Chances and Challenges of Digital-Based Education
A Literature Review

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Abstract. Digital-based education is an educational innovation that is integrated with information and communication technology. In welcoming education 4.0, digital-based education has previously been developed such as the use of digital devices and start-ups or learning applications that are tailored to the needs of students. Since the COVID-19 pandemic broke out, the digitalization of education has grown and is indispensable in the practice of distance learning. Learning that previously took place face-to-face was forced to switch to online learning, thus demanding the digitization of media, materials, and learning activities. In the post-pandemic era, digital-based education must continue to be developed to build better education. This article aims to explain the opportunities, challenges, and practices of digital-based education based on a study of several scientific journals. The research method used in this article is a literature study from several international journal databases. The results of this literature study can be used as consideration for educators, government, and learning technology developers so that the implementation of education is more relevant and effective in improving the quality of human resources.

Keywords: Digital-based education · ICT · COVID 19 · Post-pandemic

1 Introduction

Advances in information and communication technology have affected many aspects of life, including education. The dynamics of cellular technology and the internet have created new opportunities for education [1]. In teaching and learning activities, digital devices and applications are used to deliver the material. Use of digital devices such as laptops, smartphones, teacher blogs, Kahoot! Edpuzzle, Padlet, and so on are very supportive of student learning success [2].

Before the COVID-19 pandemic hit, the use of ICT in education had been carried out, but not all learning processes were digitized because face-to-face learning and conventional teaching were still common [3]. COVID-19 has wreaked devastation around the world since its emergence in late December 2019, and education, like any other industry, has been particularly heavily struck. Students, schools, colleges, and universities have all suffered significant consequences. Children are absent from the classroom due to a policy of social separation. As a result, education has undergone significant

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transformations, with the rise of e-learning and mobile learning, in which teaching is done remotely and via digital platforms.

The COVID-19 outbreak has had an impact on education. The transition from offline to online learning should be made. This adjustment has a significant impact on students' abilities. According to some previous studies, pandemics cause learning loss [4–6]. Learning loss is a decrease in learning ability caused by a learning process that is not optimal [7]. Learning during the COVID-19 emergency caused some problems and learning difficulties [8]. Both teachers and students were shocked by the change in the learning system differences in media and online learning methods cause a decrease in understanding and learning achievement.

After entering the new normal era, several regions have implemented face-to-face learning that is not full and pays attention to health protocols. Meanwhile, several other regions continue to carry out online learning. This fact shows that digital learning is still and will continue to be needed even as we enter the post-pandemic era. In addition, digital learning must continue to be developed and applied to welcome the Education and Industry 4.0 revolution to improve the quality of human resources. The role of government and institutions in mitigating the pandemic's negative effects on education is critical, notably through optimizing education's digitization, providing ICT facilities, and fostering public trust [4].

Therefore, a comprehensive analysis is needed that can help stakeholders to evaluate and improve digital-based learning. The purpose of this study is to examine the implementation of digital learning, challenges, and opportunities of digital learning in the post-pandemic era by using a literature review approach to several international journals and research on digital-based learning.

2 Methods

2.1 Research Questions

This article aims to examine scholarly publications published between 2012 and 2021 that explore the application, potential, and problems of educational digitalization. The basic questions of this paper include the following:

- What are the forms of implementing digital-based education?
- What are the chances of digital-based education?
- What are the challenges of implementing digital-based education?

2.2 Database Sources and Search Term

Journals, conferences, seminars, and debates from early January 2012 to December 2021 were used as sources for this study, with the most recent date being December 2021. SpringerLink, ERIC (Education Resources Information Center), Taylor and Francis Online, Wiley Online Library, Cambridge Core, SAGE Journals, Emerald Insight, and Science Direct are among the electronic information sources used. The document for this source was targeted using the keyword 'digital-based education' and 'digitalization of education'. The search was limited to the months of January 2012 to December 2021. After then, 2956 papers/items were discovered.

