS AND DISCUSSION

3.1. Several Considerations in Applying Educational Technology

There are several considerations in implementing educational technology, including (i) Formal and informal learning, including activities, ethics, attitudes, and skills; (ii) Education level; (iii) Curriculum development; (iv) Teaching, media, and learning; (v) Student literacy and its impact on social science and humanities subjects; (vi) Science, vocational, and engineering education and its relationship to the laboratory and industry; (vii) Student condition and motivation, teacher-student relationship, and counseling and physiology in facing pandemic and globalization; (viii) Special needs education; (ix) Management and policy, facilitation, assessment, and evaluation; and (x) New technologies in education, computer science in education, including ICT, AI, etc. The following is a further explanation of the considerations that must be considered in implementing educational technology.

3.1.1. Formal and informal learning, including activities, ethics, attitudes, and skills

Formal and Informal Learning are two different approaches to acquiring knowledge and skills. They have distinct characteristics, activities, ethics, attitudes, and skills associated with them.

(i) Formal learning: Formal learning refers to structured and organized educational experiences that typically take place within an institutional setting, such as schools, colleges, universities, or training programs. It follows a predetermined curriculum, often leads to certifications, degrees, or qualifications, and is usually facilitated by teachers, instructors, or trainers. In formal learning, activities include attending lectures, participating in classroom discussions, completing assignments, taking exams, and following a prescribed curriculum. Learning is planned, systematic, and guided by educational professionals. Besides that, in formal learning, there is an expectation of academic integrity and ethical conduct. Plagiarism, cheating, and dishonesty are generally considered unacceptable and can result in disciplinary actions. Students in formal learning environments are expected to demonstrate punctuality, respect for authority figures (such as teachers), and a commitment to their studies. They are also encouraged to engage critically with the subject matter. Formal learning aims to develop a range of skills, including critical thinking, problem-solving, effective communication, research skills, and the ability to work collaboratively (Jizat & Sulong, 2021; Ahmad, 2021a; Lumbu-ani *et al*., 2021; Sari & Faiz, 2021; Briones *et al*., 2022; Bakinde, 2022).

(ii) Informal learning: Informal learning refers to learning that occurs naturally in everyday life through experiences, interactions, and activities outside of a structured educational environment. It is often spontaneous, unstructured, and driven by personal interest or curiosity. Informal learning activities include reading books, watching documentaries, engaging in hobbies, attending workshops, seeking advice from mentors, having discussions with peers, and exploring new interests independently. While ethical considerations still apply, informal learning environments might be more flexible in

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terms of how information is acquired and shared. Informal learning allows for exploration and experimentation without the same level of rigid rules as formal learning. In general, informal learners exhibit curiosity, self-direction, and a willingness to explore new topics without the pressure of grades or formal evaluations. The focus is on personal growth and enjoyment of learning. Informal learning can also nurture skills such as self-motivation, adaptability, curiosity, independent research, and a proactive approach to acquiring new knowledge (Calixtro, 2022; Bermudez *et al*., 2021; Onikoyi, 2022; Borling *et al*., 2023).

Based on the explanation above, formal learning is structured, institutionally driven, and often leads to recognized credentials, while informal learning is self-directed, spontaneous, and motivated by personal interest. Both approaches have their benefits and can complement each other. It's important to note that the boundaries between formal and informal learning can sometimes be blurred, and many effective learning experiences incorporate elements of both.

3.1.2. Education level

Education is a process of learning and developing knowledge, skills, and values throughout one's life (Al Husaeni & Nandiyanto, 2023; Hoskins & Crick, 2010). In different countries, education levels usually consist of several levels, and the structure of education can vary from country to country. Below are examples of common educational levels:

(i) Pre-School Education: Pre-school education is the initial stage of education before entering primary school. It is usually aimed at children ages 3-6 and aims to help children's physical, cognitive, social, and emotional development. Included in preschool education are Kindergarten (TK), Early Childhood Education (PAUD), and Playgroups (Sylva *et al*., 2006; Özerem & Kavas, 2013).

(ii) Basic Education: Basic education is the level of education that usually lasts 6-8 years depending on the country and education system. In many countries, this includes SD (Elementary School) or equivalent school types such as Primary School (SR) and Junior High School (SMP) (Lassibille & Navarro, 2000; Shaturaev, 2021).

(iii) Secondary Education: Secondary education is the level of education after primary education and usually lasts 3-6 years, depending on the country and education system. In some countries, this includes Senior High Schools (SMA) and Vocational High Schools (SMK) (Sukmawijaya *et al*., 2020).

(iv) Higher Education: Higher education is the level of education after secondary education and includes various programs such as diplomas (D1, D2, D3), bachelor's (S1), master's (S2), and doctoral (S3). Typically, higher education is provided by colleges, universities, and other higher education institutions (Purnastuti & Izzaty, 2016; Estriyanto *et al*., 2017).

(v) Non-Formal Education: Apart from structured formal education, there is also non-formal education which includes courses, training, and learning programs that are not within the framework of formal education. This could include language courses, skills training, or adult education programs (Sydorenko *et al*., 2020).

(vi) Special Education: Special education includes educational programs specifically designed for individuals with special needs, such as inclusive education for children with disabilities (Al Husaeni & Nandiyanto, 2023).

From the levels that have been described, it should be noted that the structure and level of education can vary significantly from one country to another, and some countries may have additional levels of education or a more complex system.

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3.1.3. Curriculum development

Curriculum development is the process of designing, planning, and implementing educational plans that involve making decisions about what to teach, how to teach it, and how to measure learning outcomes (Landero, 2022). Curriculum development is a complex process that involves many stakeholders, including educators, school administrators, subject experts, parents, and often the government or educational authorities (Damanik & Pakpahan, 2018). In curriculum development, several steps must be followed. Many reports regarding curriculum development have been well-reported (Widiaty *et al*., 2020; Namasivayam *et al*., 2023; Susilowati *et al*., 2023; Rosina *et al*., 2021; Maryanti & Nandiyanto, 2021; Maryanti *et al*., 2021; Nursaniah, 2023; Fiandini *et al*., 2024; Gatta *et al*., 2023; Jamiu 2022). The following are general steps in curriculum development (Yunus & Aziz, 2022; Mahrudin, 2012).

(i) Needs Analysis: At this stage, the parties involved will evaluate educational needs, considering educational goals, student needs, and the demands of society and the world of work. This analysis helps determine what to teach.
(ii) Goal Setting: Setting curriculum goals is the next step. Goals must be specific, measurable, achievable, relevant, and limited in time (SMART). These objectives will serve as a guide in designing the curriculum.
(iii) Curriculum Design: At this stage, the overall curriculum is designed, including the selection of learning materials, teaching methods, assessments, and allocation of time and resources. In curriculum design, the curriculum can be divided into three main components: core curriculum (basic material that must be taught), additional curriculum (chosen material), and extracurricular curriculum (activities outside of class hours).
(iv) Development of Learning Materials: Learning materials, including textbooks, educational resources, and other learning tools, are prepared according to the curriculum design. This material must be following the learning objectives set.
(v) Selection of Teaching Methods: Teaching methods that are appropriate to the material and learning objectives are selected. This includes lectures, discussions, projects, problem-based teaching, and other methods.
(vi) Learning Assessment: The assessment system that will be used to measure the extent to which students achieve learning objectives must be designed. This involves selecting the type of test, assessment criteria, and assessment instruments.
(vii) Implementation: Once the curriculum is designed, it has to be implemented in the classroom. Teachers and instructors must be given the necessary training to teach according to the designed curriculum.
(viii) Evaluation and Revision: The curriculum development process does not end after implementation. Periodic evaluations are conducted to assess the effectiveness of the curriculum. If necessary, the curriculum is revised and updated based on feedback from teachers, students, and learning outcomes.
(ix) Continuous Monitoring: After the curriculum is implemented, it is important to continuously monitor and evaluate the learning process to ensure that educational goals are being achieved and the curriculum remains relevant to changing times.

Curriculum development is a dynamic process and must be responsive to changes in educational and societal needs (Haider, 2016). Therefore, in carrying out curriculum development, curriculum developers must consider the diversity of students and their needs to ensure inclusive and effective education.

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3.1.4. Teaching, media, and learning

Teaching, media, and learning are interrelated concepts in an educational context. These three terms play an important role in helping students understand the subject matter and achieve learning goals. Teaching itself is a process by which a teacher or instructor transmits knowledge, skills, and values to students. It involves a variety of teaching strategies and methods to facilitate student learning (Darling-Hammond & Baratz-Snowden, 2007). Teachers play an important role in explaining concepts, guiding students through subject matter, providing guidance, and creating a supportive learning environment.

If teaching is a process, media is a tool or means used in the teaching and learning process to help students understand certain concepts or topics (Abdulrahaman *et al*., 2020). Learning media can take many forms, including textbooks, pictures, diagrams, videos, audio, presentation tools, computer software, and more (Winarni & Rasiban, 2021; Millatina *et al*., 2022; Morbo, 2021; Faishol & Mashuri, 2022; Stemler, 1997). Further, recently, social media has been well-used to increase the teaching and learning process (Hashim *et al*., 2020; Haristini & Rifa'I, 2020; Bedua *et al*., 2021; Abubakar *et al*., 2022; Sopian *et al*., 2022; Prabowo & Suroso, 2022; Aladesusi *et al*., 2021).

Examples of the media are in the following:

(i) Online video (Anggraeni & Maryanti, 2021; Azizah *et al*., 2022)
(ii) Webinar (Nunu & Onojah, 2022)
(iii) Whatsapp (Suroto & Nandiyanto, 2021; Ramdhani & Nandiyanto, 2021)
(iv) Instagram (RIsnandar & Sakti, 2022)
(v) Tiktok (Gajo *et al*., 2023; Reskianissa *et al*., 2022)
(vi) Youtube (Mulya *et al*., 2023; Sutanto *et al*., 2022; Nafilah & Sakti, 2022)
(vii) Powerpoint (Firman & Nandiyanto, 2023; Kurniawati, 2022)
(viii) Other media (Stickynote, webtoon, poster, etc.) (Ardiana *et al*., 2022; Khamsah & Nandiyanto, 2024; Hartati *et al*., 2023)

Media is used to illustrate concepts, visualize information, and make learning more interesting and interactive. Media can also help students with different learning styles to understand the material better. While learning is the result of the teaching process. Learning can include acquiring knowledge, skills, and student's understanding of the material being taught. The relationship between teaching, media, and learning includes:

(i) Teaching using Media: Teachers can use various media to facilitate teaching. For example, multimedia presentations, learning videos, or educational software can be used to explain concepts more visually and interactively. The use of media can help students be more involved in learning (Winarni & Rasiban, 2021; Millatina *et al*., 2022; Morbo, 2021).
(ii) Media as a Teaching Tool: Media does not only play a role as a support for teaching but can also be the main teaching tool. In distance learning or e-learning, digital media is often used as the main platform for providing learning content (Huwaidi *et al*., 2021; Nasution & Nandiyanto, 2021).
(iii) Effective Teaching Facilitates Learning: Good and effective teaching helps students achieve deep and meaningful learning. Competent teachers use a variety of teaching strategies appropriate to the material and their students, and often media is used as a tool to support this goal.
(iv) Development of Learning Media: Learning media is often developed by considering the learning objectives and teaching methods used. Media development must be in line with the teaching plans and learning objectives that have been set (Bedua *et al*., 2021).

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3.1.5. Student literacy and its impact on social science and humanities subject

Student literacy has a significant impact on Social Sciences and Humanities subjects. But, indeed, this also influences on the science subject. Student literacy refers to students' abilities to read, write, understand, and interpret texts and information critically (Nugraha, 2023; Rainey & Moje, 2012). In Social Studies and Humanities subjects, student literacy is not only a basic skill but also a fundamental foundation for in-depth understanding and critical analysis. Therefore, developing student literacy should be a focus in education to ensure students can take maximum benefit from this subject. The impact of student literacy on Social Studies and Humanities subjects can be explained as follows:

(i) Strong student literacy enables students to better understand the material taught in Social Sciences and Humanities subjects. They can read complex texts, such as historical sources, literature, and scientific writings, with a deeper understanding (Mirzabek, 2023; Karmaker & Malaker, 2023).

