

Visualizing Trend of 21st-Century Curriculum: A Bibliometric Analysis

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Abstract—The curriculum develops by developing the era today, which has entered the 21st-century era. This study aims to analyze and visualize the 21st-century curriculum trends. The 21st-century curriculum trend analysis aims to determine the current curriculum development and see research opportunities that can be carried out in the next period. In addition, this study visualizes topics related to the curriculum using bibliometric analysis. The bibliometric analysis in this study aims to map out a general picture of curriculum topics and research trends. This study's findings indicate a decrease in discussion related to the curriculum in the period 2010-2021. The surge in discussion about the curriculum occurs in a certain period, such as in 2013, which was followed by an increase in cites per year in the same year. The results of this study are expected to be used as a literature review related to the development of curriculum trends in the 21st-century.

Keywords— curriculum, bibliometric, 21st-century

I. INTRODUCTION

The current curriculum develops in line with the needs of students and technological developments. The curriculum is often associated with graduate student outcomes. The rapid development of technology

requires curriculum development to be adaptive to technological developments. The development of technology in learning today is often associated with online learning. Online learning currently plays an important role in curriculum implementation in the 21st-century. 21st-century skills in the curriculum are beneficial for students and lecturers in preparing for professional development. The curriculum allows students to be creative and use technology to support the skills needed in the learning process.

Curriculum development in online learning is expected to be useful for professional development. Professional development prepared in a curriculum integrating technology can help universities prepare graduate students to become professionals in their work with the complexity and competence they have [1]. This research takes the topic of research on curriculum implementation and its relation to professional development. One of the reasons this topic is interesting is that based on the research roadmap related to curriculum development and bibliometric analysis conducted by previous researchers, this research has not been discussed too much. The results of Karseth's research (2010) state that the idea of a codification framework based on measurable learning outcomes is a transition to an

instrumental curriculum approach in higher education, in contrast to the traditional curriculum approach, which includes the contents of disciplines and mastery [2]. Maneerata et al (2015) who examined the comparison of curriculum frameworks in Thailand, stated that the application aims to improve the quality of learning and standardize higher education teaching, pedagogy, and learning outcomes [3]. Curriculum development for teacher training programs must be integrated with ICT, so that prospective teachers have competencies that are by teachers' competencies in the 21st century [4]. Meanwhile, the development of teacher education teachers is needed based on global developments and to accommodate socio-economic and technological changes to create a teacher education curriculum that is responsive to changes [5], and the importance of collaborative learning in the implementation of 21st-century competencies [6].

Based on the development of the curriculum in the 21st century, it can be seen that the development of the curriculum is very large. However, in reality, these assumptions are sometimes not supported by literature studies but only based on consideration of the side effects of the phenomenon of using technology in the 21st century on the curriculum. This study aims to analyze and visualize research trends related to curriculum to answer whether curriculum development increases with technological developments in the 21st century or has a downward trend.

II. LITERATURE REVIEW

A. Curriculum-based on Technology

Technological changes in the field of education that are so rapid have a big impact on digital transformation. Information and communication technology is currently an important role that affects every field in terms of exchanging knowledge and information in every field, especially in the field of education [7]. The integration of technology in the field of education indirectly affects the process of implementing the educational curriculum. The digital implementation process is not easy because teachers have to face increasing complexity to prepare learning materials in online classes. Even educational institutions with good infrastructure require a lot of effort and time to make consistent learning arrangements [8]. Changes in educational practice that harmonize with the conditions of need and development of the times are an effort by curriculum developers to create competent and knowledgeable human resources. Curriculum development needs to be synchronized with technology and science knowledge, student development, and digital transformation. Implementation of curriculum developers cannot be separated from the learning process that is currently developing. Sustainability of the learning process develops into two directions, namely (1) education that focuses on environmental sustainability; (2) education sustainability that focuses on the implementation of

education development, leadership, and innovation. Based on this, what is meant by sustainability is the importance of technology integration in the form of online learning (e-learning), which is a learning need and accommodates changes in learning orientation. [9]. Changes in learning to accommodate learning orientation can be developed by approaching curriculum materials, media, and the latest learning systems. Comparative analysis of curriculum material involves two things: careful review and analysis of documentation consisting of curriculum material. Each curriculum material discusses teacher guidelines and curriculum implementation materials [10]. The teaching guide contains curriculum design and features/main parts of the curriculum. The guidance provided to teachers includes detailed guidance on learning guides that inform how teachers implement the learning process based on curriculum development. Adaptation practices carried out by teachers and backgrounds with perspectives carry out documenting curriculum materials well [11], as shown in Figure 1. Figure1 shows the relationship between curriculum material development and teachers. In-depth analysis connects facilitators with teachers in terms of the knowledge they acquire. In addition, professional development content has a link in the curriculum implementation process. The second approach in implementing the curriculum is curriculum media.

