Bibliometric Analysis of Research Development of Smart Learning Environment for Education in Indonesia

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Abstract

Smart Learning environment has great potential to emphasizes learning flexibility, effectiveness, efficiency, engagement, adaptavity, and reflectiveness. So it is important to map the research that has been done so that it become strategy to explore its use for efficient development. To determine article content, authorship pattern, and productivity of educational writers, a bibliometric study was conducted. The data sources is the google scholar indexer, this smart learning environment article in indonesia is spread in various journals. In general, during 2010-2023 period as many as 126 resecarchers produced 50 articles, the fields that most often appeared were those related to learning and education, the most latest trend of article related to evelopment of a learning management system as a smart learning environmet on improving student cognitive, litercy skill and student's readiness for self-regulated learners. the most published research publications in after 2016 namely 44 articles (88%). And most of the, them related to concept of SLE, design and practical insight into online learning resources. And there are only 14 articles (0,28%) outside the theme of learning and education, namely 2 articles (0,04%) related to communication published in wireless personal communication, so are 2 article (0,04%) related to computer science and emerging technology, and namely 1 article (0,02%) related to machine learning, cloud computing, IOT, AI, city governance published on various journal.

Keywords: bibliometric; research development; smart learning environment; education

Abstrak

Lingkungan Pembelajaran Cerdas memiliki potensi besar untuk menekankan fleksibilitas pembelajaran, efektivitas, efisiensi, keterlibatan, adaptabilitas, dan reflektifitas. Sehingga penting untuk memetakan penelitian yang telah dilakukan sehingga menjadi strategi untuk menggali kegunaannya untuk pembangunan yang efisien. Untuk mengetahui isi artikel, pola kepenulisan, dan produktivitas penulis pendidikan, dilakukan studi bibliometrik. Sumber datanya adalah pengindeks Google Scholar, artikel lingkungan belajar cerdas di indonesia ini tersebar di berbagai jurnal. Secara umum selama kurun waktu 2010-2023 sebanyak 126 peneliti menghasilkan 50 artikel, bidang yang paling sering muncul adalah terkait pembelajaran dan pendidikan, artikel trend terkini terkait pengembangan sistem manajemen pembelajaran sebagai smart learning environmet pada peningkatan kognitif siswa, keterampilan literasi dan kesiapan siswa untuk mengatur diri belajar. publikasi penelitian yang paling banyak dipublikasikan setelah tahun 2016 yaitu 44 artikel (88%). Dan sebagian besar berkaitan dengan konsep SLE, desain dan wawasan praktis sumber belajar online. Dan hanya terdapat 14 artikel (0,28%) di luar tema pembelajaran dan pendidikan, yaitu 2 artikel (0,04%) terkait dengan komunikasi yang dimuat dalam komunikasi personal nirkabel, sehingga terdapat 2 artikel (0,04%) terkait dengan ilmu komputer dan teknologi baru, yaitu 1 artikel (0,02%) terkait pembelajaran mesin, komputasi awan, IOT, AI, tata kelola kota yang diterbitkan di berbagai jurnal.

Kata Kunci: bibliometrik; pengembangan penelitian; lingkungan belajar yang cerdas; pendidikan

1. Introduction

Current issues and new challenges on education system today has been undergoing major changes about by emerging educational concepts and technological reform. It is pose on Smart

learning environment concept. A smart learning environment conceptualized as a learning environment that emphasize learning flexibility, effectiveness, efficient, engagement, adaptively, and reflectiveness (Spector, 2014), which both formal and non-formal learning are integrated. Smart learning environment basically an adaptive system that improves learning experience based on learning traits, preferences and progress, features increases degrees of engagement, knowledge access, feedback and guidance, and uses rich-media with seamless access to pertinent information (Singh et al., 2017). Smart learning environment is regarded as learning system for facilitating efficient personalized learning (Hwang & Fu, 2020). Smart learning environment has potential on creating new pedagogical approaches are required regarding the effective application of integrating technology on the curriculum in a smart learning environment. Smart learning environment is social environment will construct social interaction and emotion of kind psychological response of human being which can influence and regulate cognitive activities such as attention, perceptions, memory think and language. Although on smart learning environment focus on imparting knowledge than affective interaction. Therefore, how to improve the affective interaction within the smart learning environment is become challenge nowadays.

