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# Development of Interactive e-modules Based on Local Wisdom Using Android to Improve Students' Higher Order Thinking Skills (HOTS)

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**Abstract:** This research aims to test the feasibility of an interactive e-module based on local wisdom using an Android application to increase students' HOTS in circular motion material according to teachers and lecturers and analyze the increase in students' HOTS abilities after using an interactive e-module based on local wisdom using an Android application. This research is development research by applying the 4-D model. The development procedure consists of 4 stages, namely; define, design, develop, and disseminate. This research was carried out at MAN 1 Mataram, MAN 1 Central Lombok, MAN 1 West Lombok and MAN 1 East Lombok. This research instrument consists of a HOTS capability assessment instrument, an interactive E-module feasibility assessment instrument based on local wisdom, and an Android application media feasibility instrument. The results of this research are that this learning tool is suitable for use in physics learning to increase students' HOTS in the good and very good categories as tested by lecturers and physics teachers; This learning tool is able to increase students' HOTS within one group (pretest-posttest) and between groups (experiment-control). Data obtained from mixed ANOVA analysis in the experimental class showed that the increase in HOTS ability was more significant than the increase in HOTS in the control group; and there are differences in the HOTS abilities of students who use local wisdom-based e-module learning devices assisted by Android applications and students who use teacher teaching materials.

**Keywords:** Android; Circular Motion; e-module; HOTs; Local wisdom

## Introduction

The 21st century requires everyone to compete optimally in the fields of science and technology globally, which is indicated by the industrial revolution 4.0. Therefore, efforts that need to be made are to improve the quality of human resources (HR). This increase in human resources can be realized through providing maximum education from elementary school, middle school, to high school (Azmar & Ali, 2022; Lase, 2020). Students must acquire various learning skills so that what they have been taught can be meaningful and applied in everyday life.

The increasingly advanced development of science and technology cannot be avoided by all levels of society. This shows that development and competition in the era of globalization require all humans to use all their abilities. The aim of implementing the curriculum in this school is that all students have creativity, are critical in thinking and communicating, and are able to become problem solvers in the teaching and learning process (Warada et al., 2021; Mardhiyah, 2022). These skills can be obtained through a good process, which is based on the development of scientific processes (Asmin et al., 2022; Turmuzi, 2023).

Students' ability to solve the problems they face shows the quality of their critical and creative thinking in the learning process in the classroom. According to the Research and Development Ministry of Education and Culture (2013) 21st century learning is characterized by; information access; growth of computing; automation systems that color human life; and

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communication that can be done anytime and anywhere. Technological advances must go hand in hand with education so that students can easily obtain information according to their needs (Eviyanti et al., 2022; Rosnaeni, 2021; Viyanti et al., 2021). Information technology is increasingly developing rapidly, and can be used as a means of surfing information to help solve learning problems as a student.

The application of subject matter in schools needs to be delivered using newer methods, meaning there needs to be innovation in the way teachers teach so that students gain knowledge using varied methods. Schools generally prohibit students from bringing cellphones to school, but sometimes cellphones are important to be involved in the learning process so that students know how to use cellphones for things that have positive value. The use of technology can improve students' literacy skills (Asyhari, 2019; Sulistya, 2019), obtain up to date information (Usman, 2014), and forming conducive and innovative learners (Ali, 2021). Information technology has been widely used in several fields such as e-learning, e-education, e-government. Information technology based on computing media or smartphones is suitable for application in learning.

One of the subjects that is often a threat at school is physics. For students, physics is a subject that is difficult to understand, confusing, and full of mathematical formulas and calculations. In fact, 21st century learning shows how students are able to change abilities at a low level to high levels. HOTS is a level of cognition that is able to connect, manipulate, think critically, logically, reflect, metacognition, and creatively to determine decisions and solve problems in new situations. (Afriana et al., 2021; Febriyani et al., 2020; Nisa et al., 2020; Ramdani et al., 2020; Zainil et al., 2023). High-level thinking abilities can be developed through providing contextual stimuli, which students often experience in everyday life.