Table 1. Database journals

Database Journals	Number of Papers	The Inclusion Criteria
ERIC	115	4
Science Direct	755	20
Cambridge Core	1040	3
SAGE Journals	609	10
Springer	154	1
Taylor and Francis Online	73	3
Emerald Insight	105	1
Wiley Online Library	105	1

2.3 Determination of Research Papers to Be Reviewed

The research article in this study was chosen and ranked according to a set of inclusion and exclusion criteria. Papers are screened by looking for titles, abstracts, and journal content that are relevant to the issue of digital-based education. Then, weed out any articles that don't match the requirements for inclusion. Articles that meet the inclusion criteria must: (1) be appropriate and relevant to the keyword 'digital-based education' and 'digitalization of education' in the title, abstract, content, and keywords; (2) specifically discuss technology-integrated education; (3) discuss the benefits and or challenges of implementing digital learning from both the student and teacher perspectives; and (4) provide empirical data and information about the research methodology used (not preliminary studies and examples).

Finally, 44 articles out of 2956 satisfied the criteria for evaluation and assessment, based on the previously established guidelines. These publications may be found in databases such as Scopus, ProQuest, EBSCO, INSPEC, ERIC, Google Scholar, PsycINFO, Gale, ERA, SCImago, Researchgate, and ERIH PLUS. Based on our search for the article, we discovered that digital education research has increased in the previous two years, particularly since the COVID-19 pandemic, which triggered changes in the education system, such as the shift from face-to-face to distant learning. Table 1 shows the results in further detail.

3 Results and Discussions

This section discusses the results of the review. The discussion is divided into three sub-sections, namely the form of digital-based education, chances, and challenges of digital-based education.

3.1 What are the Forms of Implementing Digital-Based Education?

- Electronic Learning (E-Learning). During the pandemic, e-learning has become a good alternative to learning, where teachers think that e-learning is an innovative and

effective method of transferring material to students [9]. Electronic-based learning is learning that is conducted via the use of information and communication technology, particularly electronic technology. That includes not just the internet, but also all electronic devices such as film, video, cassette, OHP, Slide, LCD, projector, and other similar technologies [10]. Some characteristics of electronic learning include utilizing electronic technology services, utilizing computer media, and using teaching materials to be studied independently that can be accessed anytime anywhere [9]. There are 9 papers that report that ICT-assisted learning (such as the use of mobile phones, digital devices, computers and videos) can increase the effectiveness of learning and student activity. Other studies report that e-learning systems are very useful and adaptive in supporting personalized learning, taking into account the user's emotional state and offering time flexibility [11].

- Mobile Learning (M-learning). M-learning is a type of learning that makes use of technology and mobile devices [12]. The gadget in this example might be a PDA, mobile phone, laptop, tablet PC, or other similar devices. Users may access digital learning information anywhere and at any time with mobile learning, eliminating the need to attend a certain location at a specific time (5 papers). Learning app, digital books, educational mobile game, social media, and learning process management are all examples of mobile learning implementation [13–15]. COVID-19 accelerated the education trend towards a digital learning environment, where mobile learning is a very appropriate alternative to enrich the quality of learning during the pandemic [12].
- Game-based Learning. Game-based learning is a form of digital learning that utilizes games for educational purposes to significantly support the learning process [16]. Many researchers in recent years have proven that game-based learning is quite successful when used in learning. Several previous studies on game-based learning showed that the games used could be PC games, Android games, web games, or iPhone games. There are 4 papers prove that game-based education has a significant impact on student motivation, and it can make students feel pleased, more excited, challenged, and foster collaboration among friends [17–20]. According to previous studies, game-based learning, particularly card games, can boost attention, motivation, and curiosity.
- Blended learning. Blended learning can be defined as a learning method that combines conventional learning methods with digital media [21]. Because its possible implementations media and approaches and is utilized for different audiences' (students') demands, the blended learning model's learning environment may be employed individually [22–25]. For example, in a teacher-directed setting with person-to-person contact in a live synchronous (direct time-dependent learning) and high-fidelity environment, face to face learning happens. While the distant learning system promotes self-paced learning and material exchanges in an asynchronous (non-time dependent) and low-fidelity environment (text only).