So according to the transformation of teaching and learning practices, embracing a variety of concept including flexible learning, personalized learning, mobile learning, adaptive learning and blended learning, some emerging concept and reforms pose a number of new challenges on smart learning environment on the development of learning process and education.

Smart learning environment have integrated different innovative means like cloud computing, learning analytics, big data, and artificial intelligent to enrich learning experience and enhance learning effectiveness. Smart learning enabled to optimize learners' ability to learn by various pedagogical and technological innovations. Seeing its potential and usefulness in the present, it is certain that in the future, its uses will be more practical and broader. So, it is important for Indonesia to be able to use this learning environment to solve the problem as inadequate school facilities and infrastructure. The lack of learning material in term of variety and richness of content, and group of people with disabilities are still in the minority. For this reason, it is necessary to carry out high research both in quantity and quality and then publish scientifically to encourage discovery and utilization in the field of smart learning environment for education in Indonesia. Mapping research into smart learning environment in Indonesia should be done, and then seeing the extent of progress related to education. One method that can be used is bibliometric.

Bibliometric has become a primary tool for the evaluation of scientific research. Bibliometric started out as a statistical tool for analysing bibliographic data made necessary by the large in the number journal and scientific papers (Salini, 2012). If you have referred to previous research, during the period 2001-2023 there was no research that specifically mapped the progress of smart learning environment research for the field of education in Indonesia. So this study answers the following problem: (1) how is the number of international scientific publications in the field of smart learning environment in Indonesia from 2010-2023 on google scholar; (2) how is the productivity level of smart learning environment researchers; and (3) how to map the development of international publications in the field of smart learning environment research based on keywords. The aims of this study are to determine: (a) the development of the number of international publication in the field of smart learning environment at google scholar 2010-2023; (b) core journals in international publication in the field of smart learning environment; (c) the productivity of researchers in the field of smart learning environment; (d) development of international research publications in the fields of

smart learning environment by subject/fields; (e) development map of international publications on smart learning environment research based on keyword and (f) authors (g) education keyword cluster (h) list of articles related to education.

2. Methods

The research method use data from International publications in the fields of instrumentations source from google scholar database (www.google-scholar.com). Collecting data through a search for publications using Publish or Perish version 8 and then using the keywords smart learning environment in Indonesia with the categories article title, abstract, keyword in the period 2010-2023, it turns out that the research was only recorded in 2018-2021 analyze by Vos-viewer, so data collection was also carried out from 2018-2021 which is conducted annually for more precise and through results. Data in the form of the number of publications per years, journals containing articles in the field of smart learning environment and subject were analyzed using Microsoft Excel 2010. Meanwhile, the trend of the development & productivity in the field of smart learning environment was analyzed using Vos-Viewer software.

3. Result and Discussion

3.1 Result

(a) Growing number of international publications in the field of smart learning environment at Google Scholar Index from 2010 – 2023;
From figure 1 it can be seen that the brighter item, the more recently topic has been researched, theme about self-learning and learning model will be the most discusses theme in 2021. Overall, dark color dominates, so there are many themes have been researched. From table 1 it can be seen that research is increasing in demand with significant increase every year, the most research conducted in 2020 is about environment or digital learning environment.

(b) Core journals in international publications in the field of smart learning environment by google scholar indexer from 2010-2023;
Source of journal dominated on Smart Learning Environment Journal from 50 article searched.

