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Indonesian elementary students' achievement in learning English speaking through viewing Hello Talk: The effectiveness

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ABSTRACT

Discussions on the subject of Mobile Assisted Language Learning (MALL) are made more interesting by this study. In particular, the work concentrated on Hello Talk's smartphone app, which promotes language learning and acquisition through communication with native speakers and other language learners. This study aims to know the effectiveness of viewing the Hello Talk application for Indonesian elementary students' speaking learning. A mixed method (qualitative and quantitative design) methodology was utilized in this study. Participants in this study were 10 students from sixth-grade elementary schools. The respondents were selected on purpose based on their own experiences of viewing the Hello Talk application during the process of learning English. Questionnaires and interviews were used as the research instruments in this study. The questions on the questionnaire were focused on students' motivation in viewing the Hello Talk app, their expectations, effectiveness, and confidence level after viewing the app. The result shows that more than 50% of the participants were motivated to view the Hello Talk application to improve their English language proficiency. About 35% of participants expected that viewing the Hello Talk application can improve students speaking ability, and the effectiveness of viewing Hello Talk is 50%, which means that half of the participants argue that this application is highly effective. The last percentage is about the students' confidence after viewing this app, it is about 38% in level 5 of 5.

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INTRODUCTION

In daily life, being able to speak is a crucial skill. Humans can speak thousands of words every day, and interaction is necessary for word production. Due to their limited vocabulary and challenging pronunciation, elementary school kids frequently struggle with speaking (Okal, 2014; Oradee, 2012; Sadiku, 2015). According to Leong & Ahmadi (2017), speaking is one of the most difficult components of learning a foreign language. They are basic speaking abilities, communication techniques, and language and discourse expertise. Speaking is seen as an essential language ability that helps in interpersonal communication (Amaniarsih et al., 2022; Palupi, 2021; Taka, 2019). Students who want to improve their speaking abilities in the classroom must actively participate, which means they must produce and demonstrate their linguistic proficiency to others (Vaidya & Vaidya, 2017). Several factors particularly influence the standard of foreign language

output. The variables are vocabulary mastery, sound element understanding, actualizing foreign language phrases, and the frequency of foreign language use (Husban & Tawalbeh, 2023). Students are required to be able to learn and use the form of productive skills, one of which is speaking skills, based on the language component. Lack of teacher-student connection in the classroom, constrained learning time, and insufficient management of learning media are the issues of this era (Aruan et al., 2020). Therefore, creative learning media are required to solve these issues.

English language skills have become an important aspect of education, especially in Indonesia where English is not the main language of instruction but has a significant role as an international language (Harun, 2020). This creates challenges in the process of teaching and learning English, especially for students at the elementary school level. With the development of technology, English learning methods have also experienced innovation, one of which is through the use of Mobile Assisted Language Learning (MALL) based applications, such as Hello Talk. This application offers an interesting approach by enabling direct interaction between students' native speakers and fellow English learners. And this is a media that is starting to gain a lot of interest among students.

As a tool for instruction in the modern era, media has been employed by teachers. The teaching approach, which is frequently used by many teachers and is boring to students, is another issue. Due to this, learning requires a medium for students to maintain interest over time (Krisna et al., 2020). Consequently, through using media, teachers have the chance to improve the process of teaching and learning. Media is derived from the term introduction, which is called a medium. Media is a tool or method used to establish a connection between the message's source and recipient (Nugroho & Surjono, 2019; Suryansah & Suwarjo, 2016). Media is described as tangible tools used to enhance learning, such as books, visual aids, audio equipment, computers, and so forth (Lusiyani & Anindya, 2021; Saputri et al., 2018; Yamin & Karmila, 2019). As a hardware and software tool, learning media are used by teachers to transfer knowledge to their students while they are learning.

According to Ramdani (2018) & Santika et al., (2020), the use of media is thought to improve the efficacy and efficiency of a learning process in achieving learning objectives. In general, a variety of media are effective for improving students' speaking abilities when teaching English. This means that the usage of media can help students learn while they are being taught. The innovation in the teaching and learning process in the twenty-first century is educating through a variety of media related to technology. While utilizing traditional media to teach has benefits in terms of fostering cultural values, employing the most recent technology or platforms, like Android, will provide us greater advantages because it directly ties to students' everyday lives in this era.

Hello, Talk is a conversation-based mobile-assisted language program that enables users to synchronously connect and communicate with native speakers from all over the world, claiming to make cultural immersion, language acquisition, and practice easy, interesting, and intuitive (Rivera, 2017). As well as written text, speech-to-text, recorded audio messages, video chats, and doodles, conversation partners can also connect through other means as well. The Hello Talk app is used to send messages, leave voicemails, receive calls, make video calls, and update status. Additionally, the app has functions that help students, including reply, translation, favorites, copy, speech, transliteration, and more. Students can download it through the iOS app store and the Google Play store for Android. The students will, nonetheless, make new international acquaintances. It is practical, affordable, and simple to activate the Hello Talk app. The students do, in fact, instinctively pick up English and improve their speaking abilities.

Hello, Talk is a useful tool for learning languages, especially for the younger generation because of its entirely social setting. This software provides a fun environment for learning new languages because of the large number of languages it supports and the eclectic assortment of features it offers. It is an impressive effort that has been carried out by the skilled Hello Talk team to provide language learners with nearly every type of facility for quick, efficient, and worthwhile learning. On-the-text edits, automatic translation, and transliteration are a few features that stand out about this program and make it stand out as a top choice. Hello, Talk experiences a lot of

limitations, just like other language learning programs. The app's drawbacks appear to be the non-free VIP membership for full translation and transliteration packages, the absence of reports and/or comments on learners' progress, and any warnings or monitoring that can serve as a motivator for users. Briefly said it is accurate to say that Hello Talk is a well-liked and widely-used language learning software that attracts the interest of a growing community. To increase the app's potential for language learning as much as possible, the Hello Talk team is urged to fix the app's minor issues (Nushi & Makiabadi, 2018).

Numerous studies have shown that technology has a significant impact on children's speaking abilities. The study "The Effectiveness of Hello Talk App on English Writing Skill" was conducted by (Mukrimaa, 2014). According to the findings of their study, students in As-Syafi'iyah Islamic Senior High School 02's 10th grade who struggle with writing are significantly helped by utilizing the Hello Talk app. In his article, Anggraini et al., (2023) also claim that using digital tools can help students speak more fluently; in this particular study, the author used the Hello English app. Research by Brown (2004) that claims that teaching pupils to use digital tools has improved their English-language proficiency supports this as well.

"The Use of Hello Talk Application in Teaching Speaking" was published in 2022. According to the study, each student's growth was assured, pleasurable, and highly driven. The students showed greater enthusiasm for learning how to talk. The practice of speaking can be actively learned by the students. In conclusion, the Hello Talk app can help students become more fluent speakers (Yorlanda & Abbas, 2022)".

According to the relevant research that has already been cited, using technology to teach and acquire vocabulary can increase student interaction and engagement. In light of prior findings, the current study tried to look at how Hello Talk is used to teach vocabulary to young learners. Because Hello Talk is a user-friendly software with a ton of features including Helloword, English Time, Hello English, Amy, Translation, an English dictionary, a notepad, and many others this is the case. Furthermore, it is still uncommon to utilize the Hello Talk app to teach young students speaking skills. In light of this, the study concentrates more on analyzing the use of Hello Talk in primary school vocabulary instruction. The researcher chose the Hello Talk application since an English teacher has never previously used it to teach speaking. Additionally, the Hello English app provides thorough English instruction that covers all major skills like speaking, reading, listening, grammar, and vocabulary through engaging scenarios and activities. Additionally, it is handy to have, portable, and has a lot of functions that are explained in detail. All of these things may be taught via this program. This inquiry is guided by the primary research question: What is the effectiveness of the Hello Talk application for Indonesian elementary students' speaking learning? This study contributes to efforts to improve English speaking skills in elementary schools through the implementation of the Hello Talk application.

METHOD

This research aims to examine the effectiveness of using the Hello Talk application in learning speaking for elementary school students. To achieve this goal, a mixed research method was used which includes qualitative and quantitative approaches. Mixed methods research is a technique for examining behavioral, social, and health-related problems by gathering and analyzing both quantitative and qualitative data in response to research questions, and then integrating or "mixing" the two types of data in a particular research design to produce insights or a new and more thorough understanding than either quantitative or qualitative data alone can provide (Stadtländer, 2009).

In the quantitative aspect, this research collects data through the use of questionnaires distributed to research participants. This questionnaire is designed to measure aspects such as students' motivation in using the Hello Talk application, their hopes for improving their English-speaking skills, perceptions of the application's effectiveness, and students' level of confidence after using the application.

Meanwhile, a qualitative approach was carried out through in-depth interviews with participants. This interview aims to obtain a more detailed and contextual understanding of

students' experiences, opinions, and feelings regarding the use of the Hello Talk application in the process of learning to speak English. Interview questions were structured to support the quantitative data that had been obtained and provide further insight into the impact of the application on the student learning process.

Participants in this research were sixth-grade students from elementary schools in Indonesia who were selected using purposive sampling. The criteria for selecting participants were based on their experience in using the Hello Talk application in the English learning process. The total number of participants involved was 10 students, this number was considered sufficient to provide representative data for qualitative analysis, while also being manageable in the context of quantitative research.

As the research tool for this study, a questionnaire and interviews were used. The focus of the questionnaire questions was on the expectations, efficacy, and confidence level of students after viewing the Hello Talk app. Researchers employed questionnaires and interviews as their study instruments to gather data. Participants received the prepared questionnaire via Google Forms. The interview is also used to elicit more detailed information from the respondents. The questionnaire's focus was on the efficiency of using the Hello Talk app to teach English speaking. The items included the students' motivation for using the app, their expectations, their efficiency, and their confidence level after using it.

RESULTS AND DISCUSSION

Results

In this section, the research results are presented by researchers regarding the effectiveness of the Hello Talk application in supporting the speaking skills of elementary school students in Indonesia. The data from the questionnaire results are explained first by the researcher, and then supported by data from the interview results.

Students' Motivation in Viewing Hello Talk Application in Learning Speaking English

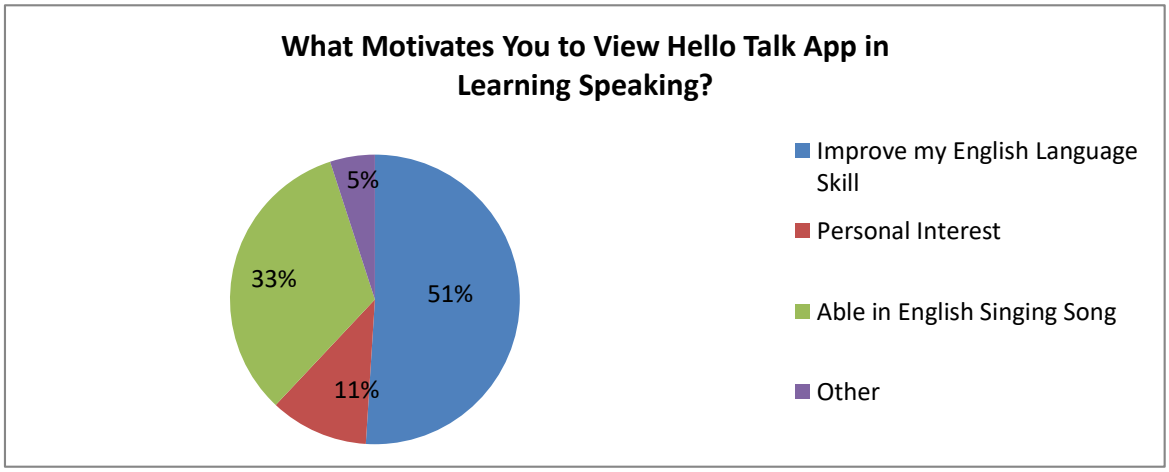

Figure 1. Motivation in viewing the Hello Talk Application

Up to 51% of respondents said that they were motivated to view the Hello Talk application to learn to speak since it will help them in school with their English language skills. In other words, more than 50% of participants exactly 5 participants out of 10 chose the application because they thought it would aid in their efforts to improve their English. While 11% of users said they were driven to be able to sing English songs, 33% of participants said they were browsing the Hello Talk application out of personal interest. On the other side, the remaining participants out for someone else.

The information listed above is directly related to the study's title. According to the comments, most students are driven to enhance their English-speaking abilities for either

employment or education, which speaks to the applicability and value of Hello Talk as a language learning platform. The comments also show that Hello Talk is used for purposes more than just personal interest since certain students are encouraged to sing English songs effectively while they are still young. Overall, this information contributes to a deeper comprehension of the factors that influence primary schools' decisions to adopt Hello Talk as a platform for language learning, which helps assess the platform's efficacy.

The Expectations When Starting to View Hello Talk App

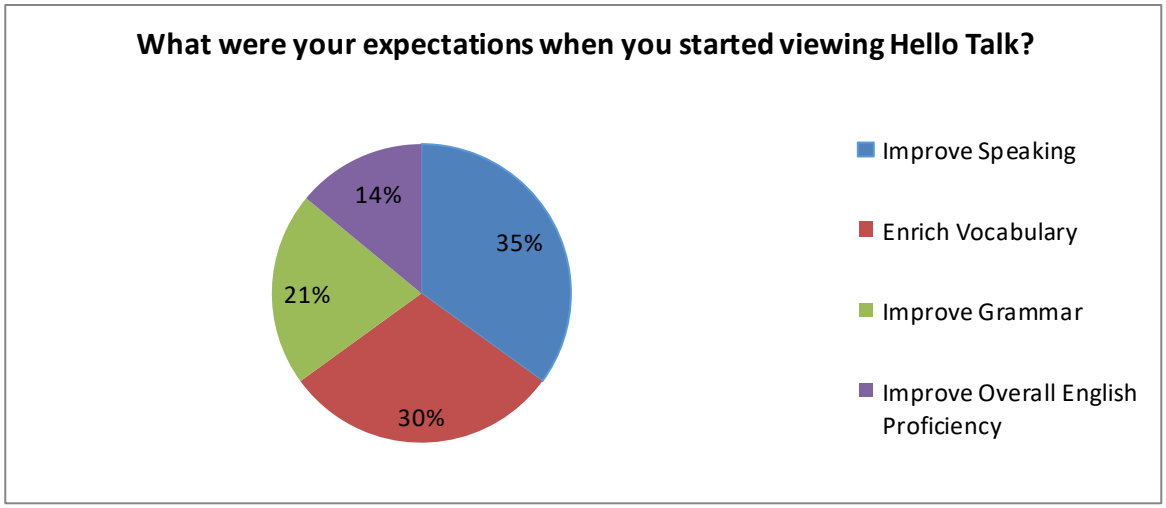

Figure 2. Expectations in Viewing Hello Talk App

By using the Hello Talk app as part of their English learning process, over 55% of students expect to improve their speaking. Along with the 30% of pupils whose vocabulary is projected to grow, 21% of students are expected to improve their grammar. The final percentage, which is 14%, represents the student's overall English proficiency improvement. The information presented here is directly related to the study's title. According to the comments, the majority of elementary school students believe that viewing Hello Talk during the learning process will help them speak more clearly. This result is consistent with the research literature, which has demonstrated that language learning apps like Hello Talk can help students become more fluent speakers of English. Students may have particular areas they want to focus on when viewing Hello Talk, as seen by the fact that some users also intend to enhance their vocabulary and grammar. Overall, this information contributes to understanding what users anticipate from the Hello Talk app as a language learning platform, which helps assess how well the platform fulfills users' requirements and objectives.

The Effectiveness of Viewing Hello Talk App in Learning Speaking English

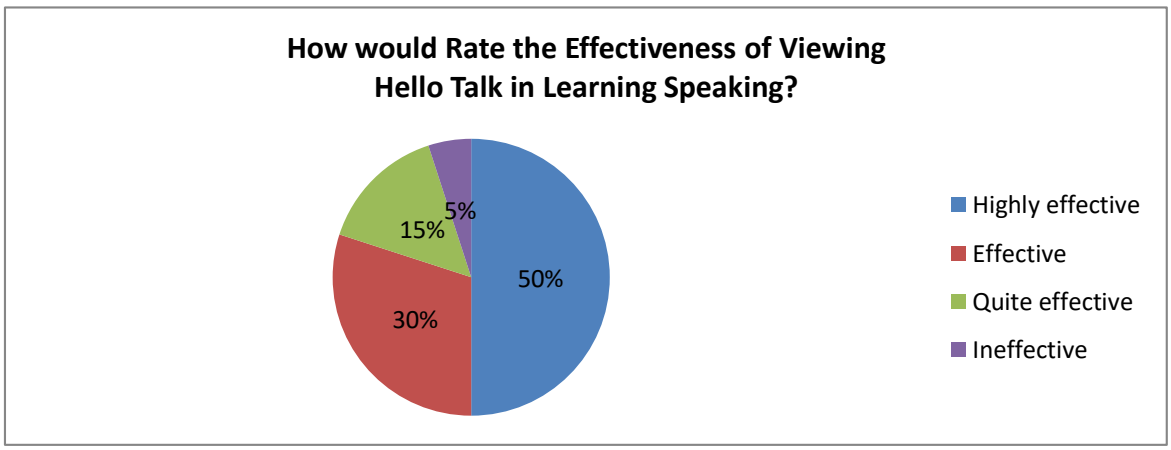

Figure 3. Effectiveness in Viewing the Hello Talk App

The Hello Talk application was rated as a very effective teaching tool for improving students' English skills by half of the participants. About 20% of participants stated the app is quite effective, while up to 30% said it is effective. Additionally, 5% of the participants said that the Hello Talk app is a substandard tool for learning English. The findings show that Hello Talk is an effective tool for learning English, and literature research indicates that most users took use of the app's availability to improve their English skills for both school and other purposes.

Confidence Level after Viewing Hello Talk App in Learning Speaking English

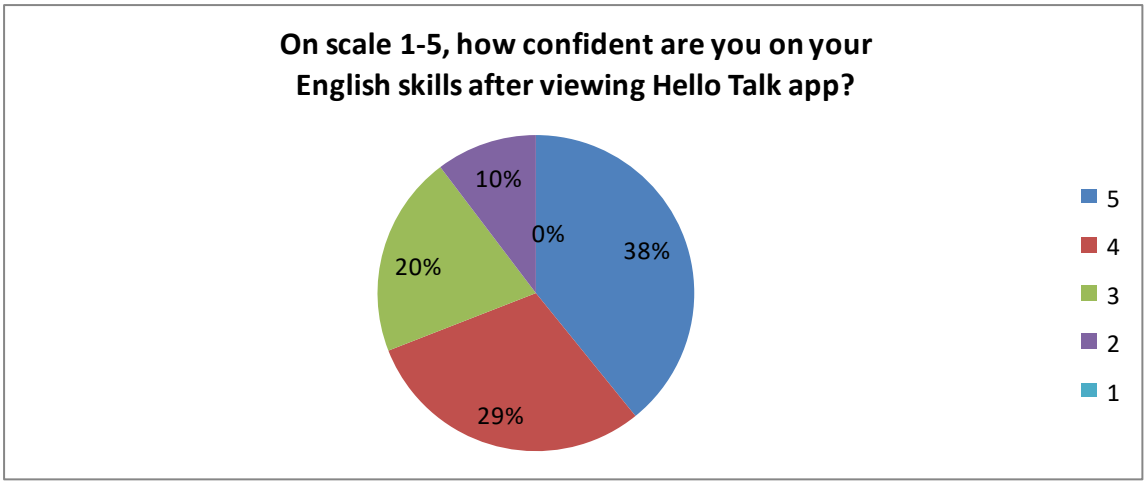

Figure 4. Confidence in Viewing Hello Talk App

The information above relates to the research, "After viewing Hello Talk, how confident are you in your English proficiency on a scale of 1 to 5?" According to the comments, most viewers of Hello Talk said that they felt about as confident as they could be speaking English. Most students (around 38%) rate their level of confidence as 5 out of 5, while 29% rate it as 4. 20% of the students gave their degree of confidence the highest rating 3 out of 5 while 10% gave it the second-highest rating 2, and none of the students gave it the lowest rating 1 out of 5. According to the research, the majority of students felt more confident in their language abilities after viewing Hello Talk, even if many students did see an improvement in their English competence. Overall, this information provides information on how students see their language competency after viewing Hello Talk as a platform for language learning.

Interview Result

A questionnaire is also utilized as the research tool, but an interview is also used to get more in-depth information from participants. The results of a survey asking respondents whether they viewed the Hello Talk app as a useful tool for learning English as a second language are listed below. The majority of respondents think the Hello Talk application is a good English learning platform because of its usefulness and accessibility. They assumed they could use the application to learn English anywhere, at any time. The outcomes of the research subjects' interviews are listed below:

In my opinion, Miss, this application is very fun for learning English, especially if we want to quickly become good at speaking, this time it is suitable Miss. Because we can communicate directly with foreigners. So slowly but surely our English will also be as good as theirs. Practice makes perfect, right Miss, if we expect us to only talk to friends, it will definitely take a long time to be able to.

Based on the interview, it is found that Hello Talk has become a nice application in some students' opinion. It is very effective for the students who want to learn and practice directly with the native speakers. This application provides a place where we as non-native speakers communicate directly to native speakers all over the world.

What about it, Miss, I feel that since I found out about Hello Talk, I've become more enthusiastic because I can talk directly to people, Miss, so it's as smooth as in the films.

The aforementioned interview's findings demonstrate how familiarizing oneself with the Hello Talk application may encourage students to speak more fluently in the target language by facilitating direct communication with native speakers.

After I saw this Hello Talk application for learning English, it seems very fun Miss, because there are many features in it, there are videos, we can also make statuses like the Facebook application, then it is commented on by foreigners. Yes, we will have many friends, right Miss, foreigners too. I who just saw it was fun, what more later when I use this application.

According to one of the students interviewed, it's entertaining just to glance at this application. It will be quite useful to utilize, especially if we use it to learn English. Numerous engaging features in this application keep students engaged and from getting bored while learning to speak. There are entertaining videos, and users may post status updates similar to those on the Facebook app, which other users can remark on across the whole country. For users to effectively learn as well as make many foreign pals who can help them indirectly improve their speaking skills.

Discussion

The results show that the main reason for seeing the Hello Talk application for the majority of users (51%) is to increase their level of academic English language proficiency. This suggests that people consider the application to be a useful tool for academic work. Additionally, users are sufficiently motivated. For example, 35% of users are driven to be able to sing English well, which is a sufficiently high rate that is given that all students are still in their early learning stages. From the results of this research, it is known that singing songs can improve a person's ability to speak English, this is because by singing or listening to English songs, indirectly, we will gain a lot of new vocabulary obtained through the lyrics of the song. This is supported by the research of a researcher Kartika & Khaeri (2020) regarding increasing students' English vocabulary using the singing method. From this research, it can be obtained that it is proven that students' vocabulary can increase by using the singing method. In addition, students' vocabulary skills can be increased by using the Hello Talk application. Then, 11% are driven by personal interests, and 5% have another drive to improve their English in preparation for travel. Students' first expectations for the Hello Talk application are oriented around speaking improvement (35% of participants). Additionally, there are about 30% of the students are motivated that the Hello Talk App can increase their vocabulary, which is also reinforced by research by Jamu et al., (2022) on the application of the Hello Talk application in teaching English to beginner learners. From this research, it was found that the Hello Talk application can assist students in improving their vocabulary abilities. Then, there are about 20% of students are expected to enrich their grammar, and there are about 14% of students are expected the Hello Talk App can enhance their overall English proficiency.

Overall English proficiency includes speaking, listening, reading, and also including writing skills. Even though the percentage for this is not very large, in several studies it can be proven that the use of the Hello Talk application is very influential in improving students' writing skills. There is a study by Febriani et al., (2023) about the effectiveness of using Hello Talk in improving students' writing skills at the higher education level. From the results of this study, it can be seen that the Hello Talk application is very effective in improving students' writing skills. Students greatly value the effectiveness of the Hello Talk program, with 50% citing it as a very useful tool and 30% citing it as effective. 15% of them are quite effective, while 5% are ineffective. Students' confidence in their English learning speaking improves after viewing the Hello Talk application with 38% expressing the highest level of confidence. It is around 29% that show in 4 levels, and 20% in 3 levels. Then there are 10% in 4 levels and the last level is none of the percentages.

Up to 51% of all participants in this study indicated that seeing the Hello Talk application had enhanced their proficiency in speaking English. These results are those of a study by the author, which discovered that using the Hello Talk app can help students' speaking skills. Zoom is used to develop the Hello Talk app for students participating in online learning. Researchers

discovered that the Hello Talk app can help pupils' speaking abilities. Speaking skills improved, but so did proficiency in other languages. The study's findings, taken together, imply that Hello Talk is a useful tool for learning English and can enhance a variety of language skills, including speaking. The findings of this study contradict prior research that claimed Hello Talk might not be successful in some circumstances. Because of this, Hello Talk can be a useful tool for language learners who want to acquire new abilities in a fun and approachable manner. Overall, the results of the data analysis indicate that Hello Speak is a useful platform for learning English that can aid in users' language proficiency improvement. The results support other studies that examined Hello Talk's usefulness as a platform for learning English. The data findings, which should be highlighted, are based on self-reported information from a small sample of participants. The success of Hello Talk as an English learning platform must thus be confirmed by more studies with a larger sample size and utilizing various techniques.

CONCLUSION

This study's comprehensive analysis makes it abundantly evident that the Hello Talk app is a very helpful tool. The results of the researcher's questionnaire, which was given to the respondents, clearly demonstrate how the application can raise students' self-confidence, English language proficiency, and motivation. Moreover, an intriguing narrative presents itself in comparison to the understanding acquired from previous studies. The study's positive trend aligns with mounting data demonstrating the Hello Talk app's potency as a stimulant for robust language acquisition. Our research contributes to the discussion by emphasizing the advantages of using digital learning resources, particularly when it comes to boosting students' interest in and proficiency in studying English, even though worries have been raised about the potential drawbacks of using a mobile phone. Thus, it is crucial to approach these findings with criticality. The potential negative effects of mobile phone-assisted language learning should be thoroughly examined in later studies. The significance of our findings in a variety of educational contexts will be enhanced by acknowledging challenges and areas for growth.

In summary, Hello Talk is an excellent illustration of language learning efficiency. These findings provide valuable insights for improving language education strategies for teachers, learners, and legislators. Though we welcome the benefits of mobile-assisted learning, we also recognize that more research is necessary to improve our knowledge, overcome obstacles, and usher in a new era of innovation and continuous improvement in language education.

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Presence of massive open online courses for accelerating One Health basic training in Indonesia

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ABSTRACT

New Emerging diseases and re-emerging diseases that are major threats to public health continue to have serious social, political, and economic impacts. In coordination with other sectors, the weak Indonesian health resilience system makes cross-sector involvement with the One Health approach (human, animal, environmental) very important. One Health Training is an effort to raise awareness about the importance of collaboration, coordination, and communication with various sectors regarding human, animal, and environmental health. This study aims to provide an overview of the existence of MOOC learning models for One Health Basic Training. The study uses qualitative research methods with a scoping review approach. This study reinforces the study of MOOCs' learning model for Health Training. This research is limited specifically to articles related to World Health Training that have implemented the MOOC learning model. The findings of this study provide insight into the various factors that need to be considered and the relevance of applying the learning model of MOOCs to One Health Basic Training.

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INTRODUCTION

New Emerging diseases and re-emerging diseases are major threats to public health that further seriously affect the social, political, and economic spheres. The pandemic that has passed also gives a picture that human life is not free from pathogenic evolution, economics, and environmental change as well as dynamic human interaction with animals (Wang et al., 2021). Many other types of viruses that have been in their natural habitats for a very long time can potentially spread between humans and animals (Jiménez, 2019; Rupprecht et al., 2022; Zhou, 2021).

According to the Health Minister's Regulation, zoonotic diseases (animal infectious diseases) are one of the forms of public health threats (Peraturan Menteri Kesehatan Nomor 21 Tahun 2020: Rencana Strategis Kementerian Kesehatan Tahun 2020-2024, 2020). 70% of new infectious diseases in humans are zoonoses, not independent of human activity. Indonesia's health resilience system needs improvement in prevention, detection, and response to new infectious diseases. Cross-sectoral involvement with the One Health approach is essential, and improved prevention,

detection, and response to emerging cases are needed to strengthen public health (Asaaga et al., 2021; Bansal et al., 2023; Thomas et al., 2021; Vesterinen et al., 2019).

One Health Basic Training is a response to the increasing spread of zoonoses in Indonesia. This training is an effort to raise awareness of the importance of collaboration, coordination, and communication with various sectors in terms of human, animal, and environmental health (Amuguni et al., 2019). This approach, which encourages the preservation of human health, the conditioning of animals, and the conservation of the environment, is a common interest that is expected to reduce even the spread of zoonoses (Erkyihun & Alemayehu, 2022). Balia et al., (2019) affirmed that the basic knowledge needed in the treatment of zoonosis related to public health, animal health, and environmental health should be integrated into the concept of the One Health approach. The important role of the three sectors (10.435 Public Health Centres, 1,691 Veterinary Health Centers, and 26 Natural Resource Conservation Halls) in being trained in the concept of the One Health approach requires strategies that can accelerate the implementation of one health basic training (Pedoman Pelatihan Jarak Jauh Bidang Kesehatan, 2023; KSDAE, 2023).

This article aims to provide an overview of the organization of training about the unprecedented training model in Indonesia, namely MOOCs. The maintenance of training through the implementation of the learning model of MOOCs has received increased interest and attention from many communities and institutions involved in distance education through the Internet (Evianto, 2020). The need to ensure efficient and economically sustainable training has focused on Technology-Enhanced Learning/TEL, one of the applications of which is through learning models MOOCs (Schettino & Capone, 2022). MOOCs are very beneficial to employees because they provide an opportunity to study independently, to study lifelong, and to develop a career at no cost (Aljaraideh, 2019; Rafiq et al., 2019; Wang et al., 2020).

The learning model of MOOCs makes one-health basic training that originally could only be carried out face-to-face become web-based by providing an open and easily accessible learning freedom to participants (Bolon et al., 2020; Linder et al., 2020; Machalaba et al., 2021; Zinsstag et al., 2022). MOOCs create new approaches to learning and teaching. If the implementation of MOOCs is well designed and organized, the training participants can organize time efficiently and be able to gain insight without expensive costs. Until now, the results of previous research on the application of MOOCs to One Health Basic Training are still focused on the screening of the release events and the outcomes of the One Health MOOCs (Bolon et al., 2020). The study seeks to complement the implementation of the One Health approach with the application of the MOOCs that have been implemented by providing an overview of the implementations of MOOCs in Health Training which have been successfully implemented in various countries. Therefore, the study aims to provide a broader overview of the learning model of MOOCs that can be applied to One Health Basic Training by reviewing various articles about MOOCs in health training. The emphasis on key factors in developing MOOCs is also the focus of this research. Through a comprehensive literature review, the research contributed to identifying patterns that could be considered for MOOCs as training models for One Health, as well as providing strategic recommendations for the development and implementation of more effective online training programs in the context of Indonesia. The results of this research are expected to serve as a reference for policymakers, instructors, and health practitioners in optimizing the use of digital technology to improve the quality and accessibility of health education in Indonesia.

METHOD

Design of Research

This research is qualitative research using the scoping review approach, i.e. using sources of articles from various journals related to the application of learning models of MOOCs to health training as a primary reference source. The use of legal references, ministerial regulations, and guidelines on One Health Basic Training is also used as a secondary source of reference. The technique of gathering data on this research is by identifying reference sources that are relevant to

the research theme. One Health Basic Training as one of the Health Field Training is further linked to the learning model of applicable MOOCs.

Procedures and Techniques of Research

This research was carried out by adopting a methodological framework developed by Arksey & O'Malley (2005) and submitted by Levac et al., (2010), which required the following steps: (1) identifying research questions, (2) finding relevant studies, (3) selecting the study, (5) mapping the data, and (5) collecting, summarizing, and reporting the results.