3.2 What are the Chances of Digital-Based Education?

- Improving the quality of teaching and learning. Digital tools will enhance the learning experience for all of our kids and adolescents [3]. We know from our student consultations that our students are already well-versed in digital technology and that

they will support their expanding usage as part of their education. There are 18 journal papers show that ICT-assisted learning can enrich the learning experience. For children and young people, digital learning activities can increase digital literacy and have a positive impact on supporting the quality of education.

- Digital-based education can help students enhance their critical thinking, problem-solving, collaboration, and learning achievement (10 papers). Using interactive digital media can support collaborative learning [26]. Blended learning and virtual learning are very good for individual learning and can improve critical thinking skills [20, 23, 27]. Electronic learning can improve group learning outcomes better than face to face learning [22]. Mobile learning has a positive effect on learning, the integration of cell phone technology with learning activities can increase student engagement, collaboration, and learning achievement [28]. On the other hand, Collaboration in pedagogical implementation is supported by a digital learning environment [29].
- More chances to create a mobile app and a website for academic purposes. We require learning innovations in the post-pandemic period. In the post-pandemic era, not all schools return to face-to-face learning, and however, we still need learning innovation to realize a more advanced 4.0 education. Digital applications, such as games, have proven to be the right and effective alternative in improving student competence [27]. Application features that are more attractive and following learning objectives still need to be developed in the future [18, 30]. The need for digital educational solutions during the pandemic has created opportunities for learning technology developers and facilitators to create media and teaching materials, both in the form of android-based and web-based tools [31].
- Increasing parental and student participation. Online learning makes parents have to accompany and be actively involved when their children learn online. This relates to self-discipline and child safety when accessing the internet. Based on findings from 3 journals, it was concluded that digital learning increases parental involvement and positive response to technology and digital media [32–34].
- Digital based education offers flexibility, interactivity and alternative tasks (9 papers). So, it increases student activeness. Digital-based education allows learning that can be adapted to the needs and conditions of students [27]. The use of ICT allows facilitators to design learning to be more interactive with a variety of student assignments [11, 20, 27].
- Elevate digital literacy. Teachers and students alike would benefit from increased experience and education in the use of digital devices and apps. Using an app might encourage kids to try new things and be more creative [3, 9]. Digital-based learning such as online learning and e-learning is actually able to improve digital literacy among teachers and students, both from aspects of basic digital literacy skills, background knowledge, ICT skills, to the perspective of thinking and behaving [35, 36].
- Educational start-ups are being developed. Quipper, Ruangguru, Zenius, and other start-ups are important in the post-pandemic age because they can facilitate personalised learning when classes are not entirely held offline yet. The need for digital solutions in the field of education opens up opportunities for start-ups, digital networks, and online learning platforms [31].

3.3 What are the Challenges of Implementing Digital-Based Education?

- Poorly internet access. Some teachers and students have difficulties to access internet because geographic conditions and their socio-economic background (9 papers). One of the serious obstacles in digital learning is the lack of educational facilities equipped with digital devices [4]. Technology and internet connectivity are important issues that hinder online learning and frustrate students to learn [9, 37]. Students who come from low-income families have difficulty accessing the internet because they cannot afford digital devices, so that their learning participation is very low during the pandemic [34].
- Digital literacy. The ability to use digital devices such as computers, laptops, mobile phones and access the internet is an important requirement for electronic learning [3]. Low digital literacy makes it difficult for them to utilize ICT and understand learning (9 papers). Poor knowledge and skills in conducting virtual learning is a significant challenge in the implementation of distance learning [34]. Teachers' age and willingness to use ICT also affect their skills in implementing digital-based learning [38–40]. Low teacher self-efficacy, as well as a lack of pedagogical understanding, might make it difficult to properly integrate technology in the classroom [39]. Teacher readiness in mobile learning systems is very important, especially professional abilities that support them to have the passion and technical skills in integrating mobile technology into the classroom [39].
- Teacher anxiety. A significant issue is teacher loss of control of students' behavior and progress in the virtual world [20]. The majority of teachers feel that virtual learning reduces their monitoring of student progress and actions. In online learning, cheating behavior, for example, cannot be monitored directly. However, the use of games with mobile phones needs to be supervised by parents and teachers. A study showed differences in student learning outcomes that were not so significant when using iPhone games and traditional games, this was because students were more interested in iPhone games not because of the learning material in the game, so it was feared that students were more addicted to gadgets [19].
- Digital learning must be infused with character education. Some of the weaknesses of digital learning include the possibility of cheating by students, integrating cultural values, and the emergence of a consumptive attitude towards the internet [41–43]. Difficulties in integrating character education in digital-based education because there is no supporting curriculum [34].
- Digital based education is not suitable for practical courses (4 papers). Difficulties in practical learning such as entrepreneurship and sports require the development of learning media that are exactly the same as real life [3, 44]. A study reports that the use of mobile digital learning media among practicum teachers is still low because there is no media that is completely identical to the actual practicum or laboratory [45].

