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## THE BIBLIOMETRICS ANALYSIS OF LITERACY OF VOCATIONAL HIGH SCHOOL STUDENT IN BUILDING CONSTRUCTION EXPERTISE

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### Abstract

This qualitative study focuses on bibliometric analysis of literacy research trends of vocational high school's students in the Field of Building Construction. The goal is to find out the direction and projection of research using a content analysis approach with Google Scholar and Scopus databases taking the range of 2003-2023. The data search process was carried out through Publish or Perish software which then obtained 1,166 raw data with the acquisition of saturated data as much as 24 data. This study analyzes trend growth, author country/geographic location, author agency/affiliation, keywords, and author distribution. The results found that the research topic in this study rose in the range of 2008-2012 with Indonesia as a country that appeared superior, supported by the superior affiliation of the country, namely Jakarta State University, with the author on behalf of Riyan Arthur getting a superior position in this research, while keyword analysis showed that vocational literacy studies had not been discussed much, indicated by the small bubble shape, some related keywords are about literacy skills in SMK, literacy components in SMK, to the required learning support such as e-modules. So that based on the results of existing research, it can be projected that the development of research in vocational literacy in SMK in the Field of Building Construction will be in line with the dominant results that appear in every analysis that has been carried out.

**Keywords:** Bibliometrics, Vocational Literacy, Vocational High School, Mapping, Research Directions

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## **Introduction**

Nowadays, literacy is a crucial basic ability and must be met by every student at any level of education (Stevenson, 2020; Techataweewan & Prasertsin, 2017). No longer described as a skill for understanding writing and reading (Parkinson & Mackay, 2016; Rusilowati et al., 2019) in recent years discussions, literacy have led to its implications for an individual's career planning and development opportunities (Polcyn & Gawrysiak, 2019; Reiska et al., 2015). This is aligned with the background of vocational education which has the aim to create a skilled workforce (Benjamin et al., 2017; Estriyanto et al., 2017; Paryono, 2017).

Various literacy developments in aspects of career planning such as the ability to be more perceptive to the various opportunities present (Strathdee & Cooper, 2017; Tomczyk et al., 2018), how to build active communication with various colleagues well as the ability to create collaboration (Getz et al., 2020; Wittner & Kauffeld, 2021), has brought the urgency of the need for more research discussions about literacy in vocational high school (Arthur et al., 2023; Choi et al., 2019). Recent research shows that the development of vocational literacy has now been divided into 4 dimensions consisting context of vocational, mastery of vocational knowledge, process to competence, and work attitudes (Arthur, et al., 2023) it is shows that literacy in vocational education increasingly shows development and needs to be followed up (Arthur et al., 2023).

The building construction field is one of the high urgency field for literacy development aligned with its need in the future (Maulana et al., 2022; Pan et al., 2020). Moreover, building construction is an influential sector for the economy in many countries (Alaloul et al., 2021; El-Adaway et al., 2020; Mahmoud et al., 2020; Saka & Adegbembo, 2022) which is related with the need for a young and skilled workforce (Ditjen Bina Konstruksi Kementerian PUPR, 2017). Data from the Directorate General of the Ministry of Public Works and Public Housing (2020) the total of skilled workers

who graduated from SMK (Vocationally – Based)/SMA (Academic – Based) were found to be 82,187 or 11.653% of all workers in the sector.

This data is a small amount for the standard of graduates at the education level who are indeed focused on its fields, so that Building Construction Expertise of Vocational Education is actually responsible for this data and need improvements in finding the efficient way to resolve this problem. In order to support the quality of graduates who are competent and competitively superior (Pertiwi & Ahmad, 2018; Supriyadi et al., 2019), one of the solutions is by integrating literacy to the learning components (Oktaviastuti et al., 2016; Rahmawati, 2017) but before going further, the development of research positions and various development opportunities are necessary to know (Zakiyyah et al., 2022). This is done in order to make the aligned research with the development and needs of students in workplace (Oliveira et al., 2019). One of the widely used ways to provide trend-related analysis and research predictions is bibliometric analysis (Glänzel, 2003; Zhang et al., 2021).

