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Information communication technologies education in elementary school: a systematic literature review

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ABSTRACT

Implementing ICT education in elementary schools in the industrial era 4.0 is urgent. Several studies have explored ICT education in elementary schools, but few studies with systematic literature reviews remain. This article presents a literature review for 2019-2023 regarding ICT education in elementary schools. The Systematic Review Literature method and PRISMA protocol use Publish or Perish 7, VOSviewer, and NVIVO 12 Plus. The search results for Scopus articles contained 812, which were then filtered according to the theme to 61 for the study. The 61 articles were analyzed according to topic via NVIVO 12 Plus, and the results were described according to the research questions. ICT education in elementary school is a form of technology in learning to send, process, create, share, display, store, and exchange information. The characteristics of ICT education in elementary schools are ICT for online learning, communication interaction, digital media, software, inclusive, real-time, TPACK-based, and making students independent. The implementation of ICT education in elementary schools is carried out in learning, digital-based projects, curriculum, tools, and learning materials for Mathematics and language in elementary schools, which are supported by teachers' digital competence. Future researchers must study ICT education in elementary schools according to technological developments.

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1. INTRODUCTION

Information communication technologies (ICT) education in elementary school is urgent in the era of industrial revolution 4.0 and society 5.0 because the current trend is a conversion from manual to digital [1], [2]. In addition to using innovative learning, elementary school teachers must adjust the development of digital pedagogy approaches, tools [3], science, technology, engineering, art, dan mathematics (STEAM), computational thinking [4], mobile technology [5], integration of digital technology and education [6], online learning with various digital platforms [7], digital media and libraries [8], Tuweb and Tuton applications for distance learning [9], distance learning with social media platforms [10], and the application of visual novel games in elementary school [11]. This indicates that elementary school teachers must adapt to the times by mastering digital pedagogy, digital competence, and mastery of ICT education [12], [13]. This is because the elementary school that uses technology positively impacts learning and outside of learning [14].

In reality, teachers in several countries are still resistant to ICT education on the grounds of lack of provision due to the lack of systematic and sustainable training in the use of ICT [15], the outsized role of teachers as tutors when using ICT [16], at least advanced training in the concept and implementation of website creation, video, conferencing, and e-learning [17], the lack of clarity on the concept of ICT, facilities and infrastructure, laboratories, funding, practice and social inclusion [18], and teachers' reliance on traditional practices, official textbooks, printed teaching modules, and unwillingness to accept critical ICT-based learning approaches [19]. According to several studies, the nature of ICT education has a positive impact on educational progress. Research in Botswana states that ICT education positively impacts student academic achievement and helps teachers during the COVID-19 pandemic [20]; as many as 1,407 elementary and junior high school teachers in Italy, only one-third reject ICT education, especially in asynchronous teaching models. However, most of the thousands of teachers agreed to use ICT tools for learning because they were satisfied and supported learning success [21]. Research in South Africa found that, apart from urban areas, ICT has a positive impact on the quality of education in rural areas [22], ICT education has a positive impact on economic growth in several countries using the ICT development index (IDI) which increases 0.175 per cent statistically which means very high [23], and almost all countries were greatly helped by ICT education during the COVID-19 pandemic and after that until now who are accustomed to the digitization of education and learning [24], [25]. This indicates that ICT education is a fixed price that must be accepted by elementary schools [26].

Several studies have explored ICT education and digital education with literature review. Meta-analysis, and systematic literature review (SLR) methods, namely digital technology in music education in Spain [27], the effect of the flipped classroom on students' academic achievement [28], [29], gaming and math anxiety [30], robotics and education [31], technological innovation in engineering education [32], Conginfo.com support in education [33], the relation of ICT literacy to students' socioeconomic status [34], best practices of educational ICT use in Spain [35], gender differences in ICT literacy [36], digital literacy in learning [37], ICT/digital devices gap in policy, theory, and practice in education [38], internet addiction and social networking [39], ICT use for digitally competent teachers [40], new technologies, nutrition programs, and activities for elementary school students [41], app usage issues in mathematics learning in Malaysia [42], use of virtual reality technology in sports education [43], teachers' pedagogical skills in teaching with YouTube [44], and integration of technology and measurement in K-12 education [45]. This proves that research using the SLR method on ICT education in elementary school is still minimal and indicates the urgency of research related to this theme.

