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Implementation of the Flipped Classroom Model in Advancing Digital Literacy in Rural Schools: A Literature Review

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Abstract

Enhancing digital literacy poses a significant challenge for rural schools in the digital age, particularly due to restricted access to technology and infrastructure. This study seeks to assess the application of the flipped classroom model as a novel strategy for enhancing students' digital literacy in rural educational institutions. This study, after an extensive literature analysis, determined that the flipped classroom model facilitates independent learning by employing digital resources prior to in-class instruction, subsequently engaging students in interactive conversations to enhance comprehension. The findings indicate that this methodology enhances digital literacy competencies, including critical thinking, problem-solving, and fundamental technological proficiency. Nonetheless, considerable obstacles exist, such as insufficient digital literacy training for educators and inadequate technological infrastructure in rural regions. Surmounting these obstacles necessitates adaptive measures, including the provision of offline resources, comprehensive training for educators, and collaborative efforts among several stakeholders to enhance technological access. This article asserts that despite the implementation issues of the flipped classroom, this method continues to be pertinent and beneficial in enhancing students' digital literacy, particularly when bolstered by contextually suitable tactics and policies in rural regions.

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INTRODUCTION

The digital era brings significant changes to the world of education, especially in efforts to improve digital literacy in various environments, including schools in rural areas encompassing elementary, middle, and high schools. This is supported by Nawaf's (2023) statement that this technological era brings significant changes in improving education, measured by the development of digital literacy. Through the utilization of digital technology such as educational and effective learning platforms, digital literacy can be obtained from equitable and quality education. However, in the improvement of digital literacy, the focus is not only on mastering technology but also on enhancing the quality

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of learning through that technology. Therefore, digital literacy is important to be implemented in the education sector so that students do not only become passive consumers of information but are also able to analyze and produce valuable digital content (Majidah and Rullyana, 2024).

To better prepare the country's future leaders to meet the challenges of the modern world, digital literacy must be fostered in the educational system (Khasanah, 2018). The use of technology in education is frequently seen in the execution of daily learning, as evidenced by the existence of distant learning processes, which, in all their many degrees, have been made possible by electronic media. This can improve the effectiveness and efficiency of the learning process and produce the best results. Even though there are many benefits to using technology in the classroom, there are still many obstacles to conducting distance learning activities, particularly in rural areas. These include teachers' and students' lack of digital literacy and insufficient use of technological resources (Falloon, 2020).

An ethnographic approach based on assumption theory that considers the implications of education's function is required to increase digital literacy in rural areas so that it might have a different impact on society (Ivan, 2021). This strategy seeks to guarantee that the potential of digital technological improvement can be as advantageous as possible and improve rural communities' quality of life. However, the development of digital literacy among the rural people may be impacted by the difficulties and restricted access to technology in rural areas (Syifa, 2024). This case's shortcomings include a lack of technical assistance, such as thorough training for teaching personnel, reluctance to change, and an inadequate technology infrastructure. According to Astutik and Binu (2022), rural areas are more susceptible to crime due to limited access to technology, which can result in technostress brought on by a lack of digital literacy.

Children's schooling in the village may also be impacted by the lack of digital literacy skills brought on by the disparity in access to technology. Due to socioeconomic disparities, there is a considerable disparity in access to educational technology between rural and urban locations. Nasution and Hasibuan (2023) state that a lack of knowledge and inadequate community empowerment continue to cause delayed development in many areas. Because of this, kids in remote schools also have less opportunity to acquire digital literacy skills, which are crucial in today's world.

The flipped classroom is one of the elements that significantly contributes to improving digital literacy. One strategy teachers can use to encourage students to actively participate and provide them the chance to independently explore the course materials is this model (Saputri, 2023). According to Rusnawati's (2020), students' motivation to learn can be raised by using the flipped classroom learning paradigm and making it available online through instructional videos. The implementation of the flipped classroom approach can give rural kids the chance to become more self-reliant in their digital media learning and skill development.

