IJCETS 10 (2) (2022): 67-75

Indonesian Journal of Curriculum and Educational Technology Studies

http://journal.unnes.ac.id/sju/index.php/jktp

Technology Integration Trends in Hybrid Learning Environments in Indonesia: A Systematic Literature Review

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DOI: https://doi.org/10.15294/ijcets.v11i1.62125

Article History

Received : May 2022
Accepted : July 2022
Published : November 2022

Keywords

Educational technology; Hybrid learning; Learning Environment; Technology integration

Abstrak

Penelitian ini bertujuan untuk mengidentifikasi teknologi yang paling sering digunakan di lingkungan belajar tatap muka atau hybrid di Indonesia dan mengidentifikasi bagaimana teknologi tersebut digunakan. Data yang terkumpul diproses menggunakan PRISMA Statement. Proses penyortiran dilakukan tiga peneliti secara kolaboratif. Artikel lalu diproses untuk memperoleh informasi bagaimana teknologi digunakan, apa mereknya, mata pelajaran apa, dan tingkat penerimaannya. Dari 121 artikel terpilih, diperoleh temuan sebagai berikut. Teknologi paling banyak digunakan untuk media pembelajaran (65). Sebagian besar artikel tidak menyebutkan merek teknologi yang digunakan (33). Sebagian besar tidak menyebutkan mata pelajaran (25). Sebagian besar penerimaan terhadap teknologi adalah positif (111). Dapat disimpulkan bahwa teknologi cenderung digunakan untuk pembelajaran dan kurang dimanfaatkan untuk membangun lingkungan belajar, pengembangan profesi, atau administrasi sekolah. Teknologi banyak digunakan untuk pelajaran STEM, Bahasa Indonesia, dan Pendidikan Agama Islam serta kurang dimanfaatkan untuk mata pelajaran seni dan ilmu pengetahuan sosial.

Abstract

This study aims to identify the most used technologies in face-to-face or hybrid learning environments in Indonesia and identify how these technologies are used. The collected data is processed using PRISMA Statement. The sorting process is conducted by three researchers collaboratively. The articles are then processed to know how the technology is used, what the brand is, what subjects, and the level of acceptance. From 121 selected articles, the following findings were obtained. Technology is most widely used for learning media (65). Most articles do not mention the brand(33). Most did not mention subjects (25). The acceptance of technology is positive (111). It can be concluded that technology tends to be used for learning and less to build a learning environment, professional development, or school administration. Technology is widely used for STEM lessons, Indonesian Language, and Islamic Religious Education and less for arts and social science subjects.

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p-ISSN 2252-6447
e-ISSN 2527-4597

INTRODUCTION

In 2022, most schools stopped remote learning and began in-person, hybrid, or multiple/mixed modalities learning (Johns Hopkins University, et al., 2021). This trend of learning impacted the use of technology. Raising demand and interest in digital resources during the pandemic, began to decrease (Nick Handrinos et al., 2022).

On the contrary of interest in digital resources, numerous reports forecast that the educational technology market will be expanded in following years (Fortune Business Insight, 2022; HolonIQ, 2022). There is only a little insight about how technology is being used in school, especially in hybrid learning settings. There was some research about technology use in education during pandemics (Sun et al., 2020; Vargo et al., 2021). However, these researches need an extension about how educational technologies applied to learning activities in post-pandemic school.

This study will provide the insight to fill the gap. The collected records from this study are intended to give a clear picture of the technology integration process in face-to-face or hybrid learning environments. This study will present an overview about how technology is being used, the brands of the technologies, the subjects that use technology, and the acceptance of technology integration. The result will provide school leaders a clear insight to form a proper policy for technology usage (Day et al., 2016; Navaridas-Nalda et al., 2020).

METHOD

The PRISMA Statement (Page et al., 2021) is used in this research.The articles were sorted by these criteria. First, the publication is a peer-reviewed article. Second, the research must be empirical research. Third, the research was conducted between July 2021 to July 2022. Fourth, the research location must be in Indonesia. Fifth, the research must describe the technology usage. Sixth, the education level must be K-12. Seventh, the research is published in English or Indonesian.