Bibliometric analysis is defined as a literature study that can be used to trace research trends that are crowded among academics (Junandi, 2018; Luo et al., 2022). Bibliometric analysis is a high-level analysis that connects various research results that boil down to determining research predictions (Yang et al., 2020) by combining statistical mathematical calculations and the meaning of the contents of various specified publications (Gallardo-Gallardo et al., 2015).

In this research, bibliometric is used to analyze research's growth trend, the geographical location of authors' countries, authors' institutions, keywords, and author's collaboration on literacy research for Vocational High School students in the Field of Building Construction which hasn't been done much in a complex way. A summary of bibliometric analysis of literacy research for Vocational High School Students in the Field

of Building Construction will be obtained which can then be used by other researchers, stakeholders, and policymakers at the relevant education level to develop the quality of Vocational High School Building graduates through integrating literacy in learning so that they are able to answer the ideal conditions of graduates.

### Research Methodology

This study was conducted in the time span of October 2022 – January 2023. In this study, qualitative research methods are used with a bibliometric-based content analysis approach whose stages can be seen through the diagram below.

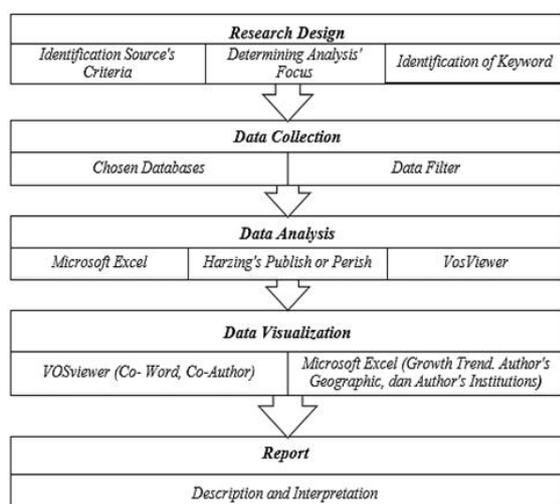


Figure 1. Research flowchart adopted from Zupic & Čater (2014)

The diagram above illustrates the flow of research carried out in this study, the diagram is adapted from the flowchart by Zupic & Čater (2014) with the stages being as follows:

- 1) The first step is the stage of determining the research design where in this step the flow is divided into 3, namely identifying source criteria, determining the focus of the analysis, and identifying the keywords to be used.
- 2) The second step is the data collection, this step has 2 stages, namely determining the selected database and filtering data. In this study, it was determined that data with Google

Scholar and Scopus indexing was used. Where it is also determined that the keywords used include: STEM Literacy, Vocational Core Competency, and Vocational Literacy with a search limit of 200 data for each keyword on each search in each database. The data obtained from the Publish or Perish software is then downloaded in two formats, namely CSV and RIS, the CSV format is then used to filter the data using Microsoft Excel by analyzing the content manually and increasing perseverance in checking the validity of the data and using documentation study instruments, then the saturated data obtained is entered into Mendeley for editing and stored in the RIS format will be used for visualization data on VOSviewer.

- 3) The third step is the data analysis stage which is divided into 3 stages, namely: analysis in Microsoft Excel, analysis of data generated on Publish or Perish, and analysis on VOSviewer.
- 4) The fourth step is the data visualization stage where the results of the analysis of growth trend, author's geographical location, and author's institution from Microsoft Excel and keyword analysis and author collaboration from VOSviewer have been obtained.
- 5) The fifth step is the final stage of the bibliometric analysis process. At this stage the various analysis results that have been obtained are then interpreted in the form of a description of the results.

### Research Results and Discussion

In this study, the limit of data search on Publish or Perish for each keyword in each database is as many as 200 publications, in other words, the maximum limit of data obtained is 1.200 data, but the data that can be generated is as much as 1.166 raw data.

