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The Effect of Implementing the Android-Based Jire Collaborative Learning Model on Momentum and Impulse Materials to Improve Student Learning Outcomes

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Abstract: This study aims to determine the effect of applying the android-based Jire collaborative learning model on momentum and impulse material to improve student learning outcomes. The research method is a quasi-experimental design with a one-group pretest-posttest research design. The research location at SMA Negeri 6 Gorontalo Utara for the 2021/2022 academic year used four research samples, namely class X IPA 1 as the experiment class and class X IPA 2, X IPA 3, and X IPA 4 as the replica class. This research begins with the preparation of learning tools that physics learning experts and learning media experts validate. The results of the validation show that the learning tools are valid and can be used in the learning process. The implementation of the learning process in this study is in the excellent category and can improve student learning outcomes. The N-Gain value for the experimental class and replica class is in the high category. Student responses to using the android-based Jire collaborative learning model show good and excellent categories. This shows that the Jire collaborative learning model can be used to improve student learning outcomes in physics learning.

Keywords: Android; Impulse; Learning; Momentum

Introduction

Physics is a science that studies the nature and phenomena of nature and all the interactions that occur in it by using several processes such as observation, measurement, analysis, and conclusions. Student mastery of physics is one of the essential goals in learning to give students an understanding that the material being taught is not just rote learning. Still, students can better understand the concept of the subject matter itself. Several problems are often found in the learning process to achieve learning goals, such as low learning outcomes achieved by students, as well as difficulties experienced by students in following and understanding lessons. This problem is usually influenced by student activities during learning, while learning activities for each individual only sometimes occur naturally. For example, sometimes it is fluent, sometimes it is not, sometimes it can quickly grasp what is learned, and sometimes it doesn't feel easy to concentrate (Ahmadi et al., 2013). In this regard, what can be done to support the learning process to run well is to use appropriate and exciting learning models and to utilize technology as a learning medium. This learning model can create meaningful learning, so students are expected to be able to apply their knowledge in everyday life (Yanti et al., 2016).

The development of technology and communication continues to increase in the 4.0 era, impacting various fields of life, including education. One impact on the education sector is innovation in creating new digital-based models, for example, learning media operated on smartphone devices with the android operating system. Android users in

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Indonesia until June 2015 reached 65.9% of all smartphone users (StatCounter, 2014). These users continue to increase yearly, including android users by students. The more students who use android-based mobile devices, the more excellent the opportunity to take advantage of technological devices in the world of education. Teachers must be creative in using learning media based on android to attract students' interest in learning because by choosing suitable media, the teacher can optimize the learning process (Melida et al., 2014). This is important to pay attention to together, considering the current trend is that students use smartphones a lot to play social media and games.

The use of android-based mobile learning applications as a learning medium has become a student learning style in the 21st century (Calimag et al., 2014). The use of android-based learning media can facilitate the implementation of learning as stated in PP No. 32 of 2013 pasal 19 ayat (1) concerning learning activities in education units that are held interactively, inspiring, fun, challenging, and motivating students. Interesting learning media can stimulate students' attention to learning material so that the material is more accessible for students to understand (Utari et al., 2014). This has the potential to improve students' academic abilities, as the results of research by Resti et al. (2016) show that the use of android-based learning media can improve the academic performance of high school students. These results are supported by findings by Vilmala et al. (2019), Rivai et al. (2021), and Astuti et al. (2017), which reveal that android-based learning media can improve student learning outcomes.

This description shows the importance of education in schools to build creative, well-informed, digitally-enabled communities with flexible knowledge and skills (Anderson et al., 2010). However, there is a gap between this pressure and school conditions. Various research results show that the benefits of using android-based mobile learning are effective in education, but their application in schools needs to be maximized. One of them is the selection of a learning model that is not by android media, even though the use of exciting learning media that is compatible with the learning model chosen by the teacher dramatically determines the success of a learning process (Abdjul et al., 2022). So that the use of android-based learning media is not maximized, based on this, a study aimed to see the effect of using the android-based Jire collaborative learning model to improve student learning outcomes in learning physics on momentum and impulse material.

Method

The method used in this study was a quasi-experiment with a one-group pretest-posttest research design (Sugiyono, 2015) 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

The flowchart of the research used is shown in Figure 1. This research started with random assignments for each class type to the posttest.

