Implementation of Android-Based Learning Media on Temperature and Heat Materials to Enhance Student Motivation and Learning Outcomes in Senior High Schools

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Abstract: This study aims to enhance the motivation and learning outcomes of high school students at SMA Negeri 7 Gorontalo for the 2022/2023 Academic Year through implementing android-based learning media on temperature and heat materials. The research method is a quasi-experimental design with a one-group pretest-posttest research design. The research sample consisted of 3 classes: class X IPA 2 as the experiment class and class X IPA 3, and X IPA 4 as a replica class. This research begins with preparing learning tools to implement learning media based on Android material on temperature and heat. The results of the validation show that the learning tools are valid and can be used in the learning process. Implementing the learning process in this study is in the very good category. It can increase student motivation and learning outcomes, where the N-Gain scores for the experimental and replica classes are in the high category.

Keywords: Android; Learning outcomes; Motivation

Introduction

The change in the educational paradigm experienced by Indonesia today has made education even more important. The field of education is required to ensure students have the learning skills to innovate, work and survive by using life skills acquired through education and skills using information technology that is currently developing. Along with the development of information technology, using smartphones as digital tools is part of this development. The smartphone is a mobile device that almost everyone owns. Currently, smartphones are not only a means of communication, but more than that, where various features have been added to facilitate the activities of their users (Kurniawan et al., 2022; Lukman et al., 2020).

One of the operating systems widely used on smartphones is Android, a Linux-based operating system consisting of an operating system, middleware, and main applications used on smartphones or tablet computers (Safaat, 2012; Abdjul et al., 2022; Lubis et al., 2015). Android also provides an open or regular source. Called Open Source, which users can use to create their applications. This makes Android attractive and has recently been used as a learning medium because users can create Android-based applications. Several previous studies have shown that Android-based learning media can be used in learning (Iqbal et al., 2016; Rasmawan et al., 2021; Zulherman et al., 2021; Setiawan et al., 2023; Setiawaty et al., 2022). Android as a learning medium has been widely developed and gives positive results in the learning process, including in learning physics (Astuti et al., 2017; Payu et al., 2023; Febyanti et al., 2022; Ntobuo et al., 2023).

Ironically, with the current development of technology and information, as well as the rampant

development of information technology-based learning media, the reality that is happening in the field based on the results of a survey conducted by the Information and communication technology centre for Education and culture in 2021, it was found that only 40% of teachers are outside subject teachers ICT literate ICT and 60% others still stutter ICT. This is certainly a challenge for teachers considering that students are currently more interested in learning by using technology learning media rather than just using traditional media (Bibic et al., 2019; Buhungo et al., 2023; Hermanto et al., 2023; Darabkh et al., 2018), so the use of Android-based learning media can be a solution to be able to increase motivation and student learning outcomes.

Physics subject is one of the subjects in senior high school. The results of a physics learning survey at SMA Negeri 7 show that the use of Android-based learning media has been used by teachers in the learning process, even though its use is still very minimal due to the limited internet quota owned by students. Most students already have Android smartphones because SMA Negeri 7 Gorontalo is located in the City Center of Gorontalo. However, most of the students complained about the use of internet quota during the learning process. Based on this, researchers feel it is important to apply learning media that do not require internet quota when used. Android-based learning media on temperature and heat is one of the learning media that researchers have previously developed, where an internet quota is only needed when downloading applications. After downloading, this learning media can be used anytime and anywhere without using the internet quota (Areed et al., 2021).

As previously explained, the implementation of Android-based learning media can improve student learning outcomes, so the use of this learning media needs to be continued. Besides improving student learning outcomes, implementing Android-based learning media can also increase student learning motivation (Tantri et al., 2022). Based on this, this study aims to implement android-based learning media on temperature and heat material to enhance student motivation and learning outcomes.