Conceptually, ICT education in elementary school is the information technology and communication technology used in education and learning [46]. There are three areas of ICT in education. First, ICT is a science that acts as a source of science, technology, art, and others. Second, ICT is a tool that facilitates learning. ICT education includes ICT tools, multimedia, graphics, computer devices, photos, posts, displays, images, visual media, and e-learning. Third, ICT is used for educational facilities such as computer laboratories, math laboratories, language laboratories, peer-teaching laboratories, music and sound recording studios, multimedia rooms, and others. Fourth, ICT is for competency standards, namely for educational facilities that can complement the functions of schools or educational institutions [47]–[49]. From this conceptual framework, in essence, ICT education in elementary school becomes a unity in the form of knowledge, tools, facilities, and competency standards for elementary school teachers to succeed in the agenda of strengthening the quality of education [50], [51]. The integration of education and ICT is needed, which can run with the key of willing and able teachers [52].

Based on the above background, which refers to social facts and literature facts, research on ICT education in elementary school is urgent. To answer this, the researcher asked the main research question: How is the concept of ICT education in elementary school? To answer this central research question, the researcher asked three specific research questions: i) How is the concept of ICT education in elementary school? ii) How are the characteristics of ICT education in elementary school? And iii) how is the implementation of ICT education in elementary school?

2. METHOD

2.1. Research design

This research on ICT education in elementary school uses the SLR method to describe the findings and analysis of ICT education in elementary school [53]. The stages of this SLR method start from identifying the latest articles relevant to ICT education in elementary school in the aspects of concepts, features, and their use on Scopus databases [54]. To facilitate the SLR method, the preferred reporting items for systematic reviews and meta-analyses (PRISMA) technique is applied to carry out the stages of identification, screening, testing feasibility, the inclusion of data, after which analysis is carried out, and presentation in the form of descriptions [55].

2.2. Inclusion and exclusion criteria for selection of publications

At this stage, researchers determined nine criteria for the articles searched. First, Scopus indexed articles. Second, the articles were in English, while other languages were not used. Third, the articles reviewed were limited to peer-reviewed scientific articles. At the same time, other literature findings such as theses, theses, dissertations, papers, book chapters, conference proceedings, research reports, and books were not used. Fourth, articles published in 2019-2023. Fifth, the articles searched are on ICT education in elementary school. Sixth, the article is in English. Seventh, article searches only use the Publish or Perish 7 application as an application that makes it easy to find articles indexed explicitly by Scopus by entering the API Key in the application. Eighth, the articles used are from open access Scopus indexed journals, while close access ones are not used, except for downloadable articles indexed in databases/indexers such as *ResearchGate.net*, *Academia.edu*, *Eric.ed.gov*, and *Issuu.com*. Ninth, the articles used were full pdfs, while the findings of articles that needed to be completed pdf were not used.

2.3. Screening and eligibility assessment for data analysis

At this stage, screening of literature findings from Scopus was carried out on January 25-29, 2023. Screening literature on aspects of title, abstract, and keywords. Different keywords determine the determination of keywords in the search; this is done to get many articles. From the search findings, 812 articles from the Scopus database were published in 2019-2023. The details are "ICT Education" 200 articles; "ICT Education in Primary Schools" 100 articles; "ICT in Primary Schools" 152 articles; "ICT in Primary Schools" 200 articles; and "ICT in Primary Schools" 160 articles for a total of 812 articles. The findings from the search of 812 articles were not all selected and reviewed, but the same articles were discarded. In the final stage, 61 articles were selected, entered into the Mendeley application, and saved in RIS format. The RIS file from the Mendeley application was then entered into the VOSviewer application for initial network mapping of theme relevance. Based on the results of the initial thematic association analysis it shows that ICT education in elementary schools has a very complex association pattern in Figure 1 in terms of network visualization and Figure 2 in terms of overlay visualization, and the article density visualization based on keywords in the VOSviewer application in Figure 3 is based on density visualization.