In Indonesia, HOTS abilities have become a learning goal for every student to develop (Afriana et al., 2021; Anggraeni & Sole, 2020; Wahyudi et al., 2022; Zainil et al., 2023). This shows the importance of developing HOTS as a step to improve the quality of the nation's human resources. The essence of the goal in improving HOTS is to ensure that students are able to evaluate, analyze and develop their abilities in understanding the subject matter taught by the teacher. (Febrina et al., 2019; Ichsan, Pertiwi, et al., 2022; Ichsan, Sigit, et al., 2022; Putri et al., 2023; Rahayu et al., 2023; Wahyudi et al., 2022; Wahyudiati et al., 2023). In physics lessons, students should be able to evaluate and analyze the relationship between physics concepts and natural phenomena that occur in everyday life. This process is the development of students' understanding in exploring their knowledge to form the ability to think critically, creatively and innovatively. Direct observation of the environment will shape students' independent character in obtaining and transferring knowledge information.

Sitorus (et al., 2021) defines HOTs as an end goal that will be achieved through approaches, processes and learning methods applied in the classroom. The physics learning process which is cooperative and discusses physics theory contextually has an influence on the process of constructing understanding collaboratively and communicatively between each student. Contextual learning can be applied through local wisdom which is based on local community habits. Integrating local culture with the world of education is an important thing to implement (Ardiawan, 2018; Gularso et al., 2017; Hikmawati, Suastra, et al., 2021; Putri et al., 2020; Usmeldi & Amini, 2020). Physics learning related to local culture combined will be a tool to increase students' interest in learning.

Local community habits in the areas of play, social culture and work can be used as learning resources (Afifah et al., 2022; Eviyanti et al., 2022; Mukaromah et al., 2022; Yanti et al., 2022). For example, in the top game, without realizing it, the top game contains physics concepts. This is what should be developed to foster students' talents and interest in studying physics (Hikmawati, Suma, et al., 2021; Matsun et al., 2019; Usmeldi & Amini, 2020; Yanti et al., 2022). This local wisdom-based learning can encourage students to explore their knowledge abilities, be critical in analyzing problems, and become solvers of the physics problems they face (Aryani & Wahyuni, 2020; Ramdani et al., 2020; Setianingrum et al., 2023; Tohri et al., 2022; Widesma & Adnan, 2019). Based on the descriptions above, researchers took the initiative to take the research theme "Development of Interactive E-Modules Based on Local Wisdom Using Android Applications to Improve Students' Higher Order Thinking Skills (HOTS) on Circular Motion Material."

Based on the problems studied, the author intends to reveal several things, including: knowing the feasibility of an interactive e-module based on local wisdom using an Android application to increase students' HOTS in circular motion material according to teachers and lecturers; and knowing the increase in students' HOTS abilities after using interactive e-modules based on local wisdom using an Android application.

## Method

This research is research and development research by applying the 4-D model from Thiangrajan and

Semmel (1974). The development procedure follows the procedure in the 4-D model which consists of 4 stages, namely; Define, Design, Develop, and Disseminate (Masruroh et al., 2019; Sa'idah et al., 2022; Sugiyono, 2015a). This research was carried out at MAN 1 Mataram, MAN 1 Central Lombok, MAN 1 West Lombok and MAN 1 East Lombok. Data collection techniques use questionnaires and Multiple-Choice tests that measure students' Higher Order Thinking Skills (HOTS) abilities, measured by looking for students' N-Gain values.

## Result and Discussion

*Development Method Data*

In this development research, the development model used is a 4D model which consists of several stages such as definition, design, development and dissemination stages (Fiantika et al., 2022; Sugiono, 2014; Sugiyono, 2015b). The Define stage is the earliest stage carried out during teaching material development activities as a research study. This initial stage aims to obtain various information related to teaching and learning activities at school. The next stage is to design teaching materials using an Android application based on the local wisdom of the spinning top game on circular motion material that suits students' needs and is aimed at making it easier for students to learn physics, especially circular motion material (Ali & Tirmayasari, 2022; Hartik et al., 2020; Prastowo, 2016; Putri et al., 2020).

*Test Data*

The data obtained consists of product feasibility test data, limited trial data, and extensive trial data.

*Feasibility Sheet Validation Test Data*

The validity of the product feasibility assessment sheet is assessed first by the lecturer. Once assessed as valid, the assessment sheet is ready to be used to assess the product being developed. This content validation is processed using the Aiken's V value.

*Product Feasibility Test*

This product development feasibility test is an advanced stage of the feasibility sheet validation test. The product developed is tested for feasibility by material experts and media experts in the form of an Android application.