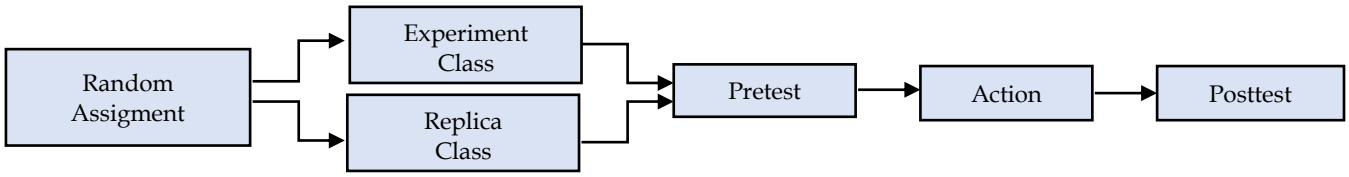

Figure 1. The flowchart of the research

The learning outcomes test was used twice to measure student learning outcomes. The first test was carried out before the learning process using the android-based Jire collaborative learning model, while the second was carried out after the last meeting learning process was completed. This test was conducted to get a score of student learning outcomes on momentum and impulse material.

This research was conducted at SMA Negeri 6 Gorontalo Utara in Province of Gorontalo for the 2021/2022 academic year with four research samples, namely Class X IPA 1 as the experiment class and X IPA 2, X IPA 3, X IPA 4 as the replication class. The implementation of this research begins with the preparation of learning tools using the android-based Jire collaborative model. Before being used in the learning process, the tools that have been compiled are validated by experts. There are four people, namely two physics learning experts and two education media experts. The validity criteria are measured by referring to Table 2 (Arikunto, 2010).

Table 2. Validation Criteria

Average Score	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

If the expert validation results are in the Very valid criteria, then the learning device using the android-based Jire collaborative learning model can be used in the learning process to determine the effect of its application on student learning outcomes in momentum and impulse material. In applying the android-based Jire collaborative learning model, teacher activity is also observed to control the suitability of implementing the process with the learning model used. The criteria for attending teacher activities refer to Table 3.

Table 3. Teacher Activity Criteria

Value Range (%)	Criteria
86 - 100	Excellent
76 – 85	Good
66 - 75	Enough
56 – 65	Less
0 - 55	Not much

Researchers used the N-Gain (g) test to determine the increase in student learning outcomes before and after using the android-based Jire collaborative learning model (Susanto et al., 2022). The following is the formula used to find the N-gain shown in equation (1):

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

Calculations from the N-Gain test (g) produce the gain factor criterion interval shown in Table 4.

Tabel 4. The Gain Factor Criteria (Hake, 1999)

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

After giving treatment in the experimental class and replication class in the form of applying the android-based Jire collaborative learning model to momentum and impulse material, students were given a questionnaire to measure student responses to the application of the android-based Jire collaborative learning model. Student response criteria also refer to Table 3.

Results and Discussion

This research begins with the preparation of learning tools by applying the android-based Jire collaborative learning model. Four experts validated this device, and the validation results showed that the android-based Jire collaborative learning model was valid for the learning process. Some of the effects of previous studies showed the same results, namely, the use of android-based learning media is valid for use in physics learning (Rany et al., 2021; Wardani et al., 2017; Zainudin et al., 2019). The selection of learning models that are appropriate to the use of android-based learning media is suitable for use in the learning process because the use of android as a learning medium is attractive to students. This application has provided innovations in the development of learning media in Indonesia.

In this study, observations of teacher activities were carried out to determine the effect of implementing the android-based Jire collaborative learning model on momentum and impulse material to control the suitability of the implementation of the process using the Jire collaborative learning model. The research results for the experimental class are shown in Figure 2.

