



E-Learning Using the Flipped Classroom Model-Based Teachmint Application and its Impact on Student Science Learning Outcomes

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ABSTRAK

Kurangnya kemampuan guru dalam menciptakan media pembelajaran IPA yang terintegrasi dengan teknologi dan informasi untuk kelas V SD mendorong dilakukannya penelitian ini. Tujuan dari penelitian ini adalah untuk menciptakan produk e-Learning yang valid, praktis dan efektif untuk kelas IPA kelas V di sekolah dasar. Metode penelitian yang digunakan adalah Research and Development dan mengacu pada model pengembangan ADDIE. Teknik Pengumpulan Data dibagi menjadi 2, yaitu Data Kualitatif dan Data Kuantitatif. Data kualitatif diperoleh dari saran dan komentar oleh validator dan praktisi. Media divalidasi oleh 2 dosen ahli materi, 2 dosen ahli media, dan 1 dosen ahli bahasa, serta diuji oleh 2 guru dan 10 siswa untuk kepraktisan, dan 31 siswa untuk keefektifan. Data kuantitatif diperoleh dari hasil penilaian angket validator dan praktisi. Teknik Analisis menggunakan skala Likert dan Uji Paired sampel t-Test. Hasil validasi dan uji coba pembelajaran IPA menunjukkan bahwa Media e-Learning berbasis Model Flipped Classroom menggunakan aplikasi Teachmint pada Tema Ekosistem 5 dikatakan sangat valid dengan skor 91, sangat praktis dengan nilai 92.5 dan sangat efektif 92.1. Berdasarkan hasil perolehan data menunjukkan bahwa e-Learning dengan menggunakan aplikasi Teachmint terhadap hasil belajar IPA dinilai sangat valid, sangat praktis, dan sangat efektif dalam pembelajaran IPA di sekolah dasar.

ABSTRACT

The lack of teachers' ability to create science learning media that is integrated with technology and information for grade V elementary schools prompted this research. The purpose of this research is to create a valid, practical and effective e-Learning product for the fifth grade science class in elementary schools. The research method used is Research and Development and refers to the ADDIE development model. Data collection techniques are divided into 2, specifically Qualitative and Quantitative data. Qualitative data had been received from suggestions and comments by means of validators and practitioners. The media became validated by 2 material professional lecturers, 2 media professional lecturers, and 1 language professional lecturer, and tested by 2 instructors and 10 students for practicality, and 31 college students for effectiveness. Quantitative information was acquired from the results of validator and practitioner questionnaire exams. Data analysis techniques uses a Likert scale and a paired sample t-test. The results of the validation and testing of science lessons show that the Media e-Learning based on the Flipped Classroom Model using the Teachmint application on Ecosystem Theme 5 is said to be very valid with a score of 91, very practical with a value of 92.5 and very effective 92.1. Based on the results of the data acquisition, it shows that e-Learning using the Teachmint application for science learning outcomes is considered very valid, very practical, and very effective in learning science in elementary schools.

1. INTRODUCTION

Thematic learning methods emphasize several basic competencies, indicators, and learning outcomes from one or several subjects, including science subjects (Dani et al., 2021; Ismail et al., 2021). Science subjects can improve students' thinking skills in understanding natural phenomena and the surrounding environment through experiments in learning (Haling et al., 2022; Lusidawaty et al., 2020). The goal of learning science in thematic learning is so that students can apply the understanding of knowledge gained and improve critical thinking skills (Gladden, 2019; Qiftiyah, 2023). In the era of society 5.0, science learning is easier to do using digital media. Digital media can help increase the effectiveness and efficiency of the student learning process in a flexible, practical, and not limited by space and time. However, inside the context of its utility, there are troubles which might be nonetheless being faced, which were found out thru observations and interviews at an primary school in the city of Padang. The information acquired shows that the technology teaching technique in colleges remains focused on face-

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to-face learning with textbooks as the principle studying resource, as well as the dearth of teachers' capability to use digital media in studying science (Febrianto et al., 2020; Puspitarini & Hanif, 2019; Vyas & Butakhieo, 2021). These issues have an impact on students' expertise of cloth which takes a long time, for this reason affecting their science studying outcomes. therefore, gaining knowledge of strategies and fashions are wanted that may take benefit of virtual-based totally media and are prepared with various mastering functions, one of which is thru the application of e-learning based at the Flipped classroom model.