Curriculum media is important for higher education components. In understanding media terminology, obtaining benefits, and how the media works, universities maximize media activities [12]. The discussion in this section is how the media can be useful for students in building ideas and seeing things from the point of view of others to form critical thinking patterns. While the third approach is the implementation of the curriculum based on the latest technology.

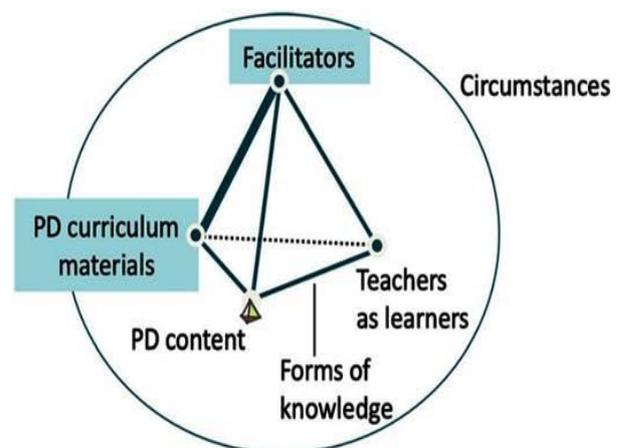


Fig.1 Correlation of teacher to curriculum [11]

1st-Century Curriculum Currently, the learning process is experiencing a shift to learning that integrates technology. One way to implement the

curriculum using the latest technology approach is to use ICT-integrated learning methods as an indicator of 21st-century learning. The competencies achieved in 21st-century learning are creativity, critical thinking, productivity, and problem-solving. In addition, the central role of ICT in the curriculum implementation process in various policies is very important because ICT is considered as (1) the need for 21st-century competence; (2) means to support the acquisition and assessment of 21st-century competencies [13]. In another study, the strategy to achieve 21st-century competence, namely the curriculum, must lead to problem-solving, critical thinking skills, collaborative learning, digital environment, and digital learning. Curriculum implementation prepares teachers to have 21st-century skills in the learning process and integrate multimedia tools [14]. The curriculum development is relevant to the 21st century, as shown in Figure 2. Therefore, future research should continue to examine the impact of using 21st-century curriculum and teaching on cognitive, academic, and social abilities and their measurement.

Figure 2 shows that the curriculum has an important role as one of the components of 21st-century learning. The curriculum appropriate to 21st-century learning focuses on constructing knowledge and encourages students to produce information that has meaning for them to develop new skills. The curriculum is designed in such a way as to enable students to master the knowledge and understand the knowledge of academic disciplines.

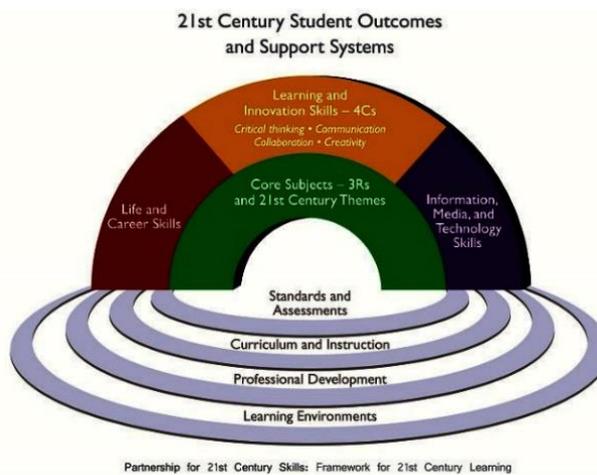


Fig.2. The framework of the 21st-century curriculum [14]

III. METHOD

The literature review in this study was downloaded from Google Scholar and Scopus. The reason for using this index data is that the data in these two indexes is very large and varied. In addition, the Google Scholar (GS) and Scopus indexes are widely used as literature review materials in various studies. GS and Scopus provide information with keywords and references

related to “21st-century curriculum”. The research takes the "21st-century curriculum" as the topic to be analyzed, and the period is from 2010 to 2021. The type of research used is a total of 420 publications. The types of documents used in this study were mostly articles (272), 64.76% of the total publications. In the second position, they are followed by documents in the form of books as many as 91 documents (21.67%), detailed as shown in Table 1.

TABLE I. TYPES OF DOCUMENT

Type of Document	Frequency	Proportion (%)
Article	272	64.76%
Book	91	21.67%
Chapter	3	0.71%
Citation	3	0.71%
Conference Paper	11	2.62%
Html	6	1.43%
Note	2	0.48%
Pdf	19	4.52%
Review	13	3.10%

Table 1 shows the distribution of research on the curriculum conducted over 11 years, between 2010 and 2021. All documents used in the research were downloaded on 30 July 2021 in the RIS Reference Format. The distribution of documents in this study is divided into two indexes, namely GS and Scopus, as shown in Figure 3.