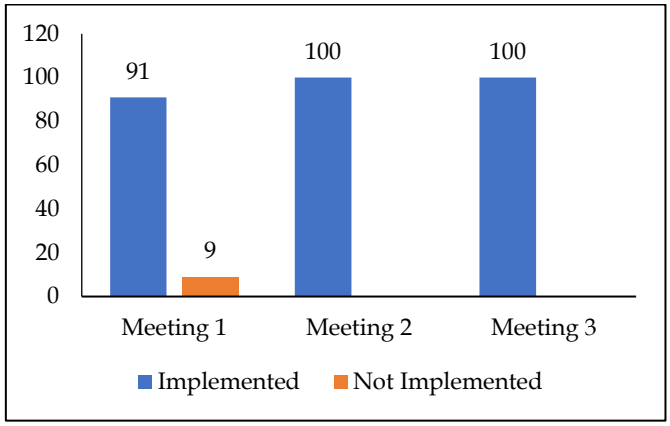

Figure 2. Teacher activity in the experiment class

Figure 2 shows that the teacher's activity was 92% in excellent criteria at the first meeting. Although there is one syntax not implemented by the teacher in the learning process, that is the re-teaching syntax. The teacher does not carry out this syntax because of the limited time allocation for learning. However, in the second and third meetings, the teacher implemented this syntax by maximizing the available time allocation. Furthermore, teacher activities for replica classes can be seen in Figure 3.

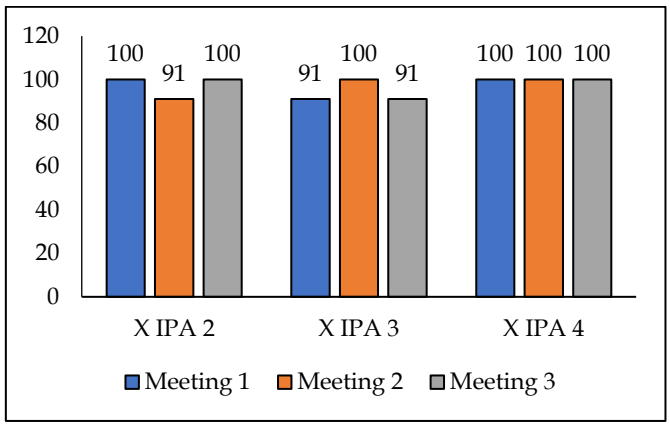

Figure 3. Teacher activity in the replica class

Figure 3 shows that teacher activity in the learning process by applying the android-based Jire collaborative learning model is in the excellent category: the percentage of teacher activity is 91% and 100%. As with the experimental class, the ratio of 91% indicates that there is one learning syntax the teacher does not carry out. In class replica 1, namely X IPA 1, the syntax that the teacher did not carry out in the second meeting learning process was re-teaching syntax, while in the second and third meetings, all syntax was carried out by the teacher. Furthermore, in class X IPA 3, in the first meeting, the teacher did not carry out re-teaching activities, and in the second meeting, all activities were carried out by the teacher. While the third meeting was in class X IPA 3, activities that the teacher did not carry out were rewarding activities. This is because students can complete all the exercises given by the teacher during the learning process. It is different in class X IPA 3. The teacher carries out all learning activities using the android-based Jire collaborative learning model in the learning process.

A researcher by Ntobuo (2018) suggests the weakness of the Jire collaborative learning model is that it requires a long time to carry out all the syntax of this learning model. However, the benefits of implementing this model can improve student learning outcomes (Ointu et al., 2022). Applying the Jire Collaborative learning model can improve student learning outcomes on momentum and impulse material, so researchers use this learning model based on android to enhance student learning outcomes.

The research results of the android-based Jire collaborative learning model to improve student learning outcomes obtained in the experiment class can be seen in Figure 4.

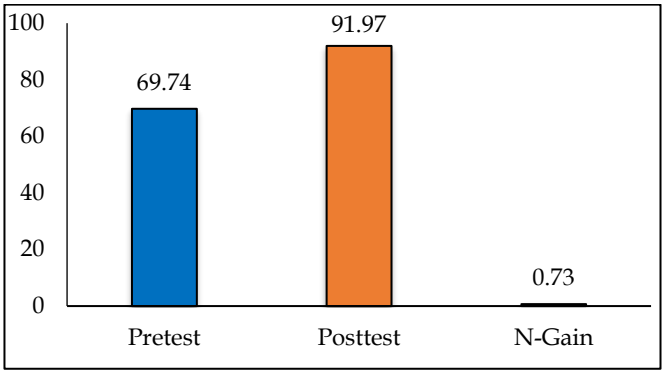

Figure 4. Learning outcomes for class X IPA 1 in the experiment class

Based on Figure 4 shows that the average pretest result of students for class X IPA 1 is 69.74. After the test was carried out at the end of the lesson using the android-based Jire collaborative learning model, the posttest obtained 91.97. Hence, the increase in student learning outcomes in class X IPA 1 indicated by the N-Gain score was 0.73 with high criteria. This states that the application of the Android-based Jire collaborative learning model can improve student learning outcomes. These results are in line with the findings in the replica class, as shown in Figure 5, Figure 6 and Figure 7.