The digital age introduces profound transformations within the educational landscape, particularly in initiatives aimed at enhancing digital literacy across diverse settings, such as rural educational institutions. Digital literacy positions individuals as active participants who engage with, comprehend, and apply information derived from diverse digital sources (McDougall et al., 2018; Polizzi, 2025). This application proves beneficial for comprehending information in an analytical, critical, and reflective manner

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(Nugroho and Fitriyani, 2022). Restianty (2018) highlighted the significance of digital literacy, which is becoming an essential skill that individuals must acquire to effectively educate and advocate for social media users. Enhanced digital literacy empowers individuals to articulate their ambitions and secure equitable rights and responsibilities, particularly in the pursuit and enhancement of educational quality. For instance, the availability of online education, educational materials, and constructive courses and training (Pitrianti et al., 2023).

In order to prepare the nation's future generations to confront the challenges of the present era, it is imperative that digital literacy be fostered within the educational sector (Khasanah, 2018). It is frequently observed that technological advancements in the field of education are utilized in the application of daily learning. This is exemplified by the presence of a distance teaching and learning process that has been facilitated through electronic media, with all of its levels. It can enhance the effectiveness and efficiency of the learning process, thereby achieving the best possible outcomes. Despite the numerous benefits of technology in education, there are still numerous regions, particularly rural areas, that are still hindered in their ability to conduct distance learning and teaching activities. These areas are characterized by the absence of digital literacy skills among educators and students, as well as the use of insufficient technological infrastructure (Maharani, 2021).

To enhance digital literacy in rural regions, an ethnographic approach grounded in the idea of assumptions regarding the educational role is essential, as it may have a distinct societal impact (Ivan, 2021). This strategy seeks to maximize the benefits of digital technological advancements and enhance the well-being of rural populations. Nonetheless, obstacles and restricted access to technology in rural regions can adversely affect the advancement of digital literacy among individuals in these places (Syifa, 2024). Constraints in this instance encompass insufficient technology infrastructure, reluctance to adapt, and a deficiency in technical support, including extensive training for educators.

The deficiency in digital literacy skills resulting from limited access to technology might adversely impact the education of children in rural areas. The disparity in technological access for educational support is pronounced between rural and urban regions, impacted by varying socioeconomic conditions (Nurlaily et al., 2023). Nasution and Hasibuan (2023) indicate that numerous villages continue to face sluggish growth due to information deficits and insufficient community empowerment. Consequently, pupils in rural schools are less inclined to cultivate the digital literacy abilities that are essential in the contemporary age.

The implementation of the flipped classroom is an essential component in the process of improving digital literacy. Through the implementation of this paradigm, educators have the ability to foster student involvement and make it easier for students to independently investigate the subject matter (Saputri, 2023). The findings of the research that the installation of a flipped classroom learning model, which is given online in the form of instructional videos, has the potential to increase the level of motivation that students have to learn information (Rusnawati, 2020). Students who are located in rural areas may have the opportunity to improve their digital media skills and learn more autonomously through the use of the flipped classroom method.

The curriculum of today's educational system places an emphasis not only on the development of cognitive abilities, but also on the critical need to cultivate individual

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personalities that are reflective of human values in order to generate a generation that is of high quality in several aspects. Character development involves the ability to think critically and creatively, which will indirectly instruct children in the process of studying material in depth, finding solutions to issues, and delivering solutions to a variety of challenges and creative ideas. This is backed by the rapid growth of technology, which requires individuals to adapt to the incorporation of technology into the learning process in order for them to be able to master a variety of skills that are relevant for the future (Saripudin & Robbani, 2024).

The search results regarding the implementation of a flipped classroom to enhance digital literacy in schools indicate that numerous studies have been conducted; however, they have not concentrated on rural schools, which face significant challenges, particularly concerning technological infrastructure necessary for effective digital education (Giawa et al., 2024). Researchers examined various problem formulations, specifically: 1) What is the efficacy of the flipped classroom model in enhancing digital literacy in rural schools? What hurdles are encountered in using the flipped classroom model to enhance digital literacy in rural schools? What measures may be employed to address the challenges of implementing a flipped classroom model to enhance digital literacy in rural schools? Consequently, the author is compelled to examine the literature pertinent to this subject, intending to assess the impact of implementing a flipped classroom model on enhancing digital literacy among students in rural schools. This study seeks to evaluate published research findings to offer a thorough overview and enhanced comprehension of the application of the flipped classroom approach, particularly in enhancing digital literacy in rural educational institutions.