An automation tool, Publish or Perish (Anne-Wil Harzing, 2007) is used to collect the data. The search was conducted 4 times in different searches using these settings. Data source is Crossref. The Years were set to 2022-2022. Keyword 1 is "penggunaan teknologi | pendidikan". Keyword 2 is "pemanfaatan teknologi | pendidikan". Keyword 3 is "technology usage | education". Keyword 4 is "technology integration | education". The search was done on August 5th, 2022 12:46 WIB (GMT+7). Data collection was conducted by author 1.

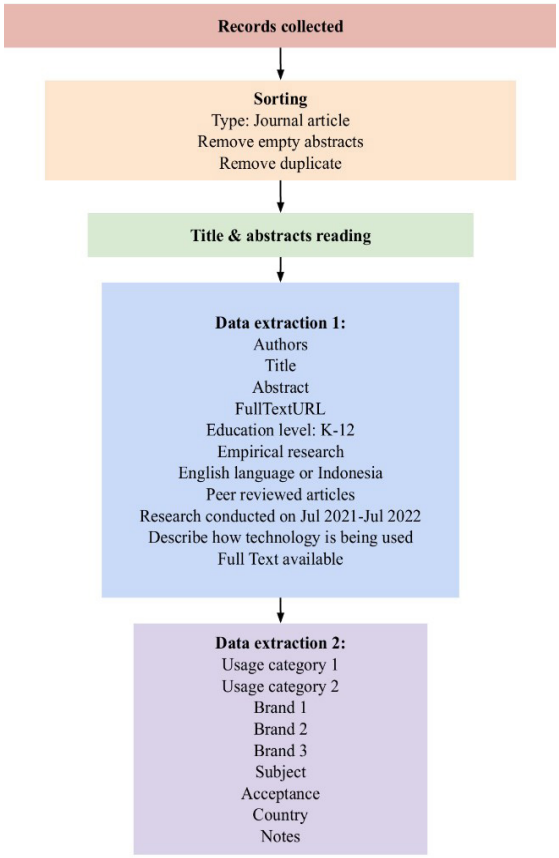
The results from Publish or Perish then were exported into a CSV file. There are 4000 records collected. Author 1 then converted it to Google Sheet. The first step of the selection process is sorting article type. Author chose only records with metadata Type:journal-article. Author then removed the duplicate record. Records with empty abstract were also excluded. Authors then collaboratively assessed title and abstract for eligibility criteria. In case there is doubt, author 1 would make the final decision.

After all titles and abstract were assessed, we conducted full text analysis. A data extraction sheet was developed. We reassessed the record. If the full text was available and met all eligibility criteria, we extracted the information about how the technology is used, what the brand is, what subjects, and the level of acceptance. Author 1 would be the final resolver if there were any doubt in this process.

Data extraction sheet are consist of Authors, Title, Abstract, FullTextURL, Education level: K-12, Empirical research, English language or Indonesia, Peer reviewed articles, Research conducted on July 2021-July 2022, Describe what and how technology is being used, Full Text available?, Accepted?, Usage category 1, Usage category 2, Brand 1, Brand 2, Brand 3, Subject, Acceptance, Country, Notes.

Authors, Title, Abstract, and FullTextURL columns are extracted from Publish or Perish. Education level: K-12, Empirical research, English language or Indonesia, Peer reviewed articles, Research conducted on July 2021-July 2022, Describe what and how technology is being used, and Full Text available? columns are checklists. If these columns were checked, then the column "Accepted?" would be written "YES". Records with "YES" mark in column "Accepted?" would be processed. Authors would fill columns Usage category 1, Usage category 2, Brand 1, Brand 2, Brand 3, Subject, Acceptance, Country, and Notes. To fill these columns, author 1 created a sheet containing usage categories, brands, and subjects. "Acceptance" is determined by the result implied in the full text reading, as well as in "Country" columns. "Notes" were given if nee-

Chart 1 Record selection process



ded. The record selection process can be illustrated in Chart 1.