4 Conclusion

From that, all reviews can be concluded that digital-based education has many benefits or chances. It shows that ICT support in education can help to build better education. Especially in the post-pandemic era, we need more innovation and elevate digital literacy.

The government can reshape school education and makes a curriculum that is integrated with digital and character education. Reducing the digital divide in all regions also can help to increase the success of digital-based education. Future research needs to consider the importance of digital learning for practical subjects and vocational schools.

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References

1. Panjaburee, P. (2018). The opportunities and challenges of mobile and ubiquitous learning for future schools: A context of Thailand, vol. 10, no. 4, pp. 485–506. Niwat Srisawasdi Recommended citation: Panjaburee, P., & Srisawasdi, N. (2018). The opportunities and challenges The opportunities and cha.
2. Argawati, N. O., Suryani, L. (2020). Digital-based instruction: Chances and challenges in English language teaching context. *9*(4), 1138–1144. U. P. Indonesia, and A. Info. https://doi.org/10.11591/ijere.v9i4.20579
3. Danmuchikwali, B. G., & Suleiman, M. M. (2020). Digital education: Opportunities, threats, and challenges. *Jurnal Evaluasi Pendidikan, 11*(2), 78–83. https://doi.org/10.21009/10.21009/jep.0126
4. Bormann, I., Brøgger, K., Pol, M., & Lazarová, B. (2021). COVID-19 and its effects: On the risk of social inequality through digitalization and the loss of trust in three European education systems. *European Educational Research Journal, 20*(5), 610–635. https://doi.org/10.1177/14749041211031356
5. Rhamdan, D., Kule, A., & Al Wahid, S. M. (2021). Analisis Pemanfaatan e-Learning di Masa Pandemi (Studi Kepustakaan: Learning Loss pada Peserta Didik). *Jurnal Pendidikan Dan Kewirausahaan*, *9*(2), 432–446. https://doi.org/10.47668/pkwu.v9i2.263
6. Maulyda, M. A., Erfan, M., & Hidayati, V. R. (2021). Analisis Situasi Pembelajaran Selama Pandemi Covid-19 di SDN Senurus: Kemungkinan Terjadinya Learning Loss. *Collase, 04*(03), 328–336.
7. Huang, Y. (2020). Curricularface: Adaptive curriculum learning loss for deep face recognition. In *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition*, pp. 5900–5909. https://doi.org/10.1109/CVPR42600.2020.00594
8. Liu, Y. (2019). Using reflections and questioning to engage and challenge online graduate learners in education. *Research and Practice in Technology Enhanced Learning, 14*(1). https://doi.org/10.1186/s41039-019-0098-z
9. Sathishkumar, V., Radha, R., Saravanakumar, A., & Mahalakshmi, K. (2020, June). E-Learning during lockdown of Covid-19 pandemic: A global perspective. *International Journal of Control and Automation, 13*, 1088–1099.
10. Hartanto, W. (2016). Penggunaan E-Learning sebagai Media Pembelajaran. *Jurnal Pendidikan Ekonomi, 10*(1), 1–18.
11. Ortigosa, A., Martín, J. M., & Carro, R. M. (2014). Sentiment analysis in Facebook and its application to e-learning. *Computers in Human Behavior, 31*(1), 527–541. https://doi.org/10.1016/j.chb.2013.05.024
12. Puebla, C., Fievet, T., Tsopanidi, M., & Clahsen, H. (2021). Mobile-assisted language learning in older adults: Chances and challenges. *ReCALL*, 1–16. https://doi.org/10.1017/S0958344021000276