METHODS

This research employs a thorough literature review methodology, systematically analyzing pertinent prior works related to the topic. Literature review as the process of examining and interpreting previously published research (Hadi & Afandi, 2021). The literature review process is conducted systematically utilizing pertinent digital information sources, employing precise keywords and criteria to achieve a cohesive and full understanding. This research utilizes literary studies as a theoretical foundation by providing empirical evidence, finding unresolved issues in the literature, and ultimately yielding an innovative contribution to pertinent concerns.

RESULTS AND DISCUSSION

Results

The data collection for this study was conducted utilizing the Google Scholar database, focusing on a timeframe of the past 10 years. Literature searches were carried out utilizing various relevant terms to uncover research findings that could assist in addressing the previously established issues. The terms utilized included “digital literacy in rural schools”, “challenges in implementing flipped classroom”, “flipped classroom in improving digital literacy” and “strategies in implementing flipped classroom”. Following the results of the conducted search, several articles were selected that can assist in addressing the outlined problems. A synthesis of these selected studies is systematically presented in Table 1, followed by a comprehensive thematic analysis derived from the empirical findings of previous scholars.

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Table 1
Research Findings

Author	Result
(Farida et al., 2019)	The adoption of the flipped classroom learning approach in the Indonesian political system course at one of the institutions is the topic of discussion in this article. As a consequence of the findings of the research, it was discovered that the implementation of flipped classrooms in higher education has the potential to enhance both the culture of independent learning and the critical thinking abilities of students.
(Fathoni et al., 2024)	Within the context of the learning interests of MA Ihyaul Ulum Dukun Gresik students, this study examines the efficacy of employing the flipped classroom technique in order to achieve success in fulfilling their interests. It is clear from the findings that implementing the flipped classroom model is an excellent method for enhancing the academic performance of pupils.
(Nasriani et al., 2022)	In this article, the discussion is on the implementation of the flipped classroom learning paradigm for pupils who are enrolled in primary schools in the 21st century. The purpose of this article is to discuss the incorporation of technology into the learning paradigm in order to facilitate a learning process that is more efficient and concentrated on the student.
(Syajili, & Abadi, 2021)	This essay examines the efficacy of using a flipped classroom during the COVID-19 pandemic and highlights its usefulness. Based on the findings, it is evident that the implementation of the flipped classroom approach is highly beneficial in enhancing students' comprehension of concepts and their capability, particularly in the area of mathematical skills.
(Hastuti, 2020)	Within the context of the post-COVID-19 pandemic, this paper investigates the impact that implementing the flipped classroom method has had on the development of students with special needs in terms of both their motivation to learn and their level of autonomy. The findings indicate that the implementation of a flipped classroom is an excellent method for enhancing students' critical thinking abilities as well as boosting the degree to which students are able to learn independently.
(Susanti & Pitra, 2019)	In this article, it is explained that the flipped classroom learning paradigm has a big impact on education in this day and age of digital technology. In light of the findings of the research that has been carried out, it has been determined that the learning strategy that makes use of the flipped classroom technique is in line with the characteristics of students who are experiencing the digital era.
(Patandean & Indrajit, 2021)	The opportunities that can be realized via the use of the flipped classroom technique in order to enhance the quality of education through the utilization of technology that is more learner-centered are discussed in this book. Additionally, the book makes reference to the fact that the implementation of flipped classrooms is one of the strategic steps that may be taken in order to create learning that is more responsive, interactive, and relevant in the modern digital world.

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Author	Result
(Lestari et al., 2024)	This essay contrasts the digital literacy skills of pupils who utilize electronic media with those who do not inside the flipped classroom learning approach. This study's results establish a foundation for employing digital technologies in the flipped classroom pedagogical approach.
(Mashis et al., 2023)	This article discusses the societal shifts that have occurred in rural areas as a result of the increasing prevalence of digital technology. The findings of this research not only provide a reflection of the transition that is taking place in rural areas, but they also present a list of activities that need to be implemented in order to guarantee digital inclusion and social sustainability in the modern era, particularly in rural areas.