(ii) Student literacy enables students to carry out critical analyses of various texts and sources of information (Hattwig *et al*., 2013). In social studies subjects, students can evaluate various viewpoints on social, political, or historical issues. In the Humanities, they can do a better analysis of literature or works of art.

(iii) Strong student literacy supports students' ability to conduct more effective research in Social Studies and Humanities subjects. They can seek and dig up information from various sources, identify reliable sources, and compile good research reports.

(iv) Literacy is also closely related to good writing skills. Students who have strong literacy tend to be able to structure essays, papers, or other writing assignments better, thereby communicating their ideas and analyses more effectively.

(v) Good student literacy also supports active participation in class discussions, seminars, or group projects. They can present arguments clearly, support their claims with evidence, and respond productively to the arguments of others (Price-Dennis *et al*., 2015).

(vi) Literacy helps students develop critical thinking skills. This enables them to explore complex ideas and evaluate arguments critically, which is important in Social Sciences and Humanities subjects.

(vii) Literacy can also increase students' understanding of culture, history, and social context in social studies and humanities subjects. They can better read historical, literary, or artistic sources that reflect various aspects of culture (Kim *et al*., 2018).

(viii) Literacy is not only relevant for education but also a very important skill in everyday life. The ability to read, write, and think critically will help students in a variety of situations, both in the academic and professional worlds.

3.1.6. Science, vocational, and engineering education and its relationship to the laboratory and industry

Science, vocational, and engineering education has close links with laboratories and industry because of its strong engagement with real-world practice, skills development, and preparation of students for work in various industrial sectors (Stephen & Festus, 2022). The relationship between education in Science, Vocational, and Engineering with laboratories and industry has a positive impact. Students who gain practical experience in the laboratory and gain insight from the industrial world will be better equipped to face real challenges on the job and contribute to innovation and development in various sectors. Education that is integrated with laboratories and industry helps bridge the gap between theory and practice,

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helping students understand the application context of what they learn in class (Ridho *et al*., 2022).

The relationship between science education and the laboratory is a place where students can conduct experiments and empirical research to observe natural phenomena and test hypotheses (Pratiwi & Nandiyanto, 2022; Bhosale, 2022). As for relations with industry, science education provides an important scientific basis for various industries, especially in the fields of research and development (R&D), medical technology, renewable energy, and information technology. The relationship between vocational education and laboratories is that students can practice using equipment, instruments, and technology used in real industries (Glushchenko, 2022). Vocational education is directly connected with industry because it aims to prepare students to work in certain fields, such as automotive, cosmetology, culinary, and many others (Ana, 2020; Rosina *et al*., 2021).

Not much different from science and vocational education, the relationship between engineering education and laboratories and industry is that engineering laboratories are places where students can design, build, and test prototypes of products or systems. Apart from that, engineering education is also very relevant to the manufacturing industry, software engineering, civil engineering, electrical engineering, and many other fields (Shaturaey, 2023).

3.1.7. Student condition and motivation, teacher-student relationship, and counseling and physiology in facing pandemic and globalization

Facing the pandemic and the era of globalization, the conditions and motivation of students, teacher-student relations, and knowledge of physiology can play an important role in education. The physical and mental condition of students can greatly affect the quality of learning. During the pandemic, many students experienced stress, anxiety, or economic instability in their families (Son, 2020). Therefore, education needs to understand and respond to the condition of students by providing the necessary emotional support and resources. Apart from that, in the current era of globalization, students need encouragement or motivation to learn and develop (Ahmad, 2021b). Therefore, the teacher needs to identify the factors that motivate students, such as personal interests, career goals, or an emphasis on the relevance of learning material to the real world.

The teacher-student relationship is very important. A good relationship between teachers and students has a positive impact on student motivation and the quality of learning. Open communication between teachers and students is key. During a pandemic and in an era of fast-changing globalization, teachers need to communicate expectations, assignments, and learning goals clearly and effectively. Counseling and physiology in the era of pandemics and globalization also need to pay close attention.

Psychological counseling and mental well-being are becoming increasingly important in dealing with the stress and pressure that students may experience (Calixtro, 2021; Manghano *et al*., 2022) during a pandemic or due to the pressures of globalization (Rivaldi & Maryanti, 2023). Schools can provide counseling and mental support services to students to help them overcome these challenges. While students' understanding of physiology is also relevant. Teachers need to know the impact of stress on the student's body and how to manage it. By understanding how the body reacts to stress, teachers can help students develop better coping strategies (Muslim, 2020).

Therefore, in facing a pandemic and globalization, education must be adaptive and inclusive. This includes taking into account differences in students' conditions and motivation and providing appropriate support. In addition, strong teacher and student relationships and good communication can help create a positive learning environment. Education and

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attention to mental well-being and an understanding of students' physiology are also key to supporting their development in this changing context. Education should be geared towards preparing students to face the challenges of globalization and crises such as the pandemic while ensuring their well-being.

3.1.8. Special needs education

Special Needs Education is an education sector that aims to provide appropriate and inclusive educational services to individuals with special educational needs (Alisov *et al*., 2018). Special educational needs can vary, including physical, mental, emotional, or learning problems (Maryanti *et al*., 2021). The aim is to ensure that all individuals, including those with special needs, have equal opportunity to receive a meaningful education, develop fully, and participate actively in society. That is why special needs education must be facilitated (Maryanti *et al*., 2021; Rahmat, 2022; Kamble & Gaikwad, 2021; Rahmat, 2021; Sumitra *et al*., 2021; Qushai *et al*., 2021; Olabo *et al*., 2022; Sudarjat, 2022; Daramola, 2022b).

Several types of special education are available. Detailed information for the classification is explained in Maryanti *et al*. (2021). In short, the types include:

(i) Education for Children with Special Needs. It is a type of special education designed for children with various types of special needs, such as learning disorders, autism, developmental disorders, communication disorders, or sensory disorders (Rusyani *et al*., 2022; Jauhari & Dewi, 2019).

(ii) Inclusive Education is an approach in which students with special needs are taught together with students without special needs in the same class (Buli-Holmberg & Jeyaprathaban, 2016).

(iii) Special Education for Behavioral Disorders. Students with conduct disorders such as Attention Deficit Hyperactivity Disorder (ADHD) or Oppositional Defiant Disorder (ODD) may need specific approaches and programs to help them deal with their behavior problems and learn effectively.

(iv) Special Education for Autism (known as Autism Spectrum Disorders). Special education programs for autism often include alternative communication strategies, social training, and therapy-based approaches.

(v) Special Education for Sensory Disorders. Students with sensory impairments such as hearing or vision loss may need educational programs tailored to their needs. This includes the use of sign language, hearing aids, or assistive technology.

(vi) Special Education for Learning Disorders is special education that includes educational programs specifically designed for students with learning disabilities such as dyslexia, dyscalculia, or dysgraphia.

(vii) Special Education for Emotional and Behavioral Disorders. Students with emotional and behavioral disorders need special support to deal with their emotional problems and develop social skills. These programs often involve counseling and mental support.

(viii) Special Education for Developmental Delays. Students with physical, mental, or emotional developmental delays may need educational programs specifically designed to help them reach certain developmental milestones.

(ix) Special Education for Special Talents and Interests. Students with special talents or interests in fields such as art, music, math, or science often need an education specifically designed to help them fulfill their potential.

(x) Special Education for Long-Term Health Disorders. Students with long-term health conditions that affect their participation in education may need educational programs designed to support their attendance and learning.

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Each student with special needs is a unique individual, and the educational approach must be tailored to their needs. Special education programs often involve collaboration between teachers, special education staff, therapists, and families to ensure that students receive appropriate support for their development and learning.

3.1.9. Management and policy, facilitation, assessment, and evaluation

Management and Policy, Facilitation, Assessment, and Evaluation (Management and Policy, Facilitation, Assessment, and Evaluation) are important elements in the education system. They assist in designing, managing, and evaluating educational programs to ensure that educational goals are effectively achieved. The following is an explanation of management and policies, facilities, assessment, and evaluation.

3.1.9.1. Management and policy

Education Management includes planning, organizing, managing resources, and controlling within an educational institution. Education management ensures that resources such as budgets, facilities, and personnel are used efficiently to support educational goals. Meanwhile, education policies are guidelines and rules governing the education system, including learning standards, curricula, funding, and other educational regulations. These policies play an important role in shaping the direction and goals of education.

3.1.9.2. Facilitation

Facilitation is the process of assisting and guiding student learning (Hmelo-Silver & Borrows, 2006). A facilitator can assist students in exploring subject matter, developing a deeper understanding, and promoting discussion and collaboration in learning.

3.1.9.3. Assessment

Many reports regarding assessment in education have been well-reported (Adesokan *et al*., 2022; Fiandini *et al*., 2024; Awofala & Olaniyi, 2023l Abulude *et al*., 2022; Hafina, 2022; Maryanti, 2021; Irawan, 2021; Pandapatan, 2024; Pathania, 2023; Nuhu *et al*., 2023; Minghat *et al*., 2022; Wijaya *et al*., 2022; Sambudi & Abosede *et al*., 2024; Isah *et al*., 2021; Thapwiroch *et al*., 2021; Adeoye, 2023; Arzagon *et al*., 2023). In general, assessment is divided into two, namely formative assessment and summative assessment. Formative assessment is an assessment carried out during the learning process to monitor student progress (Moyosore, 2015). The goal is to provide useful feedback to inform teaching and assist students in identifying areas where they need to improve. Meanwhile, a summative assessment is an assessment carried out at the end of the learning period or course (Mastagli *et al*., 2020). It aims to evaluate students' understanding of the subject matter and to provide a final grade or feedback.

3.1.9.4. Evaluation

Many reports regarding evaluation in education have been well-reported (Ayodeji *et al*., 2022; Ochayi *et al*., 2022; Anis & Masek, 2024; Agarry, 2022; Agarry & Ogundele, 2023; Daramola, 2022; Adeoye & Akinnubi, 2024; Awofala & Olaniyi, 2023; Daramola, 2022a; Adeoye, 2022; Gatta *et al*., 2023). Evaluation of an educational program that involves an overall assessment of the extent to which an educational program has achieved its objectives. This involves data analysis and feedback to make necessary changes in program design and implementation. Unlike the evaluation of educational programs, the evaluation of teacher performance is a process of measuring the quality of a teacher's teaching (Chukwubikem,

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2013). This involves classroom setting, the introduction of teaching materials, and feedback from students and colleagues.

3.10. New Technologies in Education, Computer Science in Education, Including IT, ICT, AI, etc.

New technologies have fundamentally changed the educational landscape in recent years. Computer science, including Information and Communication Technology (ICT) and Artificial Intelligence (AI), has played a critical role in this change. Many reports regarding the use of technology have been well-documented (Rachmawati, 2019; Shah, 2022; Al-Khassawneh, 2023; Alimi *et al*., 2021; Agarry *et al*., 2022; Saripudin *et al*., 2020; Shaffiyah *et al*., 2022; Bangkerd & Sangsawang, 2021; Albar *et al*., 2021). Here are some new technologies in education and the role of computer science in education:

(i) Information and Communication Technology (ICT)

- Use of Computers and the Internet: Computers and the Internet have made it possible to access large amounts of educational resources (Becker, 2000). Students can access digital textbooks, instructional videos, and other online resources for learning outside the classroom.
- Online Learning Platforms: Online learning platforms such as Moodle, Google Classroom, and Canvas are used by many schools and universities to administer courses, assign assignments, and communicate with students (Syakur, 2020).
- E-Books and Digital Materials: Digital textbooks, journals, and other digital learning materials allow students to access academic resources easily and often at a lower cost.
- Webinars and Video Conferences: These technologies allow students to attend virtual lectures and seminars from anywhere in the world.