(c) The productivity of researchers in the field of smart learning environment;
There are 126 authors, with maximum number of author per document are 25 and minimum number of document of an author are 3. So for each the 4 authors, the total strength of the co-authorship link with other author will be calculated and Number of author to be selected in this research selected by 4. (figure 4 and 5)

(d) Development of international research publications in the field of smart learning environment by subject/field;
There are 289 keywords used and divided into 3 link keywords clusters. The number of keywords indicates that there are many variations of themes and sub-themes studied by author.

(e) A map of development of international publications of research in the field smart learning environment based on the keywords and (f) the author.
From the picture it can be seen that there are many variations of the theme that have not been studied much. There are even themes that re outliners from the main theme, this shows the broad scope of the theme.

(f) The article smart learning environment for education in Indonesia developing since 2017 and can be found in various journals both domestic and international for period 2010-2023 with an optimal limit of 50 articles. Figure 7 shows that the environment theme continuous to dominate, and the latest research that still hot in 2020 is the discussion of learning activity, pandemics and online learning. Some of them discuss about Indonesia education readiness conducting distance learning in covid-19 pandemic situation (Churiyah & Sakdiyyah, 2020), the other evaluate successful online learning factor in covid-19 era either on higher education and primary school (Putri et al., 2020; Yudiawan et al., 2021). Searching article by keyword on Smart learning environment has diverse result on subject. These article can be group into IoT based cloud (Faritha Banu et al., 2020), big data, and smart city technology.

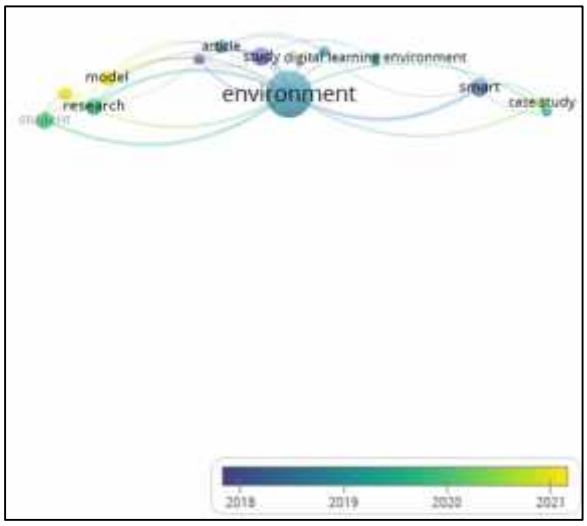

Figure 1. Overlay Visualization Smart Learning Environment.