**Table 1.** Aiken's V Value Data on the HOTS Evaluation Test

| Rated aspect | r | s | VC | Conclusion |
|---|---|---|---|---|
| Statements (questions and reasons) correspond to the indicator formulation in the grid | 2 | 1 | 1 | Valid |
| Statements are formulated briefly | 2 | 1 | 1 | Valid |
| The sentences are free from irrelevant statements | 2 | 1 | 1 | Valid |
| The sentence is free from statements that can be interpreted with more than one meaning (multiple interpretations) | 2 | 1 | 1 | Valid |
| Each statement contains only one complete idea | 2 | 1 | 1 | Valid |
| The distractors in each question item are arranged logically | 2 | 1 | 1 | Valid |
| Instructions for working on the instrument are clear | 2 | 1 | 1 | Valid |
| The number of instrument items does not make respondents boring | 2 | 1 | 1 | Valid |
| A variety of communicative languages and according to the respondent's educational level | 2 | 1 | 1 | Valid |
| The statement uses standard Indonesian | 2 | 1 | 1 | Valid |
| The statement does not use local language | 2 | 1 | 1 | Valid |
| Short and straightforward words | 2 | 1 | 1 | Valid |

*Expert Assessment Data*

This expert assessment data was obtained from the results of a questionnaire distribution given to Android application material and media experts. The questionnaire given to experts used a Likert scale. Meanwhile, the type of data obtained from experts is in the form of quantitative data which is then described into several categories with reference to the scoring guidelines presented in the following table.

**Table 2.** Recap of Data and Scores from Lecturer Assessment Results

| Aspects of assessment on material aspects | Average Lecturer Score | Criteria |
|---|---|---|
| Depth of material discussed | 3.00 | Good |
| Language and concepts are easy to understand | 3.15 | Good |
| Teaching materials are equipped with representative picture illustrations of the concepts conveyed | 3.03 | Good |
| The images displayed in the material do not give rise to student misconceptions | 3.33 | Good |
| The teaching material is equipped with an explanatory video about circular motion which can make understanding easier | 3.50 | Very Good |
| The teaching material presented in the module can improve HOTS abilities | 3.66 | Very Good |
| The teaching material presented can be closely related to the circular motion material and the spinning top game | 3.78 | Very Good |

*Physics Teacher Assessment Data on Material*

Apart from expert lecturers, physics teachers at schools are also used as assessors of the teaching material being developed. The results of the physics teacher's assessment of the learning tools can be seen in Table 3.

*Extensive Trial*

*Pretest and Posttest Results for HOTS Evaluation Test Questions*

Pretest and posttest data for the experimental class and control class can be seen in Tables 4 and 5.

**Table 3.** Physics Teacher Assessment Data and Scores on the Material

| Aspects of assessment on material aspects | Average Lecturer Score | Criteria |
|---|---|---|
| Depth of material discussed | 3.62 | Very good |
| Language and concepts are easy to understand | 3.55 | Very good |
| Teaching materials are equipped with representative picture illustrations of the concepts conveyed | 3.72 | Very good |
| The images displayed in the material do not give rise to student misconceptions | 3.53 | Very good |
| The teaching material is equipped with an explanatory video about circular motion which can make it easier for students to understand | 3.60 | Very good |
| The teaching material presented in the module can improve students' high-level thinking abilities | 3.76 | Very good |
| The teaching material presented can be There is a close relationship between circular motion and spinning tops | 3.72 | Very good |

**Table 4.** Experimental Class Pretest and Posttest Results on HOTS Questions

| School | | Begin-ning | End | Gain | Category |
|---|---|---|---|---|---|
| MAN Lombok Timur (IPA 1) | Σ | 1595.80 | 2197.83 | 12.45 | Curren-tly |
| | Ave-rage | 53.19 | 73.26 | 0.42 | |
| MAN Lombok Tengah (IPA 1) | Σ | 1686.97 | 2201.98 | 11.23 | Curren-tly |
| | Ave-rage | 56.23 | 73.40 | 0.37 | |
| MAN Lombok Barat (IPA 2) | Σ | 1572.87 | 2265.71 | 14.35 | Curren-tly |
| | Ave-rage | 52.43 | 75.52 | 0.48 | |
| MAN 1 Mataram (IPA 3) | Σ | 1587.45 | 2193.66 | 12.27 | Curren-tly |
| | Ave-rage | 5.92 | 73.12 | 0.41 | |

