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Developing an android-based learning media for physical education to enhance high School students' learning outcomes

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Abstract
The objectives of this research included (1) to describe the product of an Android-based learning media for Physical Education; (2) to create a valid and practical Android-based learning media for Physical Education; (3) and to find out the improvement of the students' learning results after using the Android-based learning media for Physical Education. This research is categorized a Research and Development with the development style of ADDIE (analyze, design, develop, implement, evaluate). The results of this research show that (1) the created product has gone through some developmental steps which are based on ADDIE development model; (2) the created product has fulfilled the criteria of being valid and practical; (3) there is improvement on the students' learning outcomes after using the product as the learning media.

Keywords: ADDIE, android, learning media, learning outcomes, physical education

Introduction
Physical Education (PE) is basically part of an educational process that focuses on physical activity in order to achieve holistic results in the quality of each individual, physically, mentally and emotionally (Claudia, 2022; Kalajas-Tilga *et al*., 2020; Roetert & Macdonald, 2015) [5, 14, 21]. As a subject, PE is a medium for improving motor skills, psychological development, and physical growth, reasoning and knowledge, as well as appreciation of attitude or mental-emotional values and as a means of getting used to a healthy lifestyle that can function to stimulate balanced quality of physical and psychological development and growth.

The COVID-19 pandemic in Indonesia which was confirmed in 2020 and is still ongoing today, has caused various problems in all sectors. Education is one of the important sectors that has perceived the negative impact of the pandemic. This is predicted to cause the full or maximum failure to achieve educational quality standards from the cognitive and affective aspects of students. The steps taken by the Ministry of Education and Culture are a form of government anticipation to reduce the negative impact that can arise in a pandemic situation, namely by using distance or online learning methods that can provide meaningful learning experiences and life skills for students.

The pattern of implementing learning that has been carried out face-to-face by teachers and students in the classroom must be changed and replaced with Distance Learning, where this situation has an impact on the quality of learning (Hauck *et al*., 2022; Mardini & Mah', 2022; Yu-Fong Chang *et al*., 2021) [12, 17, 25]. Not only that, this distance learning also raises other problems such as the threat of dropping out of school, the threat of decreasing learning achievement (Learning loss), the threat of decreasing the quality of education, as well as various kinds of distress felt by parents and students.

According to Beatty in (Fatimah & Saptandari, 2022) [9], the pattern of learning implementation that is changed from the face-to-face learning to the distance learning can cause learning loss for students with a greater risk than that of a decrease in the ability of students due to school holidays.

Furthermore, gaps in learning outcomes caused by differences in access and quality during the distance learning can result in a decrease in the quality of learning, especially for students from lower middle socio-economic backgrounds. Several other obstacles that arise in the implementation of the distance learning include the loss of children's right to learn. This is due to the lack of facilities that become obstacles in the learning process, such as not all students have proper gadgets and the difficult access to internet connection.

The challenge of learning loss is not only felt by students but also by teachers (Ardington *et al*., 2021; Buffie *et al*., 2023; Haser *et al*., 2022; Kaffenberger, 2021; Sabates *et al*., 2021) [2, 3, 11, 13, 22]. In the era of the industrial revolution 4.0 as it is today, teachers have an important role in creating high-calibre human resources (Al-Ajmi, 2022; Soledad Ramírez-Montoya *et al*., 2022) [1, 24]. There were 67% of teachers experiencing difficulties in using digital technology, while 20.4% experienced limited tools in implementing the distance learning, and 20.2% of teachers experienced difficulties in observing students in implementing the distance learning (Cerelia *et al*., 2021) [4].

In the learning process, teachers have an obligation to be able to convey their knowledge, experience, and views on a material presented to students (Eriksson *et al*., 2022; Kanca, 2018) [8, 15]. With the distance learning system, the time to convey this message is limited, this is due to changes in the structure of class hours. Thus teachers are expected to be able to present learning material efficiently, in a short time but a lot of information to be presented so that the delivery of learning material absolutely requires media assistance.