Figures 1 and 2 show discussions and studies related to ICT education in elementary school, which are very close to studies such as the concept of ICT education, characteristics of ICT education, implementation of ICT education, ICT, digital learning, integration, educational innovation, distance learning, professional development, elementary education, gamification, TPACK, teacher, teacher training, technology, 21st-century skills, and constructive learning. While the themes that have a deep connection with ICT education in elementary school are capacity, co2 emission, computational thinking, STEM, lesson plan, Greece, ICP adoption, mix-method, 21st-century learning, design and development, computer self-efficacy, using ICT, ICT use, coding, social inclusion, Asian Pacific Region, Refugees, Linear Regression Model, review, longitudinal research, use, latent growth curve modelling, smart city, scratch jr, teacher's beliefs, process, quality of life, learning modalities, pedagogical issues, IOT, k-12 classroom, Koran natural language processing, Europe, early years education, big data vr, automation, stress, science, rural China, Simpson index, LMS, is success model, Argentina, training, parent, physical education, and Ghana. Meanwhile, Figures 1 and 2.

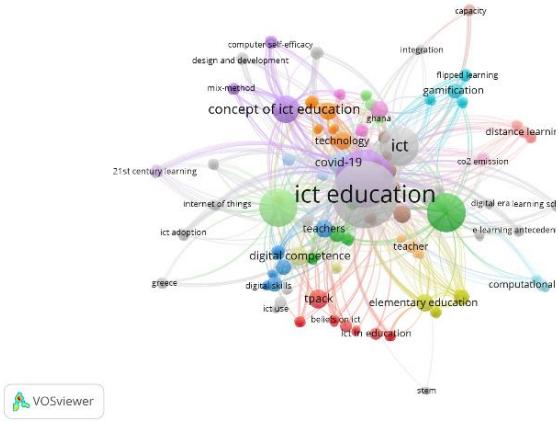

Figure 1. Initial network visualization

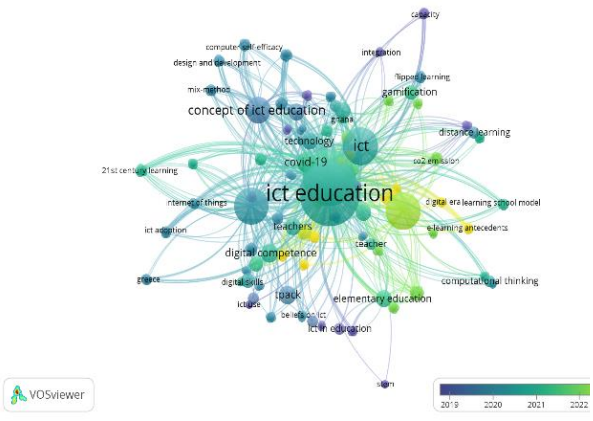

Figure 2. Initial overlay visualization

Based on the mapping of 236 keywords referring to occurrences and total link strength in VOSviewer, it was found that the most studied themes were ICT education (occurrences: 58, total link strength: 385), elementary school (occurrences: 44, total link strength: 309), ICT (occurrences: 20, total link strength: 150), implementation of ICT education (occurrences: 20, total link strength: 142), characteristic of ICT education (occurrences: 19, total link strength: 136), and concept of ICT education (occurrences: 10, total link strength: 65). The remaining keywords with less than 10 occurrences were not used for the main study because they were not related to the three research questions posed.