(ii) Artificial Intelligence (AI)

- Personalized Learning: AI is used to identify students' individual needs and provide learning content tailored to their skill level and interests.
- Student Performance Measurement: AI can be used to quickly assess student performance on a large scale, helping teachers and tutors provide faster feedback.
- Educational Chatbots: Artificial intelligence chatbots can provide students with immediate assistance with answering questions or providing curriculum-related information.

(iii) Augmented Reality (AR) and Virtual Reality (VR)

- Enhanced Learning Experiences: AR and VR are used to create immersive learning experiences (Meccawy, 2022). Students can visit historical sites, explore scientific concepts in three-dimensional space, or participate in realistic simulations.
- Teacher Training: AR and VR are also used in teacher training to provide practical experience in teaching in a variety of classroom situations.

(iv) Game-Based Online Learning

- Serious Games: Serious games are games specially designed for educational purposes (Breuer & Bente, 2010). They can be used to teach complex concepts engagingly and interactively.
- Gamification: The gamification approach uses game elements such as points, levels, and rewards to increase student engagement and motivation in learning (Hung, 2017).

(v) Educational Analytics (Educational Analytics)

- Data Mining: The use of data mining techniques and data analytics in education enables schools and colleges to identify patterns in student performance, predict dropouts, and understand trends in learning (Baradwaj & Pal, 2012).

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- Learning Analytics: Learning analytics is the measurement, collection, analysis, and reporting of data about learners and their context, for understanding and optimizing learning and the environment in which it occurs (Lee *et al*., 2020).

3.11. Indonesian Condition in Educational Research

3.11.1. Result metrics

Table 2 shows the search results metrics for publications regarding educational technology in Indonesia. The year range of all publications analyzed in this study is from 2019 to 2023. The number of papers found and metadata processed is 988. The number of citations of all publications regarding educational technology in Indonesia contained in the Google Scholar database is 13448 citations. Meanwhile, the average citation per year is 3362 times and the average citation per article is 2.82 times.

The H-Index of publications regarding educational technology in Indonesia indexed by Google Scholar is 54 with a G-Index of 88. The H-Index is a metric used to measure the contribution and impact of researchers' scientific publications (Cormode *et al*., 2013). The H-index can be calculated by looking at the number of citations of all articles published by a researcher. In this study, it was known that the h-index was 54, meaning that there were 54 papers cited at least 54 times.

Table 2. Result metrics publication on educational technology in Indonesia.

Publication years	2019-2023
Citation years	4 (2019-2023)
Papers	988
Citations	13448
Cites/year	3362.00
Cites/paper	2.82
H-index	54
G-Index	88
h1, norm	31
h1, annual	7.75
hA-index	33

3.11.2. Annual publication report

Figure 2 shows the annual publication report on education technology in Indonesia. Based on the results in **Figure 2**, it is known that research on education technology in Indonesia has increased every year. In 2019 there were 131 articles, in 2020 there were 183 articles, in 2021 there were 2016 articles, in 2022 there were 275 articles, and in 2023 there were 183 articles. If it is seen that in 2023 the number of studies has decreased, this can be due to the time of data collection for publication in this study, namely August 2023.

This means that not all months in 2023 have been completed and this allows research on education technology in Indonesia in 2023 to continue to increase. Research on technology, especially regarding technology, especially educational technology, is always increasing in demand every year due to technological developments that are increasingly advanced day by day (Laleno, 2019) and the use of technology is quite high for educational development (Ghavifekr & Rosdy, 2015).

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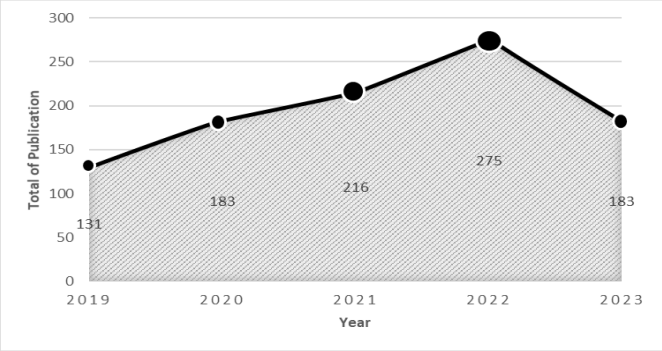

Figure 2. Annual publication report on education technology in Indonesia.

3.11.3. Article trends based on the number of citations

Table 3 shows the classification of articles regarding education technology in Indonesia. Based on the article data in **Table 3**, the article by Almarzooq *et al*. (2020) is the most cited with a total of 712 citations. Based on the most cited articles, it is known that in 2020, or when the COVID-19 pandemic occurred, research on educational technology, especially as a learning medium, was widely carried out and used as a reference. As for the second place, there is research by Sari and Aminatun (2021) published by the Journal of English Language Teaching and Learning.

Table 3. Education technology in Indonesia topics data.

No	Cites	Authors	Title	Year	Source
1	712	Almarzooq *et al*.	Virtual learning during the COVID-19 pandemic: A disruptive technology in graduate medical education	2020	Journal of the American College of Cardiology
2	347	Sari and Aminatun	Students' perception on the use of English movies to improve vocabulary mastery	2021	Journal of English language teaching and learning
3	336	Wisada and Sudarma	Development of character education-oriented instructional video media	2019	Journal of Education Technology
4	266	Zainuddin and Perera	Exploring students' competence, autonomy and relatedness in the flipped classroom pedagogical model	2019	Journal of further and higher education
5	258	Syauqi *et al*.	Students' Perceptions Toward Vocational Education on Online Learning during the COVID-19 Pandemic.	2020	International Journal of Evaluation and Research in Education
6	187	Dakhi *et al.*	Blended learning: a 21st-century learning model at College	2020	International Journal of Multi-Science
7	170	Wahono *et al*.	Evidence of STEM enactment Effectiveness in Asian student learning Outcomes	2020	International Journal of STEM Education
8	165	Effendi *et al.*	Social media adoption in SMEs impacted by COVID-19: The TOE model	2020	The Journal of Asian Finance, Economics and Business (JAFEB)
9	159	Andriyani and Suniasih	Development of learning videos based on problem-solving characteristics of animals and their habitats contain in IPA subjects on 6th-grade	2021	Journal of Education Technology
10	143	Mahdum *et al*.	Exploring teacher perceptions and motivations to ICT use in learning activities in Indonesia.	2019	Journal of Information Technology Education

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3.11.4. Co-occurrences analyst

Co-Occurrences analysis is an analysis based on the number of occurrences of an event with high frequency (Li *et al*., 2018). In this study, co-occurrence analysis was carried out on the frequency of occurrence of a word or term and author from publications regarding education technology in Indonesia through bibliometric analysis and the help of the VOSviewer application. Each co-occurrence analysis is presented in a picture of the connection between nodes. There are three types of visualization displayed in this study to see the level of frequency of occurrence of terms and authors in education technology research in Indonesia, namely Network visualization (**Figure 3**), Overlay visualization (**Figure 4**), and Density visualization (**Figure 5**).

Figure 2 shows the network visualization in education technology research in Indonesia. **Figure 2** shows the relationship between terms. The terms found in research on education technology in Indonesia were limited to a minimum number of occurrences of 10 times, so 113 terms were found. The 113 terms were separated into 6 clusters with the Indonesian term appearing 596 times and the term education technology appearing 133 times.

(i) Cluster 1 with a red color has 23 items: analysis, article assessment, augmented reality, Bahasa Indonesia, demand, development, education, education technology, elementary school studies, field, journal, level, mathematics, paper, population, research, science, stem, technology, term, trend, and web.
(ii) Cluster 2 with a green color has 23 items: achievement, activity, case study, challenge, curriculum, educational institution, English, evaluation, ICT, implementation, information, motivation, need, number, opportunity, perception, project, school, subject, teacher, teaching, training, and vocational education.
(iii) Cluster 3 with a blue color has 23 items: addition, class, distance, e-learning, educational technology, effort, era, factor, form, government, higher education, impact, influence, innovation, lecturer, online, participant, quality, role, society, time, type, and university.
(iv) Cluster 4 with a yellow color has 22 items: ability, application, concept, effect, elementary school, human resource, lack, learning, learning process, media, medium, model, outcome, phet, physics, physics education technology, problem, skill, student, study, use, and utilization.
(v) Cluster 5 with a purple color has 21 items: aspect, blended learning, case, shield, country, covid, data, effectiveness face, Indonesia, march, nation, online learning, pandemic, person, policy, questionnaire, region, republic, virus, and world.
(vi) Cluster 6 with a cyan color has 1 item: part.

The geometry of the overlay visualization is shown in **Figure 3**. On the overlay visualization, we can obtain the year the trend of education technology in Indonesia research terms was conducted. Based on Figure 3, it is known that the trend of these terms appears in the range of 2020 to 2021. Some of the terms with the most recent appearances are Covid, case, virus, pandemic, e-learning, online, policy, republic, effectiveness, media, role, factor, influence, application, journal, analysis, field, and training. **Figure 4** shows the density visualization of publications on education technology in Indonesia. Based on **Figure 4**, the color of each node can be used as a determinant of how often the node appears and is used in article discussions on education technology in Indonesia. The more often a term is used, the color in that term will be brighter approaching the yellow color in density visualization.

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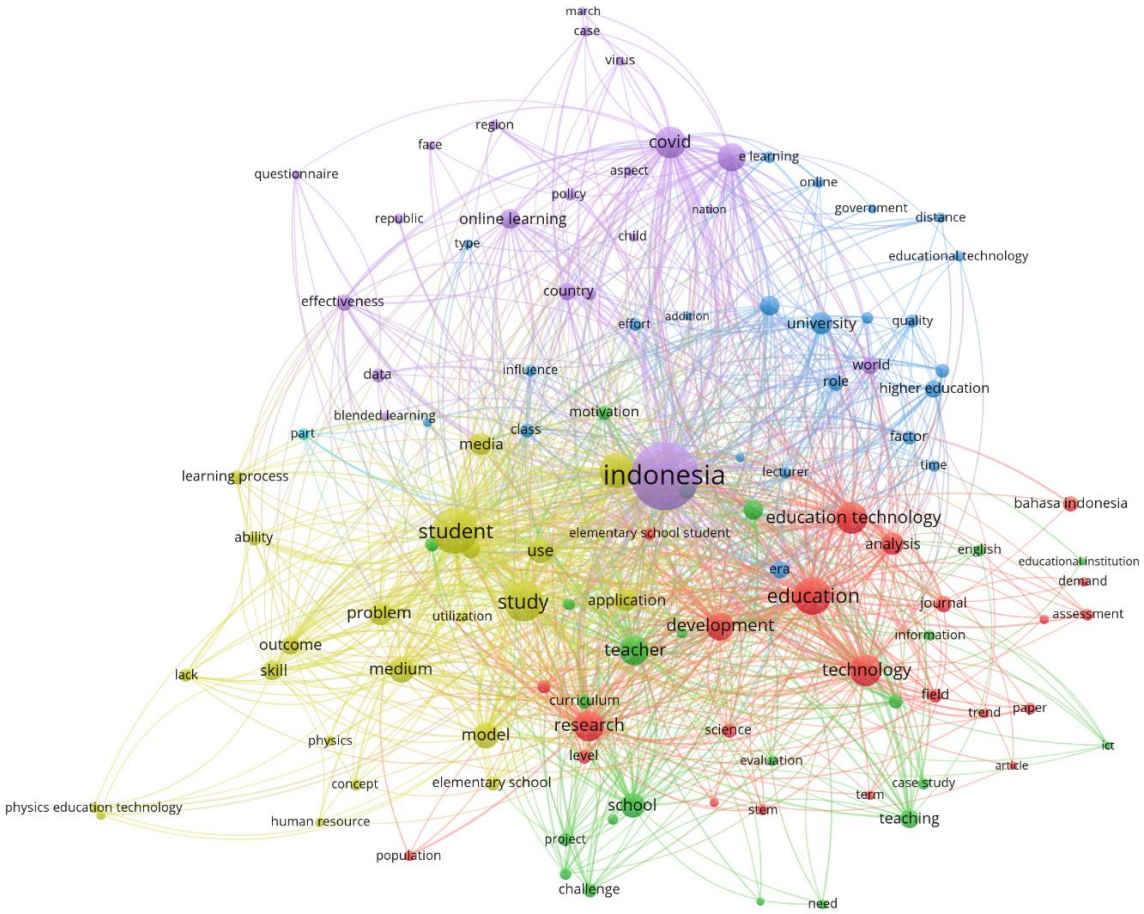

Figure 3. Network visualization in publication on education technology in Indonesia.