Media is an important part of the learning process because it is an intermediary or introductory source of the message to the recipient of the message, providing a stimulant of thought, will, feeling, and attention that can encourage a person to be involved in the learning process (Day *et al*., 2022; Haryana *et al*., 2022; Mustofa, 2020) [7, 10, 20]. With the development of science and technology, it is increasingly encouraging renewal efforts in the use of technological results in learning, especially in making learning media. Teachers are required to be able to use learning media available in schools, and these learning media must be adapted to the developments and needs of the times. Teachers can at least use learning media that are cheap and efficient even though they are simple. Besides being able to take advantage of using existing learning media, teachers are also encouraged to be able to develop skills in making learning media to be used.

The results of the survey "Implementation of Distance Learning and KPAI Complaint-Based Distance Assessment System in 2020" obtained data on most of the equipment that is often used by students, namely the majority of students use mobile phones 95.5%. Then, there are 23.9% using equipment in the form of laptops, while the other 2.4% of students use desktop computers/PCs. With these data, it can be concluded that the development of learning media on mobile phones has a very large opportunity for use. Android is an operating system on mobile phones that has a great opportunity to continue to be developed. The Android operating system provides an open platform for developers to use to create applications independently that will be used for various mobile devices. The open source nature of Android can create benefits and solutions to existing problems in the process. Android application development as a learning tool can provide students with various experiences in the learning process (Yunendar, 2016) [26]. One example of learning media that concretely utilizes technological developments in the education sector is Android-based learning media (Kuswanto, 2018) [16].

In line with the survey conducted by KPAI, the curriculum department of CT ARSA Foundatioan Sukoharjo High School conducted a survey on distance learning evaluation. Based on the results of a survey conducted by the CT ARSA Foundation Sukoharjo High School's Curriculum Affair on August 14 2020 concerning "The Evaluation of the Distance Learning Applied during the First Semester for the 2020/2021 Academic Year", it could be concluded that (1) Use of video conferencing platforms (zoom meetings, google meetings and schoology platforms) are considered quite useful by 65%; (2) the obstacles experienced by students in distance learning include signal/network/connection 53%, credit/quota/data 10%, platform/application access difficulty: 20%, gadget error/damage/lag 12%, memory/storage: 5%; (3) the costs incurred in 1 month for online learning are quite large, due to too frequent use of video conferencing platforms (zoom meetings, google meetings and schoology platforms).

In connection with the survey, the results show that most of the students of Unggulan CT ARSA Foundation Sukoharjo High School do not have gadgets with standard specifications. Thus, many students cannot access several learning platforms properly. In addition, the limited memory and internet network owned by students result in that students are not able to access or save learning videos that have been provided by the teacher. In other words, it becomes an obstacle in the implementation of distance learning.

Based on the description above, it is necessary to create learning media that can facilitate students in learning and attract students' interest in participating in the learning process, so that it can affect students' learning outcomes. Therefore, the research on "Developing an Android-Based Learning Media for Physical Education to Enhance High School Students' Learning Outcomes" was conducted.

The developed Android-Based Learning Media for Physical Education subject was made via https://appinventor.mit.edu/ which contains PE subject materials for high school level of the 10 to 12 grades. The materials contained in the learning media uses the 2013 curriculum. The appearance of the learning media is adapted to the psychological conditions of high school students so that it can attract students' interest in learning, especially in the PE subject. The objectives of this research included (1) to describe the product of an *Android*-based learning media for Physical Education; (2) to create a valid and practical *Android*-based learning media for Physical Education; (3) and to find out the improvement of the students' learning results after using the Android-based learning media for Physical Education.

Materials and Methods

This research is Research and Development (R&D). The development model used in this research is the ADDIE development model by Dick, Carey, and Carey in 2005 which includes analyze, design, develop, implement and evaluate stages. The ADDIE development model was chosen due to the willingness to create an educational product that fits current school needs. For this, a continuous evaluation process from various aspects is essentially needed. The substance of the Android-based learning media for PE subject contains teaching materials of the PE subject for the 10, 11 and 12 grades adjusted to the 2013 Curriculum. The school chosen for the product testing was the CT ARSA Foundation Sukoharjo High School. The research subjects were selected using the cluster random sampling method for the 10 grade

students at the CT ARSA Foundation Sukoharjo High School. The research was carried out in several stages: (1) the analysis stage which includes activities to analyze the basic problems faced by students in PE subjects during the Covid-19 pandemic and literature studies (2) the design stage which includes activities to design learning media prototypes in accordance with the learning objectives to be achieved (3) the develop stage which includes activities to validate the learning media developed until it is ready to be tested in the next process (4) the implementation stage which includes product testing activities to determine the criteria for practicality and effectiveness (5) the evaluation stage which includes evaluation activities at each stage carried out.