2.4. PRISMA flow diagram

The article search process with the PRISMA flowchart has four structured schemes. The four schemes are identification, screening, eligibility, and inclusion. [56]. All four schemes were implemented, and articles relevant to the research theme were obtained. Details can be seen in Figure 3. At the identification stage, 812 Scopus-indexed articles were found through the help of the Publish or Perish 7 application Table 1. In the screening stage, articles were checked for similarity according to keywords, 552 articles were found, and the remaining 260 articles were selected. Determination of similarity does not refer to databases because this SLR method only uses one database, namely Scopus, so the similarity determination is reviewed from the keywords used. From the screening stage, 125 articles were selected, while 135 irrelevant articles were discarded. At the eligibility stage, 90 articles were selected for full-text reading, while 35 were discarded. At the included stage, 61 articles were selected concerning the research question regarding title, abstract, keywords, and article substance. The final step is that all articles that have been saved in RIS format in Mendeley are entered into the Nvivo 12 Plus application to be analyzed, mapped, and presented the results according to their relevance to the research questions, namely i) How is the concept of ICT education in elementary school? ii) How are the characteristics of ICT education in elementary school? and iii) How is the implementation of ICT education in elementary school?

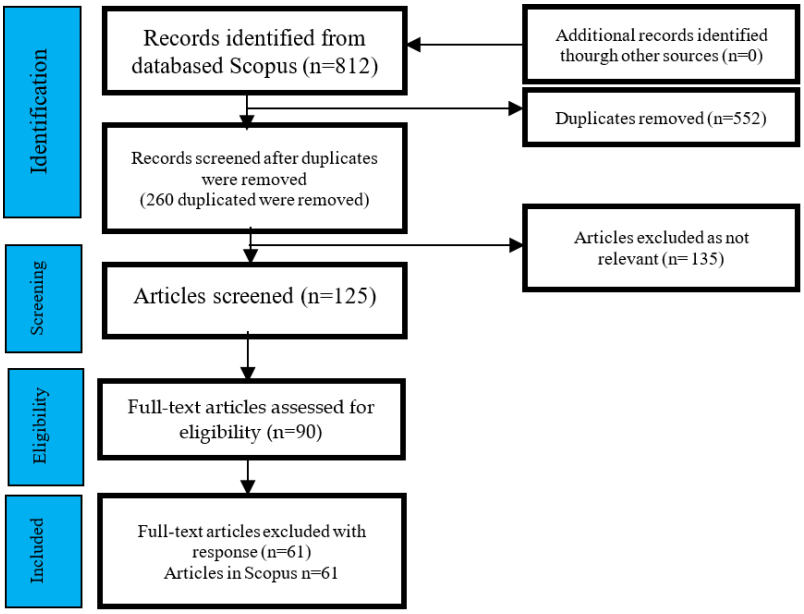

Figure 3. PRISMA flow diagram for systematic review [57]

3. RESULTS AND DISCUSSION

The results of the analysis of 61 articles before being presented according to the three research questions, first presented the results of 61 articles with the criteria of journals (journal name, volume, edition, year, and citation), country of research, methodology, and research questions (RQ) namely RQ (A) concept of ICT education in elementary school, (B) characteristics of ICT education in elementary school, and (C) implementation of ICT education in elementary school in Table 1 [58]-[118] (see in Appendix).

3.1. The concept of ICT education in elementary school

ICT education in elementary school is the technology applied in learning to transmit, process, create, share, display, store, or exchange information through electronic means between teachers and learners [85].