In the flipped classroom model, the teacher acts as a facilitator and students are more active in the learning process. The flipped classroom learning model can help teachers and students maximize the benefits of e-learning in science learning (Anugrah et al., 2020; Chrismawati et al., 2021). Before face-to-face, students study material independently through e-learning so that time in class can be used for interactions between teachers and students and between students and students (Girmen & Kaya, 2019; Triatmojo & Priyadi, 2021). During face-to-face sessions, the teacher assists students in solving problems and applying concepts learned through e-learning. Teachers can also provide problem-oriented assignments through experiments, observations and observations needed in understanding science concepts (Onyema et al., 2021; Yulianti & Wulandari, 2021).

This flipped classroom model has been applied in learning at various levels of education and has proven effective in improving student learning outcomes (Jdaitawi, 2019; Mirlanda et al., 2019). However, the implementation of the flipped classroom model requires a platform or application that can support the learning process. The platform or application used in the implementation of the flipped classroom model needs to meet several criteria, such as being easy to use, available for free or paid at an affordable price, accessible via a variety of devices, and equipped with features that support the learning process, such as discussion forums, collecting assignments, and scoring systems.

Preceding research carried out by previous study showed that the usage of the flipped lecture room gaining knowledge of version with e-learning media was effective in increasing student learning outcomes in introductory information technology subjects (Rahmelina et al., 2019). Meanwhile, research by other study shows that there may be a statistically considerable distinction within the level of student achievement among college students who use e-getting to know techniques and students who use flipped classrooms (Alfehaid et al., 2023). The results of this study also show that students feel more satisfied with flipped classroom and e-learning learning compared to traditional learning. Previous study shows that the flipped classroom has high potential in helping students develop specific and transversal competencies needed for the 21st century, such as employability, entrepreneurship, innovation, literacy, and contribution to sustainable development (Santos & Serpa, 2020).

Presently, there have been many e-learning developments that use the flipped classroom model and diverse programs inclusive of Moodle, Quipper, Edmodo, and Google classroom in elementary schools. but, there is no research that focuses on the development of e-learning based on the flipped classroom model that uses the Teachmint application for learning science for elementary students which has an impact on student learning results for science. consequently, research is needed that discusses the development of e-learning primarily based at the flipped study room model the use of the Teachmint application for studying science for elementary students, so that the impact on student learning effects may be acknowledged. Teachmint is a portable Learning Management system, very easily accessed from smartphone devices by both teachers and students (Danial, 2022; Yuliyani et al., 2023). By using Teachmint, teachers can meet students' digital learning needs. Teachmint empowers teachers to manage all class activities such as holding classes in person, recording, storing materials, compiling, and sharing learning materials starting from class preparation in two minutes, automation of attendance to creating and assessing exams in seconds (Agustina, 2022; Yulianti & Wulandari, 2021).

This study is considered essential due to the fact the flipped classroom learning model and the Teachmint application can help boom student involvement in the learning manner and facilitate a better information from learning cloth. This looks at objectives to develop e-learning primarily based on the flipped classroom model the usage of the Teachmint application for learning science which is valid, practical and effective and measuring its effect on student learning outcomes. it is hoped that the effects of this study will make a contribution to the development of learning technology and can be used as reference material for associated events to enhance the quality of learning in elementary schools.