**Table 5.** Control Class Pretest and Posttest Results on HOTS Questions

| School | | Begin-ning | End | Gain | Curren-tly |
|---|---|---|---|---|---|
| MAN Lombok Timur (IPA 2) | Σ | 145.24 | 1796.99 | 6.58 | Low |
| | Average | 48.54 | 59.90 | 0.22 | |
| MAN Lombok Tengah (IPA 2) | Σ | 1527.06 | 1778.45 | 5.07 | Low |
| | Average | 50.90 | 59.28 | 0.17 | |
| MAN Lombok Barat (IPA 1) | Σ | 1566.63 | 1777.41 | 4.39 | Low |
| | Average | 52.22 | 59.25 | 0.15 | |
| MAN Mataram (IPA 4) | Σ | 1468.74 | 1774.91 | 5.86 | Low |
| | Average | 48.96 | 59.16 | 0.19 | |

*Analysis of Trial Results*

*Analysis of Pretest and Posttest Results on Extensive Tests*

The gain values obtained from the students' pretest and posttest can be seen in Figure 1.

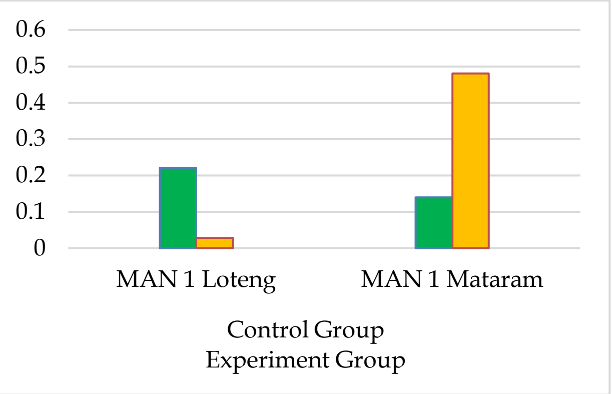


**Figure 1.** Wide Trial Score Gain

Figure 1, shows that the average score for the experimental class is higher than the control class. The gain value in the experimental class is in the medium category, while the gain value in the control class is in the low category. This shows that the HOTS abilities of students in the experimental class and control class experienced different improvements. Table 9 shows the univariate normality analysis using the SPSS Shapiro Wilk and Kolmogorov Smirnov Normality test. From this analysis, the Asymp value is obtained. Sig (2-tailed) on HOTS is 0.068 > 0.05, which means that the data on HOTS capabilities is normally distributed. Based on the univariate analysis data above, it can be concluded that H0 is accepted, meaning that the data is univariate normally distributed.

*Uji ANAVA Mixed Design*

*Statistical Description of Student HOTS Abilities*

Table 11 describes the average pretest and posttest scores of students in the experimental and control groups. Group A (experiment) and group B (control) were given a pretest before being given treatment. After the pretest was carried out, both groups good experiment and the control group were given different treatment, the experimental group was given treatment in the form of physics learning using local wisdom-based e-modules assisted by an Android application, while the control group was given treatment in the form of physics learning using teaching materials from the teacher. From the table it can be seen that the average pretest and posttest for the experimental group is 53.38 and 73.88.

The pretest and posttest averages in the control group were 49.64 and 66.60. These results indicate an increase in students' HOTS abilities in both the experimental and control classes. Apart from that, the standard deviation value was also obtained for each group, where the total standard deviation value for the experimental group in the pretest and posttest was greater than the standard deviation value in the control group. This shows that the increase in the HOTS ability of the experimental group in the pretest and posttest was more varied than in the control group, meaning that the HOTS ability of the research subjects experienced small and large increases. Statistical data can be seen in Table 7.

**Table 7.** Statistical Description

| | Assessment for k | Mean | Std. Deviation | N |
|---|---|---|---|---|
| Pre | A | 53.38 | 7.94 | 150 |
| | B | 49.63 | 5.73 | 150 |
| | Total | 51.51 | 7.16 | 300 |
| Pos | A | 73.88 | 5.65 | 150 |
| | B | 59.32 | 6.01 | 150 |
| | Total | 66.60 | 9.33 | 300 |

*HOTS Ability Improvement Curve in Experimental and Control Groups*

Figure 2 illustrates the difference in improvement in HOTS abilities of the experimental and control groups from the pretest and posttest scores. From the figure, it can be seen that the increase in students' HOTS abilities occurred in the experimental and control groups, but in the experimental group the increase was higher than in the control group. Therefore, the experimental group had a more significant increase in HOTS ability than the control group. The difference in increasing HOTS capabilities can be seen in Figure 2.