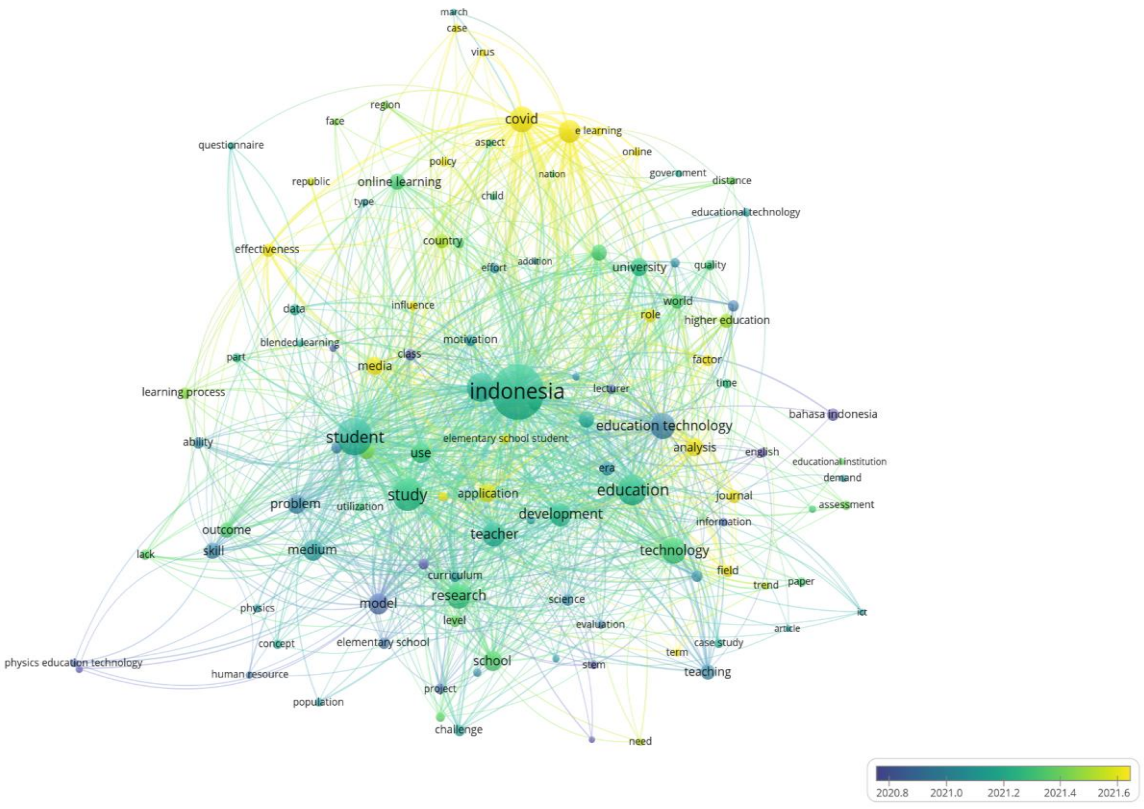

Figure 4. Overlay visualization in publication on education technology in Indonesia.

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In this study, we tried to analyze researchers who contributed to writing articles on education technology in Indonesia that had been published in national and international journals indexed by Google Scholar. Based on this co-authorship analysis, it is known that 2035 authors have contributed to writing articles on education technology in Indonesia from 2019 to 2023. **Table 4** shows 64 authors who have contributed at least 3 documents that have been published in several journals. Meanwhile, **Figure 6** shows the network visualization between authors. Sudira has the highest total documents, namely 8 documents with a total link strength of 3, and is included in cluster 2. Then, the top 5 authors who contributed the most other articles are Kurniawan 7 articles, Asrial 5 articles, Sharial 5 articles, Herwin 5 articles, and Mutohhari 5 articles. Each of these researchers has collaborated one with one another as shown in **Figure 5**. There is a relationship between the author and the ling strength value in detail in **Table 4**.

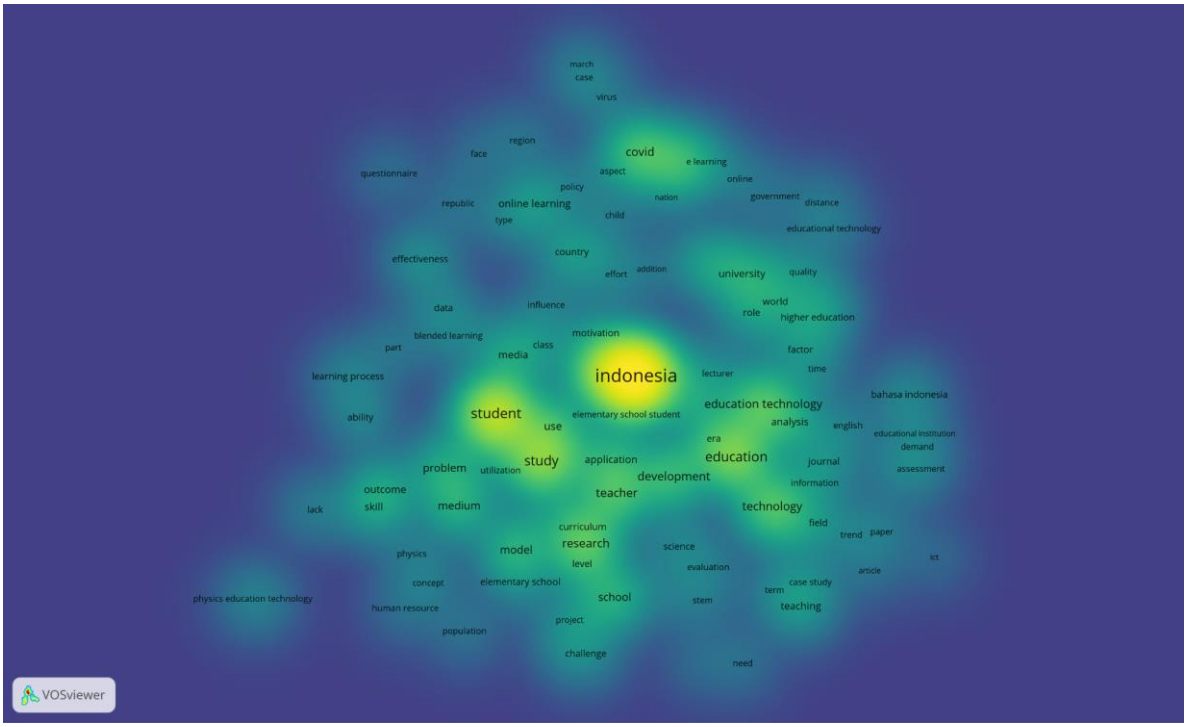

Figure 5. Density visualization in publication on education technology in Indonesia.

Table 4. A list of authors contributed to article about education technology in Indonesia (2019-2023).

Author	Total of Document	Total Link Strength	Cluster
Sudira	8	3	2
Kurniawan	7	10	1
Asrial	5	8	1
Syarial	5	8	1
Herwin	5	6	4
Mutohhari	5	5	2
Sudarma	5	0	34
Widiana	5	0	40
Astalini	4	6	1
Dahalan	4	6	4
Darmaji	4	6	1
Nurtanto	4	3	2
Agustini	4	2	6

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Table 4 (Continue). A list of authors contributed to article about education technology in Indonesia (2019-2023).

Author	Total of Document	Total Link Strength	Cluster
Ahmadi	4	2	3
Wilujeng	4	2	13
Bachri	4	1	10
Rachmadtullah	4	1	12
Kristiantari	4	0	20
Maksum	4	0	22
Roemintoyo	4	0	28
Salsabila	4	0	29
Sukmawati	4	0	37
Yusuf	4	0	41
Habibi	3	4	5
Nurhayati	3	4	4
Aditya	3	3	6
Ferdiana	3	3	6
Irwanto	3	3	9
Mukminin	3	3	5
Razak	3	3	5
Saputro	3	3	9
Sepriana	3	3	11
Aini	3	2	8
Haryono	3	2	3
Kuswanto	3	2	13
Rahardja	3	2	8
Santyasa	3	2	7
Sofyan	3	2	2
Utanto	3	2	3
Jaedun	3	1	2
Mustaji	3	1	10
Setiawan	3	1	12
Agung	3	0	14
Ali	3	0	15
Dwikurnaningsih	3	0	16
Efendi	3	0	17
Fajrianti	3	0	18
Funabiki	3	0	19
Nurlela	3	0	23
Putra	3	0	24
Ramadhani	3	0	26
Rati	3	0	27
Santosa	3	0	30
Suarjana	3	0	36
Suartama	3	0	32
Sudana	3	0	33
Sudarsana	3	0	34
Sujana	3	0	36
Surjono	3	0	38
Tuharea	3	0	39
Zulfarina	3	0	42

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Figure 6. Network visualization of the author in publication on education technology in Indonesia.

4. CONCLUSION

This study aims to examine growth trends in the field of educational technology research in Indonesia from 2018 to 2023. As a research technique, bibliometric analysis and theoretical analysis are used. The stages of the research are as follows: (i) preparing tools and materials; (ii) meetings; (iii) screening; (iv) visualizing; and (v) reviewing data published results. In the search results, the terms "Educational Technology" AND "Indonesia" came in as many as 988 articles. Based on research results, education is very important. The term education is closely related to evaluation, assessment, and curriculum. The curriculum is used as a guideline for education both in Indonesia and other countries in the world. Curriculum development involves several parties, including teachers and school administrative staff. In addition, in the era of globalization and when pandemic conditions occurred in 2020, many changes have occurred in the world of education. It is necessary to pay attention to the mental and physical health of students to create an advanced and quality education. Relations and communication between teachers and students are also one of the factors in creating quality education. The current review is also supported by bibliometric analysis to support current research trend in the use of technology for improving the quality of education.

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5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

6. REFERENCES

Abdulrahaman, M. D., Faruk, N., Oloyede, A. A., Surajudeen-Bakinde, N. T., Olawoyin, L. A., Mejabi, O. V., Imam-Fulani, Y. O., Fahm, A. O., and Azeez, A. L. (2020). Multimedia tools in the teaching and learning processes: A systematic review. *Heliyon*, *6*(11), e05312.

Abosede, P.J., Onasanya, S.A., and Ngozi, O.C. (2024). Students self-assessment of demonstration-based flipped classroom on senior secondary school students' performance in physics. *Indonesian Journal of Teaching in Science*, *4*(1), 27-40.

Abubakar, B. D., Kayode, F. E., Abiodun, M. H., Samson, A. B., and Abdulrasaq, A. (2022). Social media efficacy on prevention and control of covid-19 pandemic in Ilorin south local government area, Kwara state. *Indonesian Journal of Educational Research and Technology*, *2*(3), 195-204.

Abulude, F.O., Acha, S., Gbotoso, O.A., Arifalo, K.M., Ademilua, S.O., Bello, L.J., Olayinka, Y.F., and Aladesaye, C. (2022). Environmental education: A tertiary institution's indoor air quality assessment in Nigeria. *ASEAN Journal for Science Education*, *1*(1), 41-48.