2. METHOD

This research uses the studies and improvement (R&D) technique which interests to extend new merchandise or enhance preceding merchandise (Widya & Adri, 2021). This research uses the ADDIE development version which includes three tiers, specifically the initial diploma, the development phase, and the evaluation stage (Ilsa et al., 2020). The research was carried out at an elementary school in

Padang City with the research subjects being 31 fifth grade students in the Natural Science Theme 5 subject on Ecosystems which was carried out from October to December 2022. The preliminary phase was carried out by conducting a needs analysis and literature review, while the development phase aimed to produce e-Learning development prototype using the Teachmint application. The assessment stage is carried out to measure the validity and practicality of e-Learning and whether e-Learning can help improve science learning outcomes.

This study uses two types of data, namely qualitative data and quantitative data. Qualitative data were obtained from suggestions and comments provided by validators and practitioners. Meanwhile, quantitative data was obtained from the results of a questionnaire assessment provided by validators and practitioners (Maskar & Dewi, 2020; Maula & Fatmawati, 2022). The data collection method uses a questionnaire which consists of validity, practicality, and effectiveness questionnaires. The research data collection instrument was carried out by several techniques which can be seen in Table 1.

Table 1. Data Collection

No.	Criteria	Instrument
1	Valid	a. Validation instrument assessment sheet b. Practicality instrument assessment sheet c. Instrument effectiveness assessment sheet d. The e-Learning validation sheet uses the Teachmint application for science learning outcomes.
2	Practical	a. Practicality questionnaire by educators b. Practicality questionnaire by students
3	Effective	Test questions, in the form of descriptions given in class

The validity questionnaire was given to five professional validators, particularly 2 fabric/content material specialists, 2 media professionals and 1 language professional. Practicality questionnaires were given to two instructors and 10 students. The test questions had been given to 31 students. After the qualitative and quantitative information had been received, information processing was performed. The accrued information became analyzed using the Likert scale approach with a tremendous category, this is, wonderful statements acquired the very best weight (Hermawati et al., 2021; Mawardi, 2019; Rofiqoh et al., 2020). The final value referred to in the interval for determining validity, practicality, and effectiveness is shown in Table 2.

Table 2. Criteria for Levels of Validity, Practicality, Effectiveness

No.	Score	Criteria
1	81% - 100%	Very valid; very practical; very effective
2	61% - 80%	valid; practical; effective
3	41% - 60%	Pretty valid; quite practical; effective enough
4	21% - 40%	Less valid; less practical; and less effective
5	0% - 20%	Invalid; impractical; and not effective

When as the extent of effectiveness is thought thru the results of the pre-check before the usage of e-studying and the put up-test after the use of e-studying. The studies layout to determine the effectiveness of e-studying makes use of a one group pretest and posttest design (Hardianto & Baharuddin, 2019; Hignasari & Supriadi, 2020). The studies layout became used with the intention of looking to realize the effectiveness of college students' natural science gaining knowledge of results after using e-getting to know media. To determine the level of effectiveness of e-Learning based on the Flipped Classroom model with the Teachmint application, data were analyzed using the *Paired T-Test*. Before the data was analyzed, the data was first subjected to a prerequisite test consisting of a normality test and a homogeneity test. For the normality test, the Kolmogorov-Smirnov test was used, while for the homogeneity test, the Levene's Test for Equality of Variances was used using the SPSS application.

3. RESULT AND DISCUSSION

Result

In this study, the ADDIE model changed into used as a framework for the e-learning development methodology based on the flipped classroom model using the Teachmint application. The ADDIE model has five stages, specifically analysis, design, development, Implementation, and evaluation. those stages

can be used systematically to increase e-learning that is effective and efficient in enhancing science learning outcomes for elementary students.

Analysis Stage

This stage involves an analysis of science learning needs for elementary school students. This analysis will become the basis for developing e-Learning based on the flipped classroom model using the Teachmint application. The needs analyzed included an understanding of the elementary science curriculum, the characteristics of elementary school students, as well as the challenges and constraints faced in learning science at school. The results of the analysis are classified in [Table 3](#).