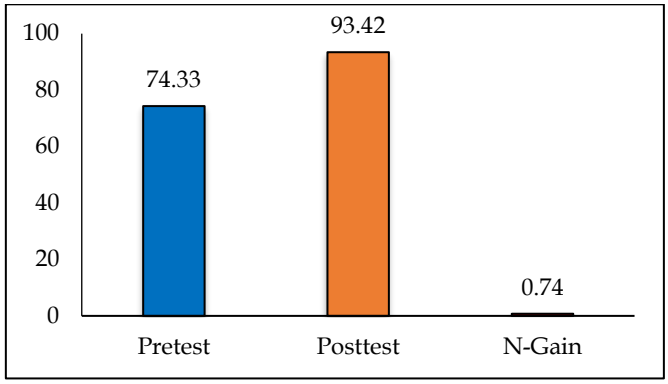

Figure 5. Learning outcomes for class X IPA 2 students in class replica 1

Figure 5 shows the average pretest result of students for class X IPA 2 is 74.33. After the test was carried out at the end of the lesson using the android-based Jire collaborative learning model, the posttest was 93.42. So that the increase in student learning outcomes in class X IPA 2, as indicated by the N-Gain score, is 0.74 with high criteria. This states that the application of the android-based Jire collaborative learning model can improve student learning outcomes.

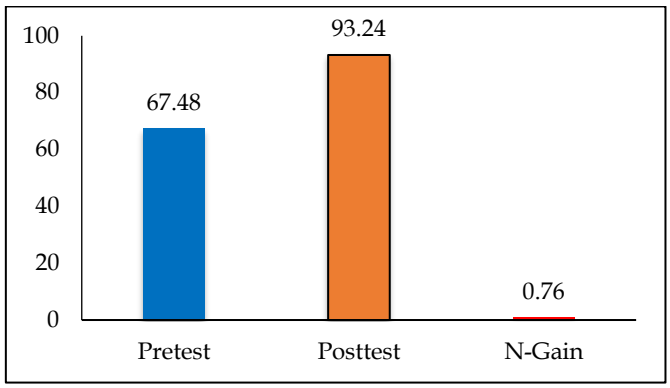

Figure 6. Learning outcomes for class X IPA 3 in class replica 2

Based on Figure 6 shows the average pretest result of students for class X IPA 3 is 67.48. After the test was carried out at the end of the lesson using the android-based Jire collaborative learning model, the posttest was 93.24. So that the increase in student learning outcomes in class X IPA 3, as indicated by the N-Gain score, is 0.74 with high criteria. This states that the application of the android-based Jire collaborative learning model can improve student learning outcomes.

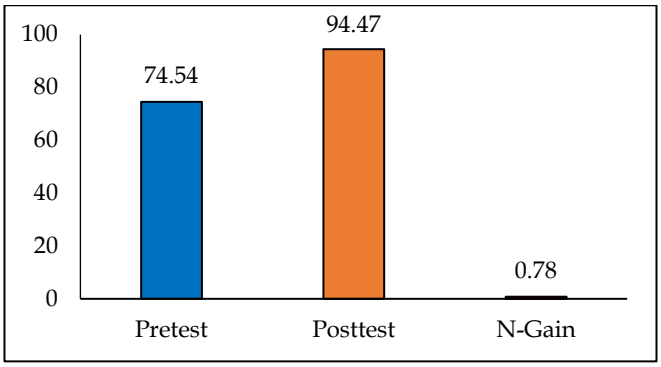

Figure 7. Learning outcomes for class X IPA 4 in class replica 3

Based on Figure 7 shows the average pretest result of students for class X IPA 4 is 74.54. After the test was carried out at the end of the lesson using the android-based Jire collaborative learning model, the posttest was 94.47. Thus, the increase in student learning outcomes in class X IPA 6, as indicated by the N-Gain score, is 0.78 with high criteria. This states that the application of the android-based Jire collaborative learning model can improve student learning outcomes.

The research findings in the experimental class and replica class support the results of previous research on the effect of the Jire collaborative learning model on student learning outcomes (Mile et al., 2022). This learning model can improve student learning outcomes on momentum and impulse material.