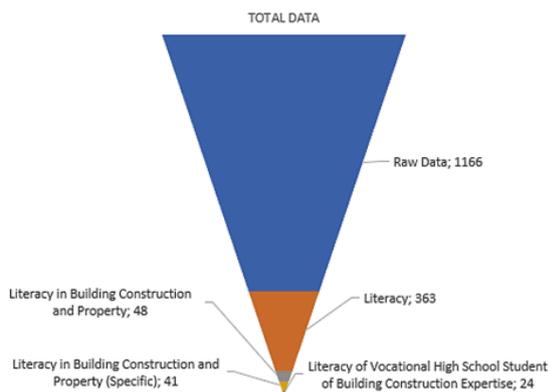


Figure 2. Data filter results diagram

The data was then filtered with the first sieve referring to the presence of the word literacy in the title of each publication, the results were obtained as many as 363 data. Screening continued by conducting data screening that focused more on discussions about literacy in the field of initial Building Construction obtained as many as 48 data, the search continued on the same focus by increasing perseverance and accuracy in reading each existing document. The results were obtained as many as 41 data, moving on to the main topic in this study, 24 publications related to the topic of literacy of Vocational High School students in the Building Construction Field were obtained.

The acquisition of data with long distances provides an illustration that there is a research vacuum related to this topic so that it can be said that literacy development for students of Vocational High School Building need to be raised more.

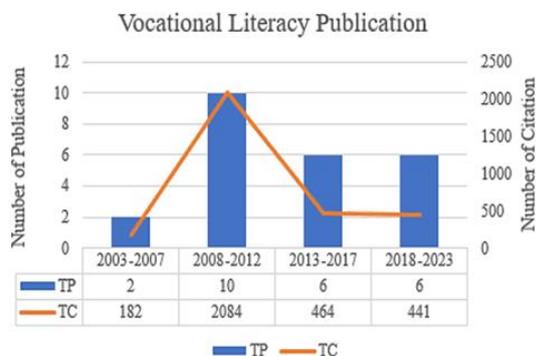


Figure 3. Growth trend graphics

In this bibliometric, an analysis of growth trend is presented to see a graph of

the research phenomenon that occurs in last 21 years. In this study, the results were obtained that the graph of the literacy research trend of Vocational High School in the Field of Building Construction students tends to rise and fall drastically. From the chart presented, it can be seen that the research rose in the range of 2008 - 2012. This result was also supported by content analysis of OECD research related to the PISA survey held in that year, namely in 2009 and 2012. Where the OECD (2009) has a focus on PISA assessment in the development of youth competencies which is then complemented by the OECD (2012) related to PISA measurements of mathematical abilities and students' problem solving on simple problems that are aligned with the principles of literacy for vocational education coupled with in that year range, there are many research discussions related to the sustainable construction sector so that the combination of both give rise to superior charts for the 2008 – 2012 range. From the table above, there is an interesting thing, in the range of 2013 - 2017 and 2018 - 2023 where the number of publications obtained the same value as the acquisition of a slightly different number of citations, even so it was found that although the graph tends to decrease, the research has focused more on integrating literacy into the learning of Vocational High School students in the Field of Building Construction (Arthur, et al., 2023; Rouf et al., 2021) such as the development of teaching materials (Maulana et al., 2022) and the analysis of the suitability of current literacy for students of Vocational High School in the Field of Building Construction (Arthur, et al., 2023).

Viewed from the trend, the data released by the OECD has a strong influence on literacy research which should not be the case because the need for literacy development is almost always changing rapidly, adjusting to the times even when the latest OECD data has not yet been released. The need for the development of vocational literacy in Vocational High School in the Field of Building Construction has been conveyed by Arthur et al (2021) as evidenced

by the results of the distribution of questionnaires on engineering mechanics subjects where the literacy level of students is still low, followed by Arthur et al (2023) where measurements of the literacy of vocational school children, especially in the Building Sector, have not been in accordance with their characteristics so that these two researches are the background for the need for development of vocational literacy. Then, the latest research by Arthur et al (2023) shows the development of vocational literacy which has reached the formation of a theoretical framework model which is divided into 4 dimensions (context of vocational, mastery of vocational knowledge, process to competence, and work attitudes) so that the direction of research in the future will develop a lot from the concept.

The next analysis is an analysis of the location of the author's country. This analysis is useful in determining which countries are dominant in this research topic which can later be used to obtain many references to the state of the country.