Method

This research was conducted at SMA Negeri 7 Gorontalo for the 2021/2022 academic year, where the sample in the study consisted of 3 classes, namely class X IPA 2 as the experimental class and class X IPA 3, X IPA 4 as a replica class, using the quasi-experimental research method. The research design chosen was one group pretest-posttest (Sugiyono, 2015), as shown in Table 1.

Table 1. One-Group Pretest-Posttest Design

Class	Pretest	Action	Posttest
Experiment Class	O	X	O
Replica Class	O	X	O

Android-based learning media for the material temperature and heat, which will be implemented in this study, has been developed in previous research, which has tested its validity. The following is a screenshot of the Android-based learning media used in this study.

To implement this Android-based learning media, appropriate learning tools are needed. The learning devices are prepared using the Jire collaborative learning model in this case. Before implementing this learning media, we tested the learning device's validity using the criteria shown in Table 2 (Arikunto, 2013).

Table 2. Validation Criteria

Average	Validation Criteria
$X \geq 3.25$	Very valid
$2.5 < X \leq 3.25$	Medium validity
$1.75 < X \leq 2.5$	Low validity
$X \leq 1.75$	Invalid

Android-based learning devices on temperature and heat material can be used in this study if the results of expert validation show very valid criteria so that it can be seen the effect of implementing android-based learning media on temperature and heat material on student motivation and learning outcomes.

The teacher's activities become part of the observation when implementing android-based learning media on temperature and heat material. This aims to measure the practicality of using Android-based learning media on temperature and heat material. Observations of teacher activities are then categorized according to the criteria referred to in Table 3.

Tabel 3. Teacher Activity Criteria Reference

Value Range (%)	Criteria
86 - 100	Very Good
76 - 85	Good
66 - 75	Enough
56 - 65	Less
0 - 55	Very less

Table 4. Reference Criteria for Student Motivation

Value Range (%)	Criteria
87 - 100	Very High
72 - 86	High
56 - 71	Enough
41 - 55	Less
25 - 40	Very Less

Student motivation was determined using a student motivation questionnaire using android-based

learning media on temperature and heat material, where the criteria used for the scores obtained by students refer to Table 4 (Azwar, 2015).

Android-based learning media material temperature and heat can increase student learning motivation if student learning motivation is at high or very high criteria.

Furthermore, student learning outcomes are measured using learning achievement test instruments. Learning outcomes are tested before and after the learning process using Android-based learning media on temperature and heat. The test results calculate the increase in student learning outcomes after using android-based learning media on temperature and heat material through the following N-Gain test equation (1) (Susanto et al., 2022).

$$N\text{–Gain } (g) = \frac{Score\ Posttest - Score\ Pretest}{Score\ Maximum - Score\ Pretest} \quad (1)$$

The obtained N-Gain value is then classified based on the criteria in Table 5 (Hake, 1999).

Table 5. N-Gain Factor Size Criteria

Interval	Criteria
g > 0.70	High
0.30 < g < 0.70	Medium
g < 0.30	Low

Implementing android-based learning media on temperature and heat material can improve student learning outcomes if the N-Gain is in the High criteria.

Result and Discussion

This study aims to implement learning media based on Android material on temperature and heat to increase student motivation and learning outcomes. This learning media has been developed in previous research and is declared valid according to expert opinion. Furthermore, learning tools were prepared by applying the Jire collaborative learning model to implement this learning media. The use of the Jire collaborative learning model is based on several things, including the results of previous research, which states that the Jire collaborative learning model can improve student learning outcomes (Mile et al., 2022; Ointu et al., 2022). In addition, the Jire collaborative learning model can be integrated with the use of IT-based learning media, as the results of research by Gusasi et al. (2022) and Chairunnisa et al. (2022), where the application of the IT-based Jire collaborative learning model can improve student learning outcomes.

The validation results of learning devices using the Jire collaborative learning model to implement Android-based learning media for temperature and heat are in the very good category. This shows that learning devices using the Jire collaborative learning model can be used in the learning process to implement Android-based learning media.