1. Identify Research Questions
   To map evidence of the application of MOOCs in health training, a curriculum examination of relevant topics was carried out. Specifically, this study aims to answer the following questions:
   a. What factors should be considered when applying MOOCs to Health Training?
   b. Are MOOCs a suitable learning model for One Health basic training?
   These two questions are aimed at finding a range of studies that observe the processes and learning outcomes of the application of MOOCs to Health Training, including the One Health Basic Training. The result is an analysis of its implementation that can be applied according to similarities in the target, media, platform, and assessment of the maintenance of the MOOCs.
2. Search Strategy
   Relevant articles are identified through the electronic database of Google Scholar. To determine the most appropriate search strategy, a preliminary analysis of the literature on MOOCs in the context of health training is carried out to determine an adequate search strategy. Specifically, the keyword algorithm used is based on the following terms: "MOOCs/MOOC", "Health", "Training", and "One Health"; the search time range covers articles published between 2019 and 2023.
3. Inclusion and Exclusion Criteria
   The articles were selected based on the following inclusion criteria: (1) qualitative and quantitative empirical studies on MOOCs for health care, (2) written in English or Indonesian, (3) with full text available online, (4) with clear and explicit methods, (5) published in journals in the last five years namely in 2019 to 2023. No geographical constraints are used.
4. Mapping Research

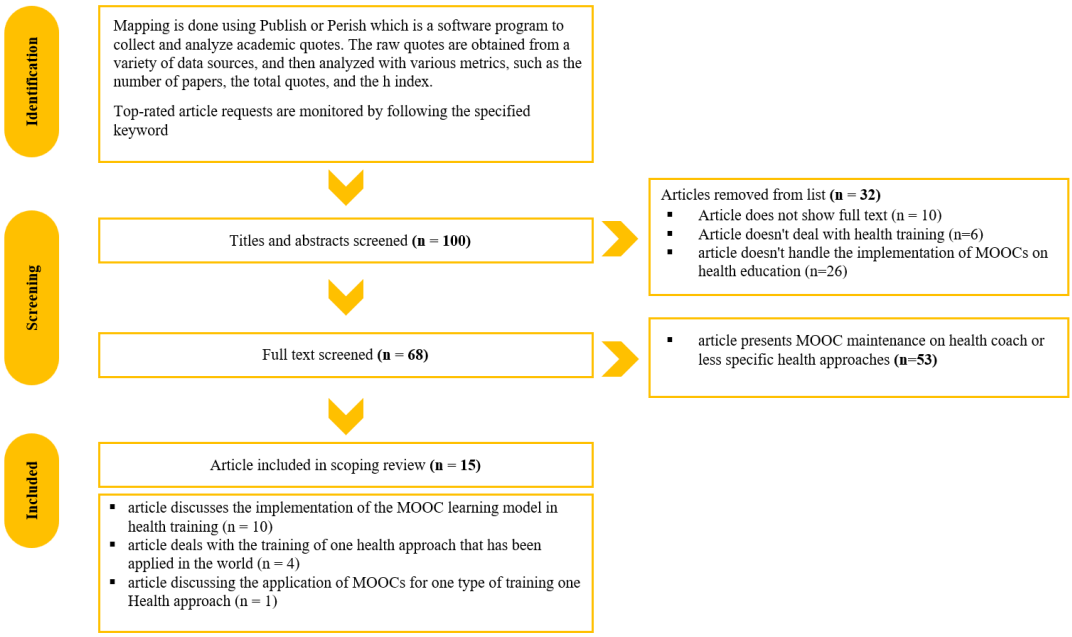

Figure 1. Flowchart of the literature search strategy and review process, Adapted from PRISMA 2020 ((Page et al., 2021)

Figure 1. Mapping Research

RESULT AND DISCUSSION

Result

The following is the article study that has been filtered according to the method of research submitted. The article study results can be found in Table 1.

Table 1. Summary of Articles Included in Research

No.	Author (Year); Country	*Platform*; Duration	Topic; Target	Media	Result
1	Bettiol et al., 2022); Australia	MOOC; 20 H	Public Health Systems; Professionals and Students	Short Instruction Videos, Articles, Readings, Discussion Forums	The MOOC Drew Wide and Diverse Public Attention to Major Public Health Issues.
2	Yahya et al., (2019); Malaysia	Open Learning	Trying to quit Smoking; Dental Student	Video, PowerPoint Lecture Slides, and Quizzes (8 Modules)	The MOOC will be an Alternative Platform for Teaching Students Curricula and Learning for Work and Personal Satisfaction for Health Professionals.
3	Hooley et al., (2020); Rwanda	D&I MOOC; 6 Weeks	Dissemination and Implementation of Hypertension Research; Health Workers, Researchers, and Students	Content (Module, Videos, Assignments, Quizzes, Capstone Projects)	The Implementation of the MOOC needs to be done in Partnership with the existing Infrastructure.
4	Pham et al., (2021); France	MOOC EIVASI-ON; 6 Months	Respiratory Physiology and Mechanical Ventilation; ICU Resident Doctor;	Classic Video, Video Simulation	Increased Knowledge and Skills in Mechanics with Ventilation
5	Floss et al., (2021); Brazil	Moodle; 80 H	Planetary Health; other Health Services on Primary Health Services	Content (Articles, Short Videos, Podcasts) Inspired by Transformative Learning	High Completion Rate; most Participants were very Satisfied with the Learning Experience
6	Launois et al., (2021); WHO	IR MOOC; 6 Weeks	Implementation Research; Researchers and Public Health Professionals, Lecturers, Students, and the General Public	Content (Modules, Videos, Discussion Forums, use in 6 Languages	Successfully Strengthened Knowledge of IR. The Knowledge Received can be Applied in Professional Practice. MOOCs are Suitable for Low and Middle Income Countries

No.	Author (Year); Country	*Platform*; Duration	Topic; Target	Media	Result
7	Wang et al., (2021); China	MOOC	Rheumatoid Arthritis; Resident Physician	For Experimental Groups: Short Videos Watched Before Class and Intra-Group Discussions; Clinical Cases	A Significant Difference in Test Scores for Experimental Groups
8	Findyartini et al., (2021); Indonesia	Moodle; 42 H	COVID-19 Management; Doctor Fresh Graduate	Video; Text; Slides; Podcasts and References	The Platform is easy to navigate, the Design is Attractive, and the Content is Tailored to the needs.
9	Dwyer et al., (2022); Australia	MOOC; 6 Weeks	Redesign of Health Services; Nurses, Health Practitioners, Medical Personnel, Administrative Staff	Text/Articles, Videos, Case Studies, Quizzes	Participants are Satisfied with the MOOC Learning Experience; MOOCs Respond to Short and Free Learning needs;
10	Coad et al., (2023); UK	Future-learn; 3 Weeks	Germline Genomic Testing; Clinical Consultant, Clinical Geneticist, and Genetic Consultant	Content, Discussion, Quizzes	MOOCs Provide Basic Knowledge and Enhance Participant Confidence
11	Linder et al., (2020); United States	Class; 13 Weeks	One Health Approach Training; Tufts University Students	Interactive Presentations, Group Assignments/ Discussions, Visual Products, Headings	Recommend MOOC Development for One Health
12	Kelly et al., (2020); Rwanda and Tanzania	One Health Platforms PREDICT	Avian Influenza (AI); Stakeholder	Collaboration, Coordination, Cross-Sector Communicatio n (Informal Meetings and Radio Broadcasts)	The Development of the One Health National Platform and Policy is Crucial
13	Machalaba et al., (2021); New York	Conference on Health; 1 Month	Important Issues One Health; Medical Schools and Global Health Centers	Resume	Use of Platforms (e.g., MOOCs) that can Promote Access widely
14	Zinsstag et al., (2022); Switzerland	Future-learn; 6 Weeks	One Health; Public and Health Professionals	Videos, Articles, Discussions	Promoting Multidisciplinary Science Activities in One Health

No.	Author (Year); Country	*Platform*; Duration	Topic; Target	Media	Result
15	Bolon et al., (2020); Kenya	Coursera; 8 Weeks	Interpretation and Application of One Health to Various Health Problems	53 Video Lectures, Readings (Short Scientific Articles, Reports, etc.), Online Practice Quizzes	The Pedagogical Approach of Incorporating MOOCs into One Health Education in the Camp Gets Positive Feedback

Discussion

Implementation of MOOCs on Health Training Models has been carried out in various countries. France, Rwanda, Brazil, China, and Indonesia are some of the countries that have successfully organized MOOCs in Health Training. The application of the intended flushing model is capable of attracting most of the attention of the participants. The high level of completion and satisfaction in conducting learning became an exciting experience for participants.

Implementation of training in the field of health is carried out with a minimum duration of 20 hours and a maximum of 6 weeks (with study 5 hours a day) that is suitable for applicable to students, lecturers, researchers, and health professionals. When linked to the rules applied in Indonesia, the state civil apparatus act and the state administration institution regulations state that the state civil apparatus has the right to a minimum of 20 Teaching Hours per year for competence development. Health training with learning models MOOCs give fresh air to the healthcare industry (especially in community health centers) to be able to develop competence without having to spend expensive and can be followed anytime and anywhere. The workload of the health care personnel in community health centers is mainly high doctors making the learning model of MOOCs very suitable to apply (Kemenkes, 2023).

The use of varied learning media according to needs in the learning model of MOOCs is the key to the implementation of health training running according to the learning objectives to be achieved. Learning media are essential to helping students acquire new concepts, skills, and competencies (Hasan, 2021). No direct interaction between participants and teachers as face-to-face training makes the learning process have to use a variety of learning media for optimal learning outcomes.

The role of the media in the learning process is to clarify the learning material. Training participants need a real picture of the material they learn using a medium to present a real experience even though they have never experienced it. For example, the proper use of APDs to reduce the risk of transmission of infectious diseases in animals requires care by professional talents that can be integrated into the learning process. The media also plays a role in generating participants' responses to cases that will be further investigated in the learning process. Moreover, in the learning model of MOOCs, the important role of media in the learning process is as a student learning resource that contains the core material studied. The various media used in the implementation of health training from the article have been summarized are modules, articles, short videos, podcasts, slides, and discussion forums.

Learning media in the application of the MOOCs development model in compulsory health training refers to the training modules that have been compiled (Pedoman Pelatihan Jarak Jauh Bidang Kesehatan, 2023). The module is a learning material in health care training designed specifically and systematically based on an accredited curriculum. The module consists of the smallest learning component that the participant can use independently to the learning objectives of the training. The module covers all the competence needs that will be achieved during the training: learning goals, guidance, materials, discussion, references, and feedback and evaluation.

In Indonesia, the learning media MOOCs developed for health training are directed to the Digital Learning Platform that is being developed by the Ministry of Health namely the Healthy

Platform (Kemenkes, 2023). When compared to the application of MOOCs in the world, media embedding in modules, articles, short videos, and slides can be facilitated while media in podcasts and forum discussions can be implemented by embedding links to targeted content.

In the future, this Digital Learning Platform should already be able to facilitate the various learning methods applied in MOOCs. Floss et al., (2021) reveal that visual communication is the key to the effective delivery of messages of complex ideas. Developers of MOOCs are supposed to do it continuously, mainly focusing on how to simplify complex messages to be easily understood by participants. The MOOC development team works with training developers and experts to represent the field of health developed visually through color and shape. The authors and designers researched images that represented the content and consciously created a color palette for the course. The use of colors and ideas must characterize the peculiarities of a MOOC.

Implementation of One Health Basic Training can adopt and adapt from the application of the One Health approach in the world. Linder et al., (2020) describes the application of one heatlh curriculum to a training for students at Tufts University, United States advancing multidisciplinary science collaboration with various groups (human medicine, veterinary medicine, nutrition, dental care, the environment, and public policy).

Experience in interdisciplinary joint work enables participants to have diverse perspectives in dealing with various health issues. Training using a variety of previous cases can be used to provide real-life examples of One Health problems that participants may face in the future. In addition, the field trip approach will be an interesting content application to help strengthen the concepts taught. To promote the dissemination of a curriculum development model MOOCs for One Health are highly recommended.

Development of the national One Health platform and policy is implemented to enhance the integration of activities and programs in various sectors in the State of Rwanda and Tanzania (Kelly et al., 2020). Collaboration, coordination, and cross-sector communications (informal meetings and radio broadcasting) are concrete steps to such integration. This means that the opportunity to create a learning model MOOCs can happen not only to the Ministry of Health involved but also to various related sectors such as the Ministry for Human Development and Culture, Ministry for Agriculture, Ministries of the Environment and Forestry, National Research and Innovation Agency, Ministers of Home Affairs, Regional Government and other stakeholders. Through the guidelines on prevention and control of zoonoses and new infectious diseases issued by the Minister of Coordination for Human Development and Culture of RI, all these sectors should be involved in the preparation of MOOCs. Information massively delivered through the respective ministries/agencies and other stakeholders will increase participation so that everyone knows and understands the importance of the One Health approach to preventing and controlling zoonoses and new infectious diseases in Indonesia.

MOOCs can be a gateway for various stakeholders involved in preventing and controlling zoonoses and new infectious diseases to introduce SIZE (Zoonosis Information System and EID). SIZE is an integrated information system that presents zoonosis and new infection data containing information about sectoral disease data, warning of a disease occurrence as well as recording responses and analysis (https://size30.onehealth-size.id/). By following the One Health Basic Training, the implementation of cross-sectoral integrated surveillance, cross-sectorial response to SIZE alerts, sharing data and information across sectors, as well as implementing technical analysis and recommendations by the region can be implemented well.

It's not just for health professionals and others who can follow this One Health Basic Training, with the application of MOOCs that can be targeted at college students from a variety of related sectors. The benefits of One Health Education for students in the United States, Switzerland, and Kenya can be examples of the One Health approach can be done (Bolon et al., 2020; Linder et al., 2020; Machalaba et al., 2021; Zinsstag et al., 2022). Students of medicine, veterinary medicine, public health, especially epidemiology, and environmental health who have learned about zoonoses and new infectious diseases can be admitted to the training.

The implementation of the learning model of MOOCs in One Health Basic Training is a matter of curiosity. In the state of Kenya, the implementation of the learning model MOOCs on the One Health approach has been implemented with positive feedback at the end of the session (Bolon

et al., 2020). An overview of how One Health is interpreted and applied to various health problems (e.g., antimicrobial resistance, rabies) and the world context is the purpose of the application of the MOOCs in question. The application of learning media such as videos, articles, and the presence of quizzes to measure learning success is also applied in the learning process. It is a fresh wind for one health activist in Indonesia to develop a similar learning model on the positive response of the world to the implementation of MOOCs. Every renewal, there must be a challenge to face. The presence of MOOCs should be considered for Internet access constraints, information technology usage skills, support, and supervision (Anisah, 2022; Harjanto & Sumunar, 2018).

CONCLUSION

This article aims to provide an overview of the organization of One Health Basic Training with an unprecedented development model in Indonesia, namely MOOCs. Various successful measures have been implemented in various countries with positive responses. Research carried out in France, Rwanda, Brazil, China, and Indonesia showed that the application of the learning model of MOOCs in Health Field Training was successfully implemented with the same target of training participants for One Health Basic Training, namely doctors, health professionals, and health personnel in the community health center. The factors that need to be considered in this model are the duration of the training time, the use of the learning media, the basic material to know, and the setting of targets according to the needs. These factors need to be discussed further in future research. Finally, the presence of MOOCs in One Health Basic Training in Indonesia is an appropriate innovation and is the subject of discussion for policymakers.

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Students learning engagement in the flipped classroom: Systematic literature review

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ABSTRACT

The flipped classroom offers greater flexibility and meaningfulness in learning activities. Students have more space and time to construct their knowledge and skills freely. However, the presence of students in learning activities does not necessarily guarantee that students are actively engaged in creating their expertise and skills. This study conducts a systematic literature review to investigate effective strategies to ensure students' learning engagement in flipped classrooms and factors that hinder students' learning engagement. It was performed following the Kitchenman and Charter's rules and strategies. The review covered 47 articles that were published between 2018-2023. The significant findings indicated that effective strategies used to ensure and enhance students' learning engagement in the flipped classroom are gamification, providing immediate feedback, timely guidance, working in groups, scaffolding, peer coaching, user-friendly technology, learning videos with a short duration, assignments before in-class session, reflective-thinking strategy, self-regulated learning, and guided questions. Additionally, supporting materials for pre-class sessions, working in groups with the same students, doing the same activities repeatedly, low level of self-regulation, long duration and low quality of learning videos, students' perception toward the roles of the lecturer and lecturer's communicative skills can hinder students from engaging in learning activities. Therefore, when implementing a flipped classroom, the lecturers should facilitate and ignite students' learning needs and interests. Moreover, using user-friendly digital technology is essential to create an atmosphere that encourages students' engagement either in pre-class, in-class, or after-class.

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INTRODUCTION

The flipped classroom is a hybrid learning that proportionally integrates online and offline learning activities (Bergmann & Sams, 2012). Students are asked to learn independently outside class to understand basic content delivered by the lecturer and learn more deeply in class through more challenging activities and the lecturer as a supporting partner. A flipped classroom shifts the lecturer's role from a communicator to a learning facilitator and supporter (Sudiarti et al., 2023). It is not a new learning model, but many educators' experiences and abilities to implement the flipped

classroom are still limited because it is not a common model used, including in higher education (Baig & Yadegaridehkordi, 2023; Mahalli et al., 2023; Wahyuningsih & Afandi, 2023). It is reported that students and educators spend relatively more time and effort in flipped classrooms than in traditionally structured courses (Hung, 2015). Furthermore, lecturers must ensure two parts of activities: independent work outside the classroom and applying knowledge in solving classroom tasks (Gonda et al., 2021). Students who do not have self-directed learning skills in doing the online requirements in pre-class activities will need help knowing what to do in class activities and will feel lost and helpless (Yilmaz, 2017). Implementing flipped classrooms in higher education settings also has unique characteristics and challenges regarding learning engagement. The shift of responsibility of learning from lecturer to student and ensuring students access the prior materials and learn before class independently are crucial and need specific strategies. In addition, Ha et al., (2019) also stated that igniting students' engagement in the classroom is a challenge since cultural factors, including "saving face," maintaining relationships, and deference to the lecturer, often contribute to a prevalent student passivity characterized by a reluctance to express personal viewpoints openly (Ha et al., 2019).

Besides, online and offline learning activities are about delivering the content to students and ensuring the students' responses (Merrill, 2013). In other words, students need to actively engage in the learning process to construct and strengthen knowledge and skills that meet the learning objectives. Student engagement is essential for learning outcomes in higher education (Boulton et al., 2019). Therefore, ensuring students actively engage in the learning process is crucial (Ridha, 2021). In the flipped classroom setting, students' satisfaction strongly predicts learning engagement (Yılmaz, 2022) It indicates that the more satisfied students are, the more engaged they are in learning. It is in line with Souksakhone et al., (2020) that the quality of the relationship between students and lecturers strongly predicts students' learning engagement. Students tend to consider engaging actively in the learning process if the lecturer provides opportunities to discuss with peers and ask freely to the lecturer. In other words, the lecturer's and peers' role in the learning process determines the quality of students' relationships. Furthermore, Wu et al., (2020) also revealed that intrinsic motivation has a relationship with self-efficacy, learning engagement, and performance. It shows that engagement is possibly associated with internal and external factors.

In this article, the researcher aims to investigate factors behind the students' learning engagement in flipped classroom settings. The review articles already published have explored the various effects of the flipped classroom, such as developing critical thinking skills through implementing a flipped classroom, based on articles in the Google Scholar, ResearchGate, EBSCO, and Emerald databases published between 2015-2020 (Nugraheni et al., 2022), trends in implementing flipped classrooms that are relevant to information systems theory based on articles in the IEEE, SAGE, Science Direct, ERIC, Springer, and Google Scholar databases published between 2014-2018 (Al-Emran et al., 2021), opportunities and challenges in implementing the flipped classroom in different fields of study based on research articles contained in the Google Scholar, NREL, Science Direct, and Web of Science databases which have been published from 2009 to 2018 (Al-Samarraie et al., 2020), advantages and challenges of implementing the flipped classroom based on research articles indexed in the ProQuest, Education Resources Information Center (ERIC), and SSCI databases in the period 1980 to 2016 (Akçayır & Akçayır, 2018), and effective flipped classroom features and how to design a flipped classroom to ensure students' active participation in learning based on articles published between 2012 to 2016 (Nguyen & Wang, 2017). However, articles that investigate the strategy to ensure students' learning engagement and factors that hinder students' learning engagement in flipped classrooms are still limited, especially in higher education settings. Therefore, this review answers the research objectives and contributes to learning using flipped classrooms in higher education.

METHOD

The data used in this review came from recent studies that focus on the student's learning engagement in flipped classrooms. The articles that were published between 2018-2023 were systematically reviewed for the current investigation. Keywords such as "flipped classroom and

learning engagement", "inverted classroom and learning engagement", "flipped classroom and student engagement", "inverted classroom and student engagement", and "student learning engagement" were used in a thorough search of the database in Google Scholar. This systematic literature review used the review method developed by Kitchenman & Charters (2007) It has four steps: inclusion and exclusion criteria, article selection process, data coding and analysis, and quality assessment. In the first step, the researcher determined the inclusion and exclusion criteria.

Table 1. The Inclusion & Exclusion Criteria

No.	Inclusion Criteria	Exclusion Criteria
1	Must be a Journal Article or Conference Proceeding	Dissertation & Thesis are not Included
2	Must be an Article about Flipped Classrooms in Higher Education Settings	Review Articles and Book Chapters are Excluded
3	Must Describe or Explain the Strategy to Ensure Students' Engagement	Articles that only Mention the Effect of Flipped Classrooms Generally
4	Must Describe or Explain the Factors that Help Ensure Student Engagement.	Articles about Flipped Classrooms other than Higher Education are not Included.

In the second step, the researcher conducted an article selection process. It is conducted based on the "Preferred Reporting Items for Systematic Reviews & Meta-Analysis (PRISMA)".

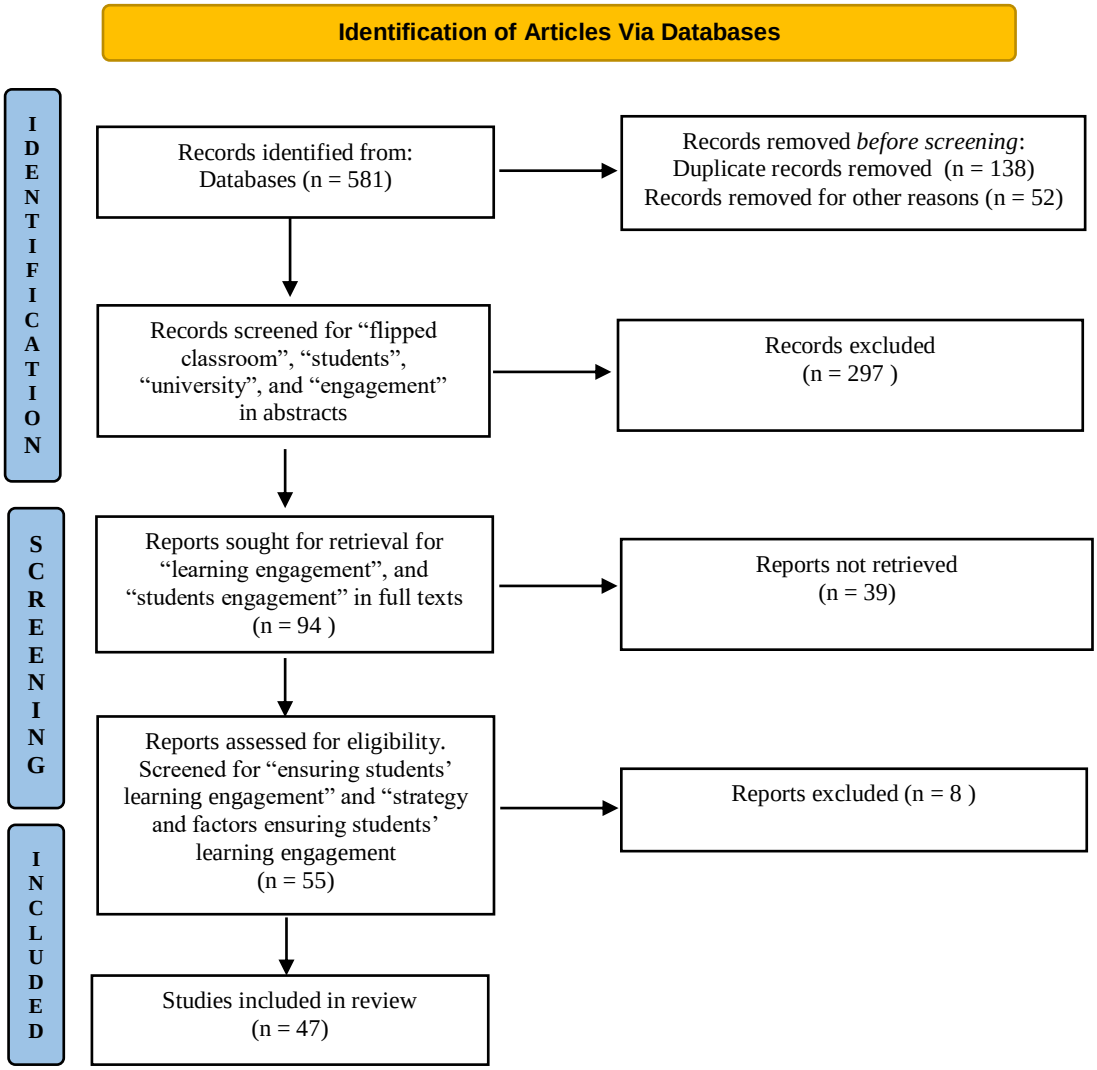

Figure 1. PRISMA Flowchart for Article Selection Process

The third step is coding and analyzing the data. Six features related to the quality of the research methodology were coded, including 1) research objectives, 2) flipped classroom design, 3) method, 4) participant, 5) the result, and 5) discussion. In the last step, the researcher measured the weight of the articles to ensure the quality and enhance the interpretation of the findings. Instruments used in assessing the quality of this article using a series of list questions include 1) clarity of research objectives; 2) clarity of the flipped classroom implementation; 3) clarity of the research methods and data collector; 4) clarity on the number of research participants; 5) completeness of the research result; and 6) clarity of analysis of research results. Each question is graded using a three-point scale, where "Yes" is worth 1 point, "No" is worth 0 points, and "Partially" is worth 0.5 points.

Table 2. The Quality Assessment Results

No.	Articles	Q1	Q2	Q3	Q4	Q5	Q6	Total
1	Article -1	1	1	1	1	1	1	6
2	Article - 2	1	0.5	1	1	1	1	5.5
3	Article - 3	1	1	1	1	1	1	5
4	Article - 4	1	1	1	0.5	1	1	5,5
5	Article - 5	1	1	1	1	1	1	6
6	Article - 6	1	0.5	0.5	1	1	1	5
7	Article - 7	1	1	1	1	1	1	6
8	Article - 8	1	0.5	1	1	1	1	5.5
9	Article - 9	1	1	1	1	1	1	6
10	Article - 10	1	0.5	1	0.5	1	1	5
11	Article - 11	1	1	1	1	1	1	6
12	Article - 12	1	0.5	1	1	1	0.5	5
13	Article - 13	1	1	1	1	1	1	6
14	Article - 14	1	0.5	1	1	1	1	5.5
15	Article - 15	1	1	1	1	1	1	6
16	Article - 16	1	1	1	1	1	1	1
17	Article - 17	1	1	1	1	1	1	1
18	Article - 18	1	1	1	1	1	1	1
19	Article - 19	1	1	1	1	1	1	1
20	Article - 20	1	1	1	1	1	1	1
21	Article - 21	1	1	1	1	1	1	1
22	Article - 22	1	1	1	1	1	1	1
23	Article - 23	1	1	0.5	1	0.5	1	5
24	Article - 24	1	1	1	1	1	1	6
25	Article - 25	1	1	1	1	1	1	6
26	Article - 26	1	1	1	1	1	1	6
27	Article - 27	1	1	1	1	1	1	6
28	Article - 28	1	1	1	1	1	1	6
29	Article - 29	1	1	1	1	1	1	6
30	Article - 30	1	1	1	1	1	1	6
31	Article - 31	1	0.5	1	1	1	1	5.5
32	Article - 32	1	1	1	1	1	1	1
33	Article - 33	1	1	1	1	1	1	1
34	Article - 34	1	1	1	1	1	1	1
35	Article - 35	1	1	1	1	1	1	1
36	Article - 36	1	1	1	1	1	1	1
37	Article - 37	1	0.5	1	1	1	1	5.5
38	Article - 38	1	0.5	1	1	1	1	5.5
39	Article - 39	1	1	1	1	1	1	6
40	Article - 40	1	1	1	0.5	1	1	5.5
41	Article - 41	1	1	1	1	1	1	6
42	Article - 42	1	1	1	1	1	1	6
43	Article - 43	1	1	1	0.5	1	1	5.5
44	Article - 44	1	1	1	1	1	1	1
45	Article - 45	1	1	1	1	1	1	1

No.	Articles	Q1	Q2	Q3	Q4	Q5	Q6	Total
46	Article - 46	1	1	1	1	0.5	1	5.5
47	Article - 47	1	1	1	1	1	1	6

In short, all the articles (n = 47) are eligible to be used for further analysis.

RESULTS AND DISCUSSION

Results

Out of the total number (N = 581) of articles collected for the analysis, it seems that only several articles (N = 47) have met the criteria.

Table 3. Articles for Systematic Literature Review

No.	Author & Year	Title of Articles	Journal Ranks	Outcome Summary
1	Kay et al., (2019)	A Comparison of Lecture-Based, Active, and Flipped Classroom Teaching Approaches in Higher Education	Scopus Q1	Active Learning was Better than Lectures in Fostering Teaching, Social, and Cognitive Presence. Besides, Social Presence is Significantly Higher for the Active and Flipped Classroom.
2	Lai et al., (2021)	A Multilevel Investigation of Factors Influencing University Students' Behavioral Engagement in Flipped Classrooms	Scopus Q1	Autonomous and Controlled Motivation, Perceived Self-Efficacy, and Instructor Competence Influenced Student Engagement.
3	Steen-Utheim & Foldnes (2018)	A Qualitative Investigation of Student Engagement in a Flipped Classroom	Scopus Q1	Students Reported Enhanced Learning Experiences and Increased Engagement Within the Flipped Classroom Model.
4	Hussain et al., (2020)	A Quasi-Qualitative Analysis of Flipped Classroom Implementation in an Engineering Course: from Theory to Practice	Scopus Q1	The Flipped Classroom Improved Academic Performance and Enhanced Student Engagement with Peers and Instructors.
5	Chen et al., (2019)	A Reflective Thinking-Promoting Approach to Enhancing Graduate Students' Flipped Learning Engagement, Participation Behaviors, Reflective Thinking, and Project Learning Outcomes	Scopus Q1	The Proposed Approach Significantly Improved Students' Learning Design Project Outcomes and Reflective Thinking Abilities. It also Enhanced Student Engagement and Participation.
6	Yilmaz (2022)	An Investigation into the Role of Course Satisfaction on Students' Engagement and Motivation in a Mobile-Assisted Learning Management System Flipped Classroom	Scopus Q1	Student Satisfaction in a Mobile-Based Flipped Classroom was Correlated with Levels of Engagement and Motivation Exhibited During Academic Tasks.
7	Tomas et al., (2019)	Are First-year Students Ready for a Flipped Classroom? A Case for a Flipped Learning Continuum	Scopus Q1	Students Reported High Levels of Engagement with the Video Content and Perceived it as Beneficial to their Learning.

No.	Author & Year	Title of Articles	Journal Ranks	Outcome Summary
8	He (2020)	Construction of a "Three-stage Asynchronous" Instructional Mode of Blended Flipped Classroom based on a Mobile Learning Platform	Scopus Q1	It Enhanced Academic Performance, Learner Autonomy, Cultivation of Collaborative Inquiry, Increased Learning Enthusiasm, Improved Classroom Engagement, Disciplined Attendance, and Strengthened Self-Efficacy.
9	Czaplinski & Fielding (2020)	Developing a Contextualized Blended Learning Framework to Enhance Medical Physics Student Learning and Engagement	Scopus Q1	Analysis of Survey Data Revealed an Overall Increase in Student Engagement with Learning Activities and Content.
10	Yoon et al., (2021)	Designing Supports for Promoting Self-Regulated Learning in the Flipped Classroom	Scopus Q1	The Experimental Group Demonstrated Significantly Higher Self-Regulated Learning Skills, Pre-Class Behavioral Engagement, in-Class Cognitive Engagement, and Overall Emotional Engagement than the Control Group.
11	Xu et al., (2021)	Effects of the Flipped Classroom Model on Student Performance and Interaction with a peer-coach Strategy	Scopus Q2	The Findings Revealed Improved Student Engagement and Out-of-Class Interaction Through Peer Coaching. There was also an Expanded Network of Interaction and Engagement with Tutors, Group Members, and Peers from other Groups.
12	Yu & Gao (2022)	Effects of Video Length on a Flipped English Classroom	Scopus Q1	The Shorter Video Durations in Group A yielded Superior Outcomes to Longer Videos in Groups B And C Regarding English Proficiency, Student Engagement, and Overall Satisfaction within the Flipped.
13	Pasaribu & Wulandari (2021)	EFL Teacher Candidates' Engagement in Mobile-Assisted Flipped Classroom	Scopus Q2	The Results Demonstrated that the Flipped Course Model Fostered Enhanced Emotional, Behavioral, Cognitive, Social, and Affective Engagement Among Learners.
14	Howell (2021)	Engaging Students in Education for Sustainable Development: The Benefits of Active Learning, Reflective Practices and Flipped Classroom Pedagogies	Scopus Q1	Over 90% of Respondents Concurred that in-Class Active Learning Exercises Enhanced Engagement and Retention of Course Material Compared to Traditional Methods.