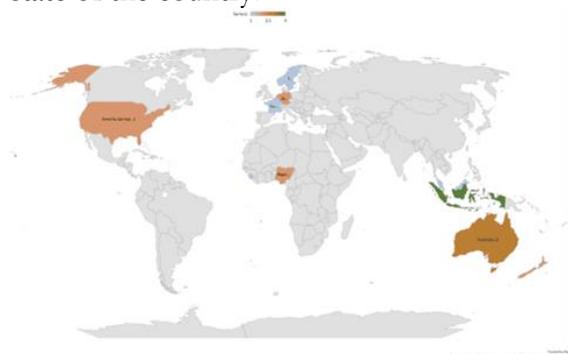


Figure 4. Distribution of author's geographical country

In this study the dominant country was represented by a green color, the medium ones presented in orange to brown color, and the minority one is presenter in blue color. From the visualization above, Indonesia is a country that appears dominantly in research topics regarding the literacy of Vocational High School students in the Field of Building Construction. This is influenced by the fact

that the literacy ability of Indonesian children is still low (Schleicher, 2018) and the high need for skilled graduates of Vocational High School students in the Field of Building Construction to be able to work in the construction industry (Direktorat Jenderal Bina Konstruksi, 2020) align with the increase in various infrastructure developments in the country and the lack of references to improve learning at Vocational High School in the Field of Building Construction which is not optimal where currently students' skills are mostly based on literacy including the skills needed in working after graduation especially as graduates who will work in the construction industry, of course, they will be very related to various things related to calculations and planning, so that increasing literacy is needed, one of which can be done through integrating literacy in the process of their activities in schools.

The results analysis of the author's geographical country distribution are related to the results of the growth trend analysis where it is known that in 2018 - 2023 the research trend tends to fall but the research is dominated by research from Indonesia with this dominance can make collaboration opportunities both from within and outside the country wide open and make this research theme crowded and can complement the shortcomings of existing research such as limited references and lack of human resources.

The next analysis is the author institution analysis which provides an overview of institutions that excel in research discussions on the topic of literacy of Vocational High School students in the Field of Building Construction. The results can be seen in the table below. The table consists of title of the article, years of publication, affiliation, percentage of the total of affiliation in the table, how many authors from the different institution, and the total of authors in every articles.

Table 1. Distribution of author institutions

Title	Year	Affiliation	Percentage	Number of author(s) involved	Total author(s)
STEM education: Proceed with caution	2011	University of Waikato	3%	1	1
Refueling the US innovation economy: Fresh approaches to science, technology, engineering and mathematics (STEM) education	2010	ITIF (Information Technology and Innovation Foundation)	3%	2	2
Learning practices in vocational education	2003	Stockholm Institute of Education	3%	1	1
Lessons for developing countries from experience with technical and vocational education and training	2012	International Growth Centre	3%	1	1
Industrializing the Nigerian society through creative skill acquisition vocational and technical education programme	2009	Alli University Ekpoma, Edo State	3%	2	2
Developments 4.0 Prospects on future requirements and impacts on work and vocational education	2015	Europa - Universität Flensburg	3%	2	3
Developments 4.0 Prospects on future requirements and impacts on work and vocational education	2015	Fachhochschule Flensburg	3%	1	
Raising numeracy and literacy to improve vocational opportunities	2012	University of Canterbury	3%	3	3
Engineering in the K-12 STEM standards of the 50 US states: An analysis of presence and extent	2012	Purdue University	3%	3	3
Integrated STEM education: A systematic review of instructional practices in secondary education.	2018	Katholieke Universiteit Leuven	3%	10	17
Integrated STEM education: A systematic review of instructional practices in secondary education.	2018	Universiteit Antwerpen	3%	4	
Integrated STEM education: A systematic review of instructional practices in secondary education.	2018	Go! Onderwijs van de Vlaamse Gemeenschap	3%	1	
Integrated STEM education: A systematic review of	2018	Vrije Universiteit Brussel	3%	1	