ICT education in elementary school is an educational platform for communication, interaction, and means of achieving educational goals, especially the development of sustainable education [93]. ICT education in elementary school conceptually originated from the development of the Industrial Revolution 4.0. In Malaysia, ICT education is developed through the integration of artificial intelligence, big data, virtual and augmented reality (AR), the internet of things (IoT), and other ICT paradigms according to the times [78]. The Horizon report calls ICT education all forms of technological tools, online tools, and digital tools used for collaboration, communication, and interaction in digital environments in elementary school. ICT education is conceptually an integration of ICT and education [88]. ICT education is conceptually an integration of ICT and education [66]. ICT education presents teachers combining ICT and pedagogy, one of which is through the technological pedagogical content knowledge (TPACK) framework [67], gamification-based learning [109], educational computing, digital skills, technology, information systems [116], learning with the latest technology such as mobile learning [89], online-based [90], or flipped learning [79]. Since the 1980s until now, as a new paradigm in modern education, ICT education in elementary school is substantially the same as e-learning, all forms of educational or learning activities that use cyber networks based on computer technology and the internet [61]. ICT education is the knowledge of various technologies from the trivial to the highest to facilitate education and learning activities such as software, interactive whiteboards, internet, videos, social media, games, and all digital devices that are safe to use in education [69]. ICT education is a product of the times that provides a didactic offer for all teachers and students to accept ICT as a tool to facilitate technology-based learning, digital tools, e-learning, internet, automation, and all ICT supports all-in-one learning [108].

ICT education in elementary school is implementing the concept of automation in education. ICT education makes learning automatic, fast, easy, effective, paper-saving, and done anywhere [117]. ICT education is a digital tool that supports learning, presentation activities, and the creation of specific content being studied [63]. ICT education has the same substance as TPACK, which integrates technology, pedagogy, and knowledge [73]. It contains the scope and outcomes of digital learning, learning techniques, digital tools, digital learn insurable results [107]. TPACK, in this context, is a conceptual framework for exploring teachers' knowledge of the pedagogical use of ICT in learning [62]. From a global view, ICT education is a digital tool that has an essential role in internet-based learning that everyone can reach regardless of ethnicity, region, and ability [92]. Narrowly, ICT education in elementary school can be defined as all ICT devices used in teaching and learning activities by teachers and learners [105]. This research argues that ICT education is all digital tools, media, facilities and resources intended for learning to improve formative processes in elementary school [72].

3.2. The characteristic of ICT education in elementary school

The characteristics of ICT education are patterns, characteristics, characters, kinds, and all technological devices that are easily integrated into education and learning, both in the form of hardware and software [101], including AR which is part of ICT education to support the achievement of social cohesion in the 21st century. AR technology has a role in development, innovation, research investment in ICT products, communication, and diversification on a global scale [87]. The characteristics of ICT education in elementary school are similar to the school level above. The characteristics of ICT education include ICT for online learning, communication-interaction-based, ICT for academic work, social exchange in digital media, software-based, and ICT for blended learning [58]. The characteristics of ICT education in the industrial era 4.0 are all forms of digital technology, innovative technology, and intelligent technology to facilitate communication, connection, and automation with comprehensive such as IoT, cloud computing, big data, and others to facilitate pedagogical work [104], virtual reality-based learning and digital technology to facilitate teachers in transferring knowledge and experience through the help of [99].

Research in Granada states that there are several characteristics of ICT education in terms of function: fast, innovative, effective, accessible anywhere, inclusive, broad, interactive, real-time, and collaborative, making students independent and communicative. In comparison, the types of ICT education are digital e-learning, virtual video, interactive multimedia, chat, and social media [94]. ICT education has characteristics with types of hardware and software that can be applied in elementary school through mastery of TPCK [83]. Several ICT education features widely used by elementary school teachers in Italy are Google Workspace (Google Suite), Google Classroom, Google Docs, and Google Drive. These facilitate interaction between teachers and students because they are cloud-based [70]. At the same time, the characteristics of ICT education in the use of computers are divided into three, namely basic computer skills, the use of computers as information tools, and the use of computers as learning tools. These three characteristics must be mastered by teachers so that ICT education can maximally support learning [98].