Adeoye, M.A. (2022). Advanced supervision in educational management: Differences between supervision, accreditation, inspection, collaboration, evaluation, and quality assurance. *ASEAN Journal of Educational Research and Technology*, *1*(2), 169-176.

Adeoye, M.A. (2023). Assessment of conflicts management strategies by secondary school principals. *Indonesian Journal of Multidiciplinary Research*, *3*(2), 261-268.

Adeoye, M.A., and Akinnubi, O.P. (2024). External evaluation in improving learners' outcomes in basic schools: Challenges and way forward. *ASEAN Journal of Science and Engineering Education*, *4*(1), 25-30

Adesokan, A., Abdulkareem, K.O., and Adesokan, T.T. (2022). Assessment of factors responsible for child abuse among students with intellectual disabilities. *ASEAN Journal of Community and Special Needs Education*, *1*(2), 89-96.

Agarry, R.O. (2022). An evaluation of early childhood educators' knowledge of their professional code of conduct. *Indonesian Journal of Multidiciplinary Research*, *2*(2), 401-408.

Agarry, R.O., and Ogundele, E.V. (2023). An evaluation of the status of qualitative research in childhood education. *Indonesian Journal of Multidiciplinary Research, 3*(1), 11-20.

Agarry, R.O., Omolafe, E.V., Animashaun, V.O., and Babalola, E.O. (2022). Primary education undergraduates' competency in the use of artificial intelligence for learning in Kwara State. *ASEAN Journal of Educational Research and Technology*, *1*(2), 111-118

Ahmad, C. V. (2021a). What makes our students demotivated in learning?. *Indonesian Journal of Educational Research and Technology, 1*(2), 51-56.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Ahmad, C.V. (2021b). College students' perspective towards lecturers' work ethics. *Indonesian Journal of Educational Research and Technology, 1*(2), 27-30.

Al Husaeni, D. F., and Al Husaeni, D. N. (2022). 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*(1), 39-48.

Al Husaeni, D. F., and Nandiyanto, A. B. D. (2022). Bibliometric computational mapping analysis of publications on mechanical engineering education using vosviewer. *Journal of Engineering Science and Technology*, *17*(2), 1135-1149.

Al Husaeni, D. F., Budisantoso, E. N. Q., Urwah, M. A., Azizah, N. N., Dinata, P. Z., Apriliany, S., and Siregar, H. (2022). The effect of using web-based interactive learning media for vocational high school students to understanding of looping: Qualitative approach. *Journal of Science Learning*, *5*(1), 115-126.

Al Husaeni, D. F., Nandiyanto, A. B. D., and Maryanti, R. (2023). Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research. *Indonesian Journal of Teaching in Science*, *3*(1), 1-8.

Al Husaeni, D. N. (2022). Bibliometric analysis of briquette research trends during the covid-19 pandemic. *ASEAN Journal for Science and Engineering in Materials*, *1*(2), 99-106.

Al Husaeni, D. N. (2023). Bibliometric analysis of research development in sports science with vosviewer. *ASEAN Journal of Physical Education and Sport Science*, *2*(1), 9-16.

Al Husaeni, D. N. and Nandiyanto, A. B. D. (2023a). A bibliometric analysis of vocational school keywords using vosviewer. *ASEAN Journal of Science and Engineering Education, 3*(1), 1-10.

Al Husaeni, D. N. and Nandiyanto, A. B. D. (2023b). Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar. *Indonesian Journal of Educational Research and Technology*, 3(1), 1-12.

Al Husaeni, D. N., Al Husaeni, D .F., Nandiyanto A. B. D., and Mahdi Al-Obaidi A. S. (2022). Introducing asean journal of science and engineering education: A bibliometric analysis study for understanding internationalization. *Data and Metadata*, *1*, 43.

Al Husaeni, D. N., and Al Husaeni, D. F. (2022). How to calculate bibliometric using vosviewer with publish or perish (using scopus data): Science education keywords. *Indonesian Journal of Educational Research and Technology*, *2*(3), 247-274.

Al Husaeni, D. N., and Nandiyanto, A. B. D. (2023). Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar. *Indo nesian Journal of Educational Research and Technology, 3*(1), 1-12.

Al Husaeni, D. N., Nandiyanto, A. B. D., and Maryanti, R. (2023). Bibliometric analysis of special needs education keyword using VOSviewer indexed by google scholar. *Indonesian Journal of Community and Special Needs Education*, *3*(1), 1-10.

Al Husaeni, D. N., Nandiyanto, A. B. D., and Maryanti, R. (2023a). Bibliometric analysis of special needs education keyword using VOSviewer indexed by Google Scholar. *Indonesian Journal of Community and Special Needs Education, 3*(1), 1-10.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Aladesusi, G. A., Issa, A. I., Abodunrin, S. O., Boris, O. A., Babalola, E. O., and Nuhu, K. M. (2021). Perception of undergraduate students on the utilization of social media to enhance learning in University of Ilorin. *ASEAN Journal of Science and Engineering Education, 2(1),* 183-192.

Albar, C. N., Widiansyah, M. G., Mubarok, S., Aziz, M. A., and Maulana, H. (2021). Application of augmented reality technology with the fuzzy logic method as an online physical education lecture method in the new normal era. *Indonesian Journal of Multidiciplinary Research, 1*(1), 35-40.

Albar, C.N., Widiansyah, M.G., Mubarok, S., Aziz, M.A., and Maulana, H. (2021). Application of augmented reality technology with the fuzzy logic method as an online physical education lecture method in the new normal era. *Indonesian Journal of Multidiciplinary Research, 1*(1), 35-40.

Alimi, A.E., Buraimoh, O.F., Aladesusi, G.A., and Babalola, E.O. (2021). University students' awareness of, access to, and use of artificial intelligence for learning in Kwara State. *Indonesian Journal of Teaching in Scienc*e, *1*(2), 91-104.

Alisov, E. A., Ivanova, O. A., Kunitsyna, S. M., Surtaeva, N. N., and Frolova, S. L. (2018). Information and technological support for inclusive education of people with special educational needs. *International Journal of Civil Engineering and Technology, 9*(13), 993-1001.

Al-Khassawneh, Y.A. (2023). A review of artificial intelligence in security and privacy: Research advances, applications, opportunities, and challenges. *Indonesian Journal of Science and Technology*, *8*(1), 79-96.

Almarzooq, Z. I., Lopes, M., and Kochar, A. (2020). Virtual learning during the COVID-19 pandemic: a disruptive technology in graduate medical education. *Journal of the American College of Cardiology*, *75*(20), 2635-2638.

Ammatulloh, M. I., Permana, N., Firmansyah, R., Sa'adah, L. N., Izzatunnisa, Z. I., Muthaqin, D. I. (2022). Strengthening character education of students through civics caring apps based on m-learning during the covid-19 pandemic. *Indonesian Journal of Educational Research and Technology*, *2*(2), 87-96.

Ana, A. (2020). Trends in expert system development: A practicum content analysis in vocational education for over grow pandemic learning problems. *Indonesian Journal of Science and Technology*, *5*(2), 246-260.

Andriyani, N. L., and Suniasih, N. W. (2021). Development of learning videos based on problem-solving characteristics of animals and their habitats contain in IPA subjects on 6th-grade. *Journal of Education Technology*, *5*(1), 37-47.

Anggraeni, R., and Maryanti, R. (2021). Implementation of video learning media in Islamic Religious Education subjects. *Indonesian Journal of Multidiciplinary Research, 1*(2), 257-266.

Anis, S.K., and Masek, A. (2024). Fuzzy Delphi method application towards usability evaluation of problem-solving framework: Application in education. *Indonesian Journal of Educational Research and Technology*, *4*(1), 49-62.

Ardiana, A., Nandiyanto, Kurniawan, T., and Bilad, M. R. (2022). Implementation of sticky note learning media to increase reading interest in 5th-grade students towards lesson books in the pandemic of Covid 19. *Indonesian Journal of Multidiciplinary Research, 2*(2), 265-270.

Arzagon, R.G., Zaragoza, M.A., and Mecida, S.V. (2023). Students' assessment of teaching of college. *Indonesian Journal of Multidiciplinary Research*, *3*(1), 131-138.

Awofala, A.O.A., and Olaniyi, A.O. (2023). Assessing teachers' formative evaluation strategy as related to senior secondary school students' achievement in mathematics. *ASEAN Journal for Science Education*, *2*(2), 77-86.

Ayodeji, a.G., Nifemi, A.O., Samuel A.O., and Omolara, O.T. (2022). Development and evaluation of lessoncast in learning selected basic technology concept in Ilorin Metropolis. *Indonesian Journal of Educational Research and Technology, 2*(1), 21-36.

Azizah, S. N., Nandiyanto, A. B. D., Wulandary, V., and Irawan, A. R. (2022). Implementation of video learning media in Islamic religious education subjects for elementary school students. *Indonesian Journal of Multidiciplinary Research, 2(*1), 91-96.

Bakinde, S.T. (2022). Physical fitness status of male, and female non-athlete in Nigeria. *Indonesian Journal of Educational Research and Technology, 2*(2), 123-132.

Bangkerd, P., and Sangsawang, T. (2021). Development of augmented reality application for exercise to promote health among elderly. *Indonesian Journal of Educational Research and Technology, 1*(3), 77-80.

Baradwaj, B. K., and Pal, S. (2012). Mining educational data to analyze students' performance. *arXiv preprint arXiv, 1201*, 3417.

Becker, H. J. (2000). Findings from the teaching, learning, and computing survey. *Education Policy Analysis Archives, 8*, 51-51.

Bedua, A. B. S. V., Bengan, C. V. B., Ea, E. P., Goleng, D. J. G., Posanso, D. G. D., Pueblo, C. T., and Abusama, H. P. (2021). Social media on the students' academic performance. *Indonesian Journal of Educational Research and Technology, 1*(2), 41-44.

Bermudez, T.C., Alcaide, A.M., Barcelona, A.M., Peralta, E., and Malaco, A. (2021). Online class: Its implication towards academic skills development. *Indonesian Journal of Educational Research and Technology, 1*(2), 61-66.

Bhosale, S. K. (2022). Development of a solar-powered submersible pump system without the use of batteries in agriculture. *Indonesian Journal of Educational Research and Technology, 2*(1), 57-64.

Bilad, M. R. (2022). 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*(2), 61-68.

Borling, K., Lagdamen, Q.B., Fegarido, J., and Besa, A. (2023). Implementation of work immersion and its effects on the social development of senior high school graduates. *Indonesian Journal of Educational Research and Technology, 3*(3), 167-172.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Breuer, J., and Bente, G. (2010). Why so serious? On the relation of serious games and learning. *Journal for Computer Game Culture, 4*, 7-24.

Briones, S. K. F., Dagamac, R. J. R., David, J. D., and Landerio, C. A. B. (2022). Factors affecting the students' scholastic performance: A survey study. *Indonesian Journal of Educational Research and Technology, 2*(2), 97-102.

Buli-Holmberg, J., and Jeyaprathaban, S. (2016). Effective practice in inclusive and special needs education. *International Journal of Special Education, 31*(1), 119-134.

Calixtro Jr., V. L. (2021). Health status and job performance of physical education instructors in higher education institutions. *Indonesian Journal of Educational Research and Technology, 1*(2), 71-76.

Calixtro, R. M. (2022). Determinants of grade 9 students' academic performance in English. *Indonesian Journal of Educational Research and Technology, 2*(2), 103-108.

Chukwubikem, P. E. I. (2013). Developing better teacher evaluation. J*ournal of Educational and Social Research, 3*(6), 49.

Cormode, G., Ma, Q., Muthukrishnan, S., and Thompson, B. (2013). Socializing the h-index. *Journal of Informetrics*, *7*(3), 718-721.

Dabas, N. (2018). Role of computer and information technology in education system. *International Journal of Engineering and Techniques*, *4*(1), 570-574.

Dakhi, O., Jama, J., and Irfan, D. (2020). Blended learning: A 21st century learning model at college. *International Journal of Multi Science*, *1*(08), 50-65.