No.	Author & Year	Title of Articles	Journal Ranks	Outcome Summary
15	Fang et al., (2022)	Exploring Student Engagement in Fully Flipped Classroom Pedagogy: Case of an Australian Business Undergraduate Degree	Scopus Q2	The Results Revealed Factors Influencing Student Engagement, Explicitly Focusing on Self-Efficacy, Emotional State, Well-Being, and a Sense of Belonging.
16	Malik et al., (2018)	Exploring the Relationship Between Student Engagement and New Pedagogical Approaches	Int. Journal	The Flipped Approach Positively Impacted Students' Physical and Cognitive Engagement. However, no Significant Improvement was Observed in their Emotional Engagement.
17	Ng & Lo (2022)	Flipped Classroom and Gamification Approach: Its Impact on Performance and Academic Commitment to Sustainable Learning in Education	Scopus Q1	The Gamification in Traditional Classrooms Positively Impacted Learner Achievement, while Gamified Flipped Classrooms Fostered Enhanced Learner Engagement.
18	Bates & Ludwig (2020)	Flipped Classroom in a Therapeutic Modality Course: Students' Perspective	Scopus Q1	Students Perceived the Flipped Classroom as a Valuable Pedagogical Approach Fostering Active Participation and Enhanced Preparedness for in-Class.
19	Antonis et al., (2023)	Flipped Classroom with Team-based Learning in Emergency Higher Education: Methodology and Results	Scopus Q1	The Flipped Classroom Augmented Student Engagement with Course Materials and Improved Academic Performance.
20	Rajaram (2019)	Flipped Classrooms: Providing a Scaffolding Support System with Real-time Learning Interventions	Int. Journal	Most Students Reported a Positive Learning Experience. The Design Effectively Enhanced Student Engagement Fostered Collaborative Learning and Cultivated Higher Levels of Critical Thinking.
21	Lee & Wallace (2018)	Flipped Learning in the English as a Foreign Language Classroom: Outcomes and Perceptions	Scopus Q1	Results Indicate that Students in the Flipped Classroom Demonstrated Significantly Higher Average Scores on the Final Three Assessments. Also, the Instructor Observed Heightened Levels of Student Engagement in the Flipped Class.
22	Loveys & Riggs (2019)	Flipping the Laboratory: Improving Student Engagement and Learning Outcomes in Second-Year Science Courses	Scopus Q1	Pre-Laboratory Activities Effectively Bridge the Theoretical and Practical Aspects of the Course (65%) and Enhance Overall

No.	Author & Year	Title of Articles	Journal Ranks	Outcome Summary
				Student Engagement with the Course Material (79%).
23	Durrani et al., (2022)	Gamified Flipped Classroom versus Traditional Classroom Learning: Which Approach is More Efficient in Business Education?	Scopus Q1	The GFC Demonstrated Greater Efficiency than the Traditional in Terms of Technique Complexity, Task Focus, Student Engagement, Satisfaction, Knowledge Acquisition, and Motivation.
24	Ho (2020)	Gamifying the Flipped Classroom: How to Motivate Chinese ESL Learners?	Scopus Q1	The Students Perceived the Group-Based Game Task as more Effective than the Group Discussion Task. This Fosters a Positive Classroom Environment and Encourages Students to Practice English.
25	Borit & Stangvaltaite -Mouhat (2020)	GoDental! Enhancing Flipped Classroom Experience with Game-based Learning	Scopus Q1	Most Students (97%) Reported a Positive Experience with the Game-Based Learning Flipped Classroom, Significantly Enhancing Student Engagement, Motivation, Social Integration, and Concentration.
26	Sammel et al., (2018)	Hidden Expectations Behind the Promise of the Flipped Classroom	Scopus Q3	Most Participants Expressed Satisfaction with Learning Outcomes and Reported Positive Experiences with the Online Video. However, Compliance with the Mandatory Viewing Requirement of Eight Weekly Videos was Inconsistent.
27	Lewis-Kipkulei et al., (2021)	Increasing Student Engagement via a Combined Roundtable Discussion and Flipped Classroom Curriculum Model in an OT and Special Education Classroom	Scopus Q2	The Findings Indicate that the Combined Roundtable Discussion and Flipped Classroom Curriculum Model Positively Influenced Student Engagement and Participation.
28	Abdullah et al., (2019)	Investigating the Effects of the Flipped Classroom Model on Omani EFL Learners' Motivation Level in English Speaking Performance	Scopus Q1	The Flipped Classroom Model Fostered a Creative, Engaging, and Motivating Atmosphere within the EFL-Speaking Classroom.
29	Alebrahim & Ku (2020)	Perceptions of Student Engagement in the Flipped Classroom: A Case Study	Scopus Q2	Findings Revealed a Spectrum of Opinions Regarding Flipped Classroom Implementation, Influenced by Factors such as Student Engagement and Classroom Environment. Student Participants also

No.	Author & Year	Title of Articles	Journal Ranks	Outcome Summary
				Expressed Enthusiasm for the Model's Challenging Nature.
30	Gu et al., (2022)	Promoting Pre-service Teacher Students' Learning Engagement: Design-Based Research in a Flipped Classroom	Scopus Q2	Findings Revealed a Significant Enhancement in Students' Behavioral, Cognitive, and Emotional Engagement Following Three Rounds of Interactive Experimentation.
31	Ling et al., (2019)	Promoting Student Engagement Using Flipped Classroom in Large Introductory Financial Accounting Class	Scopus Non-Q	The Study Demonstrated a Positive Correlation Between the Flipped Classroom and Enhanced Student Engagement. Specifically, the Model Facilitated Improved Comprehension and Fostered more Interactive Discussions.
32	Zain & Sailin (2020)	Students' Experience with Flipped Learning Approach in Higher Education	Scopus Non-Q	The Findings Identified Critical Components of Student Engagement within the Flipped Learning Approach: Enjoyment of the Learning Process, Active Participation, Collaborative Learning, and the Effective Integration of Technology.
33	Pan & Mow (2023)	Study on the Impact of Gamified Teaching Using Mobile Technology on College Students' Learning Engagement	Scopus Non-Q	The Study Revealed a Significant Improvement in Test Scores and Indicated Significant Differences in Behavioral, Cognitive, and Emotional Learning Engagement Between the Experimental and Control Groups.
34	Talan & Selvinc (2019)	The Effect of a Flipped Classroom on Students' Achievements, Academic Engagement, and Satisfaction Levels	Scopus Q2	The Experimental Groups Exhibited Significantly Higher Academic Achievement and Engagement than the Control Group. Students also Expressed Overall Satisfaction with the Flipped Classroom.
35	Ruiz (2021)	The Effect of Integrating Kahoot! and Peer Instruction in the Spanish Flipped Classroom: The Student Perspective	Scopus Q1	The Students Perceived Kahoot! as a Valuable Tool for Enhancing Engagement And Motivation, Facilitating Improved Comprehension, and Cultivating a Positive Learning Environment.
36	Elmaadaway (2018)	The Effects of a Flipped Classroom Approach on Class Engagement and Skill Performance in a	Scopus Q1	Findings Indicated Significantly Higher Levels of Activity and Engagement Among Participants in the

No.	Author & Year	Title of Articles	Journal Ranks	Outcome Summary
		Blackboard Course		Experimental Group Compared to the Control Group.
37	Doo & Bonk (2020)	The Effects of Self-Efficacy, Self-Regulation, and Social Presence on Learning Engagement in a Large University Class u Using Flipped Learning	Scopus Q1	Self-Regulation Exerted a Direct Influence on both Social Presence and Learning Engagement.
38	Hava (2021)	The Effects of the Flipped Classroom on Deep Learning Strategies and Engagement at the Undergraduate Level	Scopus Q3	The Study Findings Demonstrated that the Flipped Classroom is Better than the Traditional One in Facilitating the Utilization of Deep Learning Strategies, Enhancing Cognitive and Emotional Engagement.
39	Jung et al., (2022)	The Effects of the Regulated Learning-Supported Flipped Classroom on Student Performance.	Scopus Q1	The Study Revealed a Significant Positive Correlation Between the Flipped Classroom Model and Regulatory Guidance. However, no Evidence was Found in Pre-Class Activity Engagement.
40	Khan & Watson (2018)	The Flipped Classroom with Tutor Support: An Experience in a Level One Statistics Unit	Scopus Q2	The Flipped Classroom Approach Yielded Improved Student Performance, a Deeper Understanding of Course Concepts, and Increased Learner Engagement.
41	Smiderle et al., (2020)	The Impact of Gamification on Students' Learning, Engagement, and Behavior based on their Personality Traits	Scopus Q1	Introverted Students Demonstrated Higher Levels Of Engagement with the Gamified Version than their Extroverted Counterparts.
42	Guo (2019)	The Use of an Extended-Flipped Classroom Model in Improving Students' Learning in an Undergraduate Course	Scopus Q1	The Model Enhanced Students' Perceptions of Teaching Quality, and Peer Interaction, Facilitated the Development of Generic Skills, and Improved Performance
43	Su Ping et al., (2020)	Tracing EFL Students' Flipped Classroom Journey in a Writing Class: Lessons from Malaysia	Scopus Q1	Most Students Reported Positive Experiences with the Flipped Classroom Model.
44	Burkhart et al., (2020)	Undergraduate Students Experience of Nutrition Education Using the Flipped Classroom Approach: A Descriptive Cohort Study	Scopus Q2	Most Students Reported High Levels of Engagement, with Half Indicating Greater Engagement in the Flipped Classroom Approach (FCA) Compared to Traditional Courses.

No.	Author & Year	Title of Articles	Journal Ranks	Outcome Summary
45	Li & Li (2022)	Using the Flipped Classroom to Promote Learner Engagement for the Sustainable Development of Language Skills: A Mixed-Methods Study	Scopus Q1	Students in the Flipped Classroom Condition Exhibited Significantly Higher Mean Scores on Post-Test Engagement Measures Across Behavioral, Emotional, Cognitive, and Social Dimensions than their Traditional Classroom Counterparts.
46	Iswandari (2022)	A Student Engagement in a Virtual Class by Flip Learning Application	Sinta 5	The Study Found Evidence of Learner Engagement, with the Role of Professional Educators Emerging as the Most Influential Factor Among the Four Core Components of the Flipped Learning Framework.
47	Nissa et al., (2023)	Flipped Classroom Method and Collaborative Writing Via Google Documents to Improve Students' Participation and Writing Performance in Higher Education	Sinta 3	Findings Indicate a Significant Positive Impact on Students' Writing Quality and Enhanced Student Engagement.

Discussion

Learning engagement is defined as the intensity of involvement and active participation in the learning process (Cole & Chan, 1994). In the flipped classroom settings, it includes pre-class, in-class, and after-class activities. It is not only about attending learning activities but rather being engaged in a series of activities (Chakraborty & Nafukho, 2014). In addition, Dixson (2015) stated that learning engagement is about the time and energy students use to achieve learning objectives and how students enjoy the learning process. In other words, learning engagement is a crucial factor in learning, especially in the flipped classroom setting. It determines perceived effectiveness and learning outcomes.

In this review, the researcher highlights strategies to ensure and enhance students' learning engagement in flipped classroom settings. Durrani et al., (2022) and Zain & Sailin (2020) found that students become more enthusiastic in class discussions when challenged to answer the quiz in gamification media such as Socrative or Kahoot at the end of the in-class session. Students also become more engaged (Ho, 2020) and more focused on construction knowledge and enhanced skills when learning through gamification (Howell, 2021). It seems that integrating game elements into learning activities makes the classroom atmosphere more interesting and joyful so the students be more engaged in learning activities (Borit & Stangvaltaite, 2020; Lo & Hew, 2019; Pan & Mow, 2023; Ruiz, 2021), especially extroverted students (Smiderle et al., 2020).

Besides that, students are more engaged in the learning process and encouraged to demonstrate their abilities when the lecturer and other students give them immediate feedback either in pre-class, in-class, or after-class sessions (Abdullah et al., 2019; He, 2020; Iswandari, 2022; Kay et al., 2019; Lai et al., 2021; Lee & Wallace, 2018; Li & Li, 2022; Su Ping et al., 2020; Talan & Selvinc, 2019; Yılmaz, 2022). It indicated that students feel comfortable and encouraged to confirm their understanding and ask for explanations when the lecturer guides and assists the students timely (Hava, 2021; He, 2020; Lai et al., 2021; Li & Li, 2022; Steen-Utheim & Foldnes, 2018) and confirm their understanding and skill demonstrated (Gu et al., 2022; Ruiz, 2021; Steen-

Utheim & Foldnes, 2018). Students also perceived meaningful learning when opportunities to ask questions and get assistance from the lecturer were available in the learning process (Antonis et al., 2023).

Previous researchers also confirmed that students' engagement enhanced when students were asked to learn in groups such as debate, discussion, and do assignments in groups (Guo, 2019; Lewis-Kipkulei et al., 2021; Ruiz, 2021). It seems that learning in groups gave students more opportunities to interact and collaborate with learning content and other students (Bates & Ludwig, 2020; Burkhart et al., 2020; Czaplinski & Fielding, 2020; Ho, 2020; Iswandari, 2022; Jung et al., 2022; Lee & Wallace, 2018), made the students feel more comfortable to ask questions, confirm understanding, express opinions and explanations to other students (Fang et al., 2022), and feel more comfortable delivering constructive comments for the assignments (Nissa et al., 2023). It is in line with Lo & Hew (2019) that some students preferred to ask for help from their peers rather than the lecturer. Moreover, related to technological aspects, students become more engaged in learning activities when the lecturer uses short and concise videos (less than 5 minutes) compared to longer videos (about 10 to 30 minutes) (Yu & Gao, 2022). Short and concise videos make students more focused on a topic and grab their interest to master the content (Yılmaz, 2022).

Flipped classroom as a hybrid learning needs a high level of students' autonomous learning. Doo & Bonk (2020) also highlights that students' level of self-regulation determines their social presence and engagement in learning. For instance, Tomas et al., (2019) reported that students admitted not having time or forgetting to access the videos delivered by the lecturer in pre-class sessions. Therefore, a self-regulated learning strategy can be used to ensure students' engagement. For instance, researchers confirmed that asking students to determine their learning objectives and create a summary of what he has learned, share it in a discussion forum to get immediate feedback from the lecturer and peers, ask students to watch videos and take quizzes, and provide access to the total scores obtained and several videos have been watched is effective in ensuring students' learning engagement (Jung et al., 2022; Yoon et al., 2021). In addition, pre-class session activities are the requirement for in-class activities in the flipped classroom setting. Students reported becoming more engaged in class sessions as if they had previously accessed the videos or learning material delivered in pre-class sessions (Ling et al., 2019; Su Ping et al., 2020). In other words, ensuring students access the content in pre-class sessions is crucial for their engagement. Previous researchers stated that students spent more time and effort in learning activities when the lecturer required them to access the videos in pre-class sessions (Antonis et al., 2023; Li & Li, 2022; Sammel et al., 2018), asked to write questions that related to the content, either for confirmation or explanation (Ling et al., 2019; Malik et al., 2018) and asked to give comments about the content (Elmaadaway, 2018). Therefore, given assignments such as reading or watching the learning content and answering a series of questions as guidance to master the content (Lewis-Kipkulei et al., 2021), making notes, summarizing, and creating several reflective questions are essential for students' learning engagement.

In this review, the researcher also highlights some obstacles in students' learning engagement. In the flipped classroom, delivering learning materials in the pre-class session is crucial for students. However, the format of the materials seems to determine the students' interest. Alebrahim & Ku (2020) and Malik (2018) reported that students tend not to read the materials in digital book format, which the lecturer delivered as supporting materials in video format. The students are also less motivated to engage in learning activities while grouped with the same students repeatedly. Moreover, students were also less motivated to engage and focus on learning activities when the learning material was delivered in long duration video format (Hava, 2021; Li & Li, 2022; Yu & Gao, 2022), and students tend to find it more boring than face to face learning (Lai et al., 2021).

Furthermore, students' habitual learning activities also determine their engagement in a flipped classroom. Sammel et al., (2018) revealed that students became less or did not participate actively in learning activities in the flipped classroom, such as watching videos or mastering the basic knowledge independently in pre-class activities. Lin et al., (2019) also reported that only 25% of the students watched the pre-recorded video lectures that were delivered in pre-class sessions, but when the lecturer asked students to present their reflection notes about the videos, the number

of students watching the video increased. In other words, students still maintain a habit of receiving lectures directly from the lecturer. It seems the students tend to find that the lecturer has the job, not the students so they have to teach and explain the materials to students. The last, the lecturer's communicative skills determine students' engagement. Lai et al., (2021) revealed that students are less engaged in learning activities when the quantity and quality of the communication between lecturer and students are limited. It seems related to the classroom atmosphere or the emotional relationship between lecturers and students. When lecturers are more interactive and proactive in asking students about what they understand or don't understand and offering help before they ask for help, it motivates them to be more active in learning activities.

CONCLUSION

The systematic review reveals that previous research found that gamification, immediate feedback, timely guidance and assistance, work in groups, scaffolding, peer-coaching, user-friendly technology, short videos, pre-class assignments, reflective thinking, self-regulated learning, and guided questions are effective in ensuring students learning engagement in higher education that using flipped classroom. Furthermore, it also reveals that supported learning material, working in groups with the same people, low level of self-regulation, long and low-quality videos, repeating the same activity, and students' perception towards the role of the lecturer in the learning process and interaction can decrease students' interest to engage in the learning process. Additionally, the systematic review of the literature suggests that lecturers should ensure students' learning needs are met, creating an atmosphere that encourages students' engagement either in pre-class, in-class, or after-class, and using user-friendly digital technology. Further research is encouraged to extend this study by eliminating the restriction in higher education settings and focusing more on engagement in specific terms, including cognitive, emotional, and behavioral engagement.

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Development of innovative behaviors Android application and website for teachers using the waterfall method

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ABSTRACT

This research explores the pivotal role of innovation in education, particularly in response to the COVID-19 pandemic. It focuses on developing the Guru Inovatif Android app and website to enhance educators' innovative teaching practices. These platforms feature a survey to assess innovation levels and training modules to develop innovative skills, aiming to revolutionize teaching methodologies. (In this research, the waterfall methodology is employed, which is used to develop software from start to finish. This model involves a sequential design process, where progress flows in one direction through phases such as requirements, design, implementation, verification, and maintenance. It is utilized to create both an Android-based application and a Laravel-based website.) Testing involved 109 teachers from various educational levels across six regions in Java. Data were collected via a structured Likert-scale survey and analyzed for usability and satisfaction. Results indicated high user-friendliness (4.43) and satisfaction (4.28) but highlighted the need for design consistency (2.37) and error reduction (2.27). By addressing these issues, the Guru Inovatif platforms can better support educators in adopting innovative teaching practices.

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INTRODUCTION

Innovation is one of the keys to supporting people in their work and moving forward to improve their work subjects. Innovation can give opportunities essential to the success and growth of the people and their company so they can survive (Zainal & Matore, 2019). In the education industry, COVID-19 has had a lot of impact on schools and made them close (Scull et al., 2020). Karim et al., 2022 and Paragae, 2023 identified in this study lies in the limited implementation and recognition of online learning in developing countries, despite its potential benefits. While the COVID-19 pandemic accelerated the adoption of e-learning, significant challenges remain, such as inadequate facilities, lack of essential technology, and insufficient skills among teachers and students. The study highlights the need for targeted interventions, such as integrating Information Communication Technology (ICT) modules, offering intensive teacher training courses, and improving educational facilities. Addressing these gaps could enhance the effectiveness of online learning and support its broader adoption in developing regions. This situation improves the school's performance in delivering material or teaching more effectively and efficiently. Teachers must

improve themselves to make their teaching skills more effective and efficient by enhancing and implementing innovative behavior in their teaching. Innovative behavior can generate new ideas, new ways of communicating, and motivation for the students and teachers (Kurniawan et al., 2022; Rahmawati & Kurniawan, 2021; Wiranto, 2020).

With the use of technology, people have been improving their skills. With the help of applications, it makes everything easier. Technology has been used by many industries like government, hospitals, clinics, and even schools (Rijanandi et al., 2022). Technology, especially applications, was used to improve the quality of everything like tracking progress, quality control, health problems, information systems, and even for study (Herdiansah et al., 2021; Rijanandi et al., 2022; Sholichin, 2021; Tanuwijaya, 2018). Application in this context is desktop, mobile, and website applications. But for efficiency, websites and mobile applications are widely used by people. For example, many applications are designed for delivering teaching in schools, learning languages, and much more (Fakhruddin et al., 2024; Khair et al., 2023; Sulistyaningtyas et al., 2024; Wulandari & Ratnawati, 2024). They have a great impact on users by helping them learn more about the topics they are interested in, and they can be easily accessed at any time.

Many researchers have been making applications to improve education (Atmaja et al., 2022; Ghani et al., 2019; Nuantra et al., 2022; Ruhiawati et al., 2021). For example, game application for preschool from this research (Atmaja et al., 2022). This application helps students learn about Arithmetic by using storytelling and cartoon visuals. The game is deployed for mobile and desktop. This research shows that 4.79 out of 5 prove that this application was practical for entertainment and education. Other research is the application for library information system websites (Maryati et al., 2022). The System Usability Scale (SUS) was used to evaluate the website's performance, with a score of 57.12 showing low usability and needing revitalization. While the Android application offers useful tools for managing academic and campus activities, improvements are needed, particularly in bus tracking. Enhancing these features and integrating tools that support educational innovation could further aid teachers in adopting new teaching strategies. This would not only streamline campus life for students but also foster a more dynamic and supportive environment for both students and educators (Hossain et al., 2023). However, based on the referenced research, there is still no application focused on developing and training the innovation levels of teachers. Teachers play a crucial role in imparting knowledge to students and are expected to have a high level of innovation in their teaching methods to ensure that the material is delivered effectively and engagingly.

This paper focuses on making an Android application (Iskandar et al., 2023; Susanto et al., 2023) and a website to train teachers' innovative behavior (Najaf et al., 2023; Setyawan et al., 2023). Teachers can access the material by creating two versions of the apps to learn more about innovative behavior from their laptops or smartphones. Application Programming Interface (API) can integrate the Android application and website data, so teachers don't have to make multiple accounts. These apps have two main features: the survey function to measure the innovative behaviors of the teachers and the training material to improve innovative behavior. Highlighting the impact of COVID-19 on education, the need for teacher innovation, and the challenges in integrating technology, this research introduces a novel dual-platform approach to teacher training. The usability issues of existing applications are addressed by ensuring seamless data synchronization and providing flexible access to training materials. This contributes to the educational field by offering a practical solution to enhance teachers' innovative behavior through technology, ultimately improving educational outcomes.

METHOD

A Systems Development Life Cycle (SDLC) was used to develop this application in this research. SDLC has a lot of models that can be used. So, to adjust the current development, the researcher used the Waterfall model in SDLC (Engel et al., 2021; Rijanandi et al., 2022; Sholichin, 2021; Tanuwijaya, 2018). This waterfall model is a sequential linear model in which apps will be developed step by step from analysis, designing, implementing, testing, and maintenance, as shown in Figure 1. Each step in the waterfall model is going to be discussed below:

Requirement Analysts

The process of gathering the requirements for developing educational apps was comprehensive and aimed at harnessing educators' valuable insights and experiences. This endeavor was carried out using a Google Form survey and the invaluable input obtained during focused group discussions with 127 teachers from six private schools on the picturesque Java Island. These private schools encompassed diverse educational levels catering to elementary, junior high, and senior high school students. The participating teachers represented a wide age range from 24 to 59 years old (Kurniawan et al., 2022; Rahmawati & Kurniawan, 2021). Regarding their professional experience within the educational system, their service periods ranged from a minimum of 2 years to an impressive 36 years of dedicated teaching.

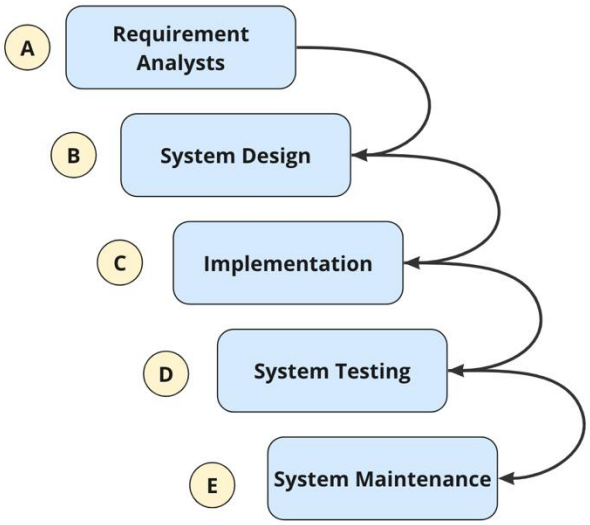

Figure 1. Systems Development Life Cycle (SDLC) Waterfall Model

The focus group discussions were conducted with great care and attention to detail. They commenced with an informative session that underscored the importance of fostering innovative behavior within the teaching community. This introductory segment served as a platform for participants to understand the significance of innovation in the educational realm.

Following this, a dynamic question and answer session was held, during which participants engaged in lively discussions about innovative behavior. This interactive dialogue allowed teachers to share their personal experiences, insights, and challenges in integrating innovative practices into their teaching methodologies.

These enlightening discussions culminated in comprehensively exploring the specific features and functionalities essential for developing educational apps. Through this collaborative process, teachers identified and prioritized the key elements that would empower them to enhance their teaching methods and make learning more engaging and effective for their students.

System Design

In this phase of the Software Development Life Cycle (SDLC), the focus is on designing the system for an upcoming application. The researcher uses insights from previous analyses to create a comprehensive blueprint for the application's architecture. This includes defining client and server specifications to ensure seamless communication and performance alignment with project objectives. Additionally, the selection of a programming library is carefully considered, considering factors like compatibility and scalability. Alongside these decisions, the researcher creates essential visual components such as system diagrams, use case diagrams, database diagrams, and user interface mock-ups. These elements provide a clear representation of the application's architecture, functionality, and user interactions, setting the stage for subsequent development stages.

Implementation

The subsequent phase within the Software Development Life Cycle (SDLC) is the crucial implementation stage. During this pivotal phase, the development process transitions from planning and design to the actual construction of the software application. To achieve this, distinct technologies are leveraged for different aspects of the project. Specifically, for mobile application development, the development team harnesses the capabilities of Android Studio, a robust and versatile integrated development environment (IDE). Android Studio empowers developers to create mobile applications tailored for the Android platform, offering a comprehensive suite of tools and resources to craft user-friendly and feature-rich applications. Simultaneously, for developing websites and creating APIs (Application Programming Interfaces), the development team embraces the Laravel framework. Laravel is a highly regarded PHP framework known for its efficiency and adaptability in building web-based solutions and robust APIs. By adhering to the Model-View-Controller (MVC) architectural pattern, Laravel provides developers with a structured and organized framework for systematically developing dynamic web applications and APIs. This approach ensures adherence to industry best practices, scalability, and maintainability throughout development.

Furthermore, a commitment to effective system design principles is integrated into this implementation phase. This encompasses applying fundamental concepts such as the Model-View-Controller (MVC) architectural pattern, which ensures a clear separation of concerns within the application's structure. Additionally, essential design artifacts like Entity-Relationship Diagrams (ERD) and mock-ups are diligently incorporated into the application and website development processes. ERDs help define the data structure and relationships, while mock-ups provide visual representations of the user interface, aiding in user experience design. These design principles and artifacts collectively create a well-structured, user-friendly, and functional software product that aligns precisely with predefined specifications and objectives. The successful execution of the implementation phase sets the stage for a software application and website that not only meets but surpasses the expectations and requirements of its intended users, offering a valuable and dependable technological solution in today's dynamic digital landscape.

System Testing

Within the Software Development Life Cycle (SDLC), the testing phase is paramount in ensuring the application and website's quality and usability. During this critical phase, the developed software components undergo rigorous testing protocols, emphasizing user experience (UX) and user interface (UI) evaluations.

The testing process is initiated by engaging educators from various schools across six distinct regions within Java. These educators, hailing from elementary, junior high, and senior high schools, constitute the primary user base for the application. They are invited to actively participate in the testing process by interacting with the application and website, providing invaluable insights into the software's ease of use and overall usability. These educators are requested to offer candid feedback, drawing from their experiences while navigating the application. Their feedback is instrumental in assessing the interface's intuitiveness, identifying navigation complexities, and reporting errors or anomalies encountered during interactions shown in Table 1. Moreover, this comprehensive evaluation encompasses an in-depth examination of the software's UI and UX, ensuring that it aligns seamlessly with educators' diverse needs and expectations.

Table 1. Question for Testing

No.	Question
1	I Find the Application or Website Easy to Use.
2	I Feel that this Application Lacks Consistency in many Aspects (Colors, Fonts, or Wording).
3	I Find the Buttons in the Application Comfortable (not too High, Low, Close to the Edge, or in Size).
4	I Find the Appearance of each Page in the Application Comfortable.
5	I Find the Appearance of this Application Easy to Understand.
6	I Find the Use of Colors in the Application Appropriate.
7	I Find it Easy to Use the Survey Feature.

No.	Question
8	I Find it Easy to Understand the Results of my Survey.
9	I Find it Easy to Use the Training Feature.
10	I Find it Easy to Download Training Module Materials.
11	I Find it Easy to View Training Video Materials.
12	I Find it Easy to Upload Assignments Provided in the Application.
13	I am Satisfied with the Features Available in the Application.
14	I Feel confident in Operating the Application.
15	I Feel the Need to Learn more about Using the Application.
16	I Often Experience Errors while Operating the Application.
17	I Understand the Instructions Provided in the Application.

System Maintenance

After receiving input from schoolteachers, the system undergoes maintenance by the defined stages of the Software Development Life Cycle (SDLC). This phase entails a meticulous process of addressing identified issues, refining functionalities, and implementing necessary updates to enhance the system's performance, security, and usability. It is a critical component of the SDLC, ensuring that the software remains current, reliable, and aligned with the evolving needs of its users.

Maintenance activities encompass various aspects, including bug fixes, security enhancements, performance optimizations, and the incorporation of feature enhancements. These efforts are undertaken systematically, carefully considering the priorities established based on the feedback received from the schoolteachers. The ultimate objective of this phase is to sustain the system's effectiveness and longevity, ensuring it continues to serve as a valuable and dependable tool within the educational context.

RESULTS AND DISCUSSION

Results

In this section, we will delve into the results and discussion concerning the research on the Guru Inovatif application and website. Based on the research findings, it has been determined that the Android application's usage is more dominant than that of iOS. Consequently, to cater to users' needs across various platforms, the decision was made to develop the Guru Inovatif website, ensuring accessibility for all platforms. The discernible prevalence of Android users drove this strategic decision, underscoring the commitment to inclusivity and universality in providing access to the Guru Inovatif platform. By offering both the Android application and a dedicated website, we aim to accommodate users regardless of their chosen operating system, thus ensuring that the benefits and resources of the Guru Inovatif platform are accessible to the broadest possible audience.

Moreover, the development of the website not only expands the platform's reach and enhances user convenience and accessibility. It allows users to access the Innovative Teacher resources from various devices, including smartphones, tablets, and desktop computers. This adaptability further strengthens the platform's utility and relevance in today's diverse and dynamic educational landscape.

The Guru Inovatif application and website have been designed with identical features. The first feature is the survey, where users, specifically school teachers, can assess their level of innovativeness in teaching across seven indicators, as determined by the research titled "Teachers' Innovative Behaviors based on Stakeholder Expectations." The second feature is the training module, which provides materials to enhance proficiency in the seven indicators above. The training materials encompass PDF documents, instructional videos embedded from YouTube by the researchers, assignments, and a submission portal. This research-based feature has been developed as part of a specialized learning management system tailored to the specific needs of innovative educators. The uniformity of features between the application and website ensures a seamless user experience, irrespective of the platform chosen for access. This approach is deliberate, underscoring the commitment to providing consistent and comprehensive support to educators seeking to cultivate

innovative teaching practices. Furthermore, including a learning management system emphasizes the importance of structured and organized teacher training. It streamlines the learning process, making it more efficient and effective while providing a means for educators to track their progress and development over time.

The interface of the Innovative Teacher application and website is designed in a purple color scheme, with the color choice informed by the psychology of colors. The Android application's design is similar to that depicted in Figure 2, while the website, developed using Laravel, follows the design elements illustrated in Figure 3.

Figure 4 portrays the user interface dedicated to the survey feature, a vital tool that measures teachers' innovativeness levels when accessed through the website. This interface has been meticulously designed to provide educators with an engaging and intuitive experience. Using this feature, teachers can comprehensively self-assess their innovative teaching practices based on the research's seven indicators. On the other hand, Figure 5 showcases the Android application's counterpart to the survey feature. This mobile platform offers teachers the same valuable capability to gauge their innovativeness as they would on the website. The user interface design for the Android application mirrors the website's design philosophy, ensuring consistency and ease of use for educators, regardless of their chosen platform. For both the website and the application, the sequential layout consists of the following elements: on the left-hand side, there is the selection of indicators users wish to assess; in the middle, you can find the source of the questions and the results after answering; and on the right, there is the survey interface.

In Figure 6, you can observe the training interface, which includes a compilation of training materials, including modules and videos, as well as a submission feature for submitting assignments. It's worth noting that this submission feature is seamlessly interconnected between the website and the Android application, as illustrated in Figure 7. This integration streamlines the process for educators, allowing them to submit their assignments on either platform, with the assurance that the data is synchronized between the website and the Android application.