Student learning outcomes are maximized by applying this Jire collaborative learning model using android-based learning media because there is a tendency for students to use android. Opportunities to improve physics learning outcomes by utilizing android-based learning media, such as research conducted (Susanto et al., 2022), show that android-based learning media can improve student learning outcomes. In addition, using android-based learning media can improve student learning outcomes and enhance students' logical thinking skills (Setiawaty et al., 2022).

The selection of appropriate learning models according to students' cognitive development stage can positively impact student learning outcomes. This study displays an increase in student learning outcomes in the use of the Jire collaborative learning model with 11 syntaxes and the use of android-based learning media on momentum and impulse materials. Similar research was conducted by Chairunnisa et al. (2022), applying the Jire collaborative learning model based on internet technology (IT) in physics learning using different materials, namely temperature and heat materials. The results of his research show that the IT-based Jire collaborative learning model can also improve student learning outcomes. Another study was conducted by Gusasi et al. (2022), which stated that using the Jire collaborative learning model based on the smart-app creator can also improve student learning outcomes and character.

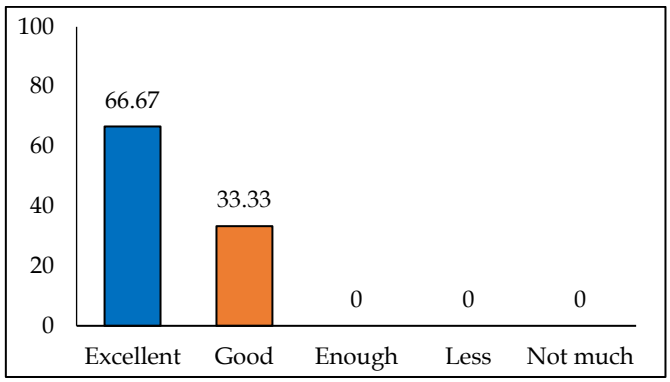

Figure 8. Responses of students for class X IPA 1 in the experimental class

Furthermore, student responses to the application of the android-based Jire collaborative learning model to improve student learning outcomes are shown in Figure 8. Figure 8 shows student responses for class X IPA 1 to the application of the android-based Jire collaborative learning model showing good and excellent categories. Meanwhile, the reaction of students in the replica class is shown in Figure 9.

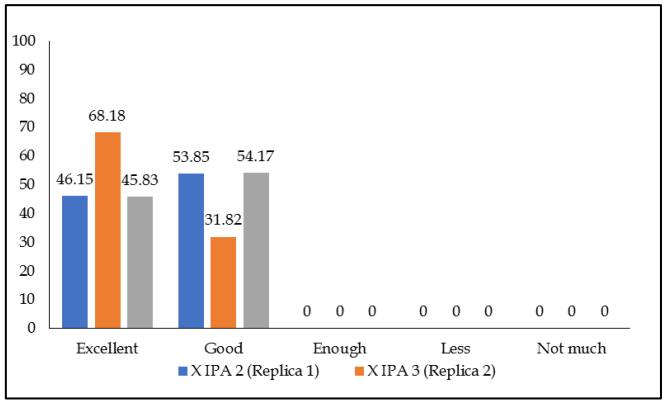

Figure 9. Student response in replica class

Based on Figure 9 shows students' responses in the replica class for classes X IPA 2, X IPA 3, and X IPA 4, showing good and excellent categories. This states that students enjoy using the android-based Jire collaborative learning model. Students build their knowledge through the materials in the application prepared by the teacher during the learning process. Applications used by students are accessed via their respective androids. The advantage of the application designed by the teacher is that it does not require internet data, so that students can explore their knowledge through the media prepared by the teacher.

Student responses are also shown by good student motivation during the learning process because the

media content is closely related to everyday life. Using real problems in students' daily lives results in a more meaningful learning process for students (Wahyuni et al., 2018). Student motivation in the learning process is excellent because students are interested in the teacher's learning conditions. This learning condition is due to the selection of appropriate learning models and the use of media students like.

Conclusion

The validation results on the application of the android-based Jire collaborative learning model are valid and can be used in the learning process. Implementing the learning process in this study is in the excellent category and can improve student learning outcomes. This result is shown by the N-Gain scores for the experimental and replica classes, each of which is greater than 0.7. This states that the increase in student learning outcomes is in the high category. Student responses to using the android-based Jire collaborative learning model were in the good and excellent categories. This response indicates that the Jire collaborative learning model can be used to improve student learning outcomes in physics learning.

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