ICT education has the characteristic of bringing changes in the lives and activities of teachers and students, such as how to operate, work, learn, and communicate. In short, ICT education has the characteristic of impacting the behaviors and development of educational people [65]. The development of ICT education gave birth to many products, such as e-learning which has pedagogy-based characteristics based on digital

technology and has the aim of facilitating the delivery system, facilitating communication with various models, mechanisms, processes, practices, procedures, communicative, interactive, and user-friendly [118]. The characteristics of ICT education for its users must have a structured framework such as digital competence, information literacy, digital technology-based communication, and problem-solving competence in the digital environment [68]. The characteristics of ICT education are the accessibility and availability of the internet, applications, and digital devices, such as Zoom, Skype, Google Meet, and Microsoft Teams, in online classes where teachers and students can access online with digital devices and the internet [112]. ICT education in the form of learning mobile systems has the characteristics of virtual-based (online), teacher-guided, using e-learning applications, software, and video conferencing [75], and creates communication and collaboration between teachers and elementary school students [97].

Accommodating new technology is one of the characteristics of ICT education. For example, this research mentions the concept of smart pedagogy, which integrates pedagogical intelligence with ICT to facilitate learning [100]. The style of ICT education in elementary school gave birth to new genres in online classes, gamification, and online tests [106], requiring teachers to master digital literacy, new media, digital media, media navigation, and the ability to prevent ICT from harming students [86]. The research mentioned that ICT education resulted in students needing to focus on the material. Teachers must also be able to guide virtually. Therefore, solid digital pedagogy is needed in elementary school teachers [81].

3.3. The implementation of ICT education in elementary school

The implementation of ICT education in Europe is applied to learning, access to education, and facilitating digital-based educational projects [64]. At the same time, elementary school students in Argentina are greatly helped to learn using ICT education because they can learn at home and school using several digital devices [102]. Schools in Korea do not just use ICT education as a tool but incorporate ICT education into the curriculum as computer science and informatics [95]. Other research suggests that students' habituation to using ICT education will make it easier for them to continue at the next school. This research suggests that all elementary schools need to implement ICT education because children's future in the next ten years will be all about using ICT [77]. To realize a "smart city" in Italy, ICT education is implemented from elementary school to university based on IoT and contemporary technology. This study mentions that ICT is developing in education, economy, health, industry, transportation, tourism, and others, which significantly support the government in realizing smart cities in Italy [84].

Research in Pakistan mentions that implementing ICT education needs to start with teachers first through training. After teachers understand, they use ICT with mobile learning platforms and software to implement learning anywhere and anytime [103]. Research in Indonesia mentioned that to use ICT education, teachers and prospective teachers must know TPACK, beliefs about ICT, and teachers' activeness in operating ICT in various situations [91]. ICT education in rural elementary schools in China is implemented through smartphones, computers, broadband internet, and access to information to facilitate learning [82]. Whereas in the United States, the implementation of ICT education is organized, and the provision of digital resources is supplied by large institutions, namely the International Society for Technology in Education (ISTE) and the Computer Science Teachers Association (CSTA) [74].

Elementary schools in Spain have implemented ICT education in collaborative learning using massive online open courses (MOOCs) and WebQuests in Social Science subjects [71]. The professionalism of elementary school teachers primarily determines the implementation of ICT education. It is necessary to realize digital competencies, professional development, and digital-based pedagogical content to make it easier for teachers to implement various ICT education platforms in digital learning [113]. The implementation of ICT education in elementary school is applied through curriculum, learning, and the use of ICT in learning to support teachers' careers. So a digital technology-friendly curriculum is needed, and teachers must be equipped with digital competence [111]. ICT education in the era of the digital revolution is a necessity to be implemented in schools, either as a tool, media, or subject matter [59], determined by the digital competence of elementary school teachers themselves [115], through education, training, development, and further study to deepen ICT education [76].

Implementing ICT education in elementary schools through the learning system to improve the quality of education through visualization, presentation, and simulation of ICT-based learning materials [60]. A survey of 155 teachers in Mauritius found that the use of ICT education had a positive impact on Mathematics learning outcomes. This is because, almost every day, 71.6% of 155 teachers use computers for learning [80]. The use of ICT education in learning elementary school mathematics by applying the science, technology, engineering and math (STEM) approach. It positively impacts motivation, problem-solving, and improved student performance in answering math problems [114]. In language learning in elementary schools, it is necessary to develop new areas such as technology enhanced language learning (TELL) which facilitates teachers in language learning [110], and a variety of spelling applications and reading techniques [96].