Discussion

Indonesia's education system is advancing, with enhancements in educational quality being realized with a focus on human resource development (Sulastri et al., 2020). Enhancing the quality of education in Indonesia is regarded as a means to achieve the nation's advancement. The primary element in basic life skills and the aspiration for desired advancement lies in enhancing digital literacy (Nurfauziyanti & Bahrudin, 2022). Digital literacy is crucial for adapting to the progression of digitalization, particularly within the educational sector. This emphasis arises from the Institute for Management Development (2022) research, which indicates that Indonesia ranks 51st out of 63 countries in digital literacy. This data is further substantiated by the Community Literacy Development Index (HDI), which stands at 69.42 on a scale of 0-100, indicating a low literacy level in Indonesia (Faryanti & Efendi, 2023). Initiatives to enhance and advance digital literacy are being implemented, particularly for school kids who will contribute to the future of the Indonesian nation.

The implemented curriculum design is crucial for executing policies aimed at enhancing students' digital literacy, utilizing the flipped classroom model to foster essential competencies such as character education, critical thinking, and technological proficiency. The use of the flipped classroom paradigm is the most effective approach to enhancing students' digital literacy through improved accessibility and comprehension of the curriculum. Research by Nasriani et al. (2022) indicates that the flipped classroom model is a novel educational method, as it centralizes the classroom learning system, enhancing student knowledge through active involvement, hence making learning significantly more successful. It analyzes the execution of a learning model that integrates synchronous and asynchronous modalities. In the flipped classroom concept, students acquire knowledge at home prior to attending class, where they subsequently apply it.

In addition, this is reinforced by study carried out by Hastuti (2020), which demonstrates that the implementation of the flipped classroom learning model has the potential to make students more independent and motivated in their educational pursuits. The flipped classroom method requires teachers to maximize the amount of time they spend in the classroom in order to engage in active interactions with students and discuss topics that are relevant to the subject matter. Due to this, students are more actively involved in the learning process, which results in a considerable improvement in their overall performance. As a result of the adaptability of the flipped classroom approach,

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which allows students to engage in learning activities that are tailored to their individual capabilities. The implementation of this strategy also has the advantage of allowing students to engage in more intense interaction with the instructor while they are in the classroom, which will result in a deeper level of comprehension on their part.

It is claimed in the research that Susanti and Pitra (2019) did that the adoption of the flipped classroom model is greatly influenced by various aspects such as the availability of suitable technology. This is one of the factors that is discussed. In addition, one of the essential components in the implementation of the flipped classroom is the degree to which the instructor is capable of improvising the instructional strategies that will be presented to the students. It is possible that the implementation of the flipped classroom approach could lead to an increase in the level of digital literacy among children living in remote areas. Through the provision of sufficient specialized training for educators, which will allow them to increase their competence in an efficient manner, and through the availability of technological infrastructure that will support its execution.

Comprehending the flipped classroom model is essential, as this pedagogical approach alters the structure of traditional learning activities through the use of digital technology. The flipped classroom offers several advantages, including increased student engagement, improved learning outcomes, and the development of skills such as problem-solving and independent learning. The book by Patandean and Indrajit (2021) elucidates that the flipped classroom model necessitates students to independently study lesson content prior to class, typically utilizing digital resources prepared by the instructor a few days in advance of the in-person session.

During class, students can participate in practice exercises and engage in more profound discussions under the teacher's direction. This strategy delegates educational responsibility to students, encouraging them to be more proactive and adaptable to technology throughout their learning experience. This educational methodology delivers material to students prior to classroom sessions, allowing them to independently examine the content offered by the instructor. Subsequently, students may utilize class time to engage in in-depth discussions regarding unclear concepts or to complete assignments related to the material covered, thereby ensuring that class sessions prioritize comprehensive understanding and practical application over mere presentation of fundamental content (Barella et al., 2024).

The research conducted by Fathoni et al. (2024) presents the success of implementing the flipped classroom model as a progressive achievement, alongside the enhancement of digital literacy, by examining the relationship between this model and the learning outcomes of students. This study's results show that the coefficient of determination (R-squared) is 0.858, representing 85.8%. This study's results demonstrate that the flipped classroom model exerts an 85% influence on student learning success, evidenced by achievements, active learning, and critical thinking during the response stages, alongside anticipated improvements in educational quality outcomes. This research highlights the flipped classroom model as an effective pedagogical approach for enhancing the quality of student learning, especially in the area of digital literacy. The enhancement of digital literacy correlates with increased interest in learning and heightened student motivation, which in turn reinforces and deepens the comprehension of the material studied.