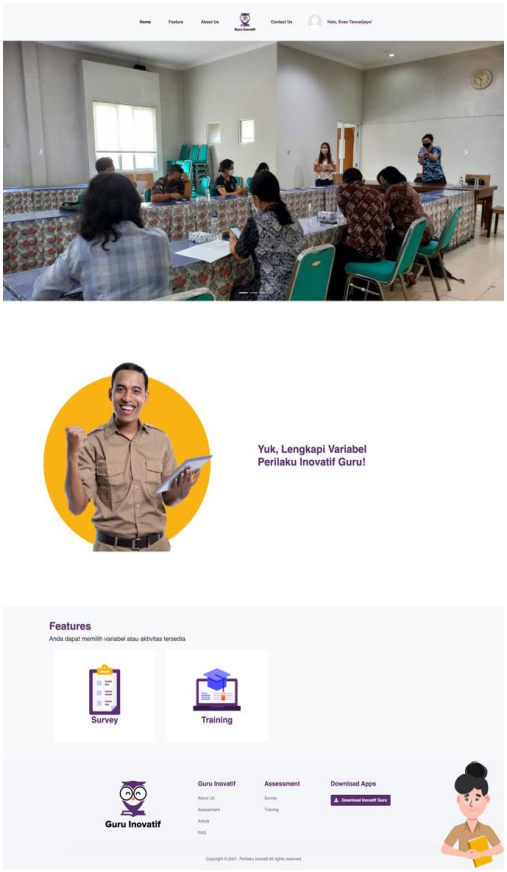

Figure 2. Guru Inovatif Website

Figure 3. Guru Inovatif Android Application

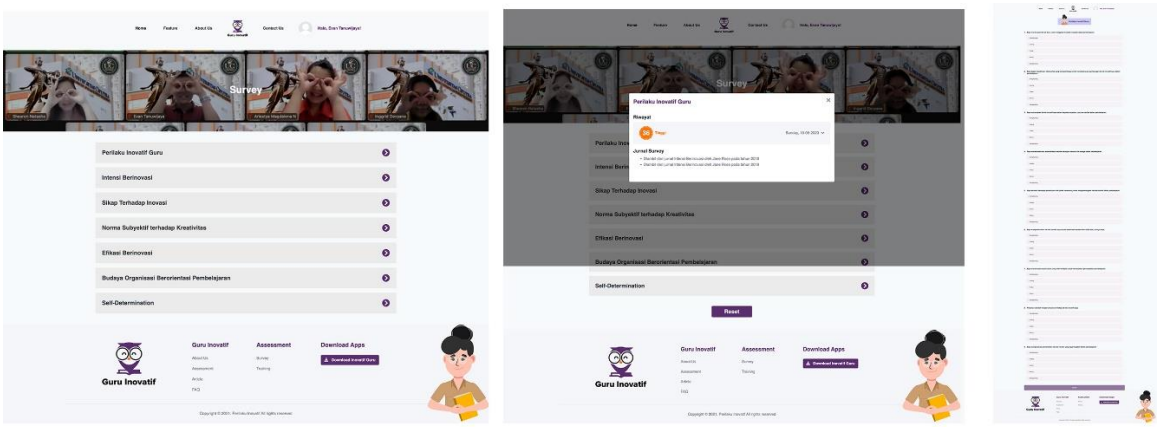

Figure 4. Survey Feature on the Website

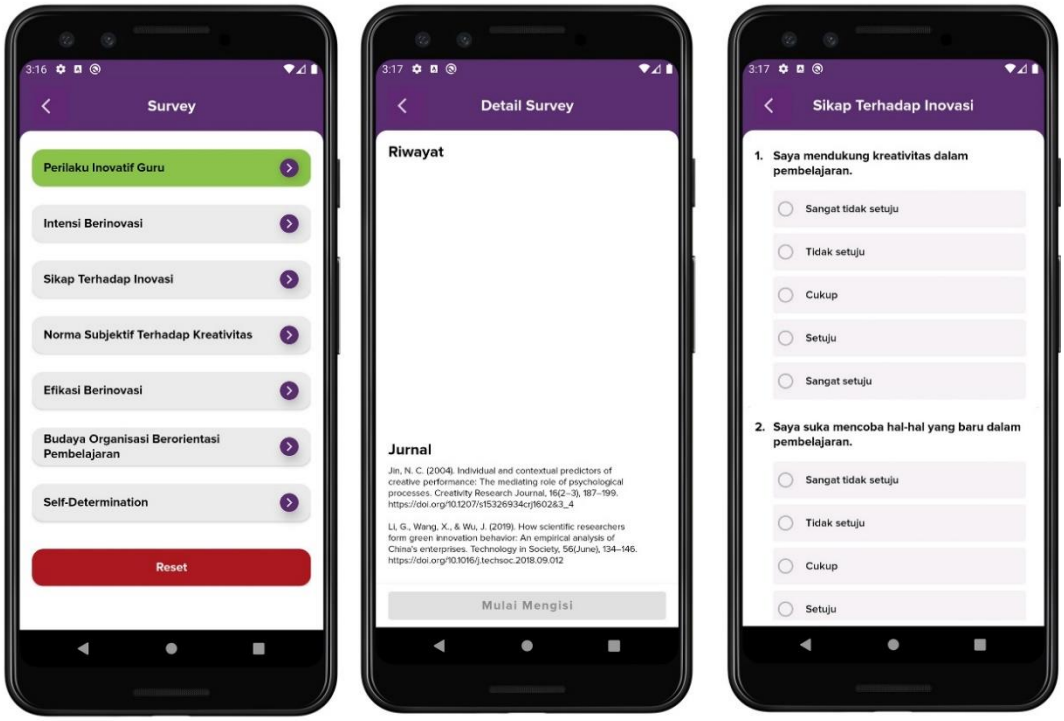

Figure 5. Survey Feature in Android Application

The system's backend utilizes Laravel API and an SQL database, as depicted in Figure 8. This robust combination of technologies ensures efficient and secure data handling and communication between the website and the Android application. Laravel API is the intermediary that facilitates seamless interactions between the frontend interfaces and the database, allowing for the retrieval and storage of user data, survey responses, training materials, and assignment submissions. The SQL database, on the other hand, provides a structured and reliable foundation for data storage and management, ensuring the integrity and accessibility of crucial information within the Guru Inovatif platform. Together, these backend components form a cohesive and dependable system that underpins the functionality and connectivity of the platform.

Upon completing the system development process, the application and website were tested by educators from six different regions across the island of Java. The testing process was executed through the systematic implementation of scenarios for each feature, followed by the solicitation of feedback from the teachers regarding their user experience while utilizing the features available on the application or website. The survey questions were thoughtfully designed with responses

structured using a Likert scale, ranging from 1, signifying "very poor," to 5, representing "excellent." Below, Table 1 presents the questions included in the survey.

The survey garnered responses from a total of 109 participants, consisting of teachers from various educational levels, including preschool, elementary, junior high, and senior high. Among these respondents, there were 29 male teachers and 80 female teachers. The average survey responses to the 17 questions are summarized in Figure 9. The survey results offer valuable insights into the reception and user experience of the Guru Inovatif application and website among educators. On the positive side, the high rating for ease of use (4.43) is a significant endorsement of the platform's user-friendliness. This suggests that it caters to educators with varying levels of technological proficiency and provides a smooth and accessible interface. However, a notable concern arises regarding consistency in elements such as colors, fonts, and wording, with an average rating of 2.37. This points to an area that requires immediate attention. Achieving consistency in design elements is pivotal for presenting a unified and professional appearance, and addressing these concerns could significantly enhance the overall aesthetics and user experience in Figure 6.

Furthermore, the favorable scores for button and page comfort (3.80 and 4.20) indicate that the platform's visual design and layout have been well-received. This is essential as it contributes to a comfortable and visually appealing interface, fostering a more engaging and productive user experience. Positive feedback regarding the ease of understanding the appearance (4.28) and the appropriate use of colors (4.28) underscores the platform's successful design choices, aligning with user expectations. The survey also highlights the effective usability of core features, including the survey, training, and assignment uploads, all receiving high average ratings above 4. This reflects a well-structured user interface that adeptly supports educators' practical needs. Additionally, high scores for satisfaction with available features (4.28) and confidence in operating the application (4.32) denote user contentment, indicating that the platform satisfactorily fulfills its intended role in Figure 7, Figure 8, and Figure 9.

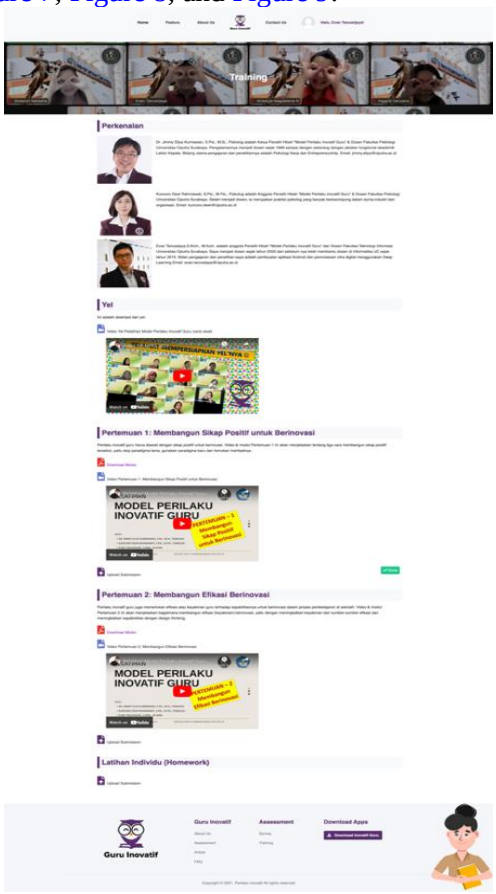

Figure 6. Training Feature on the Website

Figure 7. Training Feature in Android Application

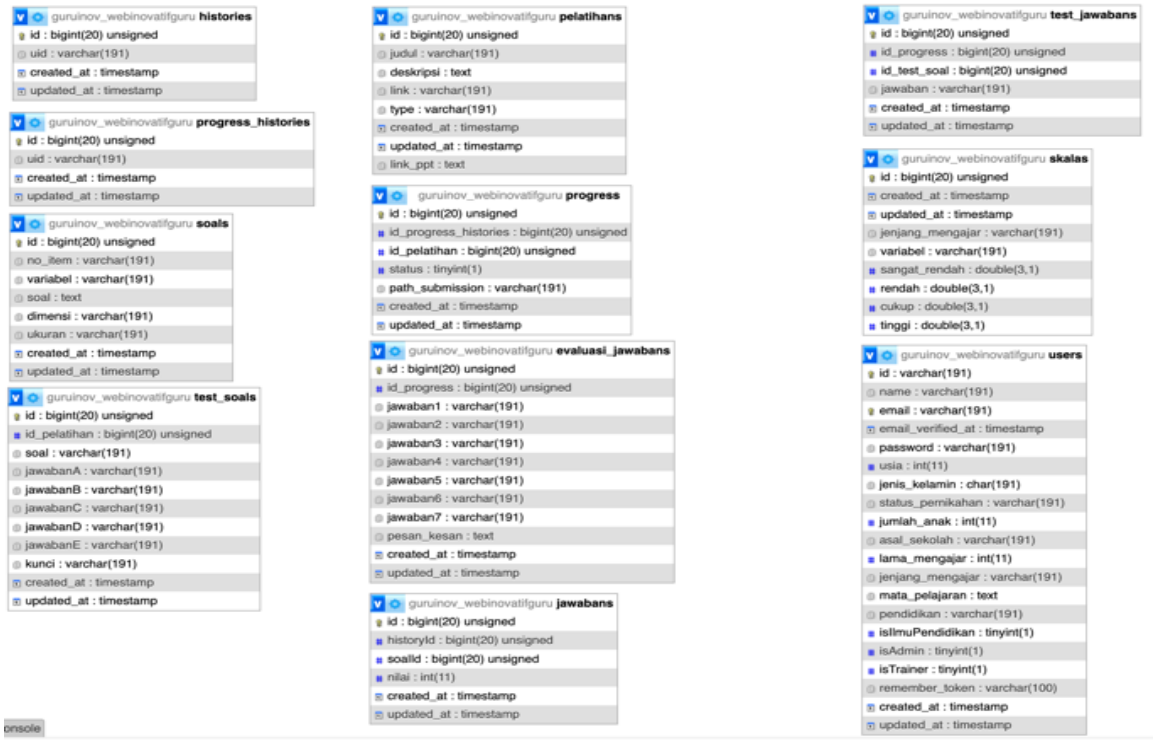

Figure 8. Database MySQL

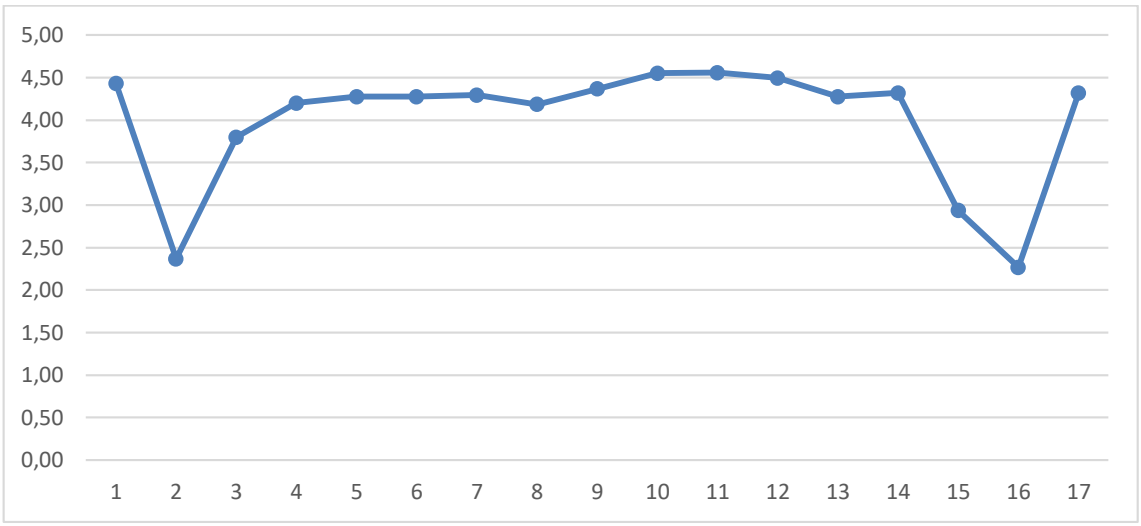

Figure 9. Average Result from Testing Survey

Nonetheless, areas of concern include the perceived need for additional learning (2.94) and reported errors during usage (2.27). These aspects may warrant attention to enhance the platform's usability and reliability. Lastly, the positive rating for understanding instructions (4.32) underscores the significance of clear and concise guidance for efficient usage.

Discussion

The application includes a feature that provides materials on how teachers can become more innovative, sourced from (Brockhus et al., 2014; Chapman & Dundas, 2018; Choi, 2004; Fernet et al., 2008; Janssen, 2000). It covers the influence of the environment and personal motivation on innovation, which is integrated into the material and assignments, including exercises and quizzes.

These can be completed through the application and submitted for direct assessment by psychologists. This feature aims to improve teacher innovation behavior by offering structured guidance, practical tasks, and personalized feedback. Based on the chart at point 13, it was found that teachers reported benefiting from the application, with a rating of 4.28 on a Likert scale of 5. This indicates that the exercises provided by the application are perceived as effective, impacting their learning process positively both before and after using the application.

Teacher innovative behavior is essential for enhancing student engagement and meeting diverse learning needs in the ever-evolving educational landscape. Innovative teachers are characterized by their openness to change, creativity, and willingness to take risks while continuously learning and collaborating with peers. This behavior fosters critical thinking and adapts to technological advances, making learning more engaging and effective. However, challenges such as resistance to change, limited resources, and the need for effective professional development can hinder innovation. To promote innovative behavior, schools should provide targeted professional development, encourage risk-taking, foster collaboration, invest in necessary resources, and recognize and reward innovation. By addressing these challenges and supporting innovative practices, educators can create more dynamic and responsive learning environments (Fakhruddin et al., 2024). For teachers, this underscores the importance of adopting innovative approaches to leverage technology effectively in the classroom. Teachers who embrace and incorporate trending digital tools and applications can potentially improve student learning behaviors by making educational content more engaging and relatable (Efendy et al., 2024). Underlining the importance of continuous improvement, practical application of new methods, and adaptability, ultimately aiming to enhance teacher effectiveness and student engagement in a dynamic educational environment (Sulistyaningtyas et al., 2024; Wulandari & Ratnawati, 2024).

Other factor is Leader expectations for creativity have little impact on teachers' innovative behavior because school management often aligns with a market orientation culture that prioritizes student and parent expectations. As a result, leader influence becomes ineffective when it merely reflects these consumer expectations. The study, limited to two private schools in Java, Indonesia, suggests that other factors like attitudes towards innovation also play a significant role and call for further research on broader populations (Kurniawan et al., 2022). To enhance teacher innovation capability, schools should foster an organizational culture that supports autonomy and extensive knowledge sharing, both tacit and explicit. Creating a positive environment boosts teacher competence and engagement, ensuring effective knowledge management. The research underscores that a strong organizational culture catalyzes knowledge sharing, which is essential for improving school performance and preparing students for the knowledge society. Teachers, as key facilitators of this process, play a critical role in equipping students for success in a knowledge-driven world (Asbari, 2024a, 2024b).

CONCLUSION

Innovation plays a crucial role in driving progress, particularly in the education sector, which has witnessed significant transformations due to events like the COVID-19 pandemic. As schools adapt to new teaching methods, teachers must embrace innovative behaviors to foster creativity and motivation. Technology, including applications, has become a powerful tool across various industries, including education. This paper focuses on developing an Android application and website to empower teachers by enhancing their innovative teaching behaviors. These platforms offer a comprehensive solution, featuring a survey to assess educators' innovation levels and training modules to develop their innovative skills further. This initiative aims to revolutionize teaching methods and provide educators with the tools they need to succeed in today's ever-changing educational landscape.

The Guru Inovatif application and website have been strategically designed to cater to users' diverse preferences, with a particular emphasis on Android users. This approach led to the creation of a dedicated website to ensure inclusivity and accessibility across all platforms. The flexibility of these platforms allows educators to access Innovative Teacher resources from various devices, promoting convenience and adaptability in the dynamic educational environment. The application

and website provide consistent features, including the innovative behavior survey and training module, which underscores the commitment to offering comprehensive support to teachers striving to improve their teaching practices. The user-friendly interface design, grounded in color psychology, enhances the user experience. While the survey results have revealed strengths such as high user-friendliness (4.43) and positive feedback on interface design, there are areas for improvement, notably the need for consistency in design elements and addressing reported errors. Addressing these areas while building on existing strengths will ensure a more effective and satisfying user experience for educators. Based on the research, there are still many aspects that can be developed. From a technological perspective, the utilization of AI to provide innovative suggestions and updates related to the latest teaching technologies can be added. Additionally, the current platform uses native development, which means iOS devices can only access it through the website. Therefore, adopting a hybrid system is necessary to ensure compatibility with all operating systems. Regular updates with new material are also needed to ensure that the application remains relevant and is used consistently.

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Social media learning strategies, teachers' digital competencies and online learning quality: A correlational study

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ABSTRACT

Digital competence for teachers needs special attention because learning today cannot be separated from the use of technology, so learning is of high quality. However, conditions in Indonesia show the opposite, where not all teachers have mastered digital technology. This study examines the relationship between social media-based learning strategies teachers' digital competencies and learning quality in Indonesia. The quantitative method with a correlational approach was used in this study. A total of 1001 teachers in Indonesia were the respondents. Data was obtained through questionnaires completed by the respondents. The results showed a positive relationship between social media-based learning strategies and teachers' digital competencies. A positive relationship is also seen between social media-based learning strategies and learning quality. The implication is that teachers should maximize the use of social media in learning to increase their digital competence and improve learning quality. On the other hand, schools should also provide facilities, training, and mentoring to encourage teachers to implement social media-based learning strategies.

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INTRODUCTION

The quality of teachers is the key to the success of education in the present and future (Inkeeree et al., 2020). Qualified teachers determine the quality of graduates (Betlem et al., 2019). Competencies from various domains must be possessed by teachers to create a meaningful learning process (Ibrahim et al., 2019). Not only that, the development of technological aspects must also be followed by teachers having various technological competencies, one of which is digital competence (Huang, 2022). An understanding of the digital world is needed because digital tools are very important to be implemented to develop the required competencies by educational agents involved in the teaching and learning process (Prestridge et al., 2019). This has led to the importance of digital competencies as one of the challenges facing today's teachers, who must implement ICT integration in their teaching practices (Meroño et al., 2018). Digital competence is utilizing digital technology to learn, work, and participate in society (Bergum et al., 2023). However, teachers' digital competence in Indonesia should receive special attention because not all teachers can use technology for learning and self-development (Saluky et al., 2022).

The quality of learning is determined by the quality of the teacher (Ariawan et al., 2019). This means that qualified teachers will produce a quality learning process (Raikes et al., 2019). Learning must be built by addressing the needs of students and determining the times so that it will produce quality outputs and outcomes. However, if you look at the condition of education in Indonesia, the learning process needs to be improved because based on the results of the National Assessment in 2023, the results of learning quality achievements for primary and secondary school levels are still in the medium category where for primary schools it only increased by 6.35, junior high schools only by 2.16 and senior high schools by 1.62 compared to 2021 (Kemdikbud, 2023). Although there has been an increase compared to the previous year, the increase is insignificant. This means that the quality of learning at various levels must receive attention.

To improve the quality of learning that produces better educational outcomes, it is important to integrate digital technology into the teaching and learning process (Dey & Bandyopadhyay, 2019). This is where teacher digital competence becomes a vital domain that must be developed to build a quality learning process according to today's demands (Vogt & Hollenstein, 2021). Thus, teachers must be able to keep up with technological changes through various online platforms for learning and performance improvement (Dai et al., 2020). As the division between digital and traditional pedagogies dissolves, teacher capacity to seamlessly integrate technology becomes imperative. Not only does this strengthen responsiveness to shifting student behaviors and preferences, but it facilitates more engaging, collaborative, and self-directed modes of education aligned with 21st-century demands. Strong teacher digital proficiency therefore remains a core contributor to improved educational outcomes.

Social media is one of the developments in the digital world, and it occupies a central position in people's lives today (Cowan & Kostyk, 2023). The use of social media in Indonesia has increased drastically from year to year. In 2024, as many as 49.9% use social media sites such as Facebook, Twitter, and Instagram (Wearesocial, 2024). Not only adults, social media has also spread to elementary and middle school-age children, increasing the number of users every year. Many people, including teachers and students, use social media to communicate, especially after the pandemic (Zucker & Kontovounisios, 2018). Adults are increasingly using social media for professional and academic development in addition to entertainment purposes (Griffiths et al., 2022). Although social media has evolved over the last few decades, educators have only recently started using social media for learning (Porat et al., 2018). The use of social media in the classroom can help reinforce practice behaviors, improve digital literacy, and develop professional networks (Ruddy & Ponte, 2019).

Social media has the potential to be used as a learning tool. Several studies have shown the positive implications of social media in education, where, in addition to entertainment, it is also used for academic purposes, especially for publishing assignments and announcements (Bannister et al., 2020). Even research by Liu & Yu (2019) shows that using Facebook as a learning tool helps in information retrieval, improving learning ability, and encouraging student self-reflection. Other research shows that social media, such as Twitter, positively correlates with great point average and student engagement in higher education (Quadir et al., 2022; Teixeira & Hash, 2017). However, existing research only sometimes shows the positive success of using social media in learning. Among them, research by Šerić shows that using social media for academic purposes does not affect educational performance measured by student learning outcomes (Šerić, 2019). Even research by Siebert supports these findings where there is a negative relationship between social media use and learning outcomes (Siebert, 2019). This means a gap exists between previous studies empirically assessing social media for learning.

Further research on social media-based learning needs to be conducted so that it will minimize the existing gap. Therefore, this study examines the relationship between social media-based learning strategies and teachers' digital competencies and learning quality in Indonesia. This research is essential because the current condition of education in Indonesia, which is running the national curriculum with several innovations, requires active, creative, effective, and fun learning with technology integration. This means that teachers with digital competencies are needed to build an effective learning process according to the demands of the times. On the other hand, learning

today must facilitate flexible and sustainable learning. The use of social media becomes a bridge in building a quality learning process with quality human resources. However, empirical evidence is needed on how social media-based learning is closely related to the quality of learning and teachers' digital competencies that support their role as educational facilitators. This study contributes to technology-enhanced learning and educational innovation by providing new insights into the interplay between social media-based learning, teacher digital competencies, and learning quality, and offers practical recommendations for policymakers, educators, and researchers seeking to leverage social media to enhance teaching and learning in Indonesia.

METHOD

Quantitative correlational research or ex post facto method (Creswell, 2009) was used in this study to reveal the relationship between social media-based learning strategies and teachers' digital competencies and learning quality. The research begins with the development of instruments, which are then tested on a small scale to groups outside the research respondents; valid questionnaires are then distributed to respondents through online forms. The data obtained is then tabulated and then analyzed with statistical calculations. Finally, conclusions are drawn based on the research results which are associated with existing theories. This research design is presented in the following Figure 1.

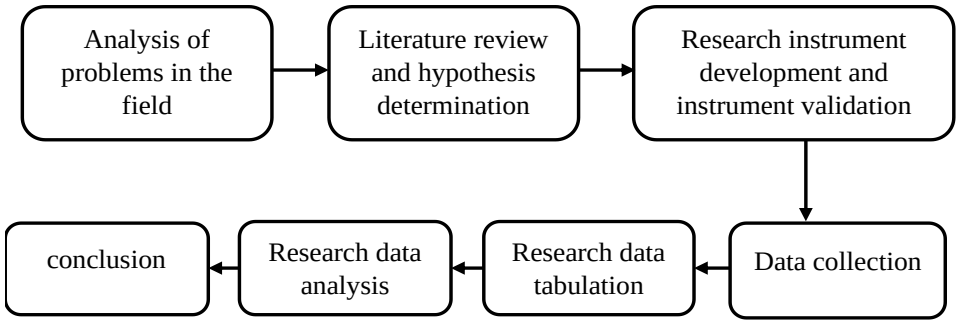

Figure 1. Research Flow Chart

Participants

The study sample comprised 1.001 teachers from both public and private schools located across several regions in Indonesia. These participants were recruited using a simple random sampling method (Sugiyono, 2019). Schools and teachers were randomly selected from various public and private educational institutions located in different areas of the country. This ensured the sample was representative yet still feasible, given resource constraints. The names of the schools and the research respondents remained confidential in observance of ethical research protocols protecting anonymity and privacy. Simple random sampling allowed conclusions from this dataset to be generalized to the broader population of Indonesian educators whilst minimizing potential bias from non-random selection. Maintaining respondent confidentiality aimed to encourage open and honest participation without fear of identification or consequences.

Questionnaire Design

The questionnaire serves multiple purposes, including gathering demographic data to gain a deeper understanding of the background of the teachers involved in the study. By better understanding these teachers, we can conduct a more comprehensive and accurate analysis and correlation. Additionally, the questionnaire measures teachers' use of social media as a tool for enhancing learning and analyzes its effectiveness based on outlined aspects, thereby assessing their social media-based learning strategy. Furthermore, the questionnaire evaluates teachers' digital competency, encompassing digital literacy, communication, collaboration, and their ability to create digital content. Lastly, it assesses different dimensions of learning quality, including the management of the learning environment, learner feedback, the effectiveness of communication

processes, and engagement in learning activities. The following Table 1 presents the indicators in detail for each variable under consideration.

Table 1. Variable Instrument

No.	Variable	Aspect	Based on
1	Social Media-Based Learning	Using social media as a learning tool	Roohani & Vincheh (2023)
2	Teacher Digital Competency	Information and Data Literacy Communication and Collaboration Digital Content Creation	Instefjord & Munthe (2016)
3	Learning Quality	Learning Management Learner Response Communicative Process Learning Activities	Bistari (2018)

The questionnaire used a 10-point Likert scale, ranging from 1 (strongly disagree) to 10 (strongly agree), to definitively gauge respondents' attitudes and opinions. The scoring system was interpreted as follows: a score of 1 represented a very strong negative perception, while a score of 10 represented a very strong positive perception. A total of 1.001 teachers participated in the study, and the questionnaire was administered electronically via a Google Form, ensuring a convenient and accessible data collection process.

Validity and Reliability Results of the Research Instruments

The validity of the research instrument was tested by giving the survey to 25 people. The obtained data was calculated using product moment correlation. The results were compared to the r Table. An item is considered valid when the calculated r value is greater than the r Table value. A summary of the instrument validity calculation results is as follows:

Table 2. Instrument Validity Test Results

No.	Variable	Number of Items Tested	Valid Items	Invalid Items
1.	Social Media-Based Learning	15	15	-
2.	Teacher Digital Competency	15	15	-
3.	Learning Quality	15	15	-

Based on Table 2, it is known that the number of questionnaire items that were tested for each variable was 15 items. The number of valid items to measure the Social Media-Based Learning variable was 15 items. All of the questionnaire items for the Teacher Digital Competency were declared valid. The 15 items of the questionnaire for the learning quality were also declared valid.

Reliability testing of the instrument was done using SPSS software. The instrument is considered reliable if the Cronbach's Alpha value calculated is more than 0.60 (Sugiyono, 2019). The results of the instrument reliability testing can be seen in the following Table 3.

Table 3. Instrument Reliability Testing Results

No.	Variable	Cronbach's Alpha
1.	Social Media-Based Learning	0.932
2.	Teacher Digital Competency	0.946
3.	Learning Quality	0.956

The results of the reliability testing are presented in Table 3 For the Social Media-Based Learning variable, the Cronbach's alpha value was 0.932. Since this exceeds the cut-off point of 0.60, the instrument measuring this variable can be considered reliable. The Teacher Digital Competency variable had a Cronbach's Alpha value of 0.946 > 0.60, indicating this instrument is also reliable. The Cronbach's alpha value for the Learning Quality variable was 0.956. This met the reliability threshold of 0.60.

In summary, all variables tested through the research instruments met or exceeded the benchmark value of 0.60. The Social Media-Based Learning, Teacher Digital Competency, and Learning Quality instruments all demonstrated good reliability based on Cronbach's Alpha results. Therefore, it can be stated that the overall set of instruments used in this study exhibited reliability that was sufficiently high for the purposes of the research. The instruments consistently measured their respective variables in a dependable and repeatable manner.

Data Collection

A two-part questionnaire was used to collect data from teachers involved as respondents in this study. The first part of the questionnaire was used to collect demographic data. Thirty items were used to measure the variables in this study. The scale items of these variables were developed based on existing theories. The questionnaire items for the social media-based learning strategy variable are based on Roohani & Vincheh (2023) theory with the revealed aspects including using social media as a learning tool. Meanwhile, items to reveal teacher digital competency variables were developed from aspects of Information and data literacy, Communication and collaboration, and Digital content creation (Instefjord & Munthe, 2016). Questionnaire items for learning quality variables were developed from aspects of learning management, learner response, communicative process, and learning activities (Bistari, 2018).

Data Analysis

The data was analyzed according to the research approach. Descriptive and inferential statistics, as well as the underlying relationships between variables, were obtained by calculating appropriate statistics using SPSS-26 software. Descriptive statistics (mean and standard deviation) were employed to uncover the relationship between the study variables. A pairwise correlation analysis was conducted by calculating Spearman-rho correlation coefficients to evaluate the association between social media-based learning strategy variables and teachers' digital competencies, as well as learning quality. This provided a quantitative understanding of how integrated social media strategies are linked to educators' digital skills and quality of instruction. The Spearman-Rho test, a nonparametric measure, determined the strength and direction of any monotonic relationships between ordinal variables. By leveraging the analytical capabilities of SPSS, inferential analysis illuminated patterns in the data, thereby supporting conclusions regarding the research questions.

RESULTS AND DISCUSSION

Result

This study employed descriptive and inferential statistical analysis using SPSS software. Descriptive statistics helped summarize and organize the data to identify patterns and relationships. Inferential statistics including correlation analysis tested hypotheses regarding associations between variables. The results of the descriptive statistical calculations in this study are shown below:

Table 4. Results of Descriptive Analysis of Social Media-Based Learning Strategies

	Descriptive Statistics								
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
SosmedLearning	1001	3	10	6.90	1.901	-.210	.077	-.693	.154
Valid N (listwise)	1001								

Table 4 shows that the data for the social media-based learning strategy variable obtained from 1.001 respondents shows a minimum value of 3 and a maximum value of 10. Meanwhile, the average answer of the research respondents is 6.90, with a standard deviation of 1.901. The

Skewness and Kurtosis values presented in Table 4 are used to determine whether the data from the research variables are normally distributed. Table 4 shows that the Skewness value is 0.210 and the Kurtosis value is 0.693, where both values are not close to zero, which means that the data is not normally distributed. This abnormal distribution makes hypothesis testing carried out with non-parametric statistics.

Table 5. Results of Descriptive Analysis of Teacher Digital Competence

Descriptive Statistics									
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Skewness**		**Kurtosis**	
	Statistic	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Std. Error**	**Statistic**	**Std. Error**
Digitalcom	1001	2	10	6.33	1.346	-.176	.077	.236	.154
Valid N (listwise)	1001								

Table 5 shows the minimum value for the teacher digital competency variable based on data from 1001 respondents is 2 with a maximum value of 10. The teacher digital competency variable measures the skills and abilities of teachers in utilizing digital technology. The average value of the digital competency variable is 6.33 indicating that on average the digital skills of teachers who responded are in the mid-range. The standard deviation of 1.346 shows that most teachers' digital competency scores are close to the mean. Meanwhile, the skewness value of 0.176 shows the data distribution is slightly positively skewed with most scores concentrated below the average. The kurtosis value of 0.236 indicates a relatively flat data distribution compared to a standard normal distribution. Overall, the data provides insight into teacher's preparedness and capability to use technology for educational purposes based on self-assessment.

Table 6. Results of Analysis of Teachers' Digital Competence in terms of Level of Education

ANOVA					
DigitalCom					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	44.216	5	8.843	4.977	.000
Within Groups	1767.962	995	1.777		
Total	**1812.178**	**1000**			

The results presented in Table 6 show a sig. value of 0.00 which is less than 0.05 and an F-count value of 4.977 which is greater than 2.37. These findings indicate there are statistically significant differences in the digital competency of teachers in Indonesia when compared based on their level of education. Specifically, a teacher's educational background impacts their competency in digital skills. The study respondents represented various levels of education including Senior High School/Equivalent, Diploma, Applied Bachelor, Bachelor, Master, and Doctorate. Therefore, there are differences in digital competencies. This highlights the role of formal education qualifications in developing educators' technical aptitude and ability to integrate digital tools into their pedagogical approaches. The results emphasize the importance of continuous training to close competency gaps dependent on a teacher's educational attainment.