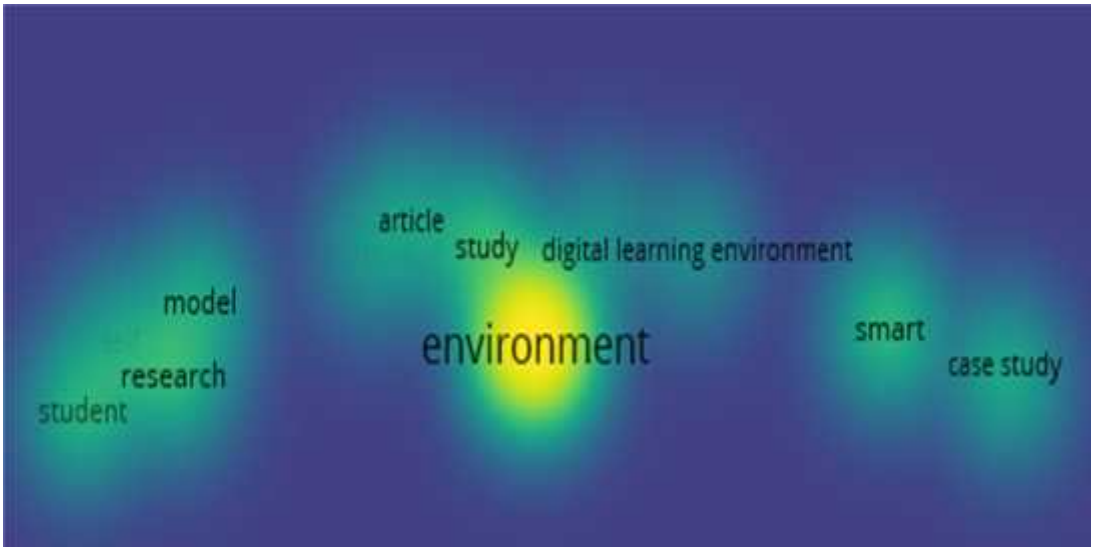

Figure 2. Density Smart Learning Environment by Item

Figure 3. Density Smart Learning Environment by Cluster

Verify selected authors

Selected	Author	Documents	Total link strength
☑	gambo, y	6	5
☑	shakir, mz	5	5
☑	agbo, fj	3	0
☑	temdee, p	3	0

Figure 4. Selected authors

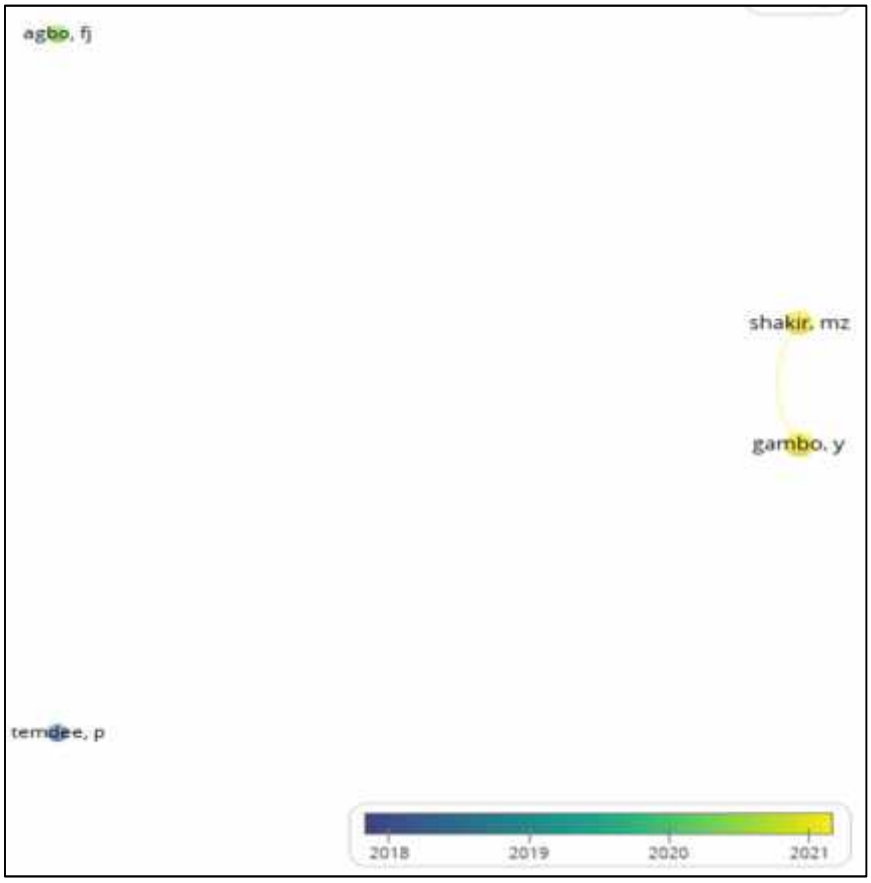

Figure 5. Overlay Visualization selected Author of Smart Learning Environment

Verify selected terms

Selected	Term	Occurrences	Relevance
☑	smart	8	1.72
☑	context	3	1.44
☑	case study	3	1.35
☑	student	7	1.23
☑	environment	49	1.17
☑	study	8	1.03
☑	article	4	0.92
☑	self	4	0.78
☑	digital learning environment	3	0.77
☑	teacher	3	0.70
☑	purpose	3	0.69
☑	research	7	0.62
☑	model	5	0.59