Damanik, H., and Pakpahan, S. P. (2018). Pengembangan bahan ajar tentang sekolah ramah anak pada mata kuliah manajemen berbasis sekolah. *Jurnal Keluarga Sehat Sejahtera*, *16*(1), 37-50.

Daramola, F.O. (2022). Development and evaluation of google course-kit in teaching selected basic technology concept in Ilorin metropolis. *ASEAN Journal of Educational Research and Technology*, *1*(1), 87-100.

Daramola, F.O. (2022a). The development and evaluation of the instructional kid blog for teaching selected computer science concepts in primary schools in Ilorin Metropolis. *Indonesian Journal of Teaching in Science*, *2*(1), 39-50.

Daramola, F.O. (2022b). Usability of assistive technologies for the learners with hearing impairment in federal college of education. *Indonesian Journal of Community and Special Needs Education*, *2*(2), 43-50.

Darling-Hammond, L., and Baratz-Snowden, J. (2007). A good teacher in every classroom: Preparing the highly qualified teachers our children deserve. *Educational Horizons*, *85*(2), 111-132.

Effendi, M. I., Sugandini, D., and Istanto, Y. (2020). Social media adoption in SMEs impacted by COVID-19: The TOE model. *The Journal of Asian Finance, Economics and Business (JAFEB)*, *7*(11), 915-925.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Estriyanto, Y., Kersten, S., Pardjono, P., and Sofyan, H. (2017). The missing productive vocational high school teacher competency standard in the Indonesian education system. *Journal of Technical Education and Training*, *9*(1), 26-44.

Fadillah, I. N., and Maryanti, R. (2021). Application of learning videos and quizizz in increasing students interest in learning English in middle schools. *Indonesian Journal of Multidiciplinary Research, 1*(2), 329-336.

Faishol, R., and Mashuri, I. (2022). The concept of learning media in the perspective of the qur'an and al-hadith. *Journal of Islamic Education Research*, *3*(2), 129-148.

Fiandini, M., Hofifah, S. N., Ragadhita, R., and Nandiyanto, A. B. D. (2024). How to make a cognitive assessment instrument in the merdeka curriculum for vocational high school students: A case study of generating device materials about the stirling engine. *ASEAN Journal for Science Education*, *3*(1), 65-86.

Firdaus, I. R., Febrianty, M. F., Awwaludin, P. N., Ilsya, M. N. F., Nurcahya, Y., and Sultoni, K. (2023). Nutritional research mapping for endurance sports: A bibliometric analysis. *ASEAN Journal of Physical Education and Sport Science*, *2*(1), 23-38.

Firman, T., and Nandiyanto, A. B. D. (2023). Effectiveness of socialization through PowerPoint media to understanding nutrition of adolescents. *ASEAN Journal of Science and Engineering Education*, *3*(3), 211-220.

Friedman, L. W., and Friedman, H. (2013). Using social media technologies to enhance online learning. *Journal of Educators Online*, *10*(1), 1-22.

Gajo, A. G. E., Gaisen, E. M. P., Lino, F. V. K. R., Edaño, L. B., and Calixtro Jr, V. L. (2023). Sustaining students' mental health through the use of tiktok application. *Indonesian Journal of Community and Special Needs Education, 3*(1), 11-20.

Gatta, S. A., Ishola, N. A., and Falobi, O.V. (2023). Evaluation of business education curriculum and 21st century entrepreneurial skills in business education undergraduates students. *ASEAN Journal of Economic and Economic Education*, *2*(2), 105-114.

Ghavifekr, S., and Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science*, *1*(2), 175-191.

Ghory, S., and Ghafory, H. (2021). The impact of modern technology in the teaching and learning process. *International Journal of Innovative Research and Scientific Studies*, *4*(3), 168-173.

Glushchenko, V.V. (2022). Ergo design of mentoring in the national ecosystem of vocational education in the period of the 10th technological order. *Indonesian Journal of Educational Research and Technology*, *2*(3), 223-236.

Hafina, A. (2022). Analysis of guidance and counseling teacher skills using self-assessment techniques. *Indonesian Journal of Community and Special Needs Education*, *2*(2), 155-162.

Haider, G. (2016). Process of curriculum development in Pakistan. I*nternational Journal of New Trends in Arts, Sports and Science Education, 5*(2), 15-20.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Hamidah, I., Ramdhani, R., Wiyono, A., Mulyanti, B., Pawinanto, R. E., Hasanah, L., and Rusydi, A. (2023). Biomass-based supercapacitors electrodes for electrical energy storage systems activated using chemical activation method: A literature review and bibliometric analysis. *Indonesian Journal of Science and Technology*, *8*(3), 439-468.

Hamidah, I., Sriyono, S., and Hudha, M. N. (2020). A Bibliometric analysis of Covid-19 research using VOSviewer. *Indonesian Journal of Science and Technology*, 34-41.

Haristiani, N., and Rifa'i, M. M. (2020). Combining chatbot and social media: Enhancing personal learning environment (PLE) in language learning. *Indonesian Journal of Science and Technology*, *5*(3), 487-506.

Hartati, A. D., Maryanti, R., Azizah, N. N., Al Husaeni, D. F., Wulandary, V., and Irawan, A. R. (2023). Webtoon comic media to improve reading comprehensions for students with hearing impairment in special primary schools. *ASEAN Journal of Community and Special Needs Education*, *2*(1), 9-16.

Hashim, S., Masek, A., Abdullah, N. S., Paimin, A. N., and Muda, W. H. N. W. (2020). Students' intention to share information via social media: A case study of covid-19 pandemic. *Indonesian Journal of Science and Technology*, *5*(2), 236-245.

Hashim, S., Masek, A., Mahthir, B. N. S. M., Rashid, A. H. A., and Nincarean, D. (2021). Association of interest, attitude and learning habit in mathematics learning towards enhancing students' achievement. *Indonesian Journal of Science and Technology*, *6*(1), 113-122.

Hattwig, D., Bussert, K., Medaille, A., and Burgess, J. (2013). Visual literacy standards in higher education: New opportunities for libraries and student learning. *Portal: Libraries and the Academy*, *13*(1), 61-89.

Hmelo-Silver, C. E., and Barrows, H. S. (2006). Goals and strategies of a problem-based learning facilitator. *Interdisciplinary Journal of Problem-Based Learning, 1*(1), 21-39.

Hoskins, B., and Crick, R. D. (2010). Competences for Learning to Learn and Active Citizenship: different currencies or two sides of the same coin?. *European Journal of education, 45*(1), 121-137.

Hung, A. C. Y. (2017). A critique and defense of gamification. *Journal of Interactive Online Learning*, *15*(1), 57-72.

Husaeni, D. N. A., and Nandiyanto, A. B. D. (2023). Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar. *Indonesian Journal of Educational Research and Technology*, *3*(1), 1-12.

Huwaidi, F., Nandiyanto, A. B. D., and Muhammad, N. (2021). The urgency of online learning media during the Covid-19 pandemic at the vocational school in Indonesia. *Indonesian Journal of Educational Research and Technology, 1*(2), 35-40.

Irawan, A.R. (2021). Handwashing ability assessment for students with intellectual barriers. *Indonesian Journal of Community and Special Needs Education, 1*(1), 9-10.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Isah, S.A., Olutola, A.T., Olatoye, R.A., and Aderogba, A.A. (2021). Assessing the impact of academic self-efficacy on academic performance of university science students in Katsina State, Nigeria. *Indonesian Journal of Teaching in Scienc*e, *1*(2), 127-136.

Issa, A. I., Jibril, M., Onojah, A. O., Onojah, A. A., and Ekunola, G. T. (2021). Effect of facebook-based learning on students' performance in educational technology concept. *Indonesian Journal of Multidiciplinary Research, 1*(2), 207-218.

Jamiu, L. A. (2022). The weaknesses of the curriculum in the teaching of Arabic (a Muslim language) as a foreign language*. ASEAN Journal of Religion, Education, and Society*, *1*(1), 31-38.

Jauhari, M. N., and Dewi, D. P. (2019). Pelaksanaan cooperative learning model pada mata kuliah media pembelajaran ABK bagi mahasiswa berkebutuhan khusus prodi pendidikan khusus FKIP universitas PGRI Adibuana Surabaya. *Buana Pendidikan: Jurnal Fakultas Keguruan dan Ilmu Pendidikan Unipa Surabaya, 15*(27), 79-89.

Jizat, N. A. M., and Sulong, M. S. (2021). Lecturer perspective on informal learning activities. *Indonesian Journal of Educational Research and Technology, 1*(2), 23-26.

Kamble, A.D.K., and Gaikwad, H.V. (2021). How should the education system approach children with special needs? *Indonesian Journal of Community and Special Needs Education, 1*(1), 15-18.

Kamila, I. N., and Sakti, A. W. (2022). Learning literature using 4m methods as an effort to increase reading interest of elementary school. *Indonesian Journal of Multidiciplinary Research, 2(*1), 69-76.

Karmaker, R., and Malaker, S. (2023). Six points a legacy of historic events in Bangladesh: An education perspective. *Indonesian Journal of Educational Research and Technology*, *3*(3), 225-238.

Khamsah, S. Z. Z., and Nandiyanto, A. B. D. (2024). The effect of educational socialization using poster media on understanding the proportion of calories for children. *ASEAN Journal of Science and Engineering Education*, *4*(1), 1-8.

Kim, J., Kim, E. G., and Kweon, S. O. (2018). Challenges in implementing english-medium instruction: Perspectives of humanities and social sciences professors teaching engineering students. *English for Specific Purposes, 51*, 111-123.

Kurniawati, K. (2022). Increasing learning outcomes of students with hearing impairment using PowerPoint as teaching media in explaining the concept of animal life cycle. *Indonesian Journal of Community and Special Needs Education, 2*(1), 45-52.

Laleno, M. F. (2019). The protection of copyright law (Copyright) in the piracy of creation. *Estudiante Law Journal*, *1*(2), 448-457.

Landero, D. J. M., Gadayan, D. V., Valderama, I. M., Falle, J.A., and Calixtro Jr., V. L. (2022). Implementation and acceptance of Latin dances in senior high school curriculum. *Indonesian Journal of Educational Research and Technology, 2*(2), 117-122.

Lassibille, G., and Navarro Gomez, L. U. C. Í. (2000). Organisation and efficiency of education systems: Some empirical findings. *Comparative Education*, *36*(1), 7-19.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Lee, L. K., Cheung, S. K., and Kwok, L. F. (2020). Learning analytics: current trends and innovative practices. *Journal of Computers in Education*, *7*, 1-6.

Li, T., Bai, J., Yang, X., Liu, Q., and Chen, Y. (2018). Co-occurrence network of high-frequency words in the bioinformatics literature: Structural characteristics and evolution. *Applied Sciences*, *8*(10), 1994.

Lumbu-ani, J., Abusama, H. P., Pangarungan, J. L., Danozo, J. J. L., Estrada, M. J. L., Hasan, H. A., and Moscoso, L. H. A. (2021). Attitude of Sultan Kudarat state university laboratory high school students and teachers on proposed "no homework policy" bill. *Indonesian Journal of Educational Research and Technology, 1*(2), 45-50.

Mahdum, M., Hadriana, H., and Safriyanti, M. (2019). Exploring teacher perceptions and motivations to ICT use in learning activities in Indonesia. *Journal of Information Technology Education*, *18*, 293-317.

Mahrudin, A. (2012). Kurikulum berbasis kebutuhan peserta didik, masyarakat, bangsa dan kehidupan global serta analisis swot dan langkah-langkah pengembangannya. *Edukasi Islami: Jurnal Pendidikan Islam*, *1*(1), 1-29.

Manghano, J. C., Magbanua, E. J., and Besa, A. (2022). Psychological effects of blended learning to the faculty of Sultan Kudarat State University, Philippines. *Indonesian Journal of Educational Research and Technology, 2*(1), 71-74.