The data in this study include material expert validation test data, media expert validation test, normality test data, reliability test data, and effectiveness data. The instruments and data collection techniques used were questionnaires with a Likert scale used to test the validity of the instrument, test the validity of the material, and test the validity of the media. The empirical validity test was carried out to validate the items, while the reliability test was carried out with Crobach's Alpha, and the normality test was carried out with the Shapiro-Wilk test. Meanwhile, the hypothesis testing was carried out using a paired sample t-test.

Results & Discussion

This research focuses on the development of Android-based learning media for Physical Education subject. There are 3 (three) criteria, including valid, practical, and effective criteria. Valid criteria are shown in the validation results of media experts, material experts, and analysis of validation and reliability results. The presentation of media and material expert validation can be seen in Table 1 and Table 2.

Table 1: Learning media validation results

Assessment Aspect	Validator		Mean	Category
	1	2		
Ease of use and navigation	4, 80	3, 80	4, 30	Very valid
Aesthetics	4, 85	4, 00	4, 42	Very valid
Media integration	5, 00	3, 50	4, 25	Very valid
Technical Quality	4, 50	3, 50	4, 00	Valid
Average	4, 78	3, 70	4, 24	Very valid

Based on Table 1, it appears that the average aspects of ease of use and navigation, aesthetics, media integration are 4.30; 4.42; 4.25 which are then categorized as very valid and a technical quality aspect of 4.00 is categorized as valid.

Table 2: Material validation results

Assessment Aspect	Validator		Mean	Category
	1	2		
Material Relevance	4,83	4,83	4,83	Very valid
Appropriateness with the situation and capabilities of the 21st century	4,20	4,30	4,25	Very valid
Assessment quality	5,00	4,67	4,83	Very valid
Average	4,68	4,60	4,64	Very valid

Based on Table 2, it appears that the mean aspects of material relevance, suitability for 21st century situations and capabilities (4C), and quality of assessment are 4.83; 4.25; and 4.83 which are then categorized as very valid. Other information obtained from the table is that each validator gives an assessment of 4.68 and 4.60 with a very valid category.

The results of the validity analysis of the questionnaire instruments that were tested on small-scale trials showed that there was 1 questionnaire item which was declared invalid. This is shown in the results where r count <r table, with r count for item 4 of 0.395 while r table is 0.413. The reliability of the questionnaire instrument with 36 statement items shows that the questionnaire instrument has very high reliability. Therefore, the questionnaire instrument can be used in large-scale tests by removing 1 item, namely point 4.

The large-scale test aims to test practicality criteria and determine the increase in student learning outcomes after using the Android-based learning media for PE subject. The results of the practicality test can be seen in Table 3.

Table 3: Practicality Test Results

Observed Aspects	Assessment Indicator	Total Score
Ease of use and navigation	Ease of use	46, 34
	Navigation accuracy	
	Media operation	
Clarity of presentation and instruction	Use of language	41, 27
	The material presented	
	Presentation of examples of activities	
	Presentation of practice questions	
Aesthetics	The attractiveness of the display	23, 84
	Neatness	
	Interface graphic display	
Helpfulness and usefulness	Media provides assistance and learning opportunities for students	33, 33
	Media increases students' learning motivation	
Total Score		145, 2
Total Maximum Score		175
Practicality Percentage		82, 92%

Based on Table 3, it can be concluded that the Android-based learning media for PE subject has met the practicality criteria reaching 82.92%.

Table 4: Normality test results

	Kolmogorov-smirnov[a]			Shapiro-wilk		
	Statics	**DF**	**Sig.**	**Statics**	**DF**	**Sig.**
Pre-test	,105	48	,200*	,972	48	,309

*. This is a lower bound of the true significance.
a. Lilliefors significance correction

Based on these results, it can be seen that the position probability value is p=0.309. This means that H_0 is accepted if pDK, because p>α with α=0.05. Thus, it can be concluded that the sample comes from a normally distributed population.