Figure 6. Selected term

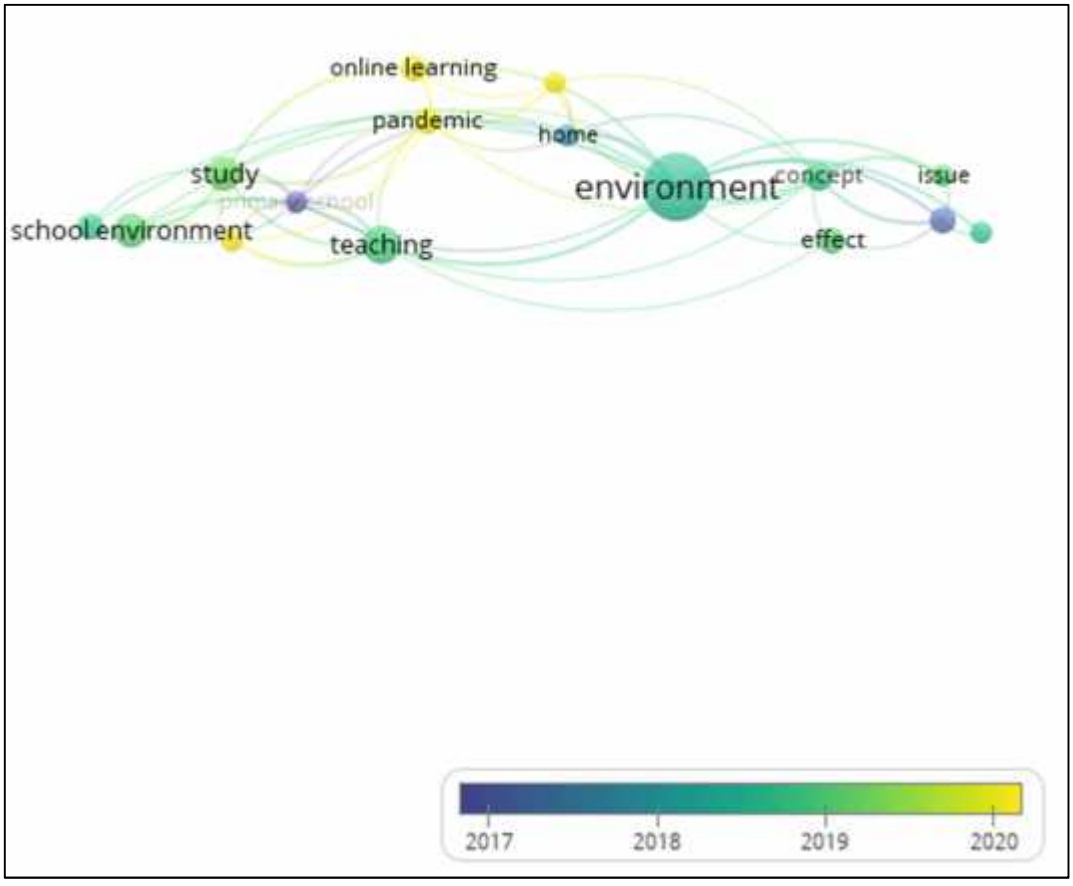

Figure 7. Network Visualization Smart Learning Environment for Education in Indonesia