Table 7. Results of Descriptive Analysis of Learning Quality

Descriptive Statistics									
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Skewness**		**Kurtosis**	
	Statistic	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Std. Error**	**Statistic**	**Std. Error**
LQuality	1001	2	10	7.75	1.373	-1.381	.077	3.445	.154
Valid N (listwise)	1001								

Based on Table 7 data on learning quality variables from 1.001 respondents shows a minimum value of 2 and a maxim value of 10. The table also shows that the average value for learning quality variables is 7.75 with a standard deviation of 1.373. The skewness value shown in Table 7 is 1.381, and the kurtosis value is 3.445. The resulting skewness and kurtosis values are not close to zero, meaning the learning quality variable data is not normally distributed. This makes the calculation process to answer the hypothesis of this study using non-parametric statistics.

Table 8. Correlation Analysis Results

Correlations					
			SosmedLearning	**Digitalcom**	**LQuality**
Spearman's rho	SosmedLearning	Correlation Coefficient	1.000	.285**	.087**
		Sig. (2-tailed)	.	.000	.006
		N	1001	1001	1001
	Digitalcom	Correlation Coefficient	.285**	1.000	.164**
		Sig. (2-tailed)	.000	.	.000
		N	1001	1001	1001
	LQuality	Correlation Coefficient	.087**	.164**	1.000
		Sig. (2-tailed)	.006	.000	.
		N	1001	1001	1001

**. Correlation is significant at the 0.01 level (2-tailed).

Table 8 demonstrates the correlation between the study variables where the correlation value between social media-based learning strategies and teacher digital competence is 0.285 with a significance value of 0.00 < 0.01. This indicates there is a positive and statistically significant relationship between the use of social media-based learning strategies and a teacher's level of digital competence. As presented in Table 8 as well, a similar relationship exists between social media-based learning strategies and learning quality. The correlation value between these two variables is 0.087, representing a positive relationship. The significance value of 0.006 < 0,05 demonstrates this association is meaningful. Therefore, the findings suggest that when teachers implement social media platforms in their teaching practices, it improves their digital skills while also enhancing the learning experience and outcome for students. The statistically significant correlations reinforce the influence of technology-driven instructional techniques.

Discussion

The level of education (low, medium, and high) reflects the skills and quality profile of people (Grigorescu et al., 2020). Each level of education teaches different skills from simple stages to complex stages so the competence of graduates of each level is different and increasing (Lee et al., 2019). This is not much different from the findings of this study which show that the digital competence of teachers has differences in terms of education level. Between Diploma, Applied Bachelor, Bachelor, Master, Doctorate, and Senior High School graduate teachers have different abilities in mastering digital devices, digital content, and understanding of the digital world.

Research by McNamara et al., (2021) found that social media can be utilized as a medium in competency development for teachers so that mastery of creative instructional planning can be possessed by teachers. Social media can be a means of learning through content sharing and is proven to retain knowledge, and critical thinking skills, make real-world connections with classroom material, empower students, and improve communication skills (Sohoni, 2019). The findings align with this study, which shows that social media-based learning strategies positively correlate with teachers' digital competencies in Indonesia. The more frequently teachers apply learning strategies with social media, the better their digital literacy level, ability to communicate and collaborate online, and creativity in developing digital content will increase. In other words, integrating social media into learning plays a significant role in improving teachers' digital competence.

The existence of social media can be used as a medium for delivering direct feedback so that interaction and collaboration can be established (Khachan & Özmen, 2019). Teachers can

collaborate and share learning resources through groups or social media accounts such as WhatsApp, Facebook, and Instagram. Similar conditions were also found in this study where teachers used social media features such as WhatsApp and Facebook groups to conduct discussions with other teachers. Sharing information related to training is also done by teachers through WhatsApp groups and sharing posts on Instagram. Learning that integrates creative processes such as memes, infographics, and podcasts in social media can develop the ability to design digital learning content for teachers (Davidson et al., 2019). This study also found similar conditions where teachers package learning materials into digital content such as videos and infographics to be shared on social media. The use of social media in learning can enhance collaborative learning among teachers and mastery of digital features (Lee, 2023). Similar conditions are also found in this study where teachers who use social media for learning master the use of computers, video editing applications, graphic design, and features on WhatsApp, Facebook, and Instagram.

Using Facebook (FB) for professional purposes can improve student communication and collaboration during distance learning (Zarzycka et al., 2021). Social media is beneficial in increasing student engagement and interaction in the classroom (Xue & Churchill, 2020). This is also found in this study, where teachers build the learning process by providing material in WhatsApp groups and posting content through YouTube and Instagram; students can discuss, and submit questions, and comments in groups and comment columns. So that there is an increase in student involvement and interaction in learning. Student engagement and the process of student interaction in learning also increased along with the utilization of online commenting and discussion through social media (Zou et al., 2022). Research by Šerić (2019) shows that using social media can increase effectiveness in learning and provide information that can make learning better. Other findings show that social media serves as a mediating agent to reach students in their Zone of proximal development (ZPD) (Alghamdi & Alanazi, 2019). The findings of previous research are in line with this study, which shows a positive relationship between social media-based learning and learning quality. This means that the use of social media elements in learning, such as online study groups on Facebook or Instagram, material sharing through YouTube, and online quiz evaluation through applications, contribute to improving learning quality.

Pittman & Haley (2023) stated that social media can increase important emotional, cognitive, and behavioral aspects of engagement in learning. Students' use of social media is positively related to their creativity and academic engagement through intrinsic motivation (Gulzar et al., 2021). This research also shows the same condition where the use of social media in learning helps teachers develop students' creativity through video-making assignment projects to be shared on Instagram and YouTube. Students are also given the freedom to comment and ask questions on Instagram and WhatsApp groups.

The use of social media as a learning tool can make the process more fun and meaningful with easy access to real content by learning materials (Pusey, 2018). This study also found the same findings where teachers disseminate digital materials such as videos and infographics to students through groups and Instagram posts. On the other hand, teachers also give students the freedom to access learning content on social media to help them understand the material delivered by the teacher.

CONCLUSION

This study successfully revealed a positive and significant relationship between social media-based learning strategies and teachers' digital competencies. The better the learning strategy by integrating social media, the better teachers' digital competence. This means that learning strategies carried out by teachers by integrating social media elements such as social media groups, online learning videos, and online competency tests have a positive effect on the development of teachers' digital competence. In addition, there is also a positive and significant relationship between social media-based learning strategies and learning quality. The use of social media in learning contributes to improving the quality of learning processes and outcomes. The findings of this study are consistent with the theoretical framework and previous research on the role of technology-based learning strategies on teachers' digital competencies and learning quality.

However, further research with a more robust design must emphasize the causal relationship between the research variables. It is also necessary to expand the scope of the sample to strengthen the generalizability of the research results.

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Development of students' worksheet-based AR video and QR-timer test on biographical text materials Class X Senior High School 1 Pelalawan

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ABSTRACT

Student worksheets are learning tools in the form of direct assignments to simplify the evaluation process. Unfortunately, the use of student worksheets is still conventionally based and burdensome for students. The proposed innovation is the development of a student worksheet integrated with QR Code digital technology, containing AR Video, and also G-Form links with material of National Biographical Indonesian Hero which is given an automatic countdown timer test extension. This research aims to determine the increase in students' interest in learning and understanding the material after using student worksheets, provide an overview of optimizing digital content and assignments for teachers and students, as well as develop the form and function of student worksheets in a more complex manner by involving digital media in the form of AR Video and QR Code integrated Form Timer Exercises. The research model uses a 4D model (define, design, develop, and disseminate). The test subjects were 25 class X students at Senior High School 1 Pelalawan. Data sources were obtained from interviews, questionnaires for needs analysis, and results questionnaires. The data in this research were analyzed using qualitative descriptive techniques to analyze interview information and quantitative analysis techniques to process data in questionnaires for needs analysis and result questionnaires. This research had received very appropriate criteria in validating research products (90%) and received very positive perceptions from class X students at Senior High School 1 Pelalawan (88%). These exact results are expected to be developed and studied further, especially related to the relationship of this media with an increase in student learning outcomes.

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INTRODUCTION

Science and technology in general is experiencing vertical development. The term Industrial Revolution, which first appeared in the 18th century in England, had a tremendous impact on digitalization globally. Further developments present branching the terms, namely Industrial Revolution 1.0, Industrial Revolution 2.0, Industrial Revolution 3.0, and Industrial Revolution 4.0 (Harahap, 2019). This development not only perfects the result of science and technological concepts but is also able to disseminate information technology on an international scale. Almost all corners of the world are influenced by technology, including in Indonesia.

Indonesia is absorbing technological demands as well, which is evidenced by the widespread provision of internet access in various regions. Based on a survey by the Indonesian Internet Service Providers Association, domestic internet has been reached by 210 million people, or 77.02 percent of the total population (APJII, 2022a). Besides that, students from the high school level have dominated the use of gadgets among students with a total of 37.69% (APJII, 2022b). This push made the range wider when the pandemic COVID-19 began to affect the world and required various activities to be carried out online (Rohana & Syahputra, 2021).

Cause of rapid development science and technology have an impact on the national education system. The education implemented is no longer conventionally based, but is also combined with digital technology. Learning evaluation activities as a benchmark for the success of students' mastery of lessons have also been transferred to digitalization (Latifah & Azrina, 2020). Various media have emerged that make the learning assessment process easier, for example, Google Form, Quizizz, Testmoz, Quizmaker, Kahoot, and Quizzlet (Mustofa, 2020). Currently, computer-based assessment is the main reference compared to manual assessment by teachers with an assessment process that is faster, easier, more flexible, and has a higher level of accuracy (Krismawati et al., 2018).

The forms of evaluation that are generally given to students in Indonesia are tests, exams, homework, and direct assignments (Febriana, 2021). Direct assignments are a form of assignment given in class to students during the available lesson hours. Often students cannot complete the assignments given in the remaining class time, so the assignments are used as homework. This homework will burden students and take up time spent with family. This form of assignment also contrasts with the K-13 Curriculum which the Independent Curriculum perfected with the same principles: creating active, efficient learning, and not burdening students (Anwar et al., 2022).

According to the results of a survey conducted by the Indonesian Child Protection Commission (KPAI), it was found that 73.2% of students considered the tasks given to be a burden. The least favorite tasks were making videos (55%), answering a lot of questions (44.5%), summarizing material (39.4%), and copying questions before answering (25.6%) (KPAI, 2020). The tasks given by teachers to students are often stuck with old methods so students find it difficult to carry out these tasks. This has an impact on the lack of interest in understanding the material and tends to forget the material after it has been completed or tested at school (Septiyawan, 2021).

One of the Indonesian language learning materials that is quite crucial and is always present in every curriculum offered is Biographical Text material in grade ten (Sapitri & Nugroho, 2022). Biographical text is writing that contains a person's life history that can be emulated in everyday life for students (Aulia & Gumilar, 2021). This text describes the beginning of a person's life–usually a hero or famous figure and then tells the life process that the character goes through until the end of his life (Rahayu et al., 2022). Therefore, biographical texts are quite long and tend to be boring if they are not combined with attentive media (Audie, 2019).

As a benchmark for students' level of understanding in analyzing biographical texts, teachers usually provide Student Worksheets (LKPD) as an evaluation medium (Novriani et al., 2021). So far, the use of students' worksheets is still done manually, namely printed first to be given to students. Furthermore, students are asked to fill in the answers to the questions listed directly by hand on the student's worksheet (Aprilianti & Astuti, 2020). As a result, it requires large costs for printing, waste of ink and paper, and waste of effective learning time because the time for working on the student's worksheet is not measurable (Novriani et al., 2021). The provision of conventional media like this also makes students tired quickly and tend to feel bored (Tafonao, 2018). Therefore, a collaboration between media and digital technology is needed in students' worksheets, involving structured evaluation and providing visualizations (Rizka, 2022), so that students are more enthusiastic about doing assignments and improving understanding according to learning outcomes (Bagaswara, 2021). Based on the problems, potentials, solutions, innovations, and status quo, the researcher will implement the Independent Curriculum students' worksheet based on AR Video and QR Code integrated with G-Form with an extension of the countdown time in grade X, especially in the Biography Text material. It is hoped that this innovation can be developed and implemented widely, so that it can contribute to realizing the 2030 Sustainable Development Goals, preparing generation

5.0 that is responsive to digital technology, and welcoming the era of Golden Indonesia 2045 (Daulay, 2021).

METHOD

This research method used the RnD research type (Tohardi, 2019). The approach we apply in this innovation is Student-Centered Learning and a discrete approach with one language aspect in each test (Diana & Rofiki, 2020). Research and development in this innovation has been running for 5 months—December 2022 to April 2023. Product trial activities were carried out on March 16 2023 at Senior High School 1 Pelalawan involving 25 students from mathematics natural sciences and social science classes. Validation of the products that were provided on December 11 2022 at Stage University of Yogyakarta involves 3 lecturers with Doctoral and Professor degrees from Yogyakarta State University and 1 Indonesian language teacher Senior High School 1 Pelalawan. This research used 4D Design which includes definition, design, development, and dissemination (Rayanto & Sugianti, 2020). The following is the flow of media development using the 4D model:

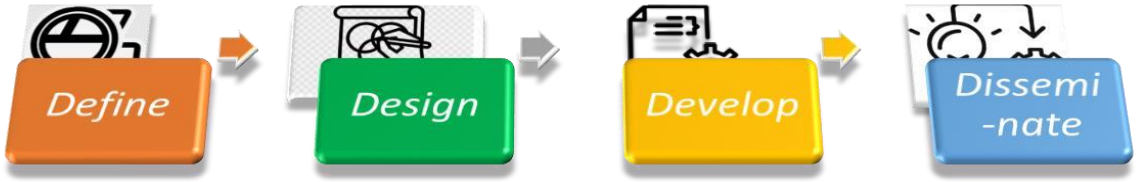

Figure 1. Media Development Flowchart with 4D Models

The research steps follow the implementation flow as shown in Figure 2 below.

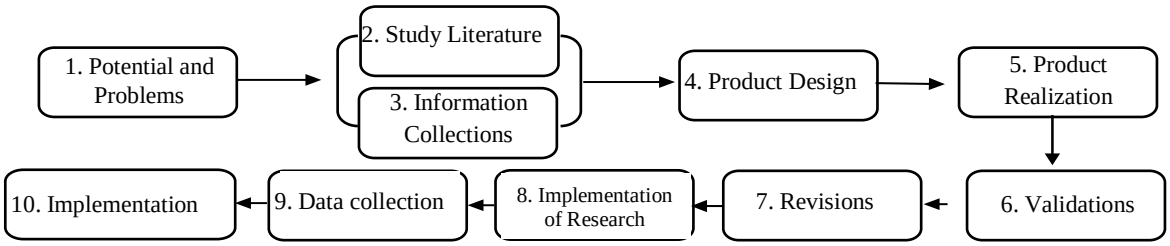

Figure 2. Research and Development Procedures with 4D Models

Activities 1 to 3 are the define stage, activities 4 to 5 are the design stage, activities 7 to 9 are the develop stage, and activity 10 is the disseminate stage (Sugiyono, 2022). The definition stage was carried out by distributing online questionnaires to various regions. The target of 100 respondents has been met with quota sampling spread across 26 different provinces. Before entering the assessment, respondents were asked to fill in the curriculum options currently being implemented at their school.

The design stage aims to design the research product. This stage begins with concept maturation, adjusting learning outcomes, exploring relevant biographical text material (Prastowo, 2015), creating customized questions, designing the cover, designing the design and contents, inputting questions on Google Form (Sahlani & Agung, 2020), adding countdown time, creating hero animations, creating biographical videos each hero (Agustien et al., 2018), converting AR to link form, and creating a QR code that combines G-Form and AR video links (Anonym, 2022).

As for the development stage, a product feasibility validation test is carried out and a review of students' perceptions of the research product is carried out. In this development, there are four validations required, namely media, language, instrument, and material validation. The experts involved in the feasibility assessment were 2 lecturers with doctoral degrees and 1 lecturer with the title of professor from the Indonesian Language and Literature Education Study Program, State University of Yogyakarta. Apart from that, 1 practitioner validator was involved, the Indonesian language teacher at Senior High School 1 Pelalawan.

At the dissemination stage, field trials are needed to see the effectiveness of the product. The subjects in our product development trials were 25 class X students, with details of 11 students of natural science and 14 students from social science. Each student is given one copy of the student's worksheet with 6 Biographical Text sub-materials along with an instruction sheet for using the students' worksheet (LKPD) integrated with AR video, QR code, and Google Form.

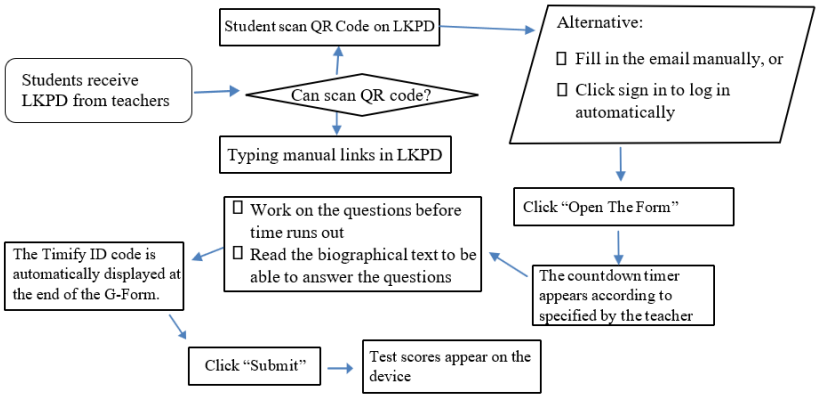

Figure 3. Flowchart of Using Student Worksheet based on G-form and Timify. me for Students

Google Form is a flexible evaluation medium and can be provided with extensions (Purba, 2020). One add-on that can be added is the Quilgo countdown timer. Quilgo's extension to Google Forms makes the form display have a countdown timer with a processing duration that can be set by the form owner. If the countdown time runs out, access to the questions will automatically be closed (Magdalena, 2020). This automatic time will trigger students to have to complete the questions or solve the problems given in the available time. On Google Forms, only question-and-answer fields are available (Mansyur et al., 2022). Meanwhile, for material to answer questions, students need to first scan Augmented Reality based on 3D animation and an interactive narrative video from one of the hero characters. The AR technology is inserted into the same QR as the G-Form link as a marker. When the device is used to work on questions, the biographical narrative can still be seen in the form of concrete text on the worksheet provided. This kind of virtual innovation is needed in learning media and direct assignments, such as worksheets. It is time for students' worksheets to no longer be done manually and conventionally, but to be given a digital touch in the process to make it more practical. That way, students will be enthusiastic about working on questions and get a realistic depiction of concepts. Teachers no longer need to correct students' answers one by one because the grades and correct answers will automatically appear after students have finished taking the test. The following are the steps for using the AR video & QR code-based Biographical Text worksheet which is integrated with Form Timer Exercises:

Figure 4. Instructions for Using Digital Students' Worksheet

Biographical text is taken from the archives of the Indonesian Ministry of Education and Culture with slight modifications and improvements in spelling. AR video and animation design designed by the team. The test questions were created independently by taking into account the Kuikulum Merdeka learning outcomes and have been validated by instrument experts. The duration of processing time is adjusted to the number of questions and level of difficulty of each test.

Table 1. The Substance of Students' Worksheet

No.	Main Topic*	Figure	The Form of Quest	Time
1.	Understanding the Meaning of Text Biography and Discuss Characteristics of Biographical Text	Rasuna Said	Group Discussions, 5 Essai Questions	45 Minutes
2.	Understand and Analyze Main Ideas and Explanatory Ideas Accurate Biography Text and Critical	Sultan Hasanuddin	10 Multiple Choice Questions	30 Minutes
3.	Analyzing Recon Texts for Finding Ideas, Thoughts, and Messages (Task 1)	Tuanku Imam Bonjol	10 Questions, True or False	30 Minutes
3.	Analyzing Recon Texts for Finding Ideas, Thoughts, and Messages (Task 2)	Buya Hamka	Copy-Paste 3 Of Parts In Structural Text	20 Minutes
4.	Examining Sign Use Read and Absorb Words in Biographical Text	Sultan Syarif Kasim II	10 Multiple Choice Questions, Error Analysis	30 Minutes
5.	Understand Internal Linguistic Aspects of Biographical Text	Ki Hadjar Dewantara	10 Multiple Choice Questions	30 Minutes
6.	Students Formative Test	Mixed	10 Multiple Choice Questions	45 Minutes
7.	Students Reflections	-	6 scale 1-5 and 2 Entries	30 Minutes

All the topics and learning objectives above are presented on digital students' worksheets separately, accompanied by biographical texts from different heroes. As an effort to introduce regional hero figures, students' worksheet 4 includes a biography of Sultan Syarif Kasim II who is a national hero from Siak, Riau. Apart from that, to avoid gender bias, Rasuna Said's biography appears in students' worksheet 1. To measure students' understanding at the end of the lesson, a summative test and student reflections are presented which are included in students' worksheet 6.

RESULTS AND DISCUSSION

Define Stage

This was done by distributing online questionnaires to various regions. The target of 100 respondents has been met with quota sampling spread across 26 different provinces. Before entering the assessment, respondents were asked to fill in the curriculum options currently being implemented at their school. The results show that 59% of the total respondents have implemented the Independent Curriculum in their schools. Next, respondents were asked to fill in several questions and the following recap results were obtained:

Table 2. Recap Data of Needs Analysis Questionnaire

No.	Questions	Number of Students who Respond					Scoring	Percentage Average
		(1)	(2)	(3)	(4)	(5)	500 Scale	
1	The Teacher gives a Students Sheet (LKPD) during the Learning	-	-	35	42	23	388	77.6%
2	Assignments given are Mostly Required to be done Manually (Written in an Assignment Book)	3	3	23	46	25	387	77.4%

No.	Questions	Number of Students who Respond					Scoring	Percentage Average
		(1)	(2)	(3)	(4)	(5)	500 Scale	
3	Students Feel Burdened if Unfinished Assignments Become Homework	8	19	23	35	15	330	66%
4	Students will Postpone Work on Assignments if the Submission Deadline is Still Long	4	4	40	33	19	359	71.8%
5	Students have been taught the Material Biographical Text	20	8	41	23	8	291	58.2%
6	Biographical Text Material is Considered quite Complicated	-	12	36	37	15	355	71%
7	Students need Practice Questions to better Master the Material, especially the Text Biography.	-	-	10	46	44	434	86.8%
8	Students have Devices and Use them to Play Games or Social Media	8	19	28	26	19	329	65.8%
9	Students are Interested in Using Practical Digital Technology in Completing Assignments	-	8	28	32	32	388	77.6%

From this data, it shows that students' worksheet is often used as a medium for assignments, but it is still conventional and manual. This makes the time for completing assignments directly at school ineffective and makes teachers make assignments as homework. This makes students feel burdened and tend to delay work. The Biographical Text material being taught or to be studied is estimated to be quite complex, so it is necessary to provide training with practical media, for example, combined with digital technology which is currently developing.

Design Stage

Aims to design research products. This stage begins with concept maturation, adjusting learning outcomes, exploring relevant biographical text material, creating customized questions, designing the cover, designing the design and contents, inputting questions on Google Forms, adding countdown time, creating hero animations, and creating biographical videos. Each hero converts AR to link form and creates a QR code that combines G-Form and AR Video links (Bahar, 2019).

Develop Stage

At this stage, product feasibility validation tests are carried out and students' perceptions of the research product are reviewed. In this development, there are four validations required, namely media, language, instrument, and material validation (Bachri, 2010). The experts involved in the feasibility assessment were 2 lecturers with doctoral degrees and 1 lecturer with the title of professor from the Indonesian Language and Literature Education Study Program, at Yogyakarta State University. Apart from that, 1 practitioner validator was involved, namely the Indonesian language teacher at Senior High School 1 Pelalawan. The accumulation of validation data that has been analyzed is as follows Table 3.

Table 3. Accumulated Development Validation Values

No.	Validator	As a	Final Score
1	Dr. Nurhadi, S.Pd., M.Hum.	Media Expert	95%
2	Prof. Dr. Drs. Maman Suryaman, M.Pd.	Linguistic	84%
3	Dr. Tadkiroatin Musfiroh, S.Pd., M.Hum.	Instrument Expert	87%

No.	Validator	As a	Final Score
4	Khairul, S.Pd.	Material Expert	94%
Amount			**360%**
Average			**90%**
Category			**Very Worth It**

Of the four validations obtained, a final summation and scoring are carried out to see the feasibility of the research product from all aspects. The final average result was 90%. This value is in the range of 82% < score > 100% so this research product is in the very worthy category (Purwanto, 2016).

When producing a product, field trials are needed to see the effectiveness of the product. The subjects in the trial of our development product were 25 class X students, 11 of whom were class Each student is given one copy of the student's worksheet along with an instruction sheet for use. Because it aims to analyze perceptions, testing was only carried out on students' worksheet 3 (first part) containing the biography of Tuanku Imam Bonjol. After data processing using the Likert Scale (Pranatawijaya et al., 2019), the data distribution was obtained as follows:

Table 4. Questionnaire Data on Student Perceptions of Research Products

No.	Questions	Number of Students who Respond					Percentage				
		(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
1	The Attractive Appearance of the Students' Worksheets makes me Motivated to Learn more about Biographical Texts	2	3	1	6	13	8%	12%	4%	24%	52%
2	The Description of the Material Uses Language that is Clear and Easy to Understand	-	2	1	1	21	-	8%	4%	4%	84%
3	The Writing and images Look clear and attractive	-	-	11	2	12	-	-	44%	8%	48%
4	The Learning Sequence is Clear and Systematic	-	-	3	10	12	-	-	12%	40%	48%
5.	The Instructions for Using the Students' Worksheet are easy to Understand and have a Clear Instructor.	-	1	-	6	18	-	4%	-	24%	72%
6	The Use of QR Codes is quite Interesting and is Something New at this School.	-	-	3	5	17	-	-	12%	20%	68%
7	Having a Countdown Time Motivates Me to do my Work on Time	1	6	-	5	13	4%	24%	-	20%	52%
8	The Available Countdown Time Prevents Me from Committing Fraud such as Browsing the Internet or Cheating	1	-	2	5	17	4%	-	8%	20%	48%

No.	Questions	Number of Students who Respond					Percentage				
		(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
9	Google Form Media is quite Interesting and Effective	-	-	2	5	18	-	-	8%	20%	52%
10	The Biography Text Material and Questions on the Google Form are Legible and have an Attractive Appearance.	-	-	1	4	20	-	-	4%	16%	80%
11	Students' Worksheet with a QR Code is more Effective than hand Writing Assignments or making Papers.	-	-	-	4	21	-	-	-	16%	84%
Amount		**4**	**12**	**24**	**53**	**182**	**16%**	**48%**	**96%**	**212%**	**728%**
Total Score							**1.222**				
Maximum Score							**1.375**				
Average							**89%**				

From the data analysis that was carried out on student responses after using the QR Code-based students' worksheet product, the final result was that 89% of the total respondents felt interested in the research product. Thus, the students' worksheet development product based on this innovation is categorized as very suitable for further development in education.

Discussion

The use of QR code-based students' worksheet in this study has received a positive response from students in Grade X of Senior High School 1 Pelalawan. The findings show that the majority of respondents found the learning sequence in the students' worksheet clear and systematic, and the explanations easy to understand. The integration of QR Codes, Google Form, and Timify.me as part of the learning tools contributed to an engaging and interactive learning experience for the students. Such technology-based learning resources are considered innovative and effectively bridge the gap between traditional learning methods and modern educational technology.

One notable finding is that the respondents were highly motivated to complete assignments punctually due to the countdown timer feature. This suggests that integrating digital tools that create a sense of urgency can enhance student engagement and reduce the opportunity for academic dishonesty. The effectiveness of integrating technology in assessment and learning processes demonstrates the feasibility of using similar approaches in different subjects or educational settings.

The visual elements of the students' worksheet, including text and images, received generally positive feedback; however, the lower rating from some respondents was primarily attributed to the black-and-white printing, which affected the visual appeal. This highlights the importance of visual design in educational materials, particularly when colors are intended to differentiate or emphasize certain elements.

Moreover, the use of Google Form as a medium for assignments was highly rated in terms of effectiveness and attractiveness. This indicates that students are comfortable with and receptive to online platforms as part of their learning experience. The efficiency and accessibility provided by Google Form make it a favorable choice for both students and educators, reducing the time needed for assignment collection and feedback.

The results also underscore the potential of QR codes as an innovative and interactive tool for linking learning resources. Students found QR codes to be an interesting feature that added value to

the learning material. The integration of QR codes not only facilitated easy access to additional information but also fostered students' enthusiasm for using technology in their learning journey.

Overall, the QR code-based students' worksheet was deemed highly feasible for implementation, with a 90% approval rate based on the validation process involving experts from various fields. Student responses further affirm that the developed product aligns well with learners' needs and expectations. The positive reception and effectiveness of the developed students' worksheet could serve as a reference for educational institutions in developing similar interactive and technology-integrated learning tools.

In conclusion, the QR code-based students' worksheet shows great potential for enhancing students' learning experience, providing clear instructions, effective learning sequences, and interactive features that align with current technological trends. This product serves as a promising development for promoting effective learning, and it will continue to be evaluated and refined based on the students' feedback and needs.

CONCLUSION

The innovation that we propose in the competition is developing students' worksheets that are adapted to the Kurikulum Merdeka on Biography Text material in class X. The students' worksheet is combined with digital media in the form of QR code, AR video, and form timer exercises to attract students' interest in doing assignments, make it easier for teachers to provide evaluations, and several other benefits.

This development activity goes through several stages, which are defining, designing, developing, and disseminating. Needs analysis was carried out by distributing questionnaires to 100 respondents. Product validation has been provided by four experts and practitioners with a final feasibility score of 90% or very feasible. Product trials involving 25 class X students of Senior High School Pelalawan obtained positive results with a final perception of 89%. This digital students' worksheet product with Biographical Text material has been 100% complete and the Flipbook-based product development guidelines for teachers have also been prepared and are ready to be distributed.

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Effectiveness of digital module development in Pancasila education learning using the Flip PDF Professional application

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ABSTRACT

This research was motivated by the fact that the use of printed textbooks in elementary schools was not able to increase student activity, motivation, and participation. The teacher's teaching materials do not yet use Flip PDF Professional. This research aims to produce a computerized module using Flip PDF Professional as a Pancasila Education teaching application. The research method used is research and development. The type of research is research and development using 4D. This 4D model, namely: defining, designing, developing, and disseminating. The research subjects were 22 fourth-grade students at Bukit Cangang Elementary School 12, 24 students at ATTS Elementary School 14 at meeting 1 and 25 students at meeting 2, as well as 18 students at Benteng Elementary School 01 at meeting 1 and 21 students at meeting 2. The digital module was declared effective after an effectiveness test was carried out. At meeting 1 on the topic of rules at home and rules at school, students obtained a completion result with a percentage of 86% and for meeting 2, on the topic of rules in the surrounding environment, students obtained a completion result with a percentage of 88%. These results provide digital module development with effective results for use. Thus, it can also be said that the digital module that supports the Flip PDF Professional application in elementary class IV schools is very significant, very easy to use, and very useful for teaching.

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INTRODUCTION

Based on the results of observations and interviews conducted by researchers three state elementary schools cluster 1, Guguk Panjang District, starting from July 18, 2023, to July 22, 2023, at ATTS Elementary School 14, Bukit Cangang Elementary School 12 and Benteng Elementary School 01, through the process of interviewing grade IV teachers and filling out observation questionnaires on student interests. Based on the results of the observations that have been carried out, there are problems regarding learning resources, namely that learning resources using printed textbooks have not been able to increase student participation and activeness in the learning process in the classroom. The impact that occurs is that it can cause students to feel bored, less active, and have poor learning motivation. This research is important to be conducted so that the problems found in grade IV of elementary school can be resolved properly. One solution to overcome these problems

is to utilize advances in science and technology in the educational aspect, namely by developing digital modules in Pancasila Education learning in grade IV of elementary school. According to Nurhasnah et al., (2020) digital modules that can be developed using software such as computers, cell phones, and others are known as E-Modules. Sintawati & Margunayasa (2021) Asserted that the e-module is a learning innovation that can improve the completeness of learning outcomes and boost student participation in the classroom.

Computer-based learning materials can be accessed with computers, laptops, and mobile devices and can help students learn learning materials easily. According to Wilujeng & Putri (2020) A flipbook is a type of software that can create digital modules and improve the quality of learning in the classroom. According to Sari & Siregar (2022) digital modules consist of materials provided to instructors and students to be used objectively with careful consideration when using Flipbook software. One example of such a module is the Flip PDF Professional application which serves as a guide on what students can do using computers, laptops, cellphones, and other devices for digital teaching. According to Aftiani et al., (2020) Flip PDF Professional is an application that can import various animated media into Flipbook. According to Belia et al., (2022) "one of the software used is the Flip PDF Professional application. Educators can add videos, images, audio, and hyperlinks with this app. The result of the media is flipbook-shaped teaching materials. According to Erniwati et al., (2022) Flip PDF Corporate Edition Software is a flipbook-shaped application that can be used to create a digital module that also looks like a flipbook. According to Nugroho et al., (2023) PDF files can be converted into digital books using a program called Flip PDF Professional, which can be opened and closed like regular books.

Most of the previous studies that have conducted research using the Flip PDF Professional application in elementary schools in Science and Mathematics subjects as subjects that will be made in the form of digital modules (Ibrohim, 2019; Ramadhina & Pranata, 2022; Yunianto, 2019), this study creates a digital module using the Flip PDF Professional application in the Pancasila Education subject in the Independent Curriculum for grade IV elementary schools. The novelty of this study is a digital module of the independent curriculum in Pancasila Education learning in grade IV elementary schools. The purpose of this study is to create an innovative and creative learning environment that is pedagogical and didactic, so educators and students themselves must use imaginative and intuitive learning resources to produce a creative, innovative, and interesting learning environment, suitable for increasing motivation, participation, and activeness of students. The contribution of the research that has been done has obtained the results of the effectiveness test of the digital module in Pancasila Education learning with the material "Rules at Home, Rules at School and Rules in the Surrounding Environment" in Grade IV of Elementary School resulting in an effective digital module. This can be seen from the results of the test sheet work which shows the average percentage of student completion after using the digital module with a percentage of 87%. These results indicate that the digital module developed is effective for use in the learning process in grade IV of elementary school.