Maryanti, R. (2021). Assessment of mathematical abilities of students with intellectual disabilities during the covid-19 pandemic. *Indonesian Journal of Community and Special Needs Education, 1*(2), 47-52.

Maryanti, R., and Nandiyanto, A. B. D. (2021). Curriculum development in science education in vocational school. *ASEAN Journal of Science and Engineering Education, 2(1),* 151-156.

Maryanti, R., Nandiyanto, A. B. D., Hufad, A., and Sunardi, S. (2021). Science education for students with special needs in Indonesia: From definition, systematic review, education system, to curriculum. *Indonesian Journal of Community and Special Needs Education, 1*(1), 1-8.

Maryanti, R., Rahayu, N. I., Muktiarni, M., Al Husaeni, D. F., Hufad, A., Sunardi, S., and Nandiyanto, A. B. D. (2022). Sustainable development goals (SDGs) in science education: Definition, literature review, and bibliometric analysis. *Journal of Engineering Science and Technology*, *17*, 161-181.

Mastagli, M., Malini, D., Hainaut, J. P., Van Hoye, A., and Bolmont, B. (2020). Summative assessment versus formative assessment: An ecological study of physical education by analyzing state-anxiety and shot-put performance among French high school students. *Journal of Physical Education and Sport, 20*, 2220-2229.

Meccawy, M. (2022). Creating an immersive xr learning experience: A roadmap for educators. *Electronics, 11*(21), 3547.

Millatina, S. N., Maryanti, R., and Wulandary, V. (2022). Strengthening literacy of cultural arts and crafts in the material of sculpture for 6th-grade elementary school students through

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

learning video media. *Indonesian Journal of Educational Research and Technology, 2*(3), 189-194.

Minghat, A.D., Abdullah, N.A., and Suparman, S. (2022). The challenges of remote e-assessments during covid-19 outbreaks among undergraduate engineering programs. *ASEAN Journal of Science and Engineering Education*, *2*(3), 229-232.

Mirzabek, R. (2023). The education and history of Timur Lenk from Uzbekistan. *Indonesian Journal of Educational Research and Technology*, *3*(2), 105-110.

Morbo, E. A. (2021). Instructional materials and alternative teaching practices in physical education. *Indonesian Journal of Educational Research and Technology, 1*(2), 67-70.

Moyosore, O. A. (2015). The effect of formative assessment on students' achievement in secondary school mathematics. *International Journal of Education and Research, 3*(10), 481-490.

Mudzakir, A., Rizky, K. M., Munawaroh, H. S. H., and Puspitasari, D. (2022). Oil palm empty fruit bunch waste pretreatment with benzotriazolium-based ionic liquids for cellulose conversion to glucose: Experiments with computational bibliometric analysis. *Indonesian Journal of Science and Technology*, *7*(2), 291-310.

Mulya, M. A., Maryanti, R., Wulandary, V., and Irawan, A. R. (2023). The effectiveness of youtube media to improve knowledge and literacy of elementary school students. *Indonesian Journal of Educational Research and Technology*, *3*(1), 19-24.

Mulyawati, I. B., and Ramadhan, D. F. (2021). Bibliometric and visualized analysis of scientific publications on geotechnics fields. *ASEAN Journal of Science and Engineering Education*, *1*(1), 37-46.

Muslim, M. (2020). Manajemen stress pada masa pandemi covid-19. *ESENSI: Jurnal Manajemen Bisnis, 23*(2), 192-201.

Nafilah, N. P., and Sakti, A. W. (2022). The effectiveness of using youtube applications as learning media to increase reading and writing interest of elementary school students. *ASEAN Journal of Educational Research and Technology*, *1*(1), 71-78.

Namasivayam, S., Al-Obaidi, A. S. M., and Fouladi, M. H. (2023). A conceptual curriculum design approach for educating engineers of and for the future. *Indonesian Journal of Science and Technology*, *8*(3), 381-396.

Nandiyanto, A. B. D., Al Husaeni, D. N., and Al Husaeni, D. F. (2023a). Introducing ASEAN journal of science and engineering: A bibliometric analysis study. *Journal of Advanced Research in Applied Sciences and Engineering Technology*, *31*(3), 173-190.

Nandiyanto, A. B. D., Al Husaeni, D. N., and Al Husaeni, D. F. (2021). A bibliometric analysis of chemical engineering research using vosviewer and its correlation with covid-19 pandemic condition. *Journal of Engineering Science and Technology*, *16*(6), 4414-4422.

Nandiyanto, A. B. D., Al Husaeni, D. N., Ragadhita, R., Fiandini, M., Al Husaeni, D. F., and Aziz, M. (2022). Resin matrix composition on the performance of brake pads made from durian seeds: From computational bibliometric literature analysis to experiment. *Automotive Experiences*, *5*(3), 328-342.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Nandiyanto, A. B. D., and Al Husaeni, D. F. (2021). A bibliometric analysis of materials research in Indonesian journal using VOSviewer. *Journal of Engineering Research*, *2021*, 1-16.

Nandiyanto, A. B. D., and Al Husaeni, D. F. (2022). Bibliometric analysis of engineering research using vosviewer indexed by Google Scholar. *Journal of Engineering Science and Technology*, *17*(2), 883-894.

Nandiyanto, A. B. D., Biddinika, M. K., and Triawan, F. (2020). How bibliographic dataset portrays decreasing number of scientific publication from Indonesia. *Indonesian Journal of Science and Technology*, *5*(1), 154-175.

Nandiyanto, A. B. D., Fiandini, M., and Al Husaeni, D. N. (2024). Research trends from the scopus database using keyword water hyacinth and ecosystem: A bibliometric literature review. *ASEAN Journal of Science and Engineering*, *4*(1), 33-48.

Nandiyanto, A. B. D., Ragadhita, R., Al Husaeni, D. N., and Nugraha, W. C. (2023). Research trend on the use of mercury in gold mining: Literature review and bibliometric analysis. *Moroccan Journal of Chemistry*, *11*(1), 11-1.

Nasution, A. R., and Nandiyanto, A. B. D. (2021). Utilization of the google meet and quiziz applications in the assistance and strengthening process of online learning during the Covid-19 pandemic. *Indonesian Journal of Educational Research and Technology, 1*(2), 31-34.

Nordin, N. A. H. M. (2022). A bibliometric analysis of computational mapping on publishing teaching science engineering using VOSviewer application and correlation. *Indonesian Journal of Teaching in Science*, *2*(2), 127-138

Nordin, N. A. H. M. (2022). Correlation between process engineering and special needs from bibliometric analysis perspectives. *ASEAN Journal of Community and Special Needs Education*, *1*(1), 9-16.

Nugraha, M.G. (2023). A scientific approach to enhance scientific literacy of junior high school students: Domain of competence. *Indonesian Journal of Educational Research and Technology*, *3*(2), 111-118.

Nugroho, W. D., Irwanto, I., and Cahyono, B. D. (2023). The effect of bamboo dancing learning method on interest, motivation, and learning outcomes in electricity law. *Indonesian Journal of Teaching in Science*, *3*(1), 83-96.

Nuhu, K. M., and Onojah, A. O. (2022). Effect of webinar multimedia platform on students' academic performance in selected educational technology concepts in University of Ilorin. *Indonesian Journal of Multidiciplinary Research, 2(*1), 9-20.

Nuhu, K.M., Adedokun, S.N.A., Asiyanbola, C., and Ajani, A.H. (2023). Assessment of students' application of binary concept using-computer science-unplugged-method in a selected secondary school in Ilorin, Kwara State, Nigeria. *ASEAN Journal of Science and Engineering Education*, *3*(1), 27-34.

Nursaniah, S. S. J. (2023). Analysis of science education curriculum for students with special needs in special schools: The curriculum of 2013. *Indonesian Journal of Community and Special Needs Education*, *3*(2), 113-130.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Nursaniah, S. S. J., and Nandiyanto, A. B. D. (2023). Bibliometric analysis for understanding "science education" for "student with special needs" using vosviewer. *ASEAN Journal of Community and Special Needs Education*, *2*(1), 45-54.

Ochayi, O.A., Olubode, O.C.Kofo, S.A., Afolake, A.N., Aderogba, O.A., and Emmanuel, A.A. (2022). Experts evaluation of flex billboard on study technology for teaching and learning. *Indonesian Journal of Educational Research and Technology, 2*(1), 37-44.

Ogundele, A. G., Umar, I. Y., Ma'aji, S. A., and Idris, A. M. (2023). The use of structured and think-aloud pair problem-solving instructional strategies on students' interest and retention in machine shop practice. *ASEAN Journal for Science Education*, *2*(2), 67-76.

Olabo, O.O., Oreoluwa, A.P., Ochayi, O.A., Muritala, N.K., and Aderogba, O.A. (2022). Acquirable of low-technological devices for learning in special schools. *Indonesian Journal of Community and Special Needs Education, 2*(1), 11-16.

Onikoyi, O. A. (2022). Job satisfaction of teachers and student's performance in academics in public secondary schools in Lagos state. *Indonesian Journal of Educational Research and Technology, 2*(2), 109-116

Özerem, A., and Kavas, R. (2013). Montessori approach in pre-school education and its effects. *The Online Journal of New Horizons in Education*, *3*(3), 12-25.

Pandapatan, A.M. (2024). Public school performance vis-à-vis safety and readiness: An assessment. *ASEAN Journal of Science and Engineering Education*, *4*(2), 107-120

Pathania, R.S. (2023). Assessment of achievement motivation, personality, and their relationship with socio-economic class of the engineering students. *ASEAN Journal of Science and Engineering Education*, *3*(2), 163-170.

Prabowo, T. T., and Suroso, D. J. (2022). Indonesian public response to online learnings during the covid-19 pandemic: An analysis of social media. *Indonesian Journal of Teaching in Science*, *2*(2), 193-206.

Pratiwi, R. A., and Nandiyanto, A. B. D. (2022). How to read and interpret UV-Vis spectrophotometric results in determining the structure of chemical compounds. *Indonesian Journal of Educational Research and Technology, 2*(1), 1-20.

Price-Dennis, D., Holmes, K. A., and Smith, E. (2015). Exploring digital literacy practices in an inclusive classroom. *The Reading Teacher*, *69*(2), 195-205.

Purnastuti, L., and Izzaty, R. E. (2016). Access and equity in higher education in Indonesia: A review from the periphery. *Widening Higher Education Participation, 8*, 119-134.

Putri, N. A. K. A., Maryanti, R., Wulandary, V., and Irawan, A. R. (2021). The influence of Covid-19 on the reading interest of 4th-grade elementary school students. *Indonesian Journal of Multidiciplinary Research, 1*(2), 399-404.

Qushai, I.L.A., Sholeh, A., Budiarta, W.N., and Triawan, F. (2021). Motorcycle child seat for child with special needs: Its design process and problem-based learning. *Indonesian Journal of Community and Special Needs Education, 1*(2), 93-102.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Rachmawati, R. (2019). Utilization and quality of information system for administration services based on ICT in Patehan, Kraton, Yogyakarta. *Indonesian Journal of Science and Technology*, *4*(1), 55-63.

Ragadhita, R., and Nandiyanto, A. B. D. (2022). Computational bibliometric analysis on publication of techno-economic education. *Indonesian Journal of Multidiciplinary Research*, *2*(1), 213-222.

Rahmat, A. (2021). Standards for dimensions of space and environment in buildings for people with special needs (i.e.Wheelchairs, crutches, canes for the visually impaired). *Indonesian Journal of Community and Special Needs Education, 1*(1), 19-24.

Rahmat, A. (2022). Creating good environment and building for people with special needs: From definition to application of guiding and warning blocks. *Indonesian Journal of Community and Special Needs Education, 2*(1), 39-44.

Rainey, E., and Moje, E. B. (2012). Building insider knowledge: Teaching students to read, write, and think within ELA and across the disciplines. *English Education*, *45*(1), 71-90.

Raja, R., and Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, *3*(1), 33-35.