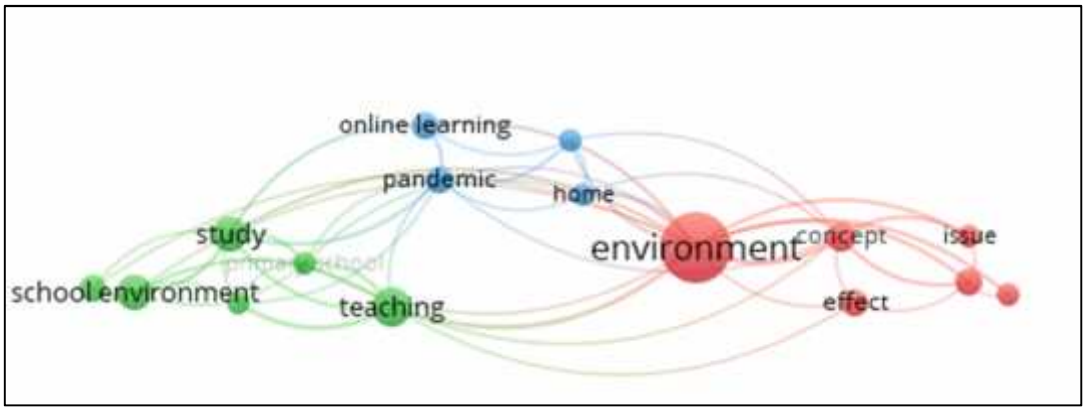

Figure 8. Network Visualization (2) Smart Learning Environment for Education in Indonesia

Table 1. 16 Items and 3 cluster SLE for education in Indonesia

Cluster 1	Cluster 2	Cluster 3
concept	character education	home
design	learning activity	online learning
effect	primary school	online learning environ
environment	school environment	pandemic
issue	study	
SLE	teaching	

3.2. Discussion

In computer in Human behaviour journal on 2016 discussed about paradigm for smart learning environment as e-learning ecosystem using four ontology considered learner model, learning object, learning activities and teaching methods. Smart learning environment by using of smart and mobile technologies can support diverse learning needs. And it has been identified that self-regulated learning process as one supporting student in the online learning environment. There is study to modelled metacognitive component in a smart learning system to facilitate the creation of a self-regulating smart learning environment. This theoretical study bridged the gap in knowledge by exploring the literature and identified and extended the SLE's metacognitive component.

Smart learning environment on education possible on implementing disruptive technology. The article explores the key factors effecting the intentions of educational institution to use block chain technology for e-learning. The study proposed an expanded model of technology acceptance by integrating the diffusion of innovation theory. And the result showed that compatibility had significant impact on block chain use in smart learning environment. And other significant effect was also found on adoption block chain technology could assist decision maker in building a smart learning environment for educational institute for the emerging economies. Systematic literature review article attempts to examine the explanatory approach in dealing with SLE by advancing online learning resources. The systematic approach search for relevant article on SLE in Industrial revolution 4.0 through two electronic databases, Scopus and web of science. The contribution provides theoretical framework with the guideline of well-adapted performance in the educational activities as the

new normal trend. For ensuring the process flow in enlarging the digital learning need readiness both instruction facilities and accessibility procedures (Mulyadi et al., 2022).

Smart learning environment provide students with opportunities to interact with learning resources and activities in way they are customize to their particular learning goals and approaches. Some challenge on developing SLE resource and task within single system in term of time, place, platform and adaptive environment. One article introduces iCollab platform. Learning analytics were used to examine their interaction with iCollab. Result shows a high level interaction with iCollab especially social interaction and indicating an interweaving of formal learning within their informal network spaces. These finding open up new possibilities for ways that SLE can be design to incorporate different factor, improving the ability system to provide adaptive and personalized learning experience relation context and time (Eduardo Araujo Oliveira, n.d.).

4. Conclusion

With various advanced in smart learning environment, both formal learning and informal learning, it is necessary to have direct interaction from early age with smart learning environment. SLE providing personalised and adaptive learning using collaborative tools. Smart learning environment can be design and conceptualized as a variety of concept, including but not limited to flexible learning, personalised learning, mobile learning and blended learning. In future, the work will focus on implementing validating paradigm for smart learning environment as e-learning ecosystem using four ontology considered learner model, learning object, learning activities and teaching methods. Then validating the model and developing it into application as proof of concept. Validating through some stage, first stage is to model a learning agent using the five metacognitive skills as input and associate learning style model as output using an artificial neural network. Second stage a generate a dataset for training and testing the model. Five metacognitive skills will be stimulated. And the third stage integrating the inference engine module with other module using smart and mobile to developed the model into self-regulated SLE to provide learning personalization for supporting online learning experience.

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