Table 5: Paired samples test

Paired differences 95									
					95% confidence interval of the difference				
		Mean	**Std. deviation**	**Std. error mean**	**Lower**	**Upper**	**t**	**DF**	**Sig. (-tailed)**
Pair 1	Pre-test-post-test	-22, 16667	11, 27855	1, 62792	-25, 44162	-18, 89172	-13, 617	47	,000

Based on the results of these calculations, it can be seen that the t count is 13.617. In addition, it can be seen from the sig-(2-tailed) calculation that the 2-way significance is obtained at 0.000 <0.05. That is, H_0 is rejected. It can be concluded that the created learning media can improve students' learning outcomes.

A previous research from (Daryanes *et al*., 2023) [6] stated that the product developed in the form of an articulate storyline interactive learning media can improve students' motivation and problem solving abilities. This is in line with research conducted by (Yunendar, 2016) [26] regarding the development of smartphone-based learning media (android). The research stated that the developed learning media met valid and practical criteria and could increase the effectiveness of student learning outcomes.

Based on these two studies, it can be concluded that android-based learning media is an effective alternative educational product to improve student learning outcomes. Additionally, the android-based learning media can be utilized in various offline and online situations. Therefore, the android-based learning media suit the students' learning needs during the COVID-19 pandemic.

In relation to the previous explanation, Physical Education is a learning subject that emphasizes on practices. Thus, it is slightly difficult to find theoretical learning resources. Meanwhile, during the COVID-19 pandemic, the implementation of PE was limited due to the teacher's lack of ability to assist the students directly. Therefore, the Android-based learning media can be used as a learning solution only by using an Android cellphone.

The developed ARSA Sport product contains materials of PE subject for grade 10, 11, 12 in the 2013 curriculum which have met the specified criteria and have been proven to be able to improve student learning outcomes. However, this application has not yet provided a comprehensive assessment system. This is because the development of the ARSA Sport product is originally intended for providing independent student learning materials in dealing with the covid-19 pandemic. Thus, this research can still be possibly developed with a system of adding assessments to each material and grade.

This research is in line with the research conducted by (Mecky & Ketaren, 2021) [27] which explains that by mastering android-based learning media, teachers can present android-based learning as interesting as possible, which is related to the materials to be learned. Moreover, this will be the best solution for online and distance learning and indeed will be in accordance with 4.0 revolution. On top all of these, according to the research conducted by (Mulyana *et al*., 2022) [28], learning media with ADDIE method can be applied to floor gymnastics learning. Added to that, in the research by (Silaen *et al*., 2021) [23] it is also explained that media with ADDIE development can improve student learning outcomes.

Conclusions

The ARSA Sport is an application that provides learning modules of PE subject for grade 10, 11, 12 in the 2013 curriculum. The product created in this study is an Android-based learning media for PE Subject in high school level in the form of an application with the name ARSA Sport. This ARSA Sport can be used as an additional learning resource that is easily accessible anytime and anywhere using student cellphones with the lowest specification of Android 5.0 (Lollipop). Based on the validation results that have been carried out by material experts, this Android-based learning media has met the very valid category so that the product is feasible to use. Meanwhile, the results of the validation by media experts stated that this learning media was very valid. The results of the analysis of the validity and reliability of the questionnaire instrument also resulted in the high validity and reliability. This Android-based learning media for PE Subject has met the practical criteria as indicated by the positive response of students at 82.92%. Respondents stated that this learning media was easy to use and had an attractive appearance. The large-scale effectiveness test using a paired sample t-test showed that this learning media has also met the effective criteria.

With the ADDIE development method, PE learning media is proven to produce effective learning, and has an effect on student learning outcomes. The PE learning media is able to be a solution to learning loss which occurs in students after the co-19 pandemic. The problem limitations in this study include the Android-based PE learning media development model referring to the ADDIE development model. This the Android-based PE learning media contains teaching materials for PE subject for grades X, XI and XII which are adjusted to 2013 curriculum. Learning media development criteria are limited by being valid, practical, and effective. Further research which can be done is the development of learning media based on other operational systems such as Ios, website, or cloud.

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