To reduce the risk of bias, the authors cross check the records with "YES" mark in column "Accepted?". The authors then discussed if there were any differences in columns Usage category 1, Usage category 2, Brand 1, Brand 2, Brand 3, Subject, and Acceptance. The meaning of "technology" here is derived from technology definition in the educational technology field. It can be interpreted as a systematic usage of knowledge to solve the problems (Definition and Terminology Committee of the Association for Educational Communications and Technology, 2007). Therefore, the terms "technology" in this paper not only refer to hardware or software but also model, techniques, strategy, and any intellectual process.

To define the usage category, we create categories based on Technology Integration in School Framework (Davies & West, 2014). There are three focuses in this framework, (1) increasing access to educational technologies, (2) increasing the use of technology for instructional purposes, and (3) improving the effectiveness of technology use to facilitate learning. To create the usage category for this paper, we simplified the areas of increasing instructional technology use and increasing effective use of technology.

From area instructional technology use, we create usage categories: professional development and learning environments. Professional development refers to educational experiences or activities related to someone's work in education, not only for teachers, but also administrators and staff. Learning environment refers to a setting or arrangement when students interact with the learning resource (Scott, 2017).

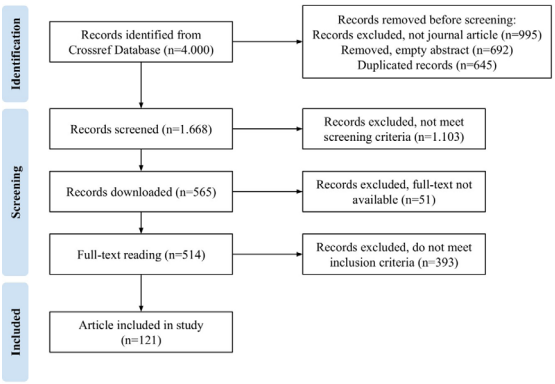
From area effective use of technology, we create categories: teaching tool, teaching/learning strategy, instructional media, and school administration. Teaching tool or teaching aid refer to the tools used by teachers to deliver the message/lesson. Teaching/learning strategies refer to an organization of learning activities (Branch, 2009). Instructional media refer to a media where students can interact to learn about something.

RESULT AND DISCUSSION

We collected 4.000 records from database search. Before starting the screening process, we removed 995 records because the type is not "journal-article". We also removed 692 records due to empty abstract and 645 records due to duplication. We began the screening process of 1.668 records by doing title and abstract reading. From this process, we removed 1.103 records because they did not meet screening criteria: education level K12, empirical research, and written in Indonesian or English. After obtaining 565 records, we began full text reading. We removed 51 records because of unavailability of the full text, and 393 records because of not meet inclusion criteria: 1) Publication is peer-reviewed, 2) Empirical research, 3) Research conducted between July 2021 to July 2022, 4) Located in Indonesia, 5) Describes technology usage, 6) Education level K-12, 7) Published in English or Indonesian. The final result of this process is 121 records and can be seen in Chart 2.

In the screening process, we excluded records for not meeting screening criteria because they do not discuss K-12, for example discussing higher education (González et al., 2022; Tafesse, 2022; Tarangul & Romaniuk, 2022), health sciences (Arii et al., 2022; Dokainish et al., 2022; Nimer et al., 2022), business (Alhadad et al., 2022; Hassan & Nika, 2022; Lin et al., 2022), or other science fields (Brož et al., 2022; Edan & Mah-

Chart 2 Flow Diagram of Review Process



mood, 2022; Tran et al., 2022). They are also not empirical research (Darifah & Erihadiana, 2022; Mareta, 2022; Wade et al., 2022), or not written in Indonesian or English (Забайкин et al., 2022; Шитов, 2022).