Figure 3 shows the distribution of analyzed documents as many as 220 GS indexed documents and 200 Scopus indexed documents. This study uses software for bibliometric analysis, namely VOSviewer. The reason for using this software is that VOSviewer allows presenting visual data and informative data. VOSviewer has an interface that is easy to operate and allows to view the distribution of data on a systematic map [15]. Quantitative data is processed using web-based data visualization tools, namely Datawrapper.



Fig.3 Distribution of document source

IV. RESULT AND DISCUSSION

Research that discusses the current curriculum has progressed more slowly than the previous period. Curriculum implementation that is tied to a period makes research related to the curriculum not provide much dynamics in the implementation process, as shown in Table 2.

TABLE II. TREND OF RESEARCH ABOUT 21ST-CENTURY CURRICULUM

Years	Google Scholar	Scopus	Total of Research
2010	23	40	63
2011	27	32	59
2012	34	33	67
2013	43	29	72
2014	28	25	53
2015	12	21	33
2016	15	7	22
2017	12	9	21
2018	19	4	23
2019	4		4
2020	2		2
2021	1		1

Table 2 shows that research related to the curriculum experienced a peak increase in 2013 as many as 72 documents (17.14%). Then followed by research in 2012 (67; 15.95%), in 2010 (63; 15.00%) and in 2011 (59; 14.05%). Discussions related to the curriculum, which are directly stated in the research title, have decreased, although it is not uncommon for this curriculum to be discussed in several titles, such as learning topics, as shown in Figure 4.

Figure 4 shows a graph of the decline in the use of curriculum-related titles in the 2010-2021 period; direct research discusses the curriculum has decreased. This may not have a direct impact on discussions related to learning. The development of research based on cite per year also needs to be analyzed, as shown in Table 3.

Table 3 shows a match between the trend of curriculum research and the distribution of cites per year, wherein in 2013, cites per year experienced a significant increase (4056.66). In the second position, quite many cites per year occurred in 2012, as many as 1760.31.

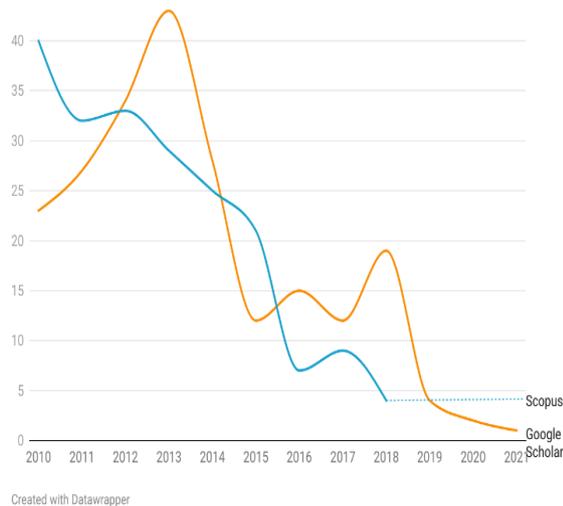


Fig.4 Trend of 21st-century curriculum

TABLE III. CITE PER YEAR OF RESEARCH ABOUT 21ST-CENTURY CURRICULUM

Year	Cite per Year at Google Scholar	Cite per Year at Scopus	Cite per Year
2010	571.91	373.02	944.93
2011	467.6	357.1	824.7
2012	1352.76	407.55	1760.31
2013	3718.35	338.31	4056.66
2014	1102.14	352	1454.14
2015	681.16	385.48	1066.64
2016	1214.2	157.2	1371.4
2017	577.75	192.5	770.25
2018	1004.03	132.67	1136.7
2019	1276		1276
2020	269		269
2021	21		21

The increase in the number of citations in the 2013 period was in line with the number of studies in the same year. If the curriculum development in Indonesia, in 2013, there was a shift in the 2013 curriculum (K13). However, further research is also needed on whether there is a change in the same year. Figure 6 shows seven research topic nodes, namely (1) Culture; (2) Assessment; (3) Teaching; (4) Students; (5) Knowledge; (6) Problems of Curriculum; and (7) Future Curriculum. There is a close relationship between the curriculum and assessment, which is indicated by a thick line of nodes, the curriculum has a relationship with assessment related to how the implementation of the curriculum is evaluated at the end of the learning process [16]. The relationship between the curriculum and students shows a link between the curriculum and the development of students. Curriculum relationship also occurs with the teaching process because the curriculum is believed to affect the quality of teaching. In addition, there is also a relationship between the curriculum and the future of education. Analysis of curriculum development. The study of bibliometric analysis in the research abstract shows that there is a close relationship between the curriculum and the implementation of curriculum, school curriculum, and implementation, as shown in Figure 7.