<b>Title</b>	<b>Year</b>	<b>Affiliation</b>	<b>Percentage</b>	<b>Number of author(s) involved</b>	<b>Total author(s)</b>
instructional practices in secondary education.					
Integrated STEM education: A systematic review of instructional practices in secondary education.	2019	Katholiek Onderwijs Vlaanderen	3%	1	
Vocational education and employment over the life cycle	2016	University of Amsterdam	3%	3	3
Ensuring curriculum relevance in vocational education and training: Epistemological perspectives in a curriculum research project	2017	Oslo and Akershus University College, Institute of Vocational Teacher Education	3%	1	1
Competency-based training, global skills mobility and the teaching of international students in vocational education and training	2013	RMIT University Melbourne	3%	2	2
Innovation and vocational education	2010	University of Western Sydney	3%	1	1
Competence-based vocational education and training (VET): The cases of England and France in a European perspective	2008	University of Westminster London	3%	2	4
Competence-based vocational education and training (VET): The cases of England and France in a European perspective	2008	LEST-UMR 6123 Aix en Provence	3%	1	
Competence-based vocational education and training (VET): The cases of England and France in a European perspective	2008	King's College London	3%	1	
Employability skills and vocational education and training policy in Australia: An analysis of employer association agendas	2005	University of New South Wales Sydney	3%	2	2
Effects of training on employees' productivity in Nigeria insurance industry	2015	University of Nigeria	3%	1	2
Effects of training on employees' productivity in Nigeria insurance industry	2015	Nnamdi Azikiwe University	3%	1	
Gaps between competence and importance of employability skills: evidence from Malaysia	2019	Universiti Malaya	3%	1	3

Title	Year	Affiliation	Percentage	Number of author(s) involved	Total author(s)
Gaps between competence and importance of employability skills: evidence from Malaysia	2019	Universiti Tun Hussein Onn Malaysia	3%	1	
Gaps between competence and importance of employability skills: evidence from Malaysia	2019	Universiti Malaya	3%	1	
The Concept of Literacy Vocational-Based E-Module of Technical Mechanical Subject	2022	Universitas Negeri Jakarta	12%	5	9
Vocational literacy: A new paradigm of vocational education and training (VET) in Indonesia	2023			3	
Is the Scientific Literacy-Based Assessment Fit for Vocational High School? Studies in Building Construction Vocational High School (VHS) in Indonesia	2023			4	
Prototype of Science Literacy Instruments on the Competence of Construction and Property Technology Expertise	2021			4	
Incorporating engineering design challenges into STEM courses	2012	Utah State University	3%	2	2
Effects of Industry 4.0 on vocational education and training	2015	University of Hohenheim	3%	1	1
Integrating knowledge, skills and attitudes: Conceptualising learning processes towards vocational competence	2011	Utrecht University	3%	2	2
Total			100%		65

From the table produced above, it is known that Universitas Negeri Jakarta is an institution that excels in generating publications related to literacy research for Vocational High School students in the Field of Building Construction. If you look closely, it is known that the level of collaboration of authors in the institution is included in a good

category, it can be described that the collaboration leads to an umbrella of research because of the interrelated publications in it. This also indicates that the collaboration of authors within the same institution has been established while collaboration between institutions or countries still needs to be improved.



related to the literacy of Vocational High School students in the Field of Building Construction are included in the new year range indicators, namely in 2020 and after. This further proves that the novelty level of this research is very supportive to be developed.



Figure 8. Density visualization of literacy research for vocational school students in the field of building construction

Furthermore, density visualization which analyze frequency of the research, also shows that research on this topic enters into a bright color frequency, meaning that in addition to the novelty is clearly visible, the gaps created related to this topic are also strong enough that more studies are needed to fill the gaps. In addition, the year indicator can be used to see opportunities for the sustainability of its research which includes the development of teaching materials such as modules and the development of soft skills of its students through literacy which is in color indicators in 2020 and after. Various research developments in the future should pay attention to the latest research on the development of vocational literacy which divides the theoretical model framework into 4 dimensions (Arthur, et al., 2023) so that the research will continue widely and be sustainable.

The last is author's collaboration analysis. This analysis is useful as a depiction of the pattern of research collaboration that exists on the topic being raised.

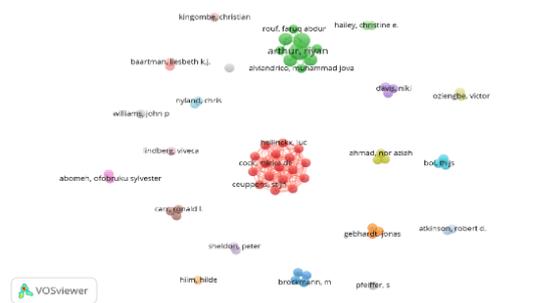


Figure 9. Author network visualization of literacy research for vocational school students in the field of building construction

From the image presented above, Riyan Arthur is an author who appears dominant among other authors. When viewed from the line of connectedness, the collaboration pattern shows that there is an internal scheme of research collaboration, and the author is the leader. This can be compared to the pattern of collaboration that was also created under it with one of its authors named Stijn Ceuppens, although it also formed a collaboration network, but the absence of a dominant name can be estimated that this collaboration is not sustainable.