In the full-text reading, the excluded records are mostly because there is no date when the research is being conducted (Novela et al., 2022; Sexcio & Dafit, 2022; Sumandya & Widana, 2022). We chose the articles that meet all inclusion criteria and did not assess the quality of the article. We assumed the quality of each article has been sorted by publisher.

In the final result, we collected 121 articles. We categorize these articles based on usage category, brands, subjects, and acceptance. For the usage category, we provide 2 possibilities of usage. In this study, we present only the first usage category of the article we reviewed. For the brands, we record only 3 most mentioned brands in each article. In this study, we present the most used or mentioned brands. For the subject, we recorded the subject mentioned in the article. In this study, we present all of the records, including the articles which did not mention the subject. For the acceptance, we recorded the result implied on each article.

Keep in mind that results in the study are taken from the Crossref database. The result may be different if the future research redo the same method using a larger database.

A. Usage Category

The technology is mostly used for instructional media (63). The usage after that are teaching and learning strategy (26), teaching tools (25), learning environment (3), professional development (2), and school administration (2).

Technology usage in instructional media is focused on a specific topic of subject. It varies from creating workbook (Musdalifah, 2022; Uno et al., 2022), videos (Lasut et al., 2022; Yuniasih, 2022), graphics & animation (Nopitasari et al., 2022; Utami et al., 2022) and other forms of instructional media.

Technology usage in teaching and learning strategy is broader than in instructional media. It is not only focused on instructional goals, but also other correlated aspects like student motivation (Halmuniati et al., 2022; Herlina, 2022) or literacy skills (Arrohman et al., 2022; Sunuyeko et al., 2022).

Technology usage in teaching tools is focused on how technology helps teachers deliver instruction. It varies from hardware (Nuzli et al., 2022; Zulkifli et al., 2022), teleconference (Nurtanti, 2022), learning management system (Nurkhaeroni & Ripaiyah, 2022; Rohmah, 2022), or any digital platform.

From this result, we can see that new technology is mostly used in teaching/learning activities. It indicates that the learning environment, teachers/staff professional development, and school administration were being built and still running in traditional ways. This result is aligned with previous research. Technology is not optimized to create a learning environment because sometimes school technological policy is outdated (Bauwens et al., 2020). Professional development activities that enabled teachers and staff to be proficient doing teaching or administrative tasks are declining over time (Francom, 2020; Rasheed et al., 2020). Therefore, technology is also not optimized to ease school administration (Rutherford, 2004; Sunaengsih et al., 2019).

B. Brands

Most articles in this study did not mention specific brands (33). But there are articles that use more than one brand. The result presented in this study (Chart 4) is a summary of the most mentioned brands. The list of complete brands can be accessed in Appendix.

The variety of brands used in the article can be a good sign. It can be an indicator that the teachers have sufficient skills to use and combine multiple technologies to serve students' needs. It is also an indicator that for a particular learning goal, there are several choices of brand available in the market (Donlon et al., 2020).

C. Subjects

The top 5 subjects that use technology are not specified (25), IPA or Nature Science (19),

Chart 3 Usage category

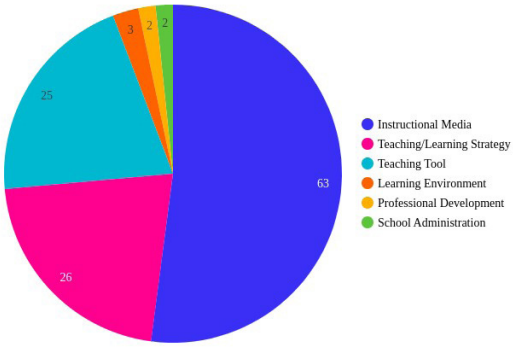
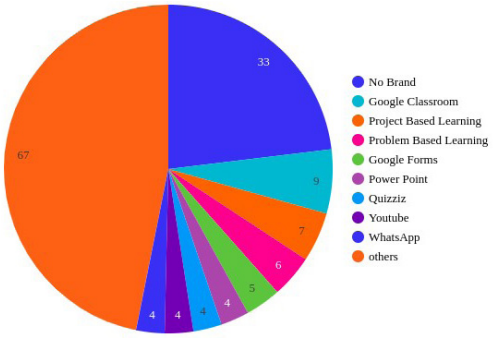