4. CONCLUSION

According to the literature findings, ICT education in elementary school is a form of technology in learning to transmit, process, create, share, display, store, or exchange information. ICT Education in elementary school is all the tools, devices, and digital media based on hardware and software to facilitate teachers and students in the learning process to succeed in educational goals. The characteristics of ICT education in elementary school consist of ICT for online learning, based on communication-interaction, digital media, software, inclusive, real-time, based on TPACK, and making students independent. The implementation of ICT education in elementary school is carried out in learning, digital-based education projects, incorporated into the curriculum, and used as tools and subject matter such as Mathematics and language materials in elementary schools supported by digital competencies owned by teachers. Future researchers must examine ICT education in elementary schools in depth according to technological developments.

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APPENDIX

Table 1. Fındıng 61 artıcles from the Scopus database

No	Journals	Countries	Method	RQ
1	Computers & Education Vol. 134 2019 [58]	Spanish	A comparative study	B
2	Education Sciences Vol. 9 No. 3 2019 [59]	Spanish	A descriptive and correlational research	C
3	Physica A: Statistical Mechanics and its Applications Vol. 513, 1 January 2019 [60]	Serbia	Qualitative	C
4	Education and Information Technologies Vol. 24 2019 [61]	Italy	Survey	A
5	Journal of Computer Assisted Learning Vol. 35 2019 [62]	Finland	Longitudinal study	A
6	Journal of Research on Technology in Education 2019 [63]	Greece	TPACK Survey	A
7	Communications of the Association for Information Systems Vol. 44 2019 [64]	Europe	Literature review	C
8	Technological Forecasting & Social Change Vol. 148 2019 [65]	Europe	Research And Development	B
9	Journal of Medical Internet Research Vol. 21 No. 9 2019 [66]	Several Countries	Systematic Search and Review	A
10	Technology, Pedagogy and Education 2019 [67]	Turkey	Survey	A
11	Education Sciences Vol. 9 2019 [68]	Mongolia	Survey	B
12	Education Research International 2019 [69]	Africa	Analytical Research	A
13	IET Smart Cities Vol. 2 No. 2 2020 [70]	Italy	Analytical Research	B
14	Sustainability Vol. 12 No. 14 2020 [71]	Spanish	Survey	C
15	Sustainability Vol. 12 No. 602 2020 [72]	Spanish	A Case Study	A
16	Australasian Journal of Educational Technology Vol. 36 No. 2 2020 [73]	Spanish	Quantitative approach	A
17	Asia-Pacific Education Researcher Vol. 29 No. 1 2020 [74]	Korea, Taiwan, Hong Kong, and China	Presenting the Research Paper	C
18	International Journal of Scientific & Technology Research Vol. 9 No. 1 2020 [75]	Indonesia	Research And Development	B
19	Kasetsart Journal of Social Sciences Vol. 41 2020 [76]	Thailand	Mixed Method approach	C
20	Sustainability Vol.12 2020 [77]	Saudi Arabia	Quantitative (Survey)	C
21	Informatics Vol. 7 No. 13 2020 [78]	Malaysia	Quantitative method	A
22	European Physical Education Review Vol. 26 No. 1 2020 [79]	United Kingdom	A case study/ appreciative inquiry approach	A
23	EURASIA Journal of Mathematics, Science and Technology Education Vol. 16 No.6 2020 [80]	Mauritius	Mixed method approach	C
24	Education and Information Technologies Vol. 25 2020 [81]	Finland	Content analysis	B
25	Applied Economics 2020 [82]	China	Survey	C
26	EURASIA Journal of Mathematics, Science and Technology Education Vol.16 No.1 2020 [83]	Indonesia	Quantitative method	B
27	Smart Cities Vol. 3 2020 [84]	Italy	Analysis Research	C
28	Technology, Knowledge and Learning Vol. 25 2020 [85]	Several Countries	Literature Review	A
29	Education and Information Technologies Vol. 25 2020 [86]	Poland	Questionnaire Research	B
30	Sustainability Vol. 12 2020 [87]	Taiwan, United States, Spain	A bibliometric analysis	B
31	Sustainability Vol. 12 2020 [88]	Spain	A quantitative and transversal work design	A
32	Technology, Knowledge and Learning 2020 [89]	Greece	Questionnaire Research	A
33	Universal Journal of Educational Research Vol. 8 (11B) 2020 [90]	Indonesia	Qualitative phenomenological approach	A
34	Data in Brief Vol. 28 2020 [91]	Indonesia	Purification of the dataset; development of instruments, survey, and exploratory factor analysis (EFA).	C
35	Sustainability Vol. 12 2020 [92]	Spanish	Quantitative research	A
36	Education and Information Technologies Vol. 26 2021 [93]	Ghana	A Semi-structured interview	A
37	Sustainability Vol. 13 2021 [94]	Granada	Qualitative	B
38	JOIV: International Journal on Informatics Visualization Vol. 5 No. 4 2021 [95]	South Korea	Study analyzed	C
39	Journal of Education and e-Learning Research Vol. 8, No. 2 2021 [96]	Selangor	A Case Study	C
40	Sustainability Vol. 13 No. 1858 2021 [97]	Spanish	Descriptive analysis	B
41	Frontiers in Psychology Vol. 12 2021 [98]	Spanish	Quantitative method	B
42	JOIV: International Journal on Informatics Visualization Vol. 5 No. 3 2021 [99]	Several Countries	Systematic Literature Review	B
43	Technology, Knowledge and Learning Vol. 26 2021 [100]	Poland	Qualitative	B
44	Education Sciences Vol. 11 2021 [101]	Portugal	A theoretical proposal	B
45	Education and Information Technologies 2022 [102]	Argentine	Quasi-experimental investigation	C