13. Elverici, S. E. (2021). Mobile technologies for education: Attitudes to social media. *European Journal of Foreign Language Teaching, 5*(3), 20–32. https://doi.org/10.46827/ejfl.v5i3.3519
14. Wright, N., & Forbes, D. (2016). Twitter in education. *E-Learning Digital Media, 13*(1–2), 3–4. https://doi.org/10.1177/2042753016666424
15. Al-Takhyneh, B. (2018). Attitudes towards using mobile applications in teaching mathematics in open learning systems. *International Journal of E-Learning & Distance Education, 33*(1), 1–16.
16. Winatha, K. R., & Setiawan, I. M. D. (2020). Pengaruh Game-Based Learning Terhadap Motivasi dan Prestasi Belajar. *Scholaria: Jurnal Pendidikan dan Kebudayaan, 10*(3), 198–206. https://doi.org/10.24246/j.js.2020.v10.i3.p198-206
17. Sanina, A., Kutergina, E., & Balashov, A. (2020, January). The Co-Creative approach to digital simulation games in social science education. *Computers & Education, 149*, 103813. https://doi.org/10.1016/j.compedu.2020.103813
18. Ronimus, M., Kujala, J., Tolvanen, A., & Lyytinen, H. (2014). Children's engagement during digital game-based learning of reading: The effects of time, rewards, and challenge. *Computers & Education, 71*, 237–246. https://doi.org/10.1016/j.compedu.2013.10.008
19. Furió, D., González-Gancedo, S., Juan, M. C., Seguí, I., & Rando, N. (2013). Evaluation of learning outcomes using an educational iPhone game vs. traditional game. *Computers & Education, 64*, 1–23. https://doi.org/10.1016/j.compedu.2012.12.001
20. Beavis, C. (2014). Teachers' beliefs about the possibilities and limitations of digital games in classrooms. *E-Learning Digital Media, 11*(6), 569–581. https://doi.org/10.2304/elea.2014.11.6.569
21. Bryan, A., & Volchenkova, K. N. (2016). Blended learning: Definition, models, implications for higher education. *Bulletin of the South Ural State University, Series Education. Education Science, 8*(2), 24–30. https://doi.org/10.14529/ped160204
22. Ferriman, N. (2013). The impact of blended e-learning on undergraduate academic essay writing in English (L2). *Computers & Education, 60*(1), 243–253. https://doi.org/10.1016/j.compedu.2012.07.008
23. Yang, Y. T. C., Chuang, Y. C., Li, L. Y., & Tseng, S. S. (2013). A blended learning environment for individualized English listening and speaking integrating critical thinking. *Computers & Education, 63*, 285–305. https://doi.org/10.1016/J.COMPEDU.2012.12.012
24. Deschacht, N., & Goeman, K. (2015). The effect of blended learning on course persistence and performance of adult learners: A difference-in-differences analysis. *Computers & Education, 87*, 83–89. https://doi.org/10.1016/j.compedu.2015.03.020
25. Dakduk, S., Santalla-Banderali, Z., & Van Der Woude, D. (2018). Acceptance of blended learning in executive education. *SAGE Open, 8*(3). https://doi.org/10.1177/2158244018800647
26. Gan, B., Menkhoff, T., & Smith, R. (2015). Enhancing students' learning process through interactive digital media: New opportunities for collaborative learning. *Computers in Human Behavior, 51*, 652–663. https://doi.org/10.1016/j.chb.2014.12.048
27. Xia, B. S., & Rekola, M. (2013). Learning outcomes and knowledge sharing using web-based technologies in Finnish forest education from an educational experience point of view. *E-Learning Digital Media, 10*(1), 95–106. https://doi.org/10.2304/elea.2013.10.1.95
28. Diacopoulos, M. M., & Crompton, H. (2020, April). A systematic review of mobile learning in social studies. *Computers & Education, 154*, 103911. https://doi.org/10.1016/j.compedu.2020.103911
29. Cloonan, A., Hutchison, K., & Paatsch, L. (2014). Innovating from the inside: Teacher influence and the 'promisingness' of digital learning environments. *E-Learning Digital Media, 11*(6), 582–592. https://doi.org/10.2304/elea.2014.11.6.582