Ramadhan, D. F., Fabian, A. M., and Saputra, H. M. (2022). Dental suction aerosol: Bibliometric analysis. *ASEAN Journal of Science and Engineering*, *2*(3), 295-302.

Ramdhani, T., and Nandiyanto, A. B. D. (2021). The use of whatsapp social media as reinforcement online learning during the Covid-19 pandemic. *Indonesian Journal of Multidiciplinary Research, 1*(1), 107-112.

Reskianissa, A., Sakti, A. W., and Azizah, N. N. (2022). TikTok platform to train middle school students' computational thinking skills in distance learning. *ASEAN Journal of Educational Research and Technology*, *1*(1), 79-86.

Ridho, A., Wardhana, K. E., Yuliana, A. S., Qolby, I. N., and Zalwana, Z. (2022). Implementasi pendidikan multikutural berbasis teknologi dalam menghadapi era society 5.0. *EDUCASIA: Jurnal Pendidikan, Pengajaran, Dan Pembelajaran, 7*(3), 195-213.

Risnandar, R., and Sakti, A. W. (2022). Optimizing instagram in sociology materials to improve digital literacy for junior high school students. *ASEAN Journal of Educational Research and Technology*, *1*(1), 39-46.

Riteshkarmaker, R. (2023). Psychological issues in Bangladeshi children for Covid-19: Losing interest in education. *Indonesian Journal of Community and Special Needs Education*, *3*(2), 103-112.

Rivaldi, M., and Maryanti, R. (2023). The effect of education on increasing student enthusiasm for learning in the transition period of online to offline learning. *Indonesian Journal of Educational Research and Technology, 3*(2), 119-126.

Rosina, H., Virgantina, V., Ayyash, Y., Dwiyanti, V., and Boonsong.S. (2021). Vocational education curriculum: Between vocational education and industrial needs. *ASEAN Journal of Science and Engineering Education, 1*(2), 105-110.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Rusyani, E., Awaliah, F. A., Maryanti, R., Al Husaeni, D. F., Ragadhita, R., and Susetyo, B. (2022). The application of speaking development on the establishment of object vocabulary in student with hearing impairment. *Indonesian Journal of Educational Research and Technology, 2*(1), 45-56.

Ruzmetov, A., and Ibragimov, A. (2023). Past, current and future trends of salicylic acid and its derivatives: A bibliometric review of papers from the Scopus database published from 2000 to 2021. *ASEAN Journal for Science and Engineering in Materials*, *2*(1), 53-68.

Sahidin, I., Nohong, N., Manggau, M.A., Arfan, A., Wahyuni, W., Meylani, I., Malaka, M.H., Rahmatika, N.S., Yodha, A.W.M., Masrika, N.U.E., Kamaluddin, A., Sundowo, A., Fajriah, S., Asasutjarit, R., Fristiohady, A., Maryanti, R., Rahayu, N.I., and Muktiarni, M. (2023). Phytochemical profile and biological activities of ethylacetate extract of peanut (Arachis hypogaea L.) stems: In-vitro and in-silico studies with bibliometric analysis. *Indonesian Journal of Science and Technology*, *8*(2), 217-242.

Sambudi, N.S., and Ramli, R.M. (2021). Integrated project as innovative assessment to enhance learning experience in thermodynamics class. *ASEAN Journal of Science and Engineering Education, 2(1),* 167-176.

Santoso, B., Hikmawan, T., and Imaniyati, N. (2022). Management information systems: bibliometric analysis and its effect on decision making. *Indonesian Journal of Science and Technology*, *7*(3), 583-602.

Sari, N. M., and Faiz, N. S. M. (2021). Internationalisation of higher education: The activity-process approach at Universiti Tun Hussein Onn Malaysia. *Indonesian Journal of Educational Research and Technology, 1*(2), 7-10.

Sari, S. N., and Aminatun, D. (2021). Students' perception on the use of English movies to improve vocabulary mastery. *Journal of English Language Teaching and Learning*, *2*(1), 16-22.

Saripudin, S., Rohendi, D., and Abdullah, A.G. (2020). Developing information technology in opencourseware: From movements to opportunities in Asia. *Indonesian Journal of Science and Technology*, *5*(3), 308-320.

Setiyo, M., Yuvenda, D., and Samuel, O. D. (2021). The Concise latest report on the advantages and disadvantages of pure biodiesel (B100) on engine performance: Literature review and bibliometric analysis. *Indonesian Journal of Science and Technology*, *6*(3), 469-490.

Shaffiyah, I., Dwiyanti, V., and Masek, A. (2022). Smart city and society 5.0: Involvement of information technology in the development of public service systems in Indonesia. *ASEAN Journal of Community Service and Education*, *1*(1), 31-42.

Shah, S.S. (2022). Teaching and learning with technology: Effectiveness of ICT integration in schools. *Indonesian Journal of Educational Research and Technology*, *2*(2), 133-140.

Shaturaev, J. (2021). 2045: Path to nation's golden age (Indonesia policies and management of education). *Science and Education*, *2*(12), 866-875.

Shaturaev, J. (2023). Economies and management as a result of the fourth industrial revolution: An education perspective. *Indonesian Journal of Educational Research and Technology, 3*(1), 51-58.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Shidiq, A. P. (2023). A bibliometric analysis of nano metal-organic frameworks synthesis research in medical science using VOSviewer. *ASEAN Journal of Science and Engineering*, *3*(1), 31-38.

Shidiq, A. S., Permanasari, A. and Hernani, S. H. (2021). The use of simple spectrophotometer in STEM education: A bibliometric analysis. *Moroccan Journal of Chemistry*, *9*(2), 290-300.

Simuforosa, M. (2013). The impact of modern technology on the educational attainment of adolescents. *International Journal of Education and Research*, *1*(9), 1-8.

Soegoto, H., Soeryanto Soegoto, E., Luckyardi, S., and Abhi Rafdhi, A. (2022). A bibliometric analysis of management bioenergy research using vosviewer application. *Indonesian Journal of Science and Technology*, *7*(1), 89-104.

Solehuddin, M., Muktiarni, M., Rahayu, N. I., and Maryanti, R. (2023). Counseling guidance in science education: Definition, literature review, and bibliometric analysis. *Journal of Engineering Science and Technology*, *18*, 1-13.

Son, C., Hegde, S., Smith, A., Wang, X., and Sasangohar, F. (2020). Effects of COVID-19 on college students' mental health in the United States: Interview survey study. *Journal of Medical Internet Research, 22*(9), e21279.

Sopian, A., Nandiyanto, A. B. D., Kurniawan, T., and Bilad, M. R. (2022). The influence use of social media on the learning motivation of junior high school students. *Indonesian Journal of Multidiciplinary Research, 2(*1), 137-142.

Stemler, L. K. (1997). Educational characteristics of multimedia: A literature review. *Journal of Educational Multimedia and Hypermedia*, *6*, 339-360.

Stephen, O. O., and Festus, O. O. (2022). Utilization of work-based learning program to develop employability skill of workforce (craftsmen) in construction industry towards industrial development. *Indonesian Journal of Educational Research and Technology*, *2*(3), 179-188.

Sudarjat, H. (2022). Parking area for people with special needs: Standard design in Indonesia. *Indonesian Journal of Community and Special Needs Education, 2*(1), 53-58.

Sudarjat, H. (2023). Computing bibliometric analysis with mapping visualization using vosviewer on "pharmacy" and "special needs" research Data in 2017-2021. *ASEAN Journal of Community and Special Needs Education*, *2*(1), 1-8.

Sukmawijaya, A., Yunita, W., and Sofyan, D. (2020). Analysing higher order thinking skills on the compulsory english textbook for tenth graders of indonesian senior high schools. *Journal of Applied Linguistics and Literature*, *5*(2), 137-148.

Sumitra, I.D., Wirawan, E., Putra, M., Kusumaningrat, I., and Maulana, H. (2021). Design of webinar information system for people with hearing impairments. *Indonesian Journal of Community and Special Needs Education, 1*(2), 77-86.

Suroto, S., and Nandiyanto, A. B. D. (2021). The effectiveness of using whatsapp social media as learning media at elementary school. *Indonesian Journal of Multidiciplinary Research, 1*(1), 79-84.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Susilowati, N. I., Liliawati, W., and Rusdiana, D. (2023). Science process skills test instruments in the new indonesian curriculum (merdeka): Physics subject in renewable energy topic. *Indonesian Journal of Teaching in Science*, *3*(2), 121-132.

Sutanto, K. I. H., Muktiarni, M., and Mupita, J. (2022). Utilization of youtube videos during online learning to increase literacy in English for middle school students. *ASEAN Journal of Educational Research and Technology*, *1*(1), 47-52.

Syakur, A. (2020). The effectiveness of english learning media through google classroom in higher education. *Britain International of Linguistics Arts and Education (BIoLAE) Journal, 2*(1), 475-483.

Syauqi, K., Munadi, S., and Triyono, M. B. (2020). Students' perceptions toward vocational education on online learning during the covid-19 pandemic. *International Journal of Evaluation and Research in Education*, *9*(4), 881-886.

Sydorenko, V., Shorobura, I., Ponomarenko, A., Dei, M., and Dzhus, O. (2020). Application of technologies of formal and non-formal education for continuous professional development of the modern specialist. *Revista Tempos e Espaços em Educação*, *13*(32), 1-24.

Sylva, K., Siraj-Blatchford, I., Taggart, B., Sammons, P., Melhuish, E., Elliot, K., and Totsika, V. (2006). Capturing quality in early childhood through environmental rating scales. *Early Childhood Research Quarterly*, *21*(1), 76-92.

Tatar, D., and Robinson, M. (2003). Use of the digital camera to increase student interest and learning in high school biology. *Journal of Science Education and Technology*, *12*, 89-95.

Thapwiroch, K., Kumlue, A., Saoyong, N., Taprasa, P., and Puengsungewan, S. (2021). Online assessment of electric circuit based on machine learning during covid-19 pandemic situation. *Indonesian Journal of Teaching in Scienc*e, *1*(2), 105-112.

Wahono, B., Lin, P. L., and Chang, C. Y. (2020). Evidence of STEM enactment effectiveness in Asian student learning outcomes. *International Journal of STEM Education*, *7*, 1-18.

Widiaty, I., Riza, L. S., Abdullah, A. G., and Mubaroq, S. R. (2020). Multiplatform application technology-based heutagogy on learning batik: A curriculum development framework. *Indonesian Journal of Science and Technology*, *5*(1), 45-61.

Wijaya, H., Maryanti, R., Wulandary, V., and Irawan, A. R. (2022). Numerical minimum competence assessment for increasing students' interest in mathematics. *ASEAN Journal of Science and Engineering Education*, *2*(3), 183-192.

Winarni, R. S., and Rasiban, L. M. (2021). Perception of Japanese students in using online video as a learning media. *Indonesian Journal of Educational Research and Technology, 1*(2), 15-16.

Wirzal, M. D. H., and Putra, Z. A. (2022). 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*(2), 103-110.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815

Wisada, P. D., and Sudarma, I. K. (2019). Pengembangan media video pembelajaran berorientasi pendidikan karakter. *Journal of Education Technology*, *3*(3), 140-146.

Yanti, H., and Syahrani, S. (2021). Standar bagi pendidik dalam standar nasional pendidikan Indonesia. *Adiba: Journal of Education*, *1*(1), 61-68.

Yunus, M., and Aziz, A. (2022). Manajemen pengembangan kurikulum bahasa Arab (Studi tentang proses dan mekanisme pengembangan kurikulum bahasa Arab). *Al-Fikru: Jurnal Pendidikan dan Sains*, *3*(1), 104-113.

Zainuddin, Z., and Perera, C. J. (2019). Exploring students' competence, autonomy and relatedness in the flipped classroom pedagogical model. *Journal of Further and Higher Education*, *43*(1), 115-126.

DOI: https://doi.org/10.17509/ajse.v4i2.62045
p- ISSN 2775-6793 e- ISSN 2775-6815