Moreover, the study by Lestari et al. (2024), which evaluated the efficacy of flipped classrooms with and without e-module media among vocational high school students,

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demonstrated notable effectiveness in enhancing their digital literacy. The research findings indicate that the mean digital literacy scores of students utilizing e-modules in flipped classroom learning were 78.53, whereas those not employing e-modules scored 73.3. This suggests that employing electronic media in the execution of the flipped classroom model is more efficacious in enhancing students' digital literacy skills.

Nonetheless, the adoption of the flipped classroom method in Indonesia encounters numerous hurdles, particularly in enhancing digital literacy. This is attributable to the persistent substantial obstacles in the extensive transmission of knowledge and technical advancement in Indonesia, particularly in rural regions. A survey conducted by the Indonesian Internet Service Providers Association (2024) indicates that in 2024, 57 million individuals, or 20% of Indonesia's entire population, remain without internet access. Regions continuing to experience internet connectivity difficulties encompass rural areas beyond Java and Bali, in addition to the eastern territories of Indonesia, including East Nusa Tenggara, Maluku, and Papua (Putri et al., 2024). Rural populations in Indonesia lack sufficient internet connectivity, resulting in inadequate capabilities to comprehend technology and adapt to 21st-century advancements. The absence of internet connectivity would undoubtedly impede advancements in enhancing digital literacy for rural populations.

The persistent technical divide in Indonesia is the primary reason for the country's poor digital literacy levels. The disparity in technology utilization and digital literacy is interconnected, since the presence of a technology gap can significantly impede an individual's capacity to attain optimal digital literacy. The technology gap refers to the disparity in access to and use of digital technology, including the internet, hardware, software, skills, and digital literacy. The disparity in access to digital technology might lead to social fragmentation and diminish productivity in community interactions (Subroto et al., 2023). This state fails to align with or fulfill the definition of developing digital literacy as a crucial ability for navigating technical breakthroughs in the digital age, hence hindering the implementation of sustainable development. It encompasses the judicious use of technology and the capacity to differentiate between facts, opinions, and misinformation.

It is also supported by the research carried out by Mashis et al. (2023), which highlights the significance of technology accessibility for rural populations. This research demonstrates that the low digital literacy that is created by access restrictions generated by the technological gap is also supported. Based on the findings of this study, it can be concluded that the equal distribution of technology accessible has an impact on the entire social change that occurs in rural community life, particularly in the fields of education. This is due to the fact that if the community is provided with sufficient knowledge and access to technology, it will eventually reach a point where it will be able to effectively utilize technology as a basis for enhancing the quality of life. It is obvious that the educational system for schools located in rural areas would be impacted by the social changes that take place.

This is due to the fact that education and social change are intertwined and have an effect on society as a whole. Education has the potential to become a catalyst for social change or renewal, and it may also influence the path that social change will take. The findings of this research indicate that the accessibility of technology can bring about various forms of social change in rural areas. These forms of change include changes in

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learning during the pandemic, advancements in communication technology, an increase in population that necessitates the establishment of new schools, and changes in the cultural system of a society.

There is a significant gap in the utilization of technology in rural regions, particularly in schools, which presents a significant obstacle for the implementation of learning models that can assist in improving digital literacy. The findings of the study that was carried out by Hariyanto et al. (2023) were similarly comparable, demonstrating that social transformation will be able to increase the technology literacy of rural communities if it is accompanied by the provision of technological understanding and adequate access. It is a pretty alarming discovery that exposes the existing gap because rural people, particularly students who are the nation's future generation, have become a marginalized and excluded group in the development process that is aimed at progress and welfare in Indonesia. This is a finding that highlights the gap that exists. The author of this research journal emphasizes that in order to improve digital literacy among rural communities, concrete efforts are required through cooperation between the government and relevant parties to create training on understanding and accessibility to technology. This training should be especially geared toward students who have a significant role to play and hope to bring about change in reducing the existing gap.