Table 1. Fındıng 61 artıcles from the Scopus database *(continue)*

No	Journals	Countries	Method	RQ
46	International Journal of Interactive Mobile Technologies (iJIM) Vol. 16 No. 09 2022 [103]	Shaheed Benazirabad, Pakistan	Quantitative method	C
47	Sustainability Vol. 14 2022 [104]	China	A Threshold Regression Analysis	B
48	Electronics Vol. 11 No. 2090 2022 [105]	Slovenia	A qualitative case study	A
49	JOIV: International Journal on Informatics Visualization Vol. 6 No. 2 2022 [106]	Malaysia	Intervention strategies	B
50	Australasian Journal of Educational Technology Vol. 38 No. 6 2022 [107]	Athens, Greece	Quantitative design	A
51	TEM Journal, Vol. 11 No. 2 2022 [108]	Croatia	Survey questionnaire	A
52	International Journal of Evaluation and Research in Education Vol. 11 No. 3 2022 [109]	Malaysia	Quantitative method	A
53	Education Sciences Vol. 13 No. 73 2023 [110]	Several Countries	A Systematic Review	C
54	EURASIA Journal of Mathematics, Science and Technology Education Vol. 19 No. 1 2023 [111]	Australia and Finland	A comparative analysis	C
55	International Journal of Evaluation and Research in Education Vol. 12 No. 1 2023 [112]	Vietnam	A case study	B
56	International Journal of Evaluation and Research in Education Vol. 12 No. 1 2023 [113]	Several Countries	A systematic literature review	C
57	Mathematics Vol. 11 No. 272 2023 [114]	Several Countries	A Systematic Review of the Literature	C
58	Journal of Intelligence Vol. 11 No. 1 2023 [115]	Several Countries	A Systematic Review	C
59	Journal of Computers in Education 2023 [116]	Several Countries	A review	A
60	International Journal of Evaluation and Research in Education Vol. 12 No. 1 2023 [117]	Peru	Qualitative approach	A
61	European Journal of Educational Research Vol 12 No 1 2023 [118]	Malaysia	Investigative Research with Fuzzy Delphi Method	B