Table 3. Scope of Analysis

No.	Analysis Scope	Analysis Results
1	Understanding of the science curriculum	3.5. Analyze the relationship between ecosystem components and food webs in the surrounding environment. 4.5 Create work on the concept of food webs in an ecosystem.
2	Characteristics of elementary school students	Cognitive abilities are still developing, attention is easily distracted, and attention spans are relatively short
3	Challenges or obstacles encountered in learning science	1) limited time to understand science concepts conveyed by the teacher in class, especially if the material is complex and difficult to understand; 2) limited access to learning resources, such as books and other teaching materials; 3) difficulties in understanding abstract science concepts, such as ecosystem material

Design Stage

The design phase will include designing science learning using the flipped classroom model and the Teachmint application. The design will include learning materials, learning methods, and application features to be used. Design coverage is show in [Table 4](#).

Table 4. Design Coverage

No.	Analysis Scope	Design Results
1	Learning Materials	Ecosystem: 1) Ecosystem Components; 2) Interaction between Living Things; 3) Type of Ecosystem; 4) Disruption to Ecosystem Balance; 5) Maintaining the Ecosystem
		
2	Learning Procedures	The first step, the teacher will send learning materials in the form of videos or articles before class begins. Then, students will study the material outside of class hours and understand its contents. During class hours, the teacher will provide activities related to material that students have studied before. These activities can be in the form of group discussions, question and answer, simulations, or other activities that allow students to apply the knowledge they have learned. After the activity is finished, the teacher will provide feedback and evaluate the results that have been achieved by students.

No.	Analysis Scope	Design Results
3	Application Features	<p>Some of the features available in this application include: a. Live Class: This feature allows teachers and students to interact directly and teachers can provide more detailed explanations regarding learning materials. b. Virtual Whiteboard: This feature allows teachers to write and draw learning materials directly, so that students can easily understand the material presented. c. Screen Sharing: This feature allows teachers to share learning materials displayed on computer screens with students. d. Recording: This feature allows teachers to record learning videos and save them, so students can access them later.</p>

Development Stage

The development phase involves making e-Learning based on the flipped classroom model using the Teachmint application based on a pre-prepared design. The e-Learning will be equipped with natural science learning materials, learning videos, and other learning features that have been planned beforehand. Teachmint application used by researchers to create e-Learning can be seen in Figure 1, and Figure 2.