METHOD

The type of research conducted by researchers is known as Research and Development (R & D). The development model used in this study is the 4-D model. According to Thiagarajan the flow of the 4D model is to define, design, develop, and disseminate (Lestari, 2018). The first stage is to analyze basic problem determination, student analysis, concept analysis, task analysis, and learning objective analysis. The second stage is the product design and design process. The third stage is development through validity, practicality, and effectiveness tests. Validity tests by experts and product revisions are carried out based on assessments, input, and suggestions from experts. Practicality tests are by providing assessment instruments to teachers and students. Effectiveness tests are to see the effectiveness of the products that have been developed by providing pre-test and post-test questions to students at trial schools and research schools. The fourth stage is the dissemination process carried out at distribution schools so that the effectiveness of products produced are effective for use in the learning process.

Effectiveness in developing digital modules is intended to determine the level of effectiveness of the products that have been developed. The effectiveness instrument is used to collect data through pre-test and post-test questions given to students, with the aim of seeing the effectiveness of using digital modules before and after being used in the learning process.

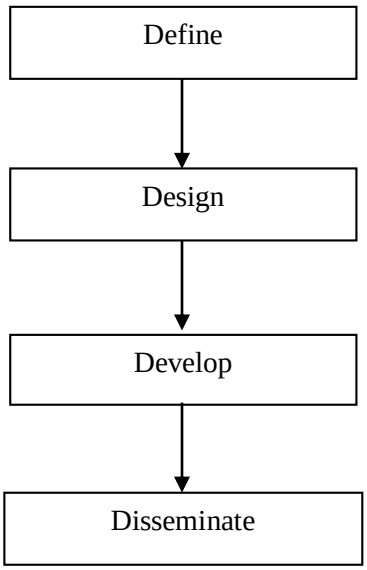

Figure 1. 4-D Model

The research Subjects were fourth-grade students at Bukit Cangang Elementary School 12, students at ATTS Elementary School 14, and students at Benteng Elementary School 01. Starting on July 18, 2023 to July 22, 2023. A detailed explanation of the research subjects can be seen in the following Table 1.

Table 1. Research Subjects

No.	School Name	Information	Number of Students 1st Meeting	Number of Students Meeting 2
1	Bukit Cangang Elementary School 12	Trial School	22 Students	22 Students
2	ATTS Elementary School 14	Research School	24 Students	25 Students
3	Benteng Elementary School 01	School of Dissemination	18 Students	21 Students

This research is conducted through analysis with two types of data sources, namely Quantitative is data obtained to produce numbers. Quantitative data is obtained from student favorite questionnaire scores. Qualitative data is structured data that cannot be verified through numbers. This information is presented as a summary and analysis that is expected to be carried out by students and teachers using the prepared topic discussion framework.

The digital module that has been tested then enters the effectiveness stage. The effectiveness test is carried out to determine whether the digital module used achieves effective goals in improving the equality of the digital module. The effectiveness test instruments are described in Table 2 dan Formula 1.

Table 2. Interval and Frequency of Completion

No.	Interval	Frequency
1.	≥ 80	Number of Students Completed
2.	≤ 80	Number of Students Not Completed

$$\text{Percentage Completed} = \frac{\text{Number of Students who Completed}}{\text{Number of Students Present}} \times 100\% \quad (1)$$

Create a percentage of student learning outcomes completed into qualitative criteria in Table 3 below.

Table 3. Percentage of Completion

No.	Interval	Criteria
1	0-39%	Very Low
2	40-59%	Low
3	60-74%	Currently
4	75-84%	Tall
5	85-100%	Very High

RESULTS AND DISCUSSION

Results

The digital module was developed based on problems found during observations in elementary schools. The problem is that the use of printed textbooks has not been fully able to increase student participation and activeness in the learning process in the classroom. The digital module that has been developed contains learning materials on the Pancasila Education subject of the independent curriculum, images, videos, and quiz links to be worked on by students, and animation designs on each page of the digital module. The first stage, namely the basic problem definition stage, is carried out through interviews with teachers and observations of students to find out and determine the problems that occur in teachers and students and determine what products are suitable to be developed in overcoming the problems faced by teachers and students, and the product developed is a digital module using the Flip PDF Professional application. In the second stage of product design, the design process is carried out by collecting teaching materials, images, videos related to the subject matter, quiz links, and animation designs on each page of the digital module that has been developed using the Flip PDF Professional application. The digital module is designed using language that is easy for students to understand and can increase student participation, motivation, and activeness.

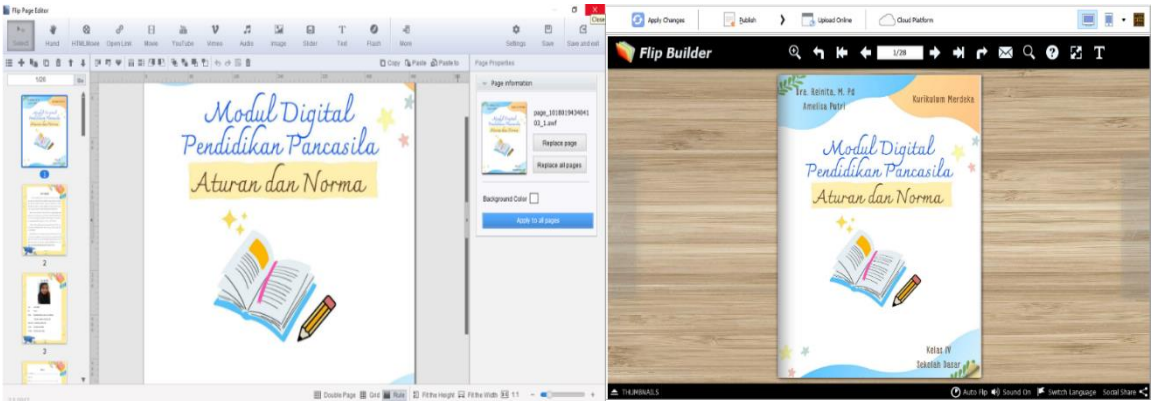

Figure 1. Page Editor Menu Display and Final Result of the Digital Module

The third stage is the digital module development stage to produce a valid, practical, and effective digital module for students to use in the learning process. The digital module development stage goes through a validity test process by experts which includes aspects of material validation, language validation, and media validation. The practicality test is carried out after the developed digital module has been validated based on the assessment of experts, by providing a practicality questionnaire to teachers and students after using the digital module and an effectiveness test by providing pre-test and post-test questions to students at trial and research schools to determine the effectiveness of the digital module. The fourth stage is the distribution of the digital module to determine the effectiveness test at the distribution school.

Analysis of Digital Module Effectiveness Test Results

The development stage includes testing the effectiveness of the product created which is carried out in trial schools and research schools.

Results of Effectiveness Tests at Trial Schools

The results of the effectiveness test on the digital module were used to determine the level of effectiveness of the digital module in class IV of Bukit Cangang Elementary School 12 which was attended by 22 students with the effectiveness of the test presented in Table 4.

Table 4. Effectiveness Tests at Trial Schools

No.	Meet	Before Using the Digital Module	After Using the Digital Module
1	First Meeting	41%	82%
2	Second Meeting	41%	86%

The percentage of fourth-grade students can be seen from the percentage calculation above. After using the digital module, the first meeting using the Flip PDF Professional application was 82%, with effective criteria. In the second meeting, the percentage of fourth-grade students can be seen from the percentage calculation above. After using the digital module the Flip PDF Professional application is 86%, with very effective criteria.

Results of Effectiveness Tests at Research Schools

The results of the effectiveness test of the development of digital modules were carried out to determine the level of effectiveness of the digital module in class IV of ATTS Elementary School 14 which was attended by 24 students, the results obtained are presented in Table 5.

Table 5. Effectiveness Tests at Research Schools

No.	Meet	Before Using the Digital Module	After Using the Digital Module
1	First Meeting	42%	88%
2	Second Meeting	44%	88%

The percentage of fourth-grade students can be seen from the percentage calculation above. After using the digital module's first meeting using the Flip PDF Professional application, the result was 88%, with very effective criteria. The percentage of fourth-grade students can be seen from the percentage calculation above. At the second meeting after using the digital module using the Flip PDF Professional application was 88%, with very effective criteria.

Results of Effectiveness Tests at Distribution Schools

The distribution stage at Benteng Elementary School 01 is a distribution school. The results of the digital module effectiveness test were carried out to determine the level of effectiveness of the digital module in class IV of Benteng Elementary School 01 which was attended by 18 students at the first meeting and 21 students at the second meeting, the results obtained are presented in Table 6.

Table 6. Effectiveness Tests at Distribution Schools

No.	Meet	Before Using the Digital Module	After Using the Digital Module
1	First Meeting	50%	89%
2	Second Meeting	48%	90%

The percentage of fourth-grade students who graduated from Benteng Elementary School 01 can be seen from the percentage calculation above. After using the digital module, and first meeting using the Flip PDF Professional application, the results were 89%, with very effective criteria. The percentage of fourth-grade students who graduated from Benteng Elementary School 01 can be seen from the percentage calculation above. After using the digital module second meeting using the Flip PDF Professional application, the result was 90%, with very effective criteria.

Discussion

Based on the results of the practicality test, the digital module was declared very effective for use in the learning process. Furthermore, the digital module can be used by teachers to help students understand the subject matter and can help students increase their participation, motivation, and activeness. Researchers developed digital learning media that adapt to the demands of 21st-century learning, by utilizing technological developments and developing digital modules using the Flip PDF Professional application. This digital module is packaged in the form of a PDF file, and then copied into a Word file so that when the link is pressed, it can be opened immediately and used digitally. This digital module contains material that is equipped with images, learning videos, and quiz links that can be accessed by students and displays attractive colored animation designs on each page. This digital module also uses language that is easy for students to understand.

This finding strengthens the research that has been conducted (Sahamudin et al., 2022), stating that digital modules are materials to help students in the learning process. There are several weaknesses in printed modules. In particular, it is less interesting for students to learn in the classroom, and also cannot display learning videos. The use of digital module materials is one way to overcome the shortcomings of printed modules. At the elementary school level, good learning can use text or module teaching materials. Modules are a type of material used to help students learn subjects in more depth. According to Wahyuni & Puspari (2017), modules are made in sentences that are easy for students to understand based on their knowledge and maturity so that they can progress freely based on the educator's journey.

One form of effort in making innovations to improve the learning process in the classroom is by using digital modules using the Flip PDF Professional application. According to Parapat & Sagala (2022), one benefit of using Flip PDF Professional is that it's quite accessible and allows you to include images, audio, and video in the module that needs to be created. According to Putri & Wijayati (2022) HTML5, EXE, Zip, Mac application, FBR, mobile type, mobile, tablet, and CD are the outputs. Meanwhile, according to Yunianto (2019) There are advantages to Flip PDF Professional, including: (1) Creating a flipbook that can be flipped like a book will produce interesting interactions. (2) In the flipbook section, interactive learning materials such as flash animations or videos are available. (3) Digital modules are a set of materials used to create materials that describe media visually. According to Rahmawati, et al., (2012) it is envisaged that students would find it simple to comprehend the information in order to successfully meet the learning objectives thanks to the benefits offered by the Flip PDF Professional program.

CONCLUSION

The results of the effectiveness test of digital modules in Pancasila Education learning produced a very effective digital module. This can be seen from the results of the test sheet which showed an average of 88% of the percentage of student completion after using the digital module. Furthermore, with the digital module using the Flip PDF Professional application, it is hoped that it can become a useful digital module for students in the learning process as well as for other researchers so that the digital module using the Flip PDF Professional application that has been developed can be a reference for other researchers to develop other digital modules.

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Wearable technology (smartwatch) as an innovative learning support media post-COVID-19 pandemic

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ABSTRACT
Post-COVID-19 pandemic, the world of education has undergone significant changes in the learning process, especially in the use of technology. The research examines the use of smartwatches to support innovative and exciting learning processes. The main objective of this research is to find out the teacher's understanding of the potential and how to use smartwatches in the learning process. The research also analyzes the significant relationship between the teacher's understanding of the subject and the use of smartwatches in the classroom by using quantitive methods. The research approach used is quantitative. Respondents from secondary and high school teachers who participated in the study were 51 teachers from private and state schools. Data analysis shows that smartwatches can be an innovative and enjoyable learning support medium. The use of smartwatches increases involvement, thus enriches the learning experience, and encourages an independent search for information. Smartwatches can also help students increase their confidence in expressing their ideas and creativity, especially when writing learning reports and other tasks. The study also shows that there is a challenge in integrating smartwatches into education, namely, teachers need to understand the potential and how to use smartwatches that can help to develop the student's knowledge through creating an innovative learning medium.

Deviyana, R. M. & Makmur, A. (2024). Wearable technology (smartwatch) as an innovative learning support media post COVID-19. *Jurnal Inovasi Teknologi Pendidikan, 11*(3), 328-337. https://doi.org/10.21831/jitp.v11i3.70884

INTRODUCTION

Education is an effort that has a purpose to mature humans through teaching and training until it could affect the attitudes and behavior of a person or group (KBBI, 2024). The main purpose of education is to help students to develop themselves into smart and good individuals. The process This process can be done in various ways, one of which is providing students with interesting learning experiences to make them more motivated to improve their learning outcomes (Zabir, 2018). The use of different media has become an important and inevitable part of today's learning process, as it allows for a diverse learning experience and increases students' interest in learning. Meanwhile, the media referred to various forms and types, which can provide the potential to increase the effectiveness and efficiency of learning (Daryanto, 2015).

The word "media" from Latin means intermediary or introducer (Sadiman, et al, 2018). Learning media refers to everything that is used to convey the content of the lesson by stimulating thinking skills, processing emotions, increasing students' attention and abilities, and allowing

students to participate enthusiastically in learning (Ibrahim & Syaodih, 2003). By using learning media, the teaching and learning process is more interesting and efficient. It also could impact the students' quality (Widodo & Jasmadi, 2008). In the post-COVID-19 pandemic era, challenges in education are becoming increasingly complex, demanding innovation in teaching methods, especially the use of technology in learning in order to increase student learning interest (Andriani et al, 2024).

The role of teachers in learning has an important task to teach and educate students. Teachers need to consistently improve their competencies until they can help students face challenges in the digital era. This is by Law Number 14 of 2005 of the Republic of Indonesia Article 8 regarding the competencies that teachers must have, namely personal, pedagogical, social, and professional competencies. The indicator of pedagogical competence is the ability to utilize various technologies as learning media. Therefore, teachers need to develop their abilities, in terms of skills and, until they can develop innovative learning mediums that solve the challenges in this digital era (Sitompul, 2022). The COVID-19 pandemic that occurred made many students experience problems in the form of mental health, physical health, and student concentration in learning. Health problems are related to excessive anxiety which makes students feel stressed and depressed (Liang et al, 2020). One of the anxieties that occur is due to the lack of physical activity carried out by students (Okuyama et al, 2021). Not only that, many students experience problems in participating in the process due to a lack of focus and involvement in the learning process (Isha & Wibawarta, 2023). Therefore, in the post-Covid-19 pandemic era, the world of education is facing a significant paradigm shift. The pandemic has forced educational institutions around the world to adapt to more flexible teaching methods by using advanced technologies, such as the use of wearable technology, which has emerged as a potential educational tool (Fauziyyah, 2019).

The use of wearable technology and smartwatches in learning shows the potential to improve student learning outcomes by providing a more engaging experience for students (Syafi & Kurniawati, 2023). Thus, the use of wearable technology emerges as an innovative solution that allows educators and students to go beyond the boundaries of traditional learning. The use of technology as a medium in learning provides real-life experiences through simulations, interactive games, and the use of virtual reality technology, which are difficult to present in traditional learning. By using these tools, teachers and students have full freedom to learn anytime and anywhere and get access to relevant and up-to-date information. With this freedom, teachers and students are more eager to gain new knowledge and understanding that can be used in the learning process. In addition, wearable technology helps in tailoring learning methods to the individual needs of each student. By collecting real-time data on how students learn, educators can customize their approach to meet diverse learning needs. This is important to support students with different ways of learning and ensure that every student gets an optimal learning experience (Tanjung & Namora, 2022).

Wearable technology, such as smartwatches, Fitbits, fitness trackers, augmented reality (AR), and virtual reality (VR) can also be used in the learning process. By utilizing wearable technology devices, such as smartwatches, students can measure heart rate, count the number of steps taken, calculate calories burned, know the level of stress experienced, etc. The use of smartwatches in everyday life can be used to track students' physical activity and integrate it with science or health lessons. It also could provide a practical understanding of concepts such as heart rate and physical health. Through the experience of measuring heart rate, counting the number of steps, and calories burned, students are invited to learn through real-life experiences that are interesting and fun until it helps students in providing new knowledge and understanding (Sadikin, 2019). This development is driven by the need to create learning methods that are not only effective but also interesting and able to adapt to the changing learning environment (Wulandari & Mudinillah 2022). Learning using smartwatches creates a sense of interest in students, thus stimulating student engagement and making learning more interactive (Liang et al, 2019).

Smartwatch is capable of being one of the popular human activity monitoring tools. With this ability, the relationship between smartwatches and learning is an interesting thing to study because of its ability to adapt quickly to fulfill students' needs. Several similar studies allude to

this, such as the use of smartwatches that can monitor student activity in real-time (Herrera et al, 2019). Smartwatches used in the learning process can ensure they achieve the targets set by the teacher while remaining safe (Attallah & Ilagure, 2018). In addition, the use of smartwatches in the learning process is proven to significantly improve student learning outcomes (Syafi, & Kurniawati, 2023). On the other hand, the use of smartwatches creates more interaction between teachers and students. It also makes learning innovative and able to increase student concentration in the classroom (Liang et al, 2019). Smartwatches used in the learning process can ultimately improve students' motivation and attitude towards learning (Koutromanos, & Kazakou, 2020).

The research provides new contributions to the existing literature by incorporating a quantitative approach to analyzing the use of smartwatches as supporting media in the innovative learning process in the post-COVID-19 pandemic era. Previous research has explored various aspects of the use of smartwatches in education, describing the characteristics of smartwatch use and identifying relationships between various variables that affect their effectiveness in learning. One of the new aspects presented in this study is the emphasis on teachers' understanding of the use of smartwatch features and how this affects the learning opportunities given to students to explore those features in the learning process. The research also offers new insights into the differences in acceptance of smartwatches at different levels of education. Based on the background and some previous research. Then this research will do some research on the formula of the problem: first, the teacher's understanding of the potential use of smartwatches in learning, second, the teachers' understanding of how to use the smartwatch, and third, whether there is a significant relationship about the understanding of a maple teacher with the use of a smartwatch in his classroom. This research can contribute to determining the right start-up for the transition back to face-to-face and hybrid classes. This research can enhance student learning experience and involvement until it can create learning experiences with real-time data. Therefore, a proper strategy is needed for teachers to integrate the use of smartwatches as technological innovations in teaching and learning processes at various levels.

METHOD

This research adopts a quantitative approach. The data is collected using research instruments. The analysis is performed quantitatively or statistically to test the hypothesis that has been established (Ardyan et al, 2023). applied a descriptive and correlational method, which aims to describe or describe the characteristics of a phenomenon or population studied as well as to identify relationships between various variables. The sample of this research consists of 50 teachers from the middle and high school levels. These teachers teach taught a wide range of subjects, including Mathematics, Religious Education, Indonesian Language, Natural Sciences (IPA), Social Science (IPS), Arts, Information and Communication Technologies (ICT), Physical Education, Sports and Health, English, and other subjects. The data collection process took place from 23 November to 6 December 2023. On the other hand, samples of respondents were randomly selected from public and private schools in different regions to ensure wider diversity and representation. The selection process of respondents is carried out by taking into account the diversity of backgrounds of the subjects enabled, to obtain a comprehensive perspective related to the application of wearable technology in the learning process.

The data collection techniques that will be used in this study are Questionnaire (questionnaire). In this study, a closed questionnaire was used, namely the questions given to respondents already had answer choices. So this type of questionnaire respondents are not allowed to express their opinions. Instrument measurement using a Likert scale. The researcher also used the Likert scale as an instrument measurement. It is used to measure the attitudes, opinions, and perceptions of a person or group of people about social phenomena. The Likert scale has two forms of statements, namely positive and negative statements. Positive statements are scored 5, 4, 3, 2, 1, while negative statements are scored 1, 2, 3, 4, 5. The answer form of the Likert scale consists of strongly agree, agree, doubt / neutral, disagree, and strongly disagree. This study uses descriptive analysis and linear regression. Descriptive analysis is the collection and processing of data without making comparisons or connecting one variable with another (Hasan, 2022). It could describe a

study conducted to describe the use of smartwatches in learning. This analysis was carried out with linear regression to investigate the effect between one dependent variable and one independent variable from the data that had been obtained (Yusuf et al, 2024).

RESULTS AND DISCUSSION

Result

Based on the analysis results listed in Table 1, it can be concluded that there are several important aspects regarding the use of smartwatches in an educational context. First, most teachers have a fair understanding of how to use the various features available on smartwatches, with an average score of 2.94. It shows that teachers already have the basic operational knowledge of the device, which is an important first step in integrating the technology into the learning process. Furthermore, the features of smartwatches are considered to be able to be utilized as effective learning media, with an average score of 2.97. This indicates the potential of smartwatches to be used as a tool in the learning process, providing opportunities for more innovative and interactive teaching methods. Furthermore, teachers observed that students generally understand the use of smartwatches well, reflected in the high average score of 3.40. The ease of using the smartwatch contributed to the high level of student understanding. A good understanding of using the smartwatch was a critical aspect that showed the students' positions as the main users of this technology in a learning context.

The research also showed that the use of smartwatches in learning provides interactive and enjoyable experiences for students, with an average score of 3.03 and 3.00, respectively. It can be concluded that smartwatch not only supports educational aspects but also aspects of the learning experience that are more interesting and fun, thereby increasing students' involvement. However, some things needed further attention. The teachers acknowledged that they knew enough about how using smartwatches could help in explaining learning material, but still lacked the opportunity to allow students to explore the features of a smartwatch, with an average score of 2.51. It shows that there was a gap in using smartwatch features in the educational context optimally. Although the use of smartwatches has shown a positive impact on the interactive and fun aspects of learning, there is still room to improve how this technology can be more effective in helping students understand the learning material. Further developments in teacher training and the integration of smartwatch features into the curriculum could be the next step toward optimizing the use of smartwatches in education.

Table 1. The Use of Smartwatch as Supporting Media in the Learning Process

No.	Item	Mean
1	Teachers Knohow to Use the Features on Smartwatches	2.94
2	Teachers Know the Use of Smartwatch Features as the Learning Media	2.97
3	Teacher Knows how to Use Smartwatch Features to Explain the Material	2.54
4	Students Get the Opportunity to Explore the Features of the Smartwatch.	2.51
5	Students Know How to Use the Smartwatch	3.40
6	The Student is Proficient in Using the Features of the Smartwatch	2.94
7	Students Use Smartwatch Features in the Learning Process	2.51
8	Students have an Interest in Exploring the Features of Smartwatches.	2.97
9	Students Enjoy Using Smartwatches in the Learning Process	2.97
10	Using a Smartwatch Provides an Interactive Learning Experience	3.03
11	Using a Smartwatch Provides a Fun Learning Experience	3.00
12	The Use of Smartwatches Helps Students to Understand the Learning Material Provided	2.83

The analysis of the data contained in Table 2 provides valuable insights into the impact of smartwatch use in the learning process, especially in student skill development. From the data collected, it is known that teachers generally agree that the use of smartwatches contributes positively to students' skill development, with an average score of 2.80. This indicates a perception

that smartwatches are not only technological aids but also effective educational tools for improving students' skills. In addition, the use of smartwatches in the learning process seems to be successful in fostering a sense of curiosity in students, with an average score of 2.91. This sense of curiosity is an important factor in learning, as it can encourage students to more actively explore and learn the learning material. The curiosity generated by the use of smartwatches can be seen as an impetus for more independent and discovery-oriented learning. Furthermore, the data shows that this sense of curiosity has a positive impact on students' self-confidence with an average score of 2.94. When students feel curious and encouraged to explore, they tend to become more confident in expressing their ideas and thoughts.

The use of smartwatches helped in facilitating this process, as reflected by the mean score of 2.83, indicating that students became more courageous in conveying the ideas they acquired during smartwatch learning. Finally, the use of smartwatches seemed to have an impact on improving students' ability to create more creative learning reports with an average score of 2.97. This suggests that the integration of wearable technology such as smartwatches in learning not only supports knowledge enhancement but also stimulates students' creativity. Through the use of smartwatches, students get the opportunity to apply their knowledge in the form of more innovative and creative learning reports or projects. The data in Table 2 shows that smartwatches had significant potential in supporting the development of students' abilities and creativity in the learning process. Smartwatches not only enrich the learning experience through technology but also play a role in encouraging students' curiosity, confidence, and creative thinking skills. It confirmed the importance of integrating wearable technology in education to create a more dynamic and interactive learning environment to support students' all-round development.

Table 2. The Use of Smartwatch as Supporting Media in the Learning Process

No.	Item	Mean
1	The Use of Smartwatches in the Learning Process Helps Students to Develop Student their Abilities such as Creativity, Fighting Power, Discipline, etc.	2.80
2	Students have a High Curiosity when Using Smartwatch in the Learning Process	2.91
3	Students are excited when Using Smartwatches to Search for New Information	2.89
4	Students have Confidence in Expressing Information Obtained when Using a Smartwatch	2.94
5	Students can Express New Ideas After Using Smartwatches in the Learning Process	2.83
6	Students can Develop their Creativity when Exploring New Material through Smartwatches	289
7	The Use of Smartwatches Helps Students to be Creative in Making Learning Reports	2.97

Based on the calculated value, Pearson correlation showed Sig. (2 tailed) of 0.09: it was found that there is an influence of subject teachers' understanding in using smartwatches in the learning process, although not all subject teachers can accept it. In addition, Mapel teachers also provide opportunities for students to explore the features of smartwatches in the learning process. It can be concluded that there is a relationship between teacher knowledge in using smartwatches. It also can be concluded that it could provide opportunities for students to explore various features in the learning process. It also correlated with the opportunities provided by teachers in utilizing the use of smartwatches to make students able to express new ideas. It can be seen in Sig. (2 tailed) of 0.03. In addition, it was found that level influences the use of smartwatches in the learning process. At the high school level, students are more interested in using smartwatch features in the learning process. On the other hand, the use of smartwatches could help students to develop character education, such as fighting power, and discipline, thus making students creative in making learning reports. It can be seen from the Sig (2-tailed) result below 0.04.

Discussion

In today's digital era, the use of technology to assist the learning process is a necessary thing to do. Technology in learning is an innovation made to be innovative and creative (effendi & Wahidy, 2019). The use of technology in the learning process can be used as a medium by teachers to make it easier to convey learning materials. By using technology in learning, students are invited to explore more knowledge and carry out a learning process that is different from what is done.

Based on Table 1, it can be seen that the use of smartwatches was one of the supporting media that can be used in the learning process. Not only that, by using technological devices learning becomes interactive and fun for teachers and students. This can happen if the teacher first uses and utilizes technology in the learning process. In addition, teachers need to invite students to be actively involved in the learning process supported by technology. Through the use of technology, such as smartwatches, students get the opportunity to understand the subject matter through real practical experience. This helps students develop a deeper understanding of learning concepts and apply this knowledge in a real-world context.

The use of various technological devices in learning is an important thing to do as an effort to answer the times. However, it should be noted that the use of technology as a learning media must pay attention to several things, namely the media used must be easy to obtain, the media used is not complicated, understand the character of students, see the class situation, and master the tools to be used (Suminar, 2019). Therefore, the use of technology in the learning process must be considered as a comprehensive and coordinated approach, especially in terms of training and professional development for teachers. The importance of technology training for teachers cannot be underestimated, as they need to be equipped with the skills and knowledge to effectively use various digital tools and platforms in learning. This included mastering the technical aspects of software and hardware, as well as developing strategies to incorporate these technologies in their lesson plans. In addition, continuous professional development was essential, allowing teachers to stay up-to-date with the latest developments in educational technology through activities such as workshops, webinars, conferences, and participation in online communities (Amin, 2019).

The results of the analysis showed that the use of smartwatches in an educational context supported the research objective of exploring the utilization of this technology as an innovative learning medium. Data showing teachers' understanding and utilization of smartwatch features (mean: 2.94) and students' positive responses (mean: 3.40) underscore how wearable technology can be integrated into education. This responds to the main research problem, which is how to adapt wearable technology in education to create more effective and engaging learning methods after the COVID-19 pandemic. In Table 2, the use of smartwatches is enough to develop student's abilities, especially in increasing curiosity to find new information, encouraging confidence in expressing the information obtained, and making interesting reports on learning outcomes. From that, it can be seen that the use of smartwatches in the learning process provides new experiences for students so that they can increase their knowledge. The use of smartwatches as an interactive learning tool shows a correlation with modern learning theories that emphasize the active exploration, discovery, and active involvement of students in the learning process (Sipahutar et al, 2023). According to the theory of constructivism, as expressed by Piaget and Vygotsky, the best learning occurs when students are actively involved in the process of building their knowledge (Vygotsky, 1978). The sense of curiosity cultivated through the use of smartwatches (mean: 2.91) and increased student self-confidence (Mean: 2,94) are manifestations of this theory in practice. The smartwatch's ability to provide direct feedback and exciting interaction encourages students to engage in a deeper learning process, the importance of a tool in learning is becoming increasingly relevant in the context of modern education.

This concept, rooted in the theory that students learn most effectively when they are slightly outside their comfort zone but still within the range of understanding, underscores the importance of the right tools in supporting the learning process. These tools can be used as digital resources of interactive tools or specially designed educational materials that bridge the gap between what students already know and what they are trying to learn. By providing this support, they enable students to achieve deeper understanding and internalize more complex knowledge. This was particularly important in helping students develop critical skills and problem-solving abilities, allowing them to move through their zone of proximal development more effectively. In practice, the use of these tools requires a structured and reflective approach from educators, who must be able to identify the specific needs of each student and provide resources that can help them on their learning journey.

This approach not only supports students' cognitive development but also increases their engagement in constructing their knowledge from their experiences (Sugrah, 2019). Technology can significantly increase student engagement in learning. Appropriate use of technology helps students in improving their learning outcomes (Budiyono, 2020). That way, students actively explore and find their own understanding in the learning process by using various available technologies, especially the use of smartwatches. The use of technology in the learning process is unavoidable. The use of technology-based learning media was an innovation that can be done in the learning process so that teachers and students are ready to face various technological developments. Teachers need to train students to have the ability to think critically and be more creative, innovative, and communicative in expressing their opinions, they could work together and collaborate to further increase students' self-confidence (Surani, 2019). This is where the teacher's role is increasingly important because the teacher is a facilitator, as well as a companion in learning who helps students understand their knowledge appropriately until they can use technology wisely and be able to share information obtained as new knowledge through concrete learning experiences with others. Learning using smartwatches can be done if subject teachers know in advance the benefits of using smartwatches in the learning process (Quintana et al, 2016). The use of smartwatches in the learning process is currently only done by science and sports teachers. In fact, by using smartwatches, students can monitor heart rate, track sleep time, and get stress management interventions (Jerath et al, 2023). By knowing these things, students can increase physical activity, monitor sleep, and manage stress better (Sieniawska et al, 2024).

In addition, some smartwatches have features for breathing exercises, which can help students manage stress and improve focus. This feature can be used as an important activity such as meditation to start learning so that students can be more prepared and focused in following the lesson. This is important because good sleep timing and effective stress management allow students to focus more on learning, which in turn can improve academic performance and reduce behavioral problems that may occur (Mitru et al, 2002). With a good understanding of the benefits of smartwatches, teachers can integrate this technology into their learning methods. Heart rate monitoring can help students understand their health conditions and make better decisions regarding physical activity. Stress management interventions through breathing exercises and meditation features can help students be calmer and prepared for academic and social challenges at school. Overall, the use of smartwatches in the learning process is not only limited to science and sports but it can be applied in a variety of subjects to support students' health and well-being. As such, smartwatch integration can create a more holistic learning environment and support students' all-round development. These findings provide important insights for educational leadership in formulating technology integration strategies. Smartwatches as learning tools offer new ways to manage teaching and learning processes that are more interactive and engaging, showing potential in education policy and planning. In the context of education economics, investment in wearable technology can be a valuable step to improve the quality of teaching and learning, offering a more personalized and engaging learning experience for students. From an educational politics perspective, the findings support initiatives to modernize curricula and teaching methods, It also could demonstrate the importance of technological innovation in education. Technological innovation helps learning by utilizing existing technology to facilitate the learning process (Rahmawati, 2022).