The teacher's activity in the experimental class in the learning process by implementing android-based learning media on temperature and heat material gives results as shown in Figure 1.
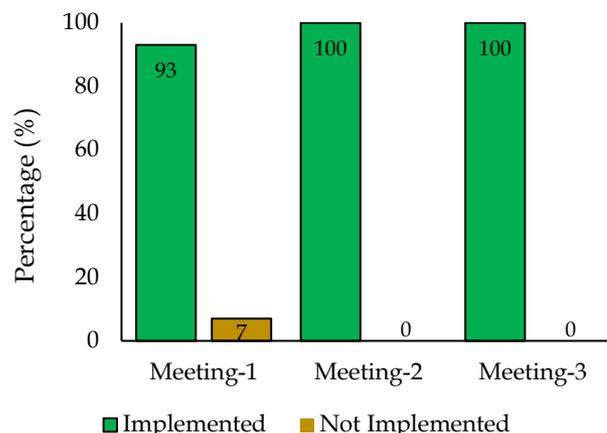
Figure 1. Teacher activity in experimental class

Figure 1 shows that the android-based learning media on temperature and heat material is practical to implement, where from the first meeting to the last meeting, the teacher's activities are in very good criteria. Consistent results were obtained in implementing android-based learning media material on temperature and heat in Replica 1 and Replica 2 classes. For replica, 1 class is shown in Figure 2.
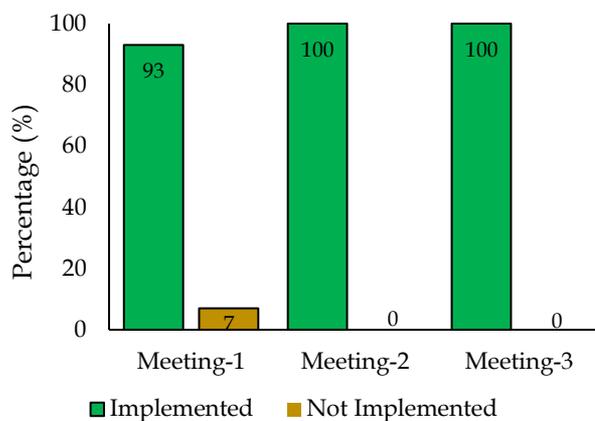
Figure 2. Teacher activities in class replica 1

Figure 2 shows the same results as Figure 1, where teacher activity for the three meetings is very good quality, then for teacher activity in class replica 2 as shown in Figure 3.
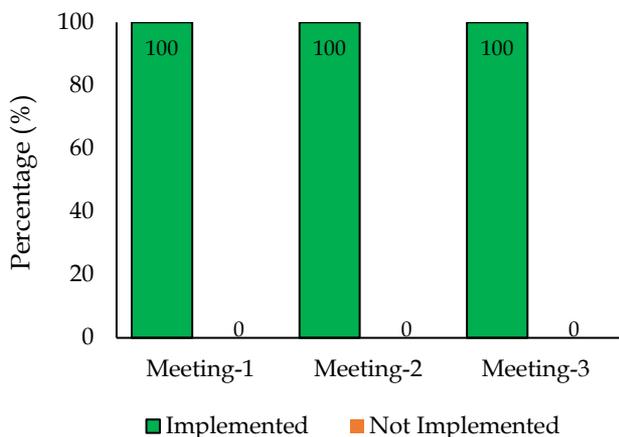
Figure 3. Teacher activities in class replica 2

Teacher activity in replica class 2, as shown in Figure 3, shows the same results as the experimental class and replica class 1, where at all meetings, the teacher's activity is in the very good category, even though in replica class 2 it can be seen that the percentage of teacher activity is all worth 100%.

The experiment and replica classes' findings show that the teacher has no problems implementing android-based learning media on temperature and heat using the Jire collaborative learning model.

Choosing learning media used in the learning process requires good planning so that its use is effective (Sutirman, 2013). Selection of learning models appropriate to the media to be used, including in planning the use of learning media. As is the case with the use of Android-based learning media using the Jire collaborative learning model. The selection of appropriate learning media supported by appropriate learning models can activate students in the learning process.