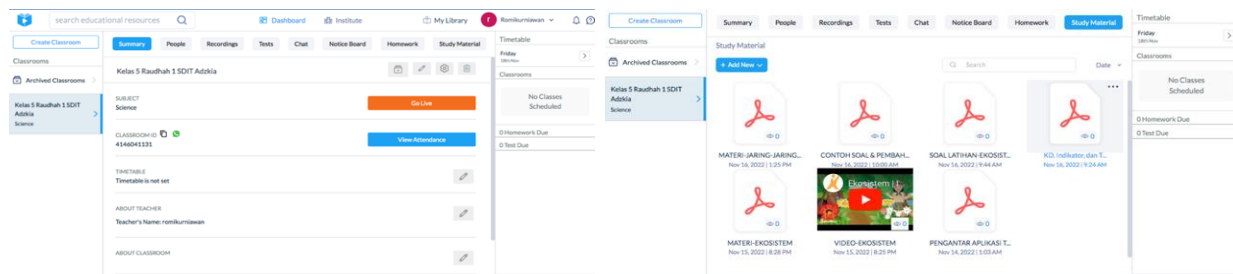


Figure 1. Teachmint App View

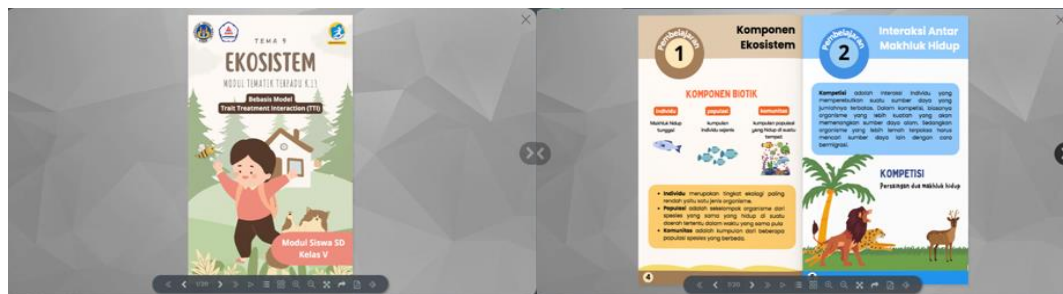


Figure 2. Display of Ecosystem Material in the Teachmint Application

Implementation Stage

The implementation phase is carried out by implementing e-Learning based on the flipped classroom model using the Teachmint application in learning natural sciences in elementary schools. To test the validity of the material/content, language, and media in this e-Learning, 2 content/material experts, 1 linguist, and 2 media experts filled out a questionnaire. The trial data is presented below :

Material Validation Test

Based on the material validity test, two validators were given a questionnaire consisting of 12 statements. Each content validation statement is given the lowest score of 1 and the highest score of 5. The score obtained can be converted into a percentage value, with the lowest score being 20% and the highest score being 100%. The data from the material validity test results shows that the average material validity by the material validator is 91%. The e-Learning product has been considered valid and can be continued to the practicality test stage.

Media Validity Test

In the media validity test, two validators were given a questionnaire with 12 statements. Each media validation statement is given the lowest score of 1 and the highest score of 5. The score obtained is then converted to a percentage value with the lowest score being 20% and the highest score being 100%. The data from the results of the media validity test show that the average validity of the media by the media validator is 94%. The e-Learning product is considered valid and can be continued to the practicality test stage.

Language Validity Test

In the results of the language validity test, it can be seen that the average validity of the media by the language validator is 88%. The e-Learning product is considered valid and can be continued to the practicality test stage. Three validators evaluate the product, the average value of e-Learning validity can be seen in [Table 5](#).

Table 5. Average Product Validation

No.	Validity	Results	Information
1	Material/Content	91%	Very valid
2	Media	94%	Very valid
3	Language	88%	Very Valid
	Average	91%	Very valid

Based on the data presented in [Table 5](#), namely the average acquisition of product validity shows 91% with a very valid category.

Practicality Test

Data on the practicality test results of e-Learning based on the flipped classroom using the teachmint application by 10 students obtained an average practicality result for e-Learning based on the flipped classroom using the Teachmint application of 93% with a very practical category and the results of practicality analysis by 2 teachers obtained a score of 92%. very practical category. Based on the results of data analysis, an average practicality result of 93% was obtained in the very practical category. Therefore, it can be concluded that e-Learning is practical and appropriate for use in learning in class V SD. The assessment given by practitioners, namely teachers and students can be presented in [Table 6](#).

Table 6. Average Product Practicality

No.	Practicality	Results	Information
1	Educator	92%	Very practical
2	Learners	93%	Very practical
	Average	92.5%	Very practical

Based on [Table 6](#), the results of the practicality of flipped classroom-based e-Learning using the teachmint application were assessed by practitioners (teachers and students) at 92.5% in the very practical category. Therefore, the product can proceed to the effectiveness test stage.

Evaluation Stage

At the evaluation stage, an evaluation will be carried out on the impact of using e-Learning based on the flipped classroom model using the Teachmint application on student science learning outcomes. This evaluation will include an assessment of students' understanding of the learning material, student involvement in the learning process, as well as an assessment of the effectiveness of e-Learning in improving student science learning outcomes.

Evaluation stages are carried out to evaluate the effectiveness of learning and improve the design and development of learning. Evaluation is carried out by assessing student learning progress before and after using the flipped classroom model with the Teachingmint application.

Effectiveness Test

To diploma the effectiveness of e-studying, the records used is the rate of science gaining knowledge of consequences earlier than and after the use of e-learning. records become accrued the usage of a technological know-how gaining knowledge of achievement test. before being analyzed, the statistics acquired turned into first subjected to a prerequisite take a look at which consist of a normality take a look at and a homogeneity test. The prerequisite test is assisted by using the SPSS application. For the normality test using the Kolmogorov-Smirnov analysis test. Based on the results of the normality test, it is known that the significance value is $0.690 > 0.05$, so it can be concluded that the residual values are normally distributed. The subsequent prerequisite check is the pattern homogeneity check. The homogeneity check used is Levene's check for Equality of Variances.