CONCLUSSION

Based on the results of research conducted to determine the use of wearable technology, especially smartwatches as one of the supporting media in the learning process, it can be concluded that teachers need to recognize the potential use of smartwatches in the learning process. That way, teachers' understanding of how to use smartwatches especially provides an understanding of MAPEL teachers, it was not only limited to science and sports teachers to use smartwatches in the learning process. There was great potential especially in students because they showed a good understanding of using smartwatches as learning media. They can utilize smartwatch features to support learning activities, such as accessing learning materials, setting study schedules, and

participating in interactive learning activities. In addition, the use of smartwatches is proven to provide a fun and interactive experience for both teachers and students. By engaging students in the learning process, teachers can present course content in a more interesting way. It was important for teachers to master the use of smartwatches in order to utilize them effectively to provide different and innovative learning experiences for students. Not only that, smartwatches contribute to the development of students' abilities, such as creativity and initiative. This happened because students were encouraged to actively seek and explore information, as well as apply knowledge in different contexts, which ultimately increased learning independence. However, the study also identified some areas for further research. It was important to explore the most suitable subjects and learning materials to be integrated with smartwatch use. Determining the right content will help teachers in making the learning process more innovative and in line with the technological developments taking place. The use of smartwatches should be viewed as an additional component that enriches, not replaces, traditional learning methods. A learning approach that is tailored to the needs of students, the characteristics of learning media, and the socio-emotional conditions of students is the key to achieving the main goal of education, which could develop human potential to be better prepared to face the challenges of life, especially in the face of technological advances. In conclusion, this study shows that smartwatches can play an important role in modern education and provide an optimal learning experience for students. However, its integration should be done by considering equality of access, teacher training, and diverse learning needs to ensure that all students get the optimal benefit from this technology.

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Development of interactive media sheet metal design modeling based on software Autodesk Inventor Professional 2023

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ABSTRACT

This research and development aims to produce learning media products presented interactively and practically based on Autodesk Inventor Professional 2023 student version software and analyze the feasibility level of learning media for CAD Manufacturing Drawing Techniques subjects to improve competence in the field of machining techniques at Vocational High School 1 Kediri. The type of research used is research and development (R&D) using the Borg and Gall model, It involved 6 students for the small-scale testing and 32 students for the large-scale testing. Based on the data obtained and descriptive analysis, among others, the results of media expert validation were 98.44%, material expert validation was 89.28%, small-scale trials were 92.08%, and operational trial results were 91.09%. These results indicate that the interactive learning media product sheet metal design modeling meets the criteria very well and can be utilized as a learning tool.

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INTRODUCTION

The phenomenon of the Industrial Revolution 4.0 currently shows the speed of technological development (Saleem et al., 2024). Everything seems to be connected to the internet system, where accessing information from the outside world feels very real given the role of technological advances today (Pratama et al., 2023). The world of education by improving its quality always adapts to changes and technological advances inherent in learning to be able to compete in the era of globalization (Ardianti & Susanti, 2022). Technology innovation and development are needed to improve the effectiveness of the current learning process integration (Myori et al., 2019). One of them is the making of learning materials which is a crucial element of the learning process, aiming to create meaningful learning, and encouraging students to develop the skills needed in the 21st century, which is a must in education (Daryanes et al., 2023).

Through education, it becomes an effort to develop Human Resources (HR) which must always be upgraded every year to improve the quality and skills that can be highly competitive (Mardhiyah et al., 2021). Various kinds of technology should be applied to learning (Miaz et al.,

2019). In the era of Education 4.0, educators must create innovative and creative learning approaches based on technology (Maolani et al., 2022; Sagita, 2019). Vocational High Schools (SMK) are educational institutions that focus on improving skills and preparing students to enter the industrial world (Kristian et al., 2023). Making Indonesia 4.0 industry manufacturers should use technology in their production process (Santika, 2021). Therefore, the use of technology in the field of engineering has become an absolute necessity and must be applied since vocational secondary education such as SMK (Fathoni & Marpanaji, 2018). Currently, most industries use computer-aided design or CAD for drawing (Pelliccia et al., 2021). The use of CAD facilitates the product design process in industry, with computers and CAD software communication through the language of images becomes more effective (Bagyo & Ngadiyono, 2020). The time required for drawing becomes shorter and the storage of drawing archives becomes more efficient, has a very important role in CAD, in line with the opinion of Gondoputranto & Purnomo (2020) said that CAD has helped optimize the manufacturing process through an integrated and intelligent computer system as the brain in operating a manufacturing industry.

The purpose of the Mechanical Engineering qualification in vocational schools is to provide knowledge about what is in the industry, and produce a competent and disciplined workforce, ready to enter the workforce and be productive (Noviyanta & Ngadiyono, 2019). One of the subjects in SMK competency in Mechanical Engineering that must be taken is Manufacturing Drawing Engineering/CAD (TGM CAD), which uses Autodesk Inventor software (Rohman et al., 2023). This subject is the basis for several applications of other subjects, such as CAM (Computer Aided Manufacturing) which require optimization and effectiveness in the learning process (Berselli et al., 2020). Skills in this subject are considered very important because it is expected that after graduating students can apply knowledge from TGM CAD subjects when continuing to the next level or when involved in the world of work (Shih & Sher, 2021).

When conducting observations, several problems were found in learning TGM CAD class XI SMK Negeri 1 Kediri, including the use of conventional learning methods such as lectures, step-by-step demonstrations of material limited to 18 meetings, and job sheets. Consistent with research by Yunus & Fransisca (2020) the method is less effective in encouraging students' active participation as well as difficult in achieving more complex skills. The complexity of CAD material related to other subjects such as Entrepreneurship Creative Products (PKK) which focuses on plate fabrication and welding work. While the use of CAD software versions 2018 to 2020 that have not been updated is one of the obstacles, on the other hand, version 2023 has appeared with the latest updated features. From observations and interviews, it is concluded that innovation in learning methods, more structured lesson plans, integration of CAD materials with other subjects, and updating CAD application software are needed.

Supported by previous research Ramadhan (2023) has developed an interactive learning product in the form of a comprehensive electronic module with video tutorials for class XI students majoring in Mechanical Engineering at Vocational High Schools 1 Kediri. The feasibility of the media is determined through four stages of product evaluation, namely material expert validation, media expert validation, small-scale testing, and operational testing. The test results concluded that the electronic module and video media products were declared suitable for use with very good assessment criteria. Based on the results of interviews with TGM CAD teaching teachers to improve the competence of students, it is necessary to develop the material discussed in the module to integrate with other subjects related to sheet metal drawing, because sheet metal is included in the design engineering material which is also taught in TGM CAD subjects. Sheet metal material is relevant to subjects such as PKK (Entrepreneurial Creative Products) to make products from plate fabrication and welding processes. This research offers a new approach by integrating sheet metal design modeling material based on Autodesk Inventor 2023 into an interactive learning module. This development not only presents more practical and up-to-date material but also connects theory with real applications in the industry. This is expected to increase students' attraction to the machining engineering program and motivate them to develop skills relevant to the needs of modern industry.

The purpose of this research is to create variations in learning TGM CAD subjects at Vocational High Schools 1 Kediri through materials formulated based on the flow of learning

objectives (ATP) and then determine the feasibility of the resulting facilities practically, effectively and interactively using learning videos synchronized with E-Modules. The product results of sheet metal design modeling development research will be presented in the form of a complete video tutorial starting from the introduction of CAD, and 3D modeling which includes 2D sketch, 3D sheet metal model, assembly, drawing, frame generator, 3D weldment and equipped with user experience using Autodesk Inventor Professional 2023 application. The media is said to be practical because it is in the form of an E-Module (PDF) that can be accessed easily via smartphone or computer without time and location restrictions, efficient because the document processing module has content that is synchronized with learning videos available on YouTube, and interactive by utilizing WhatsApp discussion groups and YouTube open comments that allow users to discuss directly. The contribution of the application of learning media development with Autodesk Inventor 2023 software is expected to improve users' understanding and retention of information through more interesting sheet metal design modeling learning materials through e-books synchronized with video tutorials on YouTube, motivating them to continue learning, while improving the quality of Vocational High School graduates of machining techniques to compete in the industry and support the realization of Indonesia 4.0.

METHOD

This research uses a type of research and development or education Research and Development (R&D). Research and development (R&D) is a research method used to design new products, test the effectiveness of existing products, and develop and create new products (Yuliani & Banjarnahor, 2021). The product developed is an interactive learning media sheet metal design modeling based on Autodesk Inventor Professional 2023 which is packaged in the form of video tutorials synchronized with electronic modules. The research procedure carried out applies the stages of the Borg and Gall development model (Sugiyono, 2013). The Borg & Gall model is taken into consideration because the model passes a series of validation processes by experts and field trials more than once so that the development product has a high level of validity and can be adjusted to the direct needs in the field (Gall et al., 2003). The research and development process will outline the stages that must be followed hierarchically in order to achieve the set goals (Siregar, 2023). The following ten stages of Borg & Gall development are described in Figure 1.

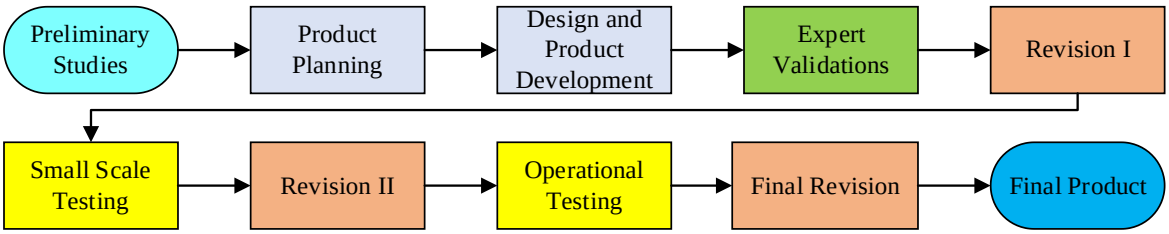

Figure 1. Research and Development Procedure

1. The purpose of the preliminary stage is to identify problems, collect relevant information to solve the problems and evaluate the products to be developed. Problem identification also involves interviews and direct observations with teachers and TGM CAD students of Vocational High School 1 Kediri to determine the media format and substance content used as guidelines for developing learning media. This process also deepens the final competency target by referring to the material items and learning objectives.
2. The product planning stage is structured by designing according to the findings of the preliminary study and literature, including product design and materials as well as the development of existing modules, based on needs analysis from interviews with teachers and students. Product planning will be implemented in the form of video tutorials and e-modules.
3. The design and product creation stage begins with the preparation of a script or storyboard as a guide for the video tutorial content. The preparation of the storyboard is based on the material items from the Flow of Learning Objectives (ATP). Next, the electronic module content material is compiled, followed by the process of recording a demonstration video that explains the material

and the steps of the task. Video making is done as interesting and clear as possible so that users can easily understand the content presented.

4. The expert validation stage is conducted to validate the product through evaluation from experts. The validation of learning products includes aspects of material quality and media quality aspects. The two types of learning media validated are electronic modules and video tutorials.
5. Revision Stage I, the aim is to improve and refine the weaknesses of the product design, based on input from media experts and material experts with student needs.
6. The next step is a small-scale trial with 6 students as subjects to get feedback. Selected students in this trial will be asked to provide comments and input on the product that has been distributed by answering the questionnaire. Representatives of small or limited groups should reflect the actual purpose of the test (Amin et al., 2023). If the evaluation of the use of learning media shows weaknesses, then improvements are needed.
7. Revision Phase II was conducted if there were still weaknesses or shortcomings identified during the small-scale testing. The product is intended to be refined before undergoing testing on a larger scale.
8. The Operational testing stage was conducted after product refinement, to obtain feedback from a wider scale of subjects.
9. Final Revision Stage, the results of feedback and recommendations obtained from the operational trial were used with the aim of refining the product before it was implemented in the learning process.
10. The Final Product stage is the final result of the development process, in the form of video tutorials and electronic modules that have been improved based on reviews, feedback, and evaluations of the previous trial and development stages.

Product Testing

To evaluate the overall feasibility of the product, product testing is needed which includes several aspects including validation tests, trial design, trial subjects, types of data, data collection tools, and data analysis methods.

Validation Test

The validation test uses a questionnaire assessment sheet given to lecturers of the Department of Mechanical and Industrial Engineering, Faculty of Engineering, State University of Malang as media and material expert validators to carry out the validation test stage of interactive learning media products. Improvements will be made immediately if the material expert or media expert provides suggestions or corrections after the review.

Product Test Design

The product feasibility trial was divided into two stages, feasibility trial on a smaller subject scale and operational trial on a larger subject scale. In the first stage, the product is tested by preparing a validation sheet that includes assessment aspects such as coloring, use of words and language, screen display, presentation, animation, and sound for media expert validators, as well as content, presentation, and contextual feasibility for material expert validators. The second stage includes the implementation of product testing by preparing a questionnaire on the results of product development, distributing products, and distributing questionnaires to students.

Test Subject

The subjects of the small-scale trial were 6 students in class XI TPM (Mechanical Engineering) Vocational High School 1 Kediri 4th semester of the 2023/2024 academic year. This sampling technique, according to Sugiyono (2013) indicates that the member sampling process is carried out randomly without regard to the educational level of the class population. The large-scale or operational test involved 32 students in class XI TPM 2 (Mechanical Engineering) Vocational High School 1 Kediri in semester 4 of the 2023/2024 academic year, chosen with the consideration that all students have uniform characteristics.

Data Collection Instruments

This process includes various methods, such as interview guides, submission of questionnaires in Google Form format shown in Table 1 Media Expert Validation Instrument, Table 2 Material Expert Validation Instrument and Table 3 User Instrument, document acquisition to document the learning process, as well as taking photos during research and observation activities to find out how teachers and students interact directly in TGM CAD learning.

Table 1. Media Expert Validation Instrument

No.	Aspects and Indicators	Answers			
		1	2	3	4
A	**Colorations**				
1	Media Coloration Does Not Interfere With Understanding The Material.				
2	Interesting Color Combination.				
B	**Use of Words and Language**				
3	The Video Used Good And Correct Indonesian Language.				
4	Language Compatibility With The User's Level Of Thinking.				
5	The Politeness Of Language Use.				
C	**Display on Screen**				
6	The Use Of Font Type And Size Is Appropriate And Easy To Read.				
7	The Video Editing Method Gives A Positive Impression That Attracts Interest In Learning.				
D	**Presentation**				
8	The Material In The Video Is Coherent With The CAD Material.				
9	Video Media Presentation Supports User Participation In Learning.				
10	Images Are In Line With The Material Presented.				
11	Short Duration (<15 Minutes) So As Not To Bore The User.				
E	**Animation and Sound**				
12	There Is A Transition Effect in the Video To Attract Attention.				
13	There Is An Explanatory Voice On The Video To Make It Easier To Understand.				
14	The Explanation Voice Is Clear And Facilitates The Learning Process.				
15	Background Music Adds Interest And Avoids Boredom.				
16	The Accuracy Of The User's Voice With The Text And Video Material.				

Table 2. Material Expert Validation Instrument

No	Aspects and Indicators	Answers			
		1	2	3	4
A	**Content Feasibility**				
1	The Material In The Learning Media Supports The Competencies To Be Achieved.				
2	The Material Presented Is Coherent Starting From The Introduction Of Concepts, Definitions, and Procedures To Implementation.				
3	The Terms Used In The Learning Media Are Appropriate.				
4	The Material Presented Can Attract Interest In Learning.				
B	**Presentation Feasibility Aspect**				
5	The Material Presented Starts From Easy Material To Difficult Material.				
6	Practice Problems Can Be Used To Hone Skills.				
7	The Materials In The Learning Media Are Interactive And Participatory.				
8	Learning Media Materials Are Adapted To The Cognitive Level Of Users.				
9	Explanations In The Learning Media Reflect The Content Of The Material.				
10	Explanations In The Learning Media Are Simple And Easy To Understand.				
C	**Contextual Feasibility Aspects**				
11	The Material In The Learning Media Is Related To The Reality In The Industrial World.				
12	The Material In The Learning Media Is Relevant To Industrial Reality.				
13	Exercise Problems Are Organized From Simple To Complex According To The Order Of The Material.				
14	The Way The Exercise Is Completed Adds Insight To Knowledge.				

Table 3. User Instrument

No.	Aspects and Indicators Assessed	Answers			
		1	2	3	4
A	**Display Aspect**				
1	Display Responses From The E-Modules And Video Tutorials.				
2	Attractiveness And Consistency Of Color Usage.				
3	Simplicity And Easy To Read.				
4	Create A Positive Impression So That It Can Attract Interest In Learning.				
5	Ease Of Language In Presenting The Material.				
B	**Effective and Efficient Aspects**				
6	The Duration Of The Video Tutorial Material Is Not Too Long So It Is Not Boring.				
7	Flexibility Of Media Use.				
8	Learning Motives For CAD In The Media Influence Respondents' Learning Attitudes And Responses.				
9	The Existence Of Tips And Tricks Can Make It Easier To Learn CAD				
10	The Presentation Of Material In The Electronic Modules And Video Tutorials Is Related To The Relevance Of Other Subjects At SMKN 1 Kediri.				
C	**Interactive Aspects**				
11	Practice Exercises Come With An Answer Key For Users To Follow.				
12	There Is An Explanatory Voice On The Video So That It Is Easier To Understand.				
13	Video And Module Materials Can Introduce New Ways Of CAD Drawing.				
14	Video Materials And Electronic Modules Can Encourage Learners To Read Technical Drawings.				
15	Modules And Video Tutorials Allow You To Follow The Steps Of CAD Drawing Directly.				
16	The Comment Section On Each Video Can Help Users Ask Questions Or Get Feedback.				
D	**Acceptability Aspect**				
17	Electronic Modules And Video Tutorials Can Foster Enthusiasm In Learning CAD.				
18	Electronic Modules And Video Tutorials Can Make Learning CAD Less Boring.				
19	The Electronic Modules And Video Tutorials Are Easy To Understand.				
20	Electronic Modules And Video Tutorials Can Support Mastery Of Manufacturing Engineering Drawing (CAD).				
E	**Critique and Suggestion Aspects**				
21	Things That Need To Be Improved/Eliminated In The Presentation Of Sheet Metal Design Modeling Learning.				
22	Things That Are Interesting When Using This Media.				

Data Analysis Techniques

There are two data analysis methods used, namely qualitative descriptive analysis and quantitative analysis. Qualitative data is obtained from observations, interviews, and documentation of test subjects or experts in their fields, and is used to strengthen the results of quantitative data. The formula for analyzing quantitative data comes from the results of questionnaires given to material experts, media experts, and test subjects. The following Formula 1 formula for analyzing data refers to Juliana & Sulistyowati (2023).

$$P = \frac{\Sigma n}{\Sigma N} \times 100\% \quad (1)$$

Description P is a percentage assessment of the evaluation of the test subjects, Σn is the total value of the answers given by respondents and ΣN is the total maximum score from the answers given.

From the evaluation conducted by material experts, media experts, and trial subjects, the results of the percentage assessment are obtained, and the criteria for determining the percentage evaluation as a guideline for evaluating the feasibility of learning materials are grouped according to Table 4 which refers to Purniawan & Sumarni (2023) below.

Table 4. Criteria for Assessment of Questionnaire Score Percentage

No.	Value Scale	Intervals	Categories
1	4	81.25% < Skor < 100%	Very Good
2	3	62.50% < Skor < 81.25%	Good
3	2	43.75% < Skor < 62.50%	Less Good
4	1	25.00% < Skor < 43.75%	Not Good

RESULTS AND DISCUSSION

Results

Results of Initial Product Development

The product being developed is an interactive learning media for sheet metal design modeling based on Autodesk Inventor 2023 software, in the form of video tutorials integrated with electronic modules. Competency outcomes are based on the formulation of the TGM CAD Learning Objectives (ATP) for the Machining Engineering Expertise Competency at SMKN 1 Kediri obtained from the 2022 Merdeka Curriculum. The competency outcomes include (1) Explanation of the use of CAD applications in the context of learning; (2) Modeling of product components (manufacturing design) in 2D and 3D formats using CAD applications; (3) Organizing the process of assembling components into a single unit (assembly) using CAD applications; (4) Preparation of drawing documents required for the manufacturing process.

Based on the ATP formulation, some additional materials have been incorporated into the learning media being developed to expand learners' knowledge in the use of CAD applications, including (1) Creating sheet metal designs through manufacturing processes; (2) Utilizing the frame generator feature available in the assembly menu; (3) Using the welding and symbol features in making components through the welding process available in the assembly menu; (4) Adding user experience as part of the product, which aims to share experiences in using Autodesk Inventor professional 2023 software to improve performance in the design process.

Results of Item Formulation and Storyboarding

The results of the formulation of interactive learning media material items sheet metal design modeling using Autodesk Inventor 2023 software, there are 8 sections of material including (1) Introduction to CAD; (2) 2D sketch; (3) 3D sheet metal model; (4) Assembly; (5) Drawing; (6) Frame Generator; (7) Weldment; (8) User Experience. The materials compiled have been adjusted to the various menus and features in the Autodesk Inventor Professional 2023 software. The material is also enriched with practice questions from various sources, including a collection of CAD practice questions from CAD course lecturers at DTMI, Faculty of Engineering, State University of Malang, and sources of practice from YouTube and Instagram platforms. To increase motivation and make it easier for users, this media is equipped with motifs or examples of CAD products, tips, and tricks in drawing, as well as links to the help website (Autodesk help) and interactive learning videos.

Result of Interactive Learning Media Product Sheet Metal Design Modeling

The results of the development of interactive learning media products for sheet metal design modeling based on Autodesk Inventor Professional 2023 software are presented in the format of video tutorials integrated with electronic modules (E-Modules). Each tutorial video section has a URL link that leads to the video on the YouTube platform. The tutorial videos are divided into two playlists, namely tutorials (9 videos) and exercises (12 videos and 15 practice questions). The practice questions are more focused on the concept of 2D sketching and 3D creation to improve students' practical skills in reading drawings. The following are Figure 2, Figure 3, and Figure 4 Displays of the developed interactive learning media.

(a) (b)

Figure 2. (a) E-Module Front Cover Design, (b) E-Module Back Cover Design.

Figure 3. A thumbnail of Tutorial Video

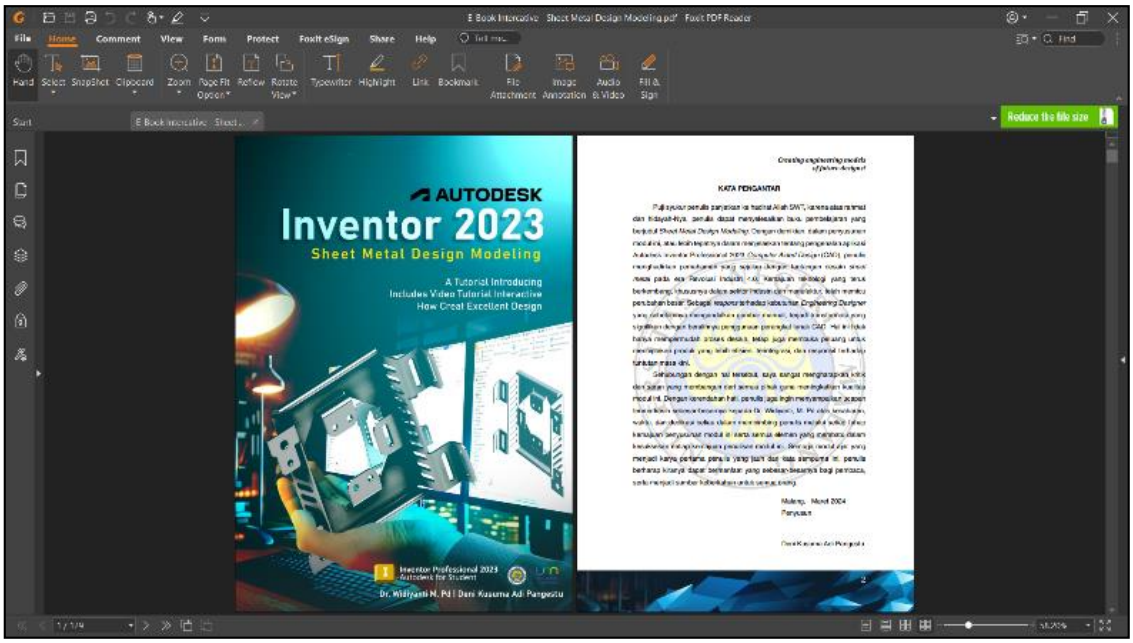

Figure 4. Display of E-Module on Computer/PC

How to Use Learning Media

This learning media can be used with various devices, such as smartphones, computers, or laptops. Video tutorials can be accessed through the YouTube app or a frequently used web browser. Meanwhile, the electronic module (e-module) can be accessed using a PDF reader or similar application. The following Figure 5 shows the procedure of using interactive learning media for sheet metal design modeling.

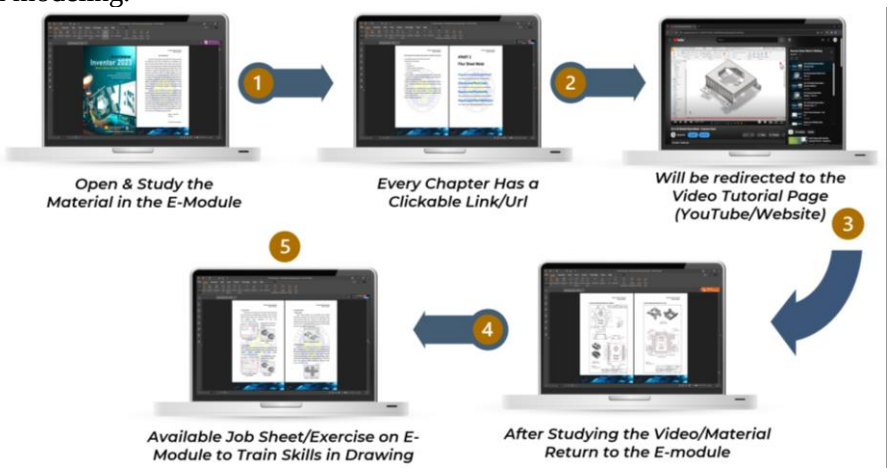

Figure 5. How to Use Learning Media

Results of Media Expert Validation

Information data regarding the results of media validation by media experts are presented in graphical form in Figure 6 below.

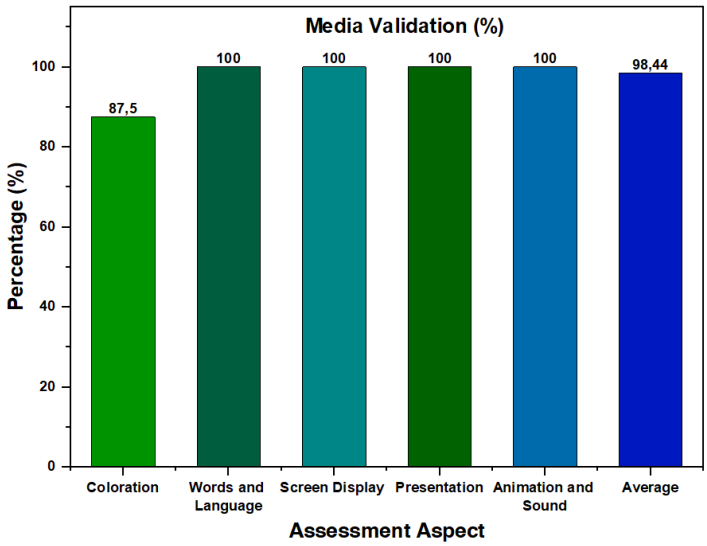

Figure 6. Media Expert Validation Results

The results of the media validation are shown in Figure 6, the total average of 5 aspects of the assessment received a score of 98.44% from 16 validation instrument items. For the aspect of coloration, as much as 2 points get an average of 3.5, for the aspect of words and language as much as 3 points gets an average of 4, for the aspect of screen display as much as 2 points gets an average of 4, the aspect of presentation as much as 4 points gets an average of 4, the aspect of animation and sound as much as 5 points gets an average of 4. Based on the results of expert validation, it is concluded that the interactive learning media for sheet metal design modeling based on Autodesk Inventor 2023 software is suitable for use and field testing with minor improvements such as color selection in the 3D cover design.

Results of Material Expert Validation

Informative data related to the results of material validation conducted by material experts are presented graphically in Figure 7.

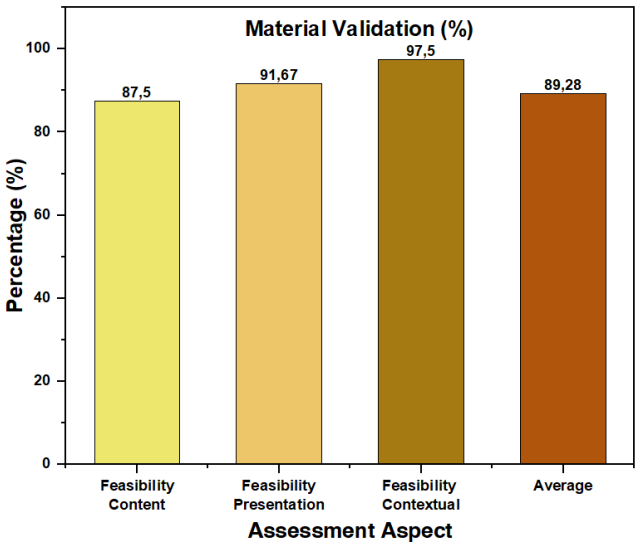

Figure 7. Material Expert Validation Results

The results of the material validation shown in Figure 7 above, the total average of the 3 aspects of the assessment received a score of 89.28% from 14 validation instrument items. The content feasibility aspect of 4 points gets an average of 3.5, the presentation feasibility aspect of 6 points gets an average of 3.66, and the contextual aspect of 4 points gets an average of 3.5. Based on the validation results, the interactive learning media sheet metal design modeling based on Autodesk Inventor 2023 software is feasible to continue with several revisions from material expert validators such as adding competency achievements in the introduction section of the E-Module, adding specific job descriptions related to sheet metal design in the industry.

Results of Product Testing

The results of product testing are classified into two stages, namely small-scale testing and operational testing, with the data presented graphically in Figure 8.

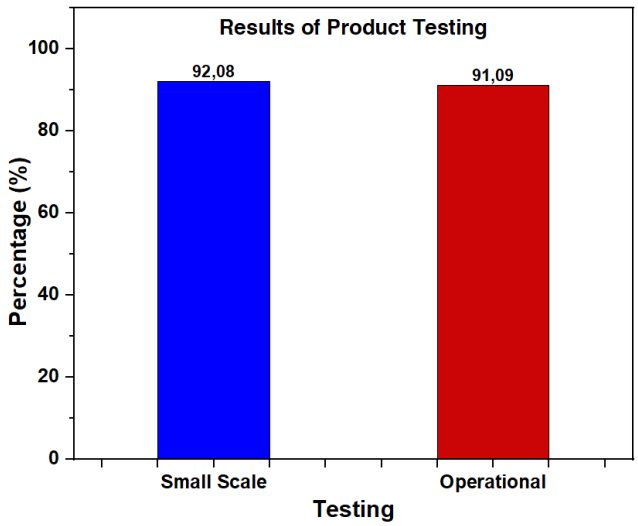

Figure 8. Results of Product Testing

Based on the data from Figure 8 of the product testing results, the score obtained from the small-scale testing was 92.08%. Referring to the assessment criteria listed in Table 1, these results are categorized as very good. Making interactive learning media sheet metal design modeling based on Autodesk Inventor 2023 software is considered feasible to proceed to operational testing.

After conducting a small-scale test, the operational testing continued for 4 days, consisting of 3 days of online interactive discussions through the WhatsApp application guided by the TGM CAD teaching teacher, followed by one offline meeting at the CAD Laboratory of Vocational High Schools 1 Kediri. The testing process involved 32 students in class XI TPM 2 who were taking TGM CAD learning and obtained operational testing results with a score of 91.09%. Referring to the assessment percentage criteria set out in Table 1, these results are categorized as very good. Making interactive learning media products sheet metal design modeling based on Autodesk Inventor 2023 software is considered feasible and can be used as a learning tool.

Discussion

The success of an interactive learning media development product is supported by several factors, including the suitability of needs analysis and applying the correct development steps (Putra & Salsabila, 2021). In addition, the success of the product is also related to the term user friendly, which means that the product or media is designed to facilitate users and make them feel comfortable (Listiyono et al., 2022). Products that include instructional videos integrated into electronic modules can provide accessibility because they can be accessed anywhere and anytime (Yang & Xia, 2023). Research shows that effective use of interactive media in learning can increase student engagement with the material and result in a more effective learning experience (Aulia et al., 2024). It fits the context of the TGM CAD topic, which emphasizes practice and skill demonstration and is efficient for use in both hands-on and self-paced learning (learn from home).

The utilization of the developed E-Module gives the impression of interactivity in which there is material on the steps of designing complex sheet metal, instructional videos, barcode group discussions, user experience, and jobsheets that can increase engagement and understanding. The utilization of technology-based interactive media is expected to be able to produce intensive communication between students and educators (Haleem et al., 2022; Fakhruddin et al., 2024). The product has gone through a validation process by material expert validators and media expert validators to ensure that the content meets the set standards.

The benefits of Interactive E-Modules include making learning more interesting and interactive, reducing teaching time, improving learning quality, enabling learning anywhere and anytime, and improving students learning attitudes (Permitasari et al., 2022). The results of product testing with students show that the presentation aspect still has shortcomings, so providing suggestions and input from students is important as a reference for improving the final product to improve its quality. Suggestions and input that are considered relevant are considered and implemented in product revisions based on expert validation and field testing results. In addition, the positive response from students to the products made shows that users are very enthusiastic and interested in using interactive learning media sheet metal design modeling based on Autodesk Inventor 2023 software. This product successfully fulfills the expectations and needs of the learning activities of students.