In order to reach the point where efforts are being made to maximize the growth of digital literacy skills among students in rural regions, it is necessary to fully actualize the adoption of the flipped classroom model. In order to improve digital literacy in rural schools, the achievements and accomplishments that were achieved in the deployment of the flipped classroom model serve as a reference. It is possible for the government and society to collaborate in order to eradicate social and cultural stigmas that impede access to education. This helps to support and advance the role of education as an agent of social change in the process of achieving progress. In order to improve access to digital technology, it is required to give the appropriate training and education, develop internet networks in rural areas, and supply affordable technical products to rural people. These are the key features that need to be implemented.

It is possible to say that the implementation of the flipped classroom model can be carried out with modifications that may differ from the standard application of the flipped classroom model. This is in accordance with the purpose of this article, which is to provide a comprehensive overview of the implementation of the flipped classroom model in the enhancement of digital literacy in rural schools. It is imperative that the deployment of the flipped classroom model for the advancement of digital literacy be in accordance with the innovative learning site that is maintained by the Ministry of Education and Culture. Specifically, the flipped classroom is broken up into three stages: 1) Students' chores for independent learning at home, 2) Students' tasks for face-to-face learning at school, and 3) All of the students' assignments. Both evaluation and subsequent action are required. According to Syajili and Abadi (2021), this third phase has the potential to be improved upon and utilized as the learning framework of this model.

Particularly for educational institutions situated in rural regions, the implementation of the reversed classroom in the context of fostering digital literacy presents a variety of opportunities and challenges. To be more precise, the flipped classroom model implements three primary components to enhance digital literacy: the pedagogical digital competence of instructors to generate online content, manage learning platforms, and foster productive

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interactions with students in the classroom. In order for educators to assist students in enhancing their digital literacy skills, they must possess a high level of digital pedagogical competency and the capacity to access information. Students are capable of accessing information and online resources in a more comprehensive manner when they possess the requisite digital literacy skills. Additionally, the reversed classroom learning approach has the potential to enhance students' independent learning skills by allowing them to independently acquire material at home at an early stage.

Individuals will acquire a sense of comfort with the process of autonomous learning through the use of digital media. These three arguments illustrate that the level of digital literacy is not solely determined by the availability of technology; the engagement of instructors as educators and students as learners also contributes to its improvement. It is accurate that additional policies and initiatives are necessary to address the technological accessibility disparity in rural institutions; nevertheless, it is feasible to accomplish this objective. Farida et al. (2019) conducted research that elucidates the application of teachers' digital pedagogical competence, thereby enhancing students' digital literacy, by implementing a flipped classroom model that employs video media as learning materials prior to attendance in the classroom. The students will be able to understand the material that will be further explored or addressed in the classroom if they watch the film. This will lead to a more productive and engaging learning experience for the students in the classroom.

Internet access and the availability of learning facilities continue to pose obstacles to the implementation of the flipped classroom model in rural institutions. Nevertheless, the flipped classroom learning model can be implemented to improve the digital literacy of students. In order to achieve this, educators and pertinent parties must develop alternative learning media that students can access without the need for internet connectivity. The reversed classroom learning model can be implemented without the need for a robust internet connection or sophisticated technology. This is due to the fact that the primary focus is not solely on the use of advanced electronic devices; rather, the implementation of the flipped classroom learning paradigm can commence with the facilities and availability of the devices.

CONCLUSION

This study investigates the implementation of the flipped classroom paradigm to enhance digital literacy in rural schools, especially in regions with restricted technical access. This study demonstrates that the flipped classroom format facilitates enhanced interaction between instructors and students. Furthermore, the adoption of the flipped classroom model can augment students' autonomous learning capabilities and elevate their digital literacy competencies. Nonetheless, the implementation of this learning approach has challenges, including inadequate technological infrastructure. To resolve this challenge, the involvement and ingenuity of educators are essential in creating alternative learning medium. Implementing the flipped classroom model can be achieved by leveraging diverse media, supported by the competencies of educators and relevant stakeholders, to address the problems encountered in enhancing digital literacy in remote schools.

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Author contributions statement

ANA: Conceptualization, methodology, formal analysis, investigation, original draft. BT: Conceptualization, data curation, formal analysis, resources, writing & editing. HM: Review & editing, analysis, visualization, writing & editing.

Conflict of interest statement

Authors state no conflict of interest.

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