Primarily based on the outcomes of the normality test, it is recognized that the importance value is $0.690 > 0.05$, so it can be concluded that the residual values are usually distributed. The following prerequisite test is the sample homogeneity test. The homogeneity test used is Levene's test for Equality of Variances. based on the effects of the homogeneity take a look at, it is known that the significance value is $0.733 > 0.05$, it could be concluded that the facts has a homogeneous distribution. From the results of the normality take a look at of statistics distribution and the homogeneity of variance of the era mastering outcomes statistics, it can be concluded that the statistics comes from a population this is normally allocated and homogeneous, the necessities for hypothesis locating out with the Paired T-test can be fulfilled. The results of the paired T-Test analysis can be presented in [Table 7](#).

Table 7. Paired T-Test Test Results

		Paired Differences				t	df	Sig. (2-tailed)	
		Means	Standard Deviation	std. Error Means	95% confidence interval of the difference decrease Upper				
Prair 1	pretest - posttest	-10.484	6.239	1.121	-12.772	-8.195	-9.356	30	0.000

Base on [Table 7](#) it is regarded that the Sig. (2-tailed) of zero.000 < 0.05 , it could be concluded that there may be a sizeable difference amongst generation reading effects within the Pretest and Posttest information. Comparison of scores before and after using e-Learning is presented in this [Table 8](#).

Table 8. Comparison of Values Before and After Using e-Learning

	Pretest	Posttest
Average	81.61	92.10
Median	80	90
Standard Deviation	5.68	5.29

Based totally completely on [Table 8](#), it could be seen that the average price of college students' technology mastering effects after using e-gaining knowledge of increased from 81.61 to 92.10.

Discussion

This research was conducted with the aim of developing e-Learning through the use of the Teachmint application based on the Flipped Classroom model, and assessing its impact on student learning outcomes in science subjects. The findings from this study will be compared with previous research to evaluate its consistency and contribution to existing knowledge. A number of previous studies have indicated that e-Learning is very suitable for use in independent learning, and can increase student involvement and motivation in the learning process ([Chiu, 2022](#); [Rasmitadila et al., 2020](#)). Research by previous study shows that technology and innovation in learning, including the development of e-Learning, can increase student engagement and their understanding of the material lesson ([Al-Jedaiah, 2020](#); [Denan et al., 2020](#); [Encarnacion et al., 2021](#)). Other studies state the use of e-Learning media also provides practicality in its use, both for teachers and students ([Ristanto et al., 2020](#); [Suartama et al., 2020](#)). Teachers can easily compile and present science learning materials through the Teachmint

application, while students can access the material anytime and anywhere according to their needs. The use of technology in e-Learning also provides students with greater flexibility and involvement in the learning process (Chanaa, 2021; Kumar & Sharma, 2020; Yaniawati et al., 2020). The development of e-Learning also pays attention to important aspects such as graphic display, materials and language to create an optimal learning experience.

Several previous studies have shown the benefits of using the Flipped Classroom model in increasing student achievement (Pallavi et al., 2022). Previous study concluded that e-learning with the flipped classroom model is very helpful in introducing Information Technology and as an e-learning guide in other subjects (Rahmelina et al., 2019). Research by other research found that Flipped Classroom and e-learning support each other in creating continuous learning, while found that e-learning and Flipped Classroom contributed to increased teaching success (Chen, 2021). Then other study found that the Flipped Classroom model can increase students' understanding and involvement in the learning process (Du, 2020). Research conducted that supports these findings, showing that this model encourages discussion, collaboration, and application of concepts in the classroom (Shana & Alwaely, 2021). In the Flipped Classroom model, students can study material independently at home through the material available in the application, while class time is used for more in-depth discussions and collaborative activities (Aidoo et al., 2022; Sosa Díaz et al., 2021).