CONCLUSION

The conclusions that can be drawn from the research objectives of developing interactive learning media for sheet metal design modeling based on Autodesk Inventor 2023 software are as follows: 1) The product is produced by utilizing video tutorials integrated with a complete E-Module from the introduction of CAD, 3D modeling which includes 2D sketch, 3D sheet metal model, assembly, drawing, frame generator, 3D weldment and equipped with a user experience that can be accessed anytime and anywhere. 2) The research and development model applied follows the stages contained in the Borg & Gall development model. 3) E-Module products through the media validation stage, presented validation results with a value of 98.44% with very good assessment percentage criteria and revision notes in several parts. 4) E-Module products go through the validation stage for the material, presented validation results with a score of 89.28% in the criteria

for very good assessment percentage, and revision notes in several parts. 5) This E-Module product was also tested on a small scale of 6 respondents from students of class XI TPM 1 and obtained a score of 92.08%. According to the predetermined assessment percentage criteria, these results fall into the very good category. 6) The E-Module product was also tested on a large/operational scale as many as 32 respondents from students of class XI TPM 2, stated the results obtained with a score of 91.09%. These results fall into the category of very good and very feasible to be utilized as a learning tool, based on the assessment criteria.

For the next research, it is suggested to improve the quality of interactive learning media for sheet metal design modeling based on Autodesk Inventor 2023 by adding materials that improve students' competencies, such as cable and harness, tube and pipe, surface design, inventor studio, and mold design. It is also recommended to improve the user experience and add exercises or jobsheets that are complex and integrated with real products in the industry. Educators are expected to develop and utilize this media to improve student learning outcomes.

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Semaphore AR card: Interactive scout learning media

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ABSTRACT

This development was triggered by issues related to the lack of interest and enthusiasm of students toward Scout extracurriculars, especially in the Semaphore material aspect. This research aims to produce and implement a Scout educational media design based on augmented reality (AR) Cards and evaluate the responses given by students and coaches. This research applies a Research and Development (R&D) method approach by following the ADDIE development model framework. Research subjects included class X students and extracurricular Scout teachers at Vocational High School 2 Singaraja. The final product of this development is an augmented reality application and Card that can be used on smartphone devices that use the Android operating system. The final results of the research showed very positive achievements, with the black box test producing a success rate of 100%. Validity testing by content experts and media experts Semaphore AR Card got a score of 1.00, indicating a very high level of validity. Likewise, an evaluation of users, which includes both students and trainers, using the UEQ assessment, resulted in a rating of "Excellence" in 6 aspects, including attractiveness, clarity, efficiency, accuracy, stimulation, and novelty. The recommendations from this research are expanding use to various school levels as well as user training to ensure effective use and in-depth understanding. Overall, the developed Scout Semaphore AR Card educational media can be considered a learning tool that is suitable for use in carrying out scouting activities.

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INTRODUCTION

The Scout Movement is a form of informal education that is carried out voluntarily, is non-political, and is open to all groups regardless of racial, ethnic, or religious background (Panjaitan et al., 2020). To support the moral development of students through the Scout Movement Scouts, the government has stipulated the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 63 of 2014 concerning Scouting Education, which makes it a component that must be followed in a series of extracurricular activities at the elementary and secondary education levels.

State Vocational School 2 Singaraja is located on Jalan Srikandi, No. 9, Singaraja, and focuses on education in the tourism and beauty sectors. Grade X students are required to be involved in extracurricular activities as a requirement to participate in the Final Semester Assessment (Susanti,

2021). The principal (Kamabigus) and scoutmaster are responsible for organizing and implementing scouting education in the school environment (Arifin et al., 2018). Scout leaders can be class teachers or subject teachers who have a basic advanced course certificate, or individuals who meet the requirements as scout leaders according to the Minister of Education and Culture Regulation No. 63 of 2014.

In extracurricular Scouting activities, there are various teaching materials taught, including knowledge and skills called scouting techniques (Tekpram), which are an important part of the scouting education structure. One of the basic skills included in Tekpram is Semaphore (Syahrul et al., 2019). Semaphore is a communication method that involves the use of flags, paddles, sticks, hand gestures, or gloves to send and receive messages (Gumilang & Fachrie, 2020). In the context of current scouting education, generally using a pair of red and yellow flags is the main tool. This Semaphore skill is considered one of the basic competencies that must be mastered in scouting education.

Based on the results of preliminary interviews conducted by the researcher together with a Scouting extracurricular activity supervisor at Vocational High School 2 Singaraja, several findings obtained include 1) The involvement of all 505 grade X students in mandatory Scouting extracurricular activities, plus 32 students who took Scouting extracurricular activities as an option. 2) The teaching materials used in the teaching process are limited to the material contained in the Scout pocketbook or the Requirements. General Competence (SKU). 3) The process of delivering scouting materials still uses traditional (conventional) methods provided by instructors or students who participate in Scouting extracurricular activities, so that students' enthusiasm for involvement in Scouting extracurricular activities, both mandatory and optional, is not very high. 4) The short duration of time in delivering the material results in students not being able to understand and memorize the movements required in Semaphore, both letters and numbers, properly.

In addition to conducting interviews with instructors, researchers also distributed questionnaires regarding student needs through the Google Form platform, and the number of respondents reached 32 students. Data collected from the questionnaire showed that 83.7% of students experienced occasional boredom when instructors used learning media in delivering materials. As many as 56.3% of students expressed their happiness when learning materials were accompanied by images or animations that could facilitate the explanation of concepts. In addition, 90.6% of students felt it was important to have easy access to learning media via smartphones. Furthermore, as many as 85% of students stated that they already had devices such as computers, laptops, or smartphones. Based on the results of this questionnaire, it can be concluded that students felt less interested in learning Semaphore because the learning media used felt less entertaining and monotonous, with a large portion focused on text.

Referring to the problems that have been explained previously, one of the options that can be used as a solution is to utilize learning media as a supporting tool in the student education process, both when they are learning independently and when guided by teachers (Budiman, 2017). This idea is similar to the view expressed by Kamiana et al., (2019), which reflects the influence of the development of information and communication technology in the context of the teaching and learning process, which involves an increase in the variety of learning resources and learning tools. A similar opinion is also found in a study conducted by Widiyanti & Ansori (2020), which highlights that the use of learning media can increase students' enthusiasm for learning.

Research with the same focus on the development of augmented reality learning media for the topic of Semaphore has been previously conducted (Azmi, 2020). The results of this research indicate that augmented reality technology can act as an effective teaching tool in introducing the use of Semaphore codes to students (Antriyanti, 2017). However, this study has several weaknesses, including the absence of practice questions that emphasize the content of the Semaphore material itself. A study with a similar focus was also realized in the research conducted by Hamdani & Hendriyani (2022), which produced learning media that can be accessed via smartphone devices and supports students' understanding of Semaphore. In addition, other research on the development of augmented reality-based learning media has been conducted by Harta et al., (2021), and received

positive responses from teachers and students. The media they developed was considered interesting and easy to use in the learning process.

This research contributes to the provision of independent learning media about scouting. Although this study has positive values, the researchers also provide recommendations for further research to expand the scope of Semaphore material and go deeper into understanding the concept, as well as to include exercises in composing words with Semaphore.

METHOD

A study on the development of AR Card Scout Education Media Semaphore is done through a Research and Development approach, commonly known as the Research and Development (R&D) method. Furthermore, this study applies a development model known as the ADDIE model (Sadiman et al., 2009). As stated by Kamiana et al., (2019), the ADDIE development model refers to a system-based, efficient, and interactive learning design approach. This allows the evaluation results at each stage to guide the improvement and development of learning at the next stage so that the resulting product becomes more valid and reliable. The final result of this research is the creation of a product in the form of Scout learning media based on augmented reality technology aimed at understanding Semaphore material.

This research was conducted at Vocational High School 2 Singaraja, with research subjects involving students from class X of Vocational High School 2 Singaraja and also Scout extracurricular instructors. The process of compiling the Scout Semaphore AR Card educational media product in this study refers to the ADDIE development model framework structure. This ADDIE model has a structure that is divided into five main stages, namely analysis, design, development, implementation, and assessment (Sweller, 2021). It is important to note that in this ADDIE model, the evaluation process can be applied at every stage of product development (Sugiyono, 2015).

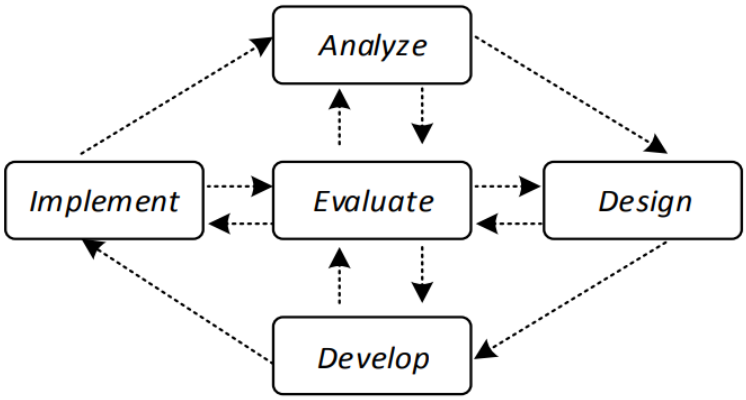

Figure 1. ADDIE Model (Dick & Carey, 1996)

In the ADDIE development model used in this study, the explanation of each stage of the ADDIE model is as follows.

1. Analysis
   The analysis stage in the ADDIE model aims to collect information to ensure that the product being developed is in accordance with the needs and expectations of the target, with a focus on analyzing student characteristics, learning, learning resources, and student needs using appropriate and relevant data collection techniques.
2. Design
   The design stage in the ADDIE development model involves creating a design for the appearance and functionality of a learning application that is easy to use, including creating flowcharts, software designs, architectures, and software interfaces that suit user needs.
3. Development
   The development stage in the ADDIE model involves the creation of augmented reality-based educational media for Semaphore material, with steps such as 3D object modeling, marker

creation, and validity testing by content experts and media experts to ensure the validity and suitability of the content. Evaluation is carried out through black box testing to ensure the function of the software and questionnaires evaluated by Scout leaders and supervising lecturers, with a minimum of two experts in their respective fields to ensure the validity and effectiveness of the learning media.

4. Implementation
   At the implementation stage of the ADDIE model, the augmented reality learning media product was tested in the field to obtain an overview of the experience of use in extracurricular Scout learning, with a focus on the practicality of the media and the responses of students and instructors which were evaluated through the User Experience Questionnaire (UEQ) in six main aspects.
5. Evaluation
   The evaluation stage in the ADDIE model is carried out in stages, including expert testing for the validity of the design and product of learning media and user response testing to ensure that the learning media is in accordance with the learning objectives and needs that have been designed. This evaluation ensures that each stage in the development of learning media is to the plan that has been set.

The data collection process using interview techniques aims to explore information on learning resources currently being used by Scout extracurricular instructors as learning resources and teaching materials. Content experts and media experts carry out the use of questionnaires to ensure the validity of learning content, then continue with user response tests, namely instructors and students. Then for the analysis of student and instructor response data using UEQ (User Experience Questionnaire). The tabulation of content and media validity test data using the Gregory formula can be seen in Table 1.

Table 1. Gregory Test Matrix

No.	Expert 1		Expert 2	
	Not Relevant	**Relevant**	**Not Relevant**	**Relevant**
1	A	B	A	B
2	C	D	C	D

After the validation process using the Gregory formula, the level of validity is then determined by referring to the criteria or validity coefficients listed in Table 2 below.

Table 2. Media Validation Criteria

No.	Validity Coefficient	Validity Level
1	0.91 – 1.00	Very High
2	0.71 – 0.90	High
3	0.41 – 0.70	Enough
4	0.21 – 0.40	Low
5	0.00 – 0.20	Very Low

Next, in order to evaluate user responses, predefined categories were used for each aspect of the UEQ, which can be found in Table 3.

Table 3. UEQ Aspect Category

Aspect	Category				
	Excellent	Good	Above Average	Below Average	Bad
Attractiveness	$\underline{X} \geq 1.75$	$1.52 \leq \underline{X} < 1.75$	$1.17 \leq \underline{X} < 1.52$	$0.7 \leq \underline{X} < 1.17$	$\underline{X} \leq 0.7$
Clarity	$\underline{X} \geq 1.9$	$1.56 \leq \underline{X} < 1.9$	$1.08 \leq \underline{X} < 1.56$	$0.64 \leq \underline{X} < 1.08$	$\underline{X} \leq 0.64$
Efficiency	$\underline{X} \geq 1.78$	$1.47 \leq \underline{X} < 1.78$	$0.98 \leq \underline{X} < 1.47$	$0.54 \leq \underline{X} < 0.98$	$\underline{X} \leq 0.54$
Accuracy	$\underline{X} \geq 1.65$	$1.48 \leq \underline{X} < 1.65$	$1.14 \leq \underline{X} < 1.48$	$0.78 \leq \underline{X} < 1.14$	$\underline{X} \leq 0.78$
Stimulation	$\underline{X} \geq 1.55$	$1.31 \leq \underline{X} < 1.55$	$0.99 \leq \underline{X} < 1.31$	$0.5 \leq \underline{X} < 0.99$	$\underline{X} \leq 0.5$
Novelty	$\underline{X} \geq 1.4$	$1.05 \leq \underline{X} < 1.4$	$0.71 \leq \underline{X} < 1.05$	$0.3 \leq \underline{X} < 0.71$	$\underline{X} \leq 0.3$

RESULTS AND DISCUSSION

Results

Study (research) on the Development of Scout Educational Media Semaphore AR Card following the ADDIE research and development model (Analysis-Design-Development-Implementation-Evaluation) and creating results in the form of a Scout education application based on Semaphore AR cards. Below, we present the results of research related to the development process using the ADDIE model.

Analysis Stage

The first stage in the ADDIE development model is analysis. In the context of this research, researchers conducted an analysis to identify problems and potential solutions related to students, including an analysis of student characteristics, characteristics of learning processes, learning resources, and student needs.

The results of the analysis of student characteristics show that students often feel bored when participating in extracurricular Scout learning, especially Semaphore material, which of course has an impact on the learning process when students do not pay attention to what is conveyed by the instructor. Then the results of the learning analysis are that learning on Semaphore material is difficult to understand if explained with theory alone. Students also have difficulty demonstrating Semaphore movements if they do not understand and memorize the movements that have been explained by the instructor. Furthermore, the data obtained from the analysis of teaching materials refers to the learning sources used in the Scout extracurricular learning process, especially on Semaphore material. These sources consist of Scout pocketbooks or SKU (General Proficiency Requirements) and Boyman's Book (Sunardi, 2016). Finally, an analysis of student needs was also carried out, namely that students need a learning media that can introduce letters and numbers in Semaphores using AR technology.

Design Stage

The application display design and its contents are designed according to the needs at the analysis stage. In addition, the design stage also focuses more on creating a system that is easy to use and understand by users. This design stage consists of the stages of creating an application design (flowchart), software functional design, software architecture design, and software interface design. The application design aims to present the logical flow and process of the application visually and easily understood. Then continued with the creation of a functional design of the software consisting of a use case diagram that functions to describe the interaction between actors and functions of a system that can be seen in Figure 2.

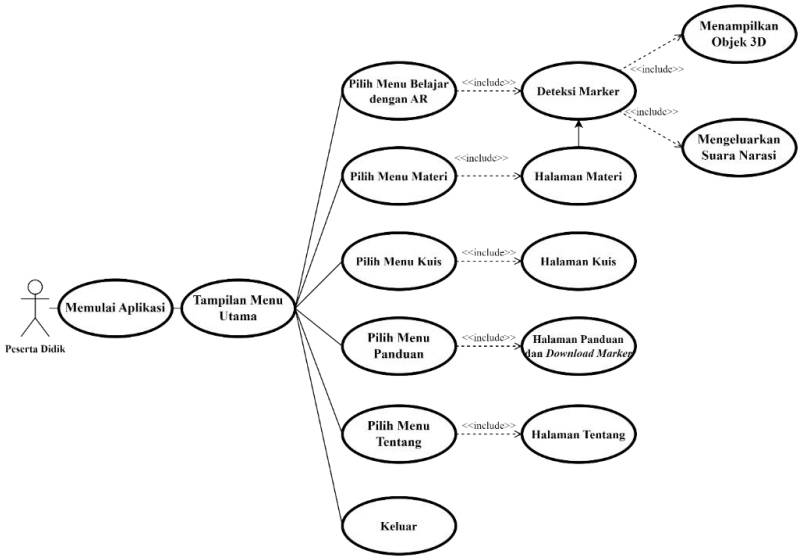

Figure 2. Use Case Diagram Media Augmented reality Semaphore

After the use case diagram is complete, the next step is to create a use case scenario for each case or feature. A Use Case scenario is a sequence of steps or interactions between actors and systems that explain how use cases are run (Jennah, 2009). Then, after the use case scenario is completed, the next step is to re-create the design of the activity diagram which is used to describe in more detail the interactions or activities carried out between the system and the actor or user. The interface design has also been created at this design stage. The goal is to create an interface that is easy to use, intuitive, efficient, and attractive to users. The appearance of the interface design of this application can be seen in Figure 3.

Figure 3. Main Menu Page Interface Design

In addition to designing the main menu page interface, the researcher also designed the main feature page of this application, namely the AR menu page, which can be seen in Figure 4.

Figure 4. AR Menu Display Design

Development Stage

In the third stage in the ADDIE model, called the development stage (Pegi, 2020), the design previously made in the design stage will be run and implemented into an augmented reality media that focuses on Semaphore material. This process is carried out by utilizing development tools such as Unity 3D, Vuforia, Blender, and other development tools. For more details, see the description below.

a) Creating a User Interface for an Application. The purpose of creating a user interface is to create a positive and efficient user experience in using an application or system.
b) Marker Creation. AR (Augmented reality) markers are used as references or markers that help the AR system track and recognize objects in the real world.
c) Character Creation. Character creation is done using the Blender application. This character is the main object in augmented reality media. Semaphore.
d) Semaphore Flag Object Creation. Semaphore flag creation is done using the Blender application. The flag colors that researchers use are red and yellow which are called Oscar flags.
e) Making Animation of Letter and Number Movements on Semaphore. In the process of making animation of letter and number movements on Semaphore, researchers use the Blender application, starting from rigging to making animations per letter or number.
f) Database Creation Marker with Vuforia Engine. In the process of creating a marker database, the author uses the help of the website from the Vuforia Engine, then the researcher uploads the markers that have been created into the database.
g) Merging All Assets Into An Application Using Unity 3D. In the process of building an augmented reality application Semaphore, researchers use the help of the Unity 3D application. In the Unity 3D application, researchers combine assets, create features of the application, add back sound, add sound effects, and provide functions or commands using the C# programming language.

The results of the development process that has been carried out have produced educational media for Scouts Semaphore AR Card. In the initial format of this opener or main page, users will wait for 5 seconds before they can enter the main menu display. When they can enter the main display, the main menu page will appear which can be seen in Figure 5. On the main menu, there are several buttons such as the Learn with AR button, the Semaphore Material button, the Semaphore Quiz button, the Exit button, the Guide button, the About button, and the Background sound.

Figure 5. Main Menu Page View

The main feature of this application is located on the "Learn with AR" button, which when clicked will display the option to choose the "Recognizing Letters and Numbers" menu or the "Compiling Words" menu. The recognizing letters and numbers menu is used to introduce the shape of letters and numbers in Semaphore using AR. The composing words menu is used to find out the Semaphore movement in the form of words. However, before using this feature, users must scan the marker provided on the instructions page located on the main menu. The appearance of the marker from this application can be seen in Figure 6 and Figure 7. Meanwhile, the appearance of these two main features can be seen in Figure 8, Figure 9 for the recognizing letters and numbers feature, and in Figure 10, Figure 11 for the composing words feature.

Figure 6. Marker Display for Recognizing Letters and Numbers

Figure 7. Word Arrangement Marker Display

Figure 8. Display of the Letter or Number Input Menu in the Recognizing Letters and Numbers Menu

Figure 9. 3D Animated View of Recognizing Letters and Numbers

Figure 10. Word Input Display on the Word Composing Menu

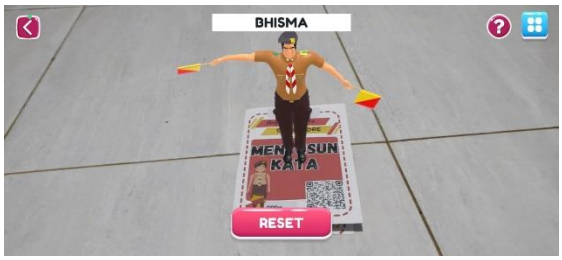

Figure 11. 3D View of Word Formation Animation

After the development process is complete, tests are carried out to ensure that the developed application is appropriate and runs well (Wiharto & Budihartanti, 2017). The tests carried out include black box testing, evaluation by content experts, and evaluation by media experts. The following is an explanation of each of these tests.

Testing of Case Study 1 aims to test the validity of the journey of the Semaphore AR Card Scout educational media process, while testing of Case Study 2 is carried out to assess whether the Semaphore educational media application that has been developed runs well and can be used by other users. The results of this black box test obtained a success percentage of 100%.

The content expert test was conducted on July 11-12, 2023. This testing activity was carried out by experts or content experts who aimed to ensure the suitability of the content of the material implemented in the Semaphore AR Card Scout educational media based on what had been determined or was by related sources. This evaluation was carried out by two experts in their fields, namely Mr. I Kadek Suputra Ekajana, S.Pd.SD., M.Pd., who also serves as a member of the Bina Muda Kwartir Karangasem Branch and serves as the first content expert, and Mr. I Gede Tangkas

Dyana Jatinegara, S.Pd., M.Pd., who is one of the Scout extracurricular instructors at Vocational High School 2 Singaraja and acts as the second content expert in this assessment. The testing carried out was by directly operating the Semaphore Scout educational media AR Card and content experts provided assessments related to the appropriateness of the content, language, and presentation of information using a questionnaire instrument. By referring to the results of data processing from the assessment by content experts, the Gregory formula can be used to measure the level of validity of the Semaphore AR Card Scout educational media. Then get the results as in Formula 1.

$$Validity_{of\ Content} = \frac{D}{A+B+C+D} = \frac{12}{0+0+0+12} = 1.00 \quad (1)$$

Based on the assessment results from content experts that have been explained in the calculation above, it is then continued by converting using the table of content validity level criteria in Table 2, so it is known that the level of validity of the Semaphore AR Card Scout educational media is in the "Very High" category.

Furthermore, the media expert test was carried out on July 13-14, 2023. This media expert test activity aims to assess the Semaphore AR Card Scout educational media in terms of content and appearance in order to determine whether the Semaphore AR Card Scout learning media is worthy of being field tested or not. The results of the media expert test are based on a questionnaire that has been filled out by 2 media experts, namely Mr. I Nengah Eka Mertayasa, S.Pd., M.Pd. from the Informatics Engineering Education study program as media expert 1 and Mr. Gede Ari Adnyana, S.Pd. from Ganesha Inovasi Teknologi as media expert 2. Based on data from the tabulation results of the media expert test assessment, the Gregory formula can be used to obtain the level of validity of the Semaphore AR Card Scout educational media. Then get the results as in Formula 2.

$$Validity_{of\ Content} = \frac{D}{A+B+C+D} = \frac{16}{0+0+0+16} = 1.00 \quad (2)$$

By referring to the evaluation that has been explained by the media expert in the previous calculation, it is then continued by converting using the table of content validity level criteria in Table 2, so that it is known that the level of validity of the Semaphore AR Card Scout educational media is in the "Very High" category. Thus, the Semaphore AR Card Scout educational media can be declared very valid and suitable for use in scouting activities.

Implementation Stage

The fourth stage in the ADDIE model is to implement. In this case, the Semaphore augmented reality media has been developed and has been tested black box, and expert tests and has been improved according to input and suggestions from the experts, then the user response test will be carried out.

The result of the implementation stage is an augmented reality media product. Semaphore that has been applied to class X students as part of the Scout extracurricular activities. During the implementation, instructors and students use their smartphone devices to access and run augmented reality media. Semaphore that has been developed by researchers. After the implementation process of the Semaphore augmented reality media, the researcher then gave a questionnaire to find out the responses of students and instructors regarding the Semaphore augmented reality media that the researcher had developed. The evaluation questionnaire used was the User Experience Questionnaire (UEQ). The users in this study were class X students of Vocational High School 2 Singaraja. The response test of instructors and students was only carried out once, namely on July 16, 2023, involving 30 students and 2 instructors. After changing the respondent data into the appropriate form and calculating the average value, variance, and standard deviation, the next step was to determine the standard data as a reference. The benchmark standard for the User Experience Questionnaire (UEQ) is based on data that has been previously collected and processed using UEQ. The average results for all statement items as in Figure 12 and the UEQ scale measurement can be seen in Table 4.

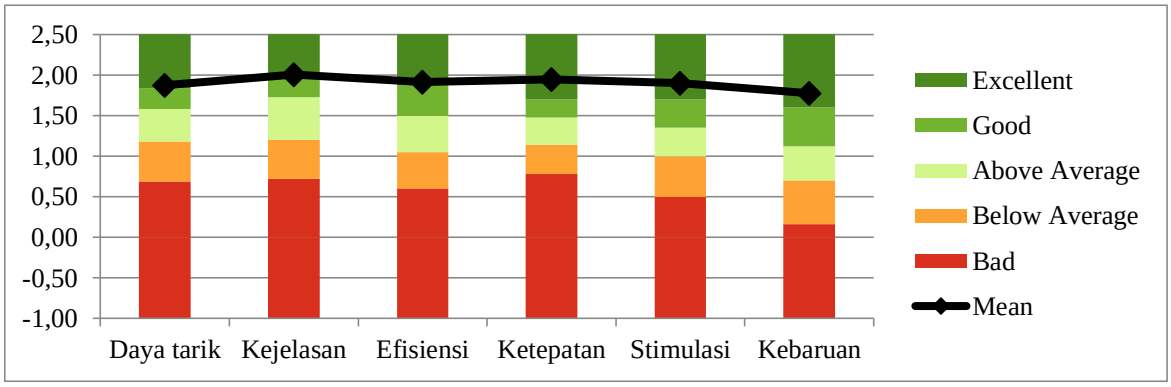

Figure 12. Graph of Average Group Impression Values

Table 4. UEQ Scale Measurement Results

No.	Aspect	Average	Category
1	Attractiveness	1.88	Excellent
2	Perspicuity	2.01	Excellent
3	Efficiency	1.91	Excellent
4	Dependability	1.95	Excellent
5	Stimulation	1.90	Excellent
6	Novelty	1.77	Excellent

From the data in Table 4, it can be seen that based on the results of the User Experience Questionnaire (UEQ), students and instructors gave high average scores for each aspect of the evaluation. The average score for the Attractiveness aspect was 1.88, Clarity was 2.01, Efficiency was 1.91, Accuracy was 1.95, Stimulation was 1.90, and Novelty was 1.77, with all categories showing very good ratings. In other words, the overall evaluation results show that the responses of students and instructors can be described as very good or " Excellent."

Evaluation Stage

The last stage in the ADDIE development model is the evaluation stage (Cahyadi, 2019). The evaluation stage is used to evaluate each stage of analysis, design, development, and implementation to ensure that each stage has run properly and there are no obstacles. The following is an evaluation of each ADDIE stage which can be seen in Table 5 for the analysis stage evaluation, Table 6 for the design stage evaluation, Table 7 for the development stage evaluation, and Table 8 for the implementation stage evaluation.

Table 5. Results of Analysis Phase Evaluation

No.	Statement	Information	
		Yes (Already)	No (Not Yet)
1	Conducting an Interview Process with Instructors and Distributing Questionnaires to Students aims to Gather Information about Student Profiles, Learning Attributes, Learning Resources Used, and Students' Special Needs.	✓	
2	Functional and Non-Functional Requirements Designed Software.	✓	

Table 6. Design Phase Evaluation Results

No.	Statement	Information	
		Yes (Already)	No (Not Yet)
1	Functional Model of Software or Often Called Use Case and Activity Diagram.	✓	
2	Design/Creation of Application Architecture.	✓	

No.	Statement	Information	
		Yes (Already)	No (Not Yet)
3	Design/Creation of Application Interfaces.	✓	

Table 7. Development Phase Evaluation Results

No.	Statement	Information	
		Yes (Already)	No (Not Yet)
1	Developing Semaphore AR Card Educational Media According to the Design.	✓	
2	Searching and Collecting all the Resources Needed for Software Development.	✓	
3	Semaphore Augmented Reality Development.	✓	
4	Semaphore Augmented Reality Media has Undergone Black Box Testing.	✓	
5	Conduct an Evaluation of Augmented Reality Media by Involving Content Experts and Media Experts to Obtain Recommendations and Input that can Improve the Quality of the Product so that it is Ready for Implementation.	✓	
6	All the Review Results of Content Experts and Media Experts have been Revised so that the Semaphore Augmented Reality Media is Completely Finished and Ready to be Implemented.	✓	

Table 8. Results of the Implementation Phase Evaluation

No.	Statement	Information	
		Yes (Already)	No (Not Yet)
1	Semaphore Augmented Reality Media has Undergone User Response Testing.	✓	

Discussion

The Scout educational media "Semaphore AR Card" was developed as a response to problems identified after conducting a series of interviews with instructors and also a survey via a questionnaire to class X students at Vocational High School 2 Singaraja (Susilana & Riyana, 2012). The results of interviews with instructors indicate that the learning resources used in delivering the material are limited to the Scout pocket book or SKU (General Proficiency Requirements), and the method of teaching scouting material still uses a conventional approach, so that students' interest in participating in Scout extracurricular activities, both mandatory and elective, is less enthusiastic. From the results of distributing questionnaires to students, it is also seen that students feel bored with the learning method that only relies on the general proficiency requirements book as the main source, and they express the need for learning media that can be easily accessed via their smartphone devices.

From these problems, the researcher conducted further research on the right solution to deal with these problems. The solution obtained was to develop interesting Scout educational media that could increase students' interest and motivation in learning. From the results of this study, it can be seen that the development of the Scout educational media "Semaphore AR Card" aims to overcome the problem of students' interest and enthusiasm for Scout extracurricular activities, especially in Semaphore learning. The theories underlying this approach include the views of Kamiana et al., (2019) which state that information and communication technology (ICT) plays an important role in enriching learning resources and learning aids. In this context, the development of technology-based media such as the Semaphore AR Card is expected to increase students' interest in learning. Furthermore, previous similar studies have also reported positive results that support this view.

The conclusion of this study shows very satisfactory results, with the black box test achieving a success rate of 100%. Validity evaluation by content experts and media experts for the Semaphore AR Card reached a value of 1.00, indicating that its validity level is very high. Moreover, the UEQ assessment of users, both students, and instructors, showed results that reached the category "Excellent" in 6 aspects, including the level of appeal: 1.88, the level of clarity: 2.01, the level of efficiency: 1.91, the level of accuracy: 1.95, the level of stimulation: 1.90, and the level of novelty:

1.77. Thus, overall, the development of the Semaphore AR Card Scout educational media can be considered suitable for use as a learning aid in the context of Scout activities.

The results of this study are in line with several previous studies conducted by Azmi (2020) which stated that it is true that the existence of augmented reality-based learning media can be used as a learning medium to introduce semaphore code to students. In addition, research conducted by Hamdani & Hendriyani (2022) in the study produced a learning media that can be accessed via smartphones and can help students get to know Semaphore. Then research on AR-based learning media has also been conducted by Harta et al., (2021) obtained positive responses from teachers and students, the media developed was also interesting and easy to use.

From the discussion above, this research can overcome problems related to Scout learning media, and less interesting learning resources, and with this research, problems related to students' interest and boredom in learning Semaphore can be overcome according to the results of the tests that have been carried out. The final result of this development research is the development of Semaphore AR Card Scout educational media in the form of an Android application. The advantages of this educational media are 1) This Scout educational media can be accessed anytime and anywhere, 2) this application there are also interesting features such as learning with AR, Semaphore material, and Semaphore quizzes, 3) this application can also make it easier for instructors to deliver Scouting material, especially Semaphore and for students it can also be a media that can attract their interest in learning by using the AR feature to recognize letters or compose words. In addition to advantages, every development will always have shortcomings, including the development of Semaphore AR Card Scout educational media that researchers carried out. The disadvantages of this Scout educational media are: 1) This media can only run on mobile phones that have an Android operating system, 2) Sometimes there are bugs when running the AR camera which is purely caused by the Unity 3D software, 3) This educational media is still focused on introducing Semaphore, not yet at the stage of exploring it further, and 4) The media developed is still static, in the future it is hoped that dynamic media can be developed using a database.

CONCLUSION

The Semaphore AR Card Scout educational media uses the ADDIE (Analyze-Design-Development-Implementation-Evaluation) development model. It has succeeded in developing and implementing the Semaphore AR Card Scout educational media by the application development model, namely the ADDIE model, which starts from the analysis stage to evaluation. The results of the tests that have been carried out indicate very positive achievements, with the results of the black box test reaching a success rate of 100%. The validity test by content experts and media experts for the Semaphore AR Card produced a score of 1.00, indicating a very high level of validity. Furthermore, the evaluation of users, including students and instructors, used the UEQ assessment method, and the results showed an assessment that was classified as "Very Good" in 6 categories, including the level of appeal: 1.88, the level of clarity: 2.01, the level of efficiency: 1.91, the level of accuracy: 1.95, the level of stimulation: 1.90, and the level of novelty: 1.77. Overall, the results of the development of the Semaphore AR Card Scout educational media show strong suitability for use as an educational tool in Scout activities.

Innovative database usage features to the application being developed so that the development of application usage can be saved and the application size can be lighter. In addition, the application being developed is still in the scope of introducing Semaphore letters and numbers and composing words by displaying animated 3D objects that focus on the success of bringing up 3D animated objects. For further researchers, it is hoped that they can develop Scout education media on other Scouting materials by the Scouting materials applied to Scout extracurricular activities.

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