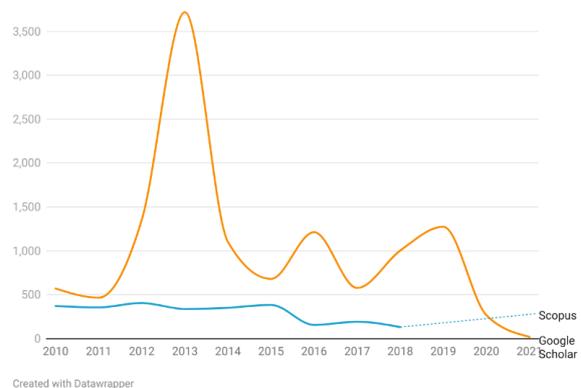


Fig.5 Cite per year of 21st-century curriculum research

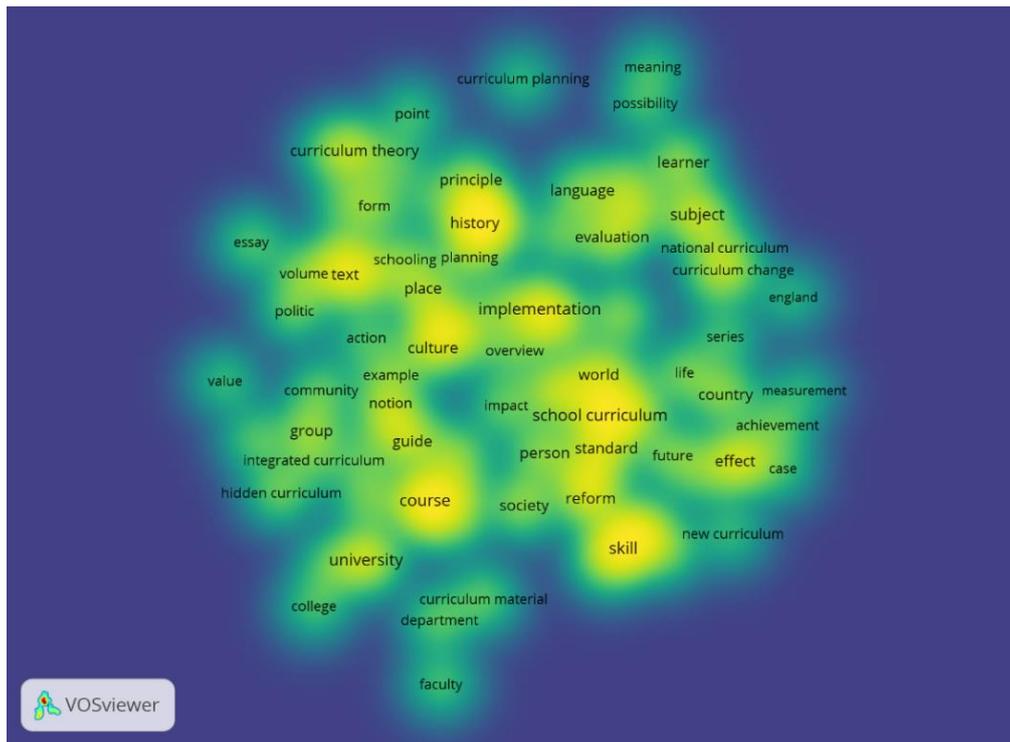


Fig. 8 Keywords density visualization map of 21st-century curriculum -related research

The next analysis is related to density analysis on curriculum topics. Density analysis shows the density of the keywords used. The visualization shows the density based on the color difference, as shown in Figure 8. This study presents a map of research trends related to the curriculum. Figure 8 shows the color of each item indicates the level of density where the yellow area means that the research topic is widely discussed, while the blue area indicates the discussion of topics related to the curriculum is still low. Density analysis aims to understand the whole of the research map and provide a focal point for further research that can be carried out [17]. The bibliometric analysis provides benefits for further research because the results of this study make it possible to see how often a topic is discussed and its relationship to other sub-topics and topics.

V. CONCLUSION

The curriculum is currently an important part of education development, but there is not much research that discusses it. Changes in the dynamics in the curriculum seem to be followed by the growth of curriculum-related research. This study found that curriculum research experienced a significant spike in research in 2013. Many factors underlie this, such as changes in the curriculum in Indonesia, thus providing opportunities for researchers interest in discussing curriculum-related issues. The bibliometric analysis opens opportunities for researchers to find further research gaps and the relationship between a topic and

another topic. The limitation of this research is the limited use of document data on GS and Scopus. The use of more diverse data, such as involving documents from the Web of Science (WOS), Pubmed, Microsoft Academic, and Crossref, is believed to present a narrower research gap. The implementation of this bibliometric analysis can help for curriculum development and provide insight into any sub-topics that have been discussed previously. Curriculum linkages to the discussion of other topics provide opportunities for scientific development related to the curriculum.

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