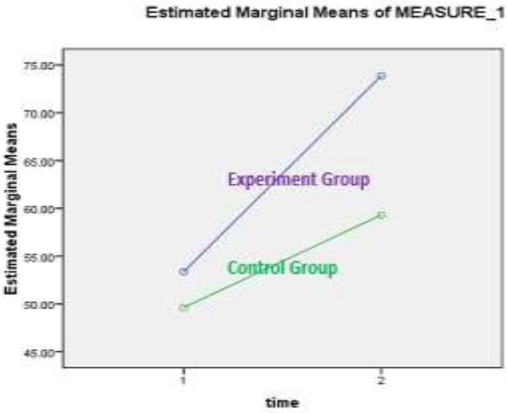


**Figure 2.** Differences in HOTS Ability Improvement in the Experimental and Control Groups

*Product Revision*

The e-module learning device based on local wisdom assisted by an Android application that has been developed needs to be revised again in order to produce a good final product. An e-module learning device based on local wisdom assisted by an Android application that was created in advance in consultation with colleagues (physics lecturers). Comments and suggestions from colleagues are used as a reference to revise the tools that have been created and then submitted to expert lecturers to validate them in terms of material and media aspects. The results of the review by expert lecturers are used as material for improving local wisdom-based e-module learning devices assisted by Android applications. The assessments given by expert lecturers are used as validation data for local wisdom-based e-module devices assisted by Android applications. Apart from validation data from expert lecturers, validation data was also obtained from physics teachers at the research school.

Several things suggested by expert lecturers and physics teachers to be improved in learning tools are that the teaching material in the cover section must be adapted to contextual events in everyday life. Follow-up: Changing the cover with the picture to a cover with the picture "top game"; There are still some colors on the cover and material content that do not match the writing. Follow-up: adjust the color of the text and background so that it is easy and comfortable to read; writing KI and KD in teaching materials is not required. Follow-up: Remove KI and KD from teaching materials; There are still errors in writing the formula. Follow-up: improve formula writing using equations; Examples of questions and discussions still contain errors in writing numbers. Follow-up: Improve the writing of formulas in example questions and discussions, replace numbers or letters that are still wrong, and improve the solution process in more detail and in accordance with the concept of circular motion; Images must be accompanied by reference sources. Follow-up: Complete the image with the source; and English words in teaching materials should be replaced. Follow-up: English words are translated into standard Indonesian.

Apart from that, it is also recommended regarding the HOTS question test that the images used in the questions should be made by yourself so that they are more connected to the existing concept. Follow-up: The pictures in the questions are made by yourself; The description in the question sentence must be simple, detailed and easy for students to understand. Follow-up: Replace words and sentences to make them simpler and more detailed. And the related Android application media still has some parts of the color and writing that are inappropriate and too bright. Follow-up: replace the background with blue and the writing with black; and the next question display should use "next" not "scroll". Follow-up: Replace it with “next” view.

*Final Product Review*

The final product produced is an e-module learning device based on local wisdom assisted by an Android application on circular motion material which aims to improve students' HOTS abilities. The resulting learning tool follows the process and steps for developing a 4D model. The local wisdom-based e-module learning device assisted by an Android application as the final product has been revised. The revisions made were adjusted to suggestions and comments from fellow lecturers and physics teachers. The latest revision is based on the results of studies on extensive trials in schools consisting of student responses and learning observations. At the extensive testing stage, tests are carried out to determine students' HOTS abilities. The learning tools that have been developed consist of teaching materials, HOTS questions, and Android application media. The goal to be achieved through the learning tools developed is to increase students' HOTS, so they are designed based on the STEM model, contextual approach, demonstrations, questions and answers, discussions, experiments, and the use of Android application media.

Validation carried out by lecturers on the teaching material learning device assisted by the Android application provides data that has been analyzed. Validation of the assessment sheet is processed using Aiken's V validation which gives the result that all learning tools have an Aiken's V index value of 1.00, which indicates that the assessment sheet is valid for use. The feasibility assessment was also carried out by the lecturer, the score for assessing the feasibility of teaching material learning tools was 3.03 with good criteria, HOTS questions 3.50 with very good criteria, and Android application media 3.78 with very good categories. Analysis of feasibility assessment data carried out by physics teachers shows that the learning tools that have been developed can be used in the physics learning process. The score on the teaching material was 3.21 in the good category, the HOTS questions were 3.67 in the very good category, and the student response questionnaire to the Android application media was 3.63 in the very good category.