Chart 4 The most mentioned brands



Matematika or Mathematic (18), Bahasa indonesia or Indonesian Language (13), and Pendidikan Agama Islam or Islamic Education (11). "Not specified" means the article did not mention a specific subject or it is about elementary school students. Curriculum for elementary school in Indonesia categorizes learning in thematic based instead of subject based. The completed list of subjects can be seen in Table 1. The notes on "not specified" subjects can be accessed in Appendix.

This result is interesting. Most articles labeled "not specified" are from elementary grade. It is understandable because most teachers in Indonesia are elementary school teachers. Total elementary school teachers under the Ministry of Education and Culture alone is 1.5 million (Badan Pusat Statistik, 2021a), compared to about 600.000 junior (Badan Pusat Statistik, 2021b) and 300.000 high school teachers (Badan Pusat Statistik, 2021c).

Another unique result from Indonesia's landscape is the usage of technology in Bahasa Indonesia and Islamic Education. It seems understandable also. Bahasa Indonesia is a national language and Islamic Education is in the national curriculum. It needs more research to validate this finding and to find what factors that drive Bahasa Indonesia and Islamic Education to use technology more compared to other subjects.

Table 1 Subject count

Subject	n
Not specified	25
Nature Science	19
Mathematics	18
Bahasa Indonesia	13
Islamic Education	11
Physics	6
Social Science	4
Chemistry	4
Biology	3
Economy	3
Arab Language	2
English Language	2
Advanced Mathematics	1
Internship (PKL)	1
Informatics	1
Citizenship (PPKN)	1
Physical Education	1
Accounting	1
Pancasila Education	1
Sociology	1
Basic Retail Business Management	1
Information Technology and Communication	1
History	1

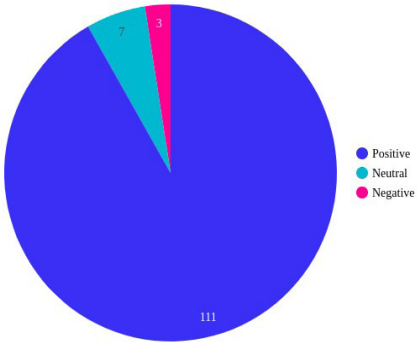
D. Acceptance

The acceptance of technology usage is mostly positive (111). There are only 7 articles that implied neutral acceptance, and 3 articles with negative acceptance (Chart 5). These findings are aligned with previous research. Most Indonesian users perceive positively in new educational technology integration (Ngabiyanto et al., 2021; Pratama, 2021; Zulherman et al., 2021).

CONCLUSION

From this study, we can conclude that technology is most widely used for instructional media. The usage in learning environments, professional development, and school administration is not optimized because of outdated technological policy and declining technology training and support. Most articles did not mention specific technology brands, or use more than one technology. It indicates that the teacher began to grasp technological skill and

Chart 5 Acceptance



utilize available technology in the market. The subjects that use technology the most are STEM, Indonesian Language, and Islamic Education. There are articles that did not mention specific subjects because the elementary grade curriculum categorizes learning in thematic scheme. In general, acceptance of technology integration in Indonesia is also positive.

Conclusion of this study opens the opportunity for further research about findings in this study. Further systematic research with larger database resources can be conducted to gain more comprehensive results. The findings in this study also needed further research to confirm the validity and the factors related, for example, the factors that drive Bahasa Indonesia or Islamic Education teachers to integrate technology into their classroom.

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APPENDIX

1. Datasets of this study can be downloaded at https://osf.io/yczgp/?view_only=docc5acf6ce840d4974e0f26fc18ec53