The use of Android-based learning media makes it easier for teachers to convey material to students and motivates students to follow the learning process. As stated by Sanjaya (2016), learning media has a motivational function, where student motivation is shown: A = There is a desire to succeed in learning, B = There is a desire, enthusiasm and need for learning, C = Have hopes and aspirations for the future, D = There is an award in the learning process, and E = There is a conducive environment for good learning (Iskandar, 2008). Student motivation is shown in Figure 4.

The study's results, as shown in Figure 4, show that student learning motivation for all indicators is in the high and very high categories after the teacher uses Android-based learning media. This shows that the use of learning media can increase student motivation. This result is in line with previous findings, which state that the use of android in the learning process can increase

student learning motivation as indicated by the interest and desire to participate in the learning process (Andriani et al., 2021; Vilmala et al.,2019).
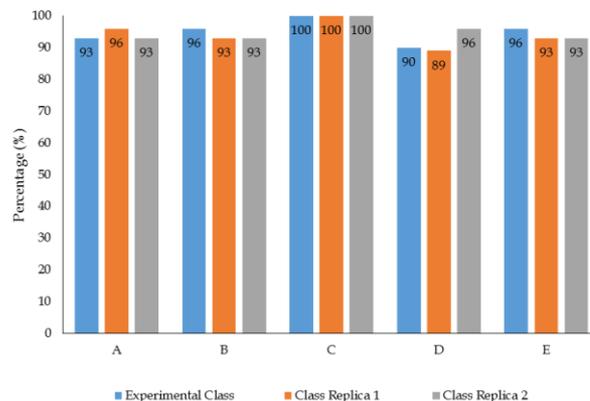

Figure 4. Student learning motivation

The use of learning media in the teaching and learning process is aimed at facilitating the implementation of learning and motivating students to do learning. According to Sanjaya (2016) that one of the functions of learning media is a function of motivation, where by using learning media, students will be more motivated in the learning process. Students who are motivated to participate in learning will be reflected in one way or another through their response to the learning being carried out. Students who have the motivation to learn will follow the learning given carefully according to the duration of the learning time, do the assignments well, and have tenacity in learning.
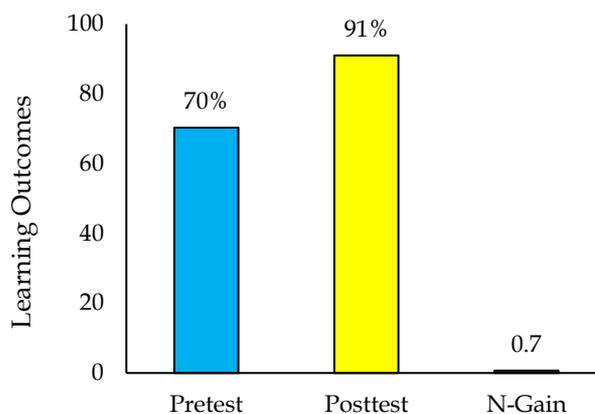

Figure 5. Student learning outcomes in experimental class

Besides increasing student learning motivation using android-based learning media on temperature and heat material, it can be used to improve student learning outcomes. Following are the results of implementing android-based learning media on the

material temperature and heat, providing data in the experimental class, as shown in Figure 5.

The student learning outcomes shown in Figure 5 shows that the pre-test results of students in the experimental class were 70.3%, while in the post-test, the score was 91%. This shows increased student learning outcomes, where the N-Gain value obtained was 0.7 with high criteria. This finding aligns with the results obtained in replica class 1 and replica 2, as shown in Figure 6 and Figure 7.