30. Xie, K., Di Tosto, G., Chen, S. B., & Vongkulluksn, V. W. (2018). A systematic review of design and technology components of educational digital resources. *Computers & Education, 127*, 90–106. https://doi.org/10.1016/j.compedu.2018.08.011
31. Cone, L., Brøgger, K., Berghmans, M., Decuypere, M., Förschler, A., Grimaldi, E., & Vanermen, L. (2021). Pandemic acceleration: Covid-19 and the emergency digitalization of European education. https://doi.org/10.1177/14749041211041793
32. Ihmeideh, F., & Alkhawaldeh, M. (2017). Teachers' and parents' perceptions of the role of technology and digital media in developing child culture in the early years. *Children and Youth Services Review, 77*(2016), 139–146. https://doi.org/10.1016/j.childyouth.2017.04.013
33. Watson, S. (2013). New digital technologies: Educational opportunities for Australian indigenous learners. *The Australian Journal of Indigenous Education, 42*(1), 58–67. https://doi.org/10.1017/jie.2013.8
34. Ford, T. G., Kwon, K. A., & Tsotsoros, J. D. (2021). Early childhood distance learning in the U.S. during the COVID pandemic: Challenges and opportunities. *Children and Youth Services Review, 131*, 106297. https://doi.org/10.1016/J.CHILDYOUTH.2021.106297
35. Irhandayaningsih, A. (2020). Pengukuran Literasi Digital pada Peserta Pembelajaran Daring di Masa Pandemi COVID-19. *Anuva, 4*(2), 231–240.
36. Pratama, W. A., Hartini, S., & Misbah, M. (2019). Analisis Literasi Digital Siswa Melalui Penerapan E-Learning Berbasis Schoology. *Jurnal Inovasi Dan Pembelajaran Fisika, 06*(1), 9–13. https://ejournal.unsri.ac.id/index.php/jipf/article/view/10398/0
37. Hussein, E., Daoud, S., Alrabaiah, H., & Badawi, R. (2020, August). Exploring undergraduate students' attitudes towards emergency online learning during COVID-19: A case from the UAE. *Children and Youth Services Review, 119*, 105699. https://doi.org/10.1016/j.childyouth.2020.105699
38. Luo, W., Berson, I. R., Berson, M. J., & Li, H. (2021). Are early childhood teachers ready for digital transformation of instruction in Mainland China? A systematic literature review. *Children and Youth Services Review, 120*, 105718. https://doi.org/10.1016/j.childyouth.2020.105718
39. Christensen, R., & Knezek, G. (2017). Readiness for integrating mobile learning in the classroom: Challenges, preferences and possibilities. *Computers in Human Behavior, 76*, 112–121. https://doi.org/10.1016/j.chb.2017.07.014
40. Hung, M. L. (2016). Teacher readiness for online learning: Scale development and teacher perceptions. *Computers & Education, 94*, 120–133. https://doi.org/10.1016/j.compedu.2015.11.012
41. Kumar Basak, S., Wotto, M., & Belanger, P. (2018). E-learning, M-learning and D-learning: Conceptual definition and comparative analysis. *E-learning and Digital Media, 15*(4), 191–216. https://doi.org/10.1177/2042753018785180
42. Su, F., Zou, D., Xie, H., & Wang, F. L. (2021). A comparative review of mobile and non-mobile games for language learning. *SAGE Open, 11*(4), https://doi.org/10.1177/21582440211067247
43. Derounian, J. G. (2020). Mobiles in class? *Active Learning in Higher Education, 21*(2), 142–153. https://doi.org/10.1177/1469787417745214
44. Ratten, V. (2020). Coronavirus (Covid-19) and the entrepreneurship education community. *Journal of Enterprising Communities, 14*(5), 753–764. https://doi.org/10.1108/JEC-06-2020-0121
45. Walker, Z., Kho, H. H., Tan, D., & Lim, N. (2019). Practicum teachers' use of mobile technology as measured by the technology acceptance model, vol. 40, no. 2, pp. 230–246. https://doi.org/10.1080/02188791.2019.1671808