In reviewing the findings of this study, the difference with previous research lies in the focus on e-Learning development using the Teachmint application and the application of the Flipped Classroom model in science learning. In this study, through the Teachmint application, students can access science learning materials independently and flexibly, as well as interact directly with teachers and fellow students through the interactive features provided. The graphic design of the Teachmint application has been adapted to the characteristics of elementary school students, by using attractive colors and simple pictures according to students' understanding. Sound effects are also added in this application with the aim of attracting students' attention and creating a comfortable and interesting learning atmosphere for students.

The implications of this study indicate that the development of e-Learning using the Flipped Classroom model-based Teachmint application can improve students' science learning outcomes. The material presented through this application is designed in a simple yet profound way, and is supported by pictures that help students understand. Instructions for use provided in the application also provide assistance to teachers and students in understanding the use of the application better. To follow up on the findings of this study, further development and implementation can be carried out in the context of learning science. Future research could involve a more detailed measurement of the impact of developing e-Learning using the Flipped Classroom-based Teachmint application and local wisdom-based audiovisual learning media on students' science learning outcomes. This measurement can include the level of understanding of concepts and practical skills improvement in science. In addition, research can involve a greater number of subjects and subjects to explore the potential for developing e-Learning to improve student learning outcomes.

However, this research has some limitations that need to be considered. First, this research only focuses on the development of e-Learning using the Flipped Classroom model-based Teachmint application in the context of learning science. This research has not covered all aspects of learning and other subjects that may be relevant in the development of e-Learning as a whole. Second, technical factors such as internet accessibility and device availability also need to be considered in using the Teachmint application. Not all students may have the same access to the internet and the devices required to use these applications. In addition, adequate technological skills of students and teachers also need to be considered, because the use of this application requires understanding and proficiency in using technology.

To overcome these limitations, further research can take the following steps. First, involving more subjects and subjects in the development of e-Learning using the Flipped Classroom model-based Teachmint application. By involving more subjects and subjects, research can investigate the potential use of this model in different learning contexts. This will provide a more comprehensive understanding of the effectiveness of this model in improving overall student learning outcomes. Second, it is important to involve student and teacher participation in e-Learning development. By actively involving them, both students and teachers can provide valuable input, experience, and perspectives in the development of Teachmint applications. This participatory approach will ensure that the applications developed are more relevant and responsive to the needs and challenges faced by end users. Third, implementing training and mentoring for teachers in using the Teachmint application and implementing the Flipped Classroom model is an important step. Teachers need to be supported with adequate training and ongoing assistance to be able to properly integrate this technology in their learning.

In this training, special attention can be paid to the effective use of the application and implementation of the Flipped Classroom model. By paying attention to these steps, future research can provide deeper insight into the development of e-Learning using the Flipped Classroom model-based Teachmint application and make a greater contribution to improving student learning outcomes. Future research could involve collecting more comprehensive data to measure the impact of developing e-Learning using the Flipped Classroom model-based Teachmint application on student learning outcomes. This measurement can include the level of understanding of concepts and practical skills improvement in science subjects and other subjects. By collecting more in-depth and detailed data, further research is expected to provide more complete information about the effectiveness and potential of developing e-Learning using the Flipped Classroom model-based Teachmint application in improving student learning outcomes. Furthermore, research can also pay attention to existing limitations and continue research in the direction previously suggested. Thus, this research can make a more significant contribution to the development of technology-based education and improve the learning process as a whole.

4. CONCLUSION

The study found that e-Learning using the Teachmint application in a flipped classroom model can significantly improve students' learning outcomes in science. The use of e-Learning can provide an alternative and effective solution in digital-era education by promoting independent learning, enhancing creativity, and boosting students' confidence in science learning. However, future research should expand the scope to include different subjects and educational settings with larger sample sizes, while also considering the role of teacher guidance and support in implementing e-Learning.

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