Figure 6 shows the average pretest result for students in Replica 1 class is 69.89% and the posttest result is 91.23%, with an N-Gain score of 0.7 which indicates that the increase in student learning outcomes using android-based learning media material temperature and heat is in the high category. Similar results are also shown by the findings of student learning outcomes in class replica 2, as shown in Figure 7.
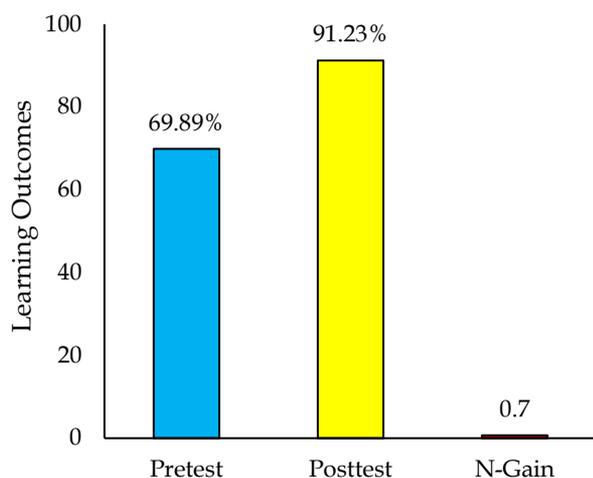

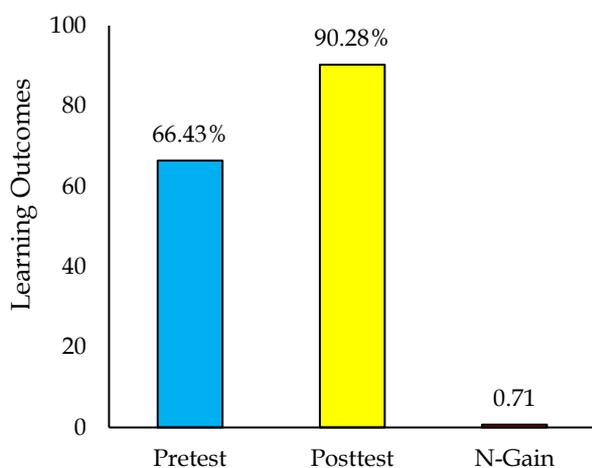**Figure 6.** Student learning outcomes in class replica 1

Figure 7. Student learning outcomes in class replica 2

Figure 7 shows the average pretest result of students in replica class 2 was 66.43% and the student's posttest result was 90.28%, and a N-Gain score of 0.71 was obtained with high criteria. As previously mentioned, these results are relevant to the findings in the experimental class and replica class 1.

The findings in the experimental class, replica 1 and replica 2 show that the implementation of android-based learning media on temperature and heat can improve student learning outcomes, so the use of android-based learning media is a challenge in itself for teachers, considering that students' dependence on android is getting higher. Teachers must always try to use Android-based learning media. Of course, the learning media used are learning media that were previously developed and have been tested to increase students' understanding of the material, which will ultimately have a positive impact on student learning outcomes.

Enhancing students' understanding after learning using Android-based learning media can be the basis for teachers to continue working to improve student learning outcomes through the use of Android-based learning media. Research shows that using Android-based learning media can improve high school physics learning outcomes (Yuliana et al., 2020; Nirmala et al., 2022; Amali et al., 2023).

These findings make using Android as a learning medium one of the solutions to overcome current educational problems which impact low student learning outcomes, especially with the current condition of students dependent on smartphones. Using Android as a learning medium is certainly the right choice.

Conclusion

The implementation of android-based learning media on temperature and heat material shows that this learning media is practically used in the learning process, indicated by teacher activity in the good and very good categories. This learning media can also increase student motivation and learning outcomes, where student motivation is in the high and very high categories, and the learning outcomes shown by N-Gain are in this category.

Author Contributions

Nova Elysia Ntobuo: Conceptualization, writing—original draft preparation, methodology, writing—review and editing; Lanto Ningrayati Amali: Methodology; Lanto Mohamad Kamil Amali: Validation, data curation; Nancy Katili: Formal analysis.

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Conflicts of Interest

The authors declare no conflict of interest.

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