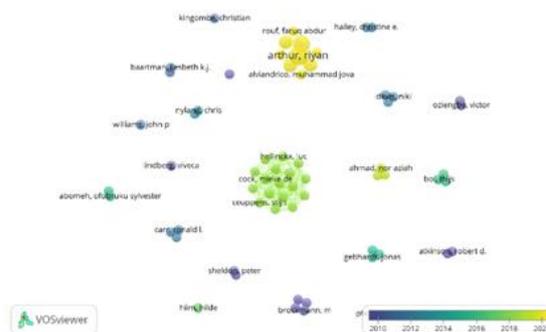


Figure 10. Author overlay visualization of literacy research for vocational school students in the field of building construction

In the overlay visualization author on behalf of Riyan Arthur and the team entered the yellow year indicator. This means that the research theme he presents contains high novelty value with a form of collaboration that forms a research umbrella it is very possible to carry out sustainable research

development and race on a clear roadmap and the possibility to expand the network of collaboration with other authors in their fields.

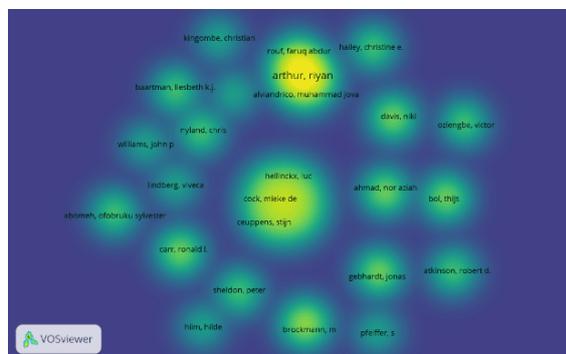


Figure 11. Author density visualization of literacy research for vocational school students in the field of building construction

In the density visualization, it can also be seen that Riyan Arthur and team are included in the brightest color density among other collaboration circles. This is influenced by the novelty of the research because when compared to Stijn Ceuppens and team who also formed a collaboration circle and the resulting color team is less bright even though it forms a collaboration as well.

The results of the co-author analysis reconfirm all the analysis carried out in this study, where in the last year in the analysis of the growth of research trends – his research has a focus on the literacy of Vocational High School in the Field of Building Construction which is filled by many authors from Indonesia, namely from Universitas Negeri Jakarta with the novelty of his research with authors who form a research umbrella with a road map. which is directed so that in the future the direction of research will be based on the development of the latest research at this time to be used as a basis for improving the quality of learning for Vocational High School in the Field of Building Construction through strengthening literacy which boils down to improving the quality of graduates and improving the quality of SMK as a vocational education level that is oriented towards creating skilled graduates.

## Conclusion

Based on the results and discussion above, several points can be concluded as follows:

- 1) The results of the growth trend analysis show an up and down chart, the highest phenomenon was found in 2008 – 2012 which was heavily influenced by OECD data related to the PISA survey.
- 2) The results of the analysis of the author's institution can be seen that Universitas Negeri Jakarta is a dominant institution related to research on the literacy theme of Vocational High School students in the Field of Building Construction.
- 3) The results analysis of Author's Geographical Country show that Indonesia is the dominant country on this subject matter.
- 4) The results analysis of keywords are divided into 19 clusters with themes related to the literacy of Vocational High School students in the Field of Building Construction have not been widely challenged, causing high novelty values.
- 5) The result analysis of the author's collaboration show that there is still a low research collaboration created among researchers, with *authors* who excel on behalf of Riyan Arthur from State University of Jakarta and the collaboration forms an internal scheme of research collaboration.
- 6) From the various results and discussions above, it can be estimated that the future research direction on the topic of literacy of Vocational High School students in the Field of Building Construction will be in line with the development of student literacy needs, existing research gaps, and the latest research related to vocational literacy.

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