In this development research, the research group was divided into two, namely, the experimental group and the control group. The experimental group was given treatment by providing a local wisdom-based e-module assisted by an Android application used in learning the physics of circular motion. Local wisdom-based e-module tools are prepared based on contextual events in everyday life, which are often experienced by students themselves. Very dynamic technological advances are used as learning media using local wisdom-based e-modules, in this case the media used is Android application media.

The Android application is not only equipped with theoretical material, but is also equipped with student worksheet, questions and discussions, practice questions, exam questions and learning videos. In its use, local wisdom-based e-modules assisted by Android applications follow the syntax that has been developed, namely, initiation (constructivism), exploration (inquiry, questioning), concept development (learning community, modeling), application (authentic), and concept consolidation (reflection). Meanwhile, in the control group students were taught using teaching materials used by teachers at school. The methods applied in the control group learning were lecture, discussion and question and answer methods.

In the learning process, students responded very well to the local wisdom-based e-module device assisted by an Android application. Students are very enthusiastic about taking lessons using Android applications, they feel that finding information about the material being taught is easier and more practical. Based on the results of the tests that have been carried out, it is proven that students' HOTS abilities have increased with detailed gain values for the experimental class and control class of 0.42 in the medium category and 0.18 in the low category. This shows that the gain value in the experimental class is higher than the control class.

The local wisdom-based e-module learning device assisted by an Android application has several advantages, including the learning process that is applied which is focused on the ability to analyze, evaluate and create, the scope of teaching material taught also consists of contextual events in everyday life so that learning will be more meaningful. The student worksheet presented also teaches students to be more active in learning physics through simple tools and materials that can be found easily from the living environment, android application media that prepares teaching materials, student worksheet, HOTS questions, and contextual pictures are able to motivate students in learning physics practically, this is in line with findings by Lubis & Saragih (2011) which stated that contextually based learning can significantly increase student achievement.

The availability of learning activities in the Android application will inform students about the things that will be completed in learning, so as to form students' attitudes that are more responsible for the physics learning process, they participate in. This is in accordance with the results of research conducted by Al-Sharqi, Hashim, & Kutbi (2015) which states that the use of social media can have a positive effect on several things in students, namely, thinking style, interacting with the community, and can improve open thinking skills. (open-mindedness). This indicates that the use of media which is a guide in students' daily lives can influence students personally and socially. Personally, students can improve their thinking skills and socially, students can interact well with the wider community. Therefore, the use of Android application media has a role in improving students' HOTS abilities and responsible attitudes.

This learning device is also designed according to needs based on contextual learning which includes cognitive, affective and psychomotor aspects. Therefore, the teaching material learning device assisted by an Android application is suitable for improving students' HOTS abilities and motivating students' learning. The development of learning tools should be based on the characteristics of students at school, so it requires teacher creativity to choose the right measuring tools. Local wisdom-based e-module devices assisted by Android applications can be an alternative for being creative in teaching circular motion material such as using question and answer techniques, discussions and using Android applications.

## Conclusion

Based on the local wisdom-based e-module learning device product assisted by an Android application on circular motion material which aims to increase high school students' HOTS, the conclusion can be drawn, namely. The results of this research are that this learning device is suitable for use in physics learning to increase students' HOTS in the good category. and very well tested by physics lecturers and teachers; This learning tool is able to increase students' HOTS within one group (pretest-posttest) and between groups (experiment-control). Data obtained from mixed

ANOVA analysis in the experimental class showed that the increase in HOTS ability was more significant than the increase in HOTS in the control group; and there are differences in the HOTS abilities of students who use local wisdom-based e-module learning devices assisted by Android applications and students who use teacher teaching materials. The development of learning tools that have been developed has several limitations, including: some students do not have Android smartphones to use in physics learning, so they are overcome by providing screenshots of teaching materials, student worksheet, example questions and discussions, and practice questions in the Android application. However, to obtain more information, students who do not have Android smartphones join other friends; The teacher's learning tools used in the control class are still being modified by researchers, because there are several points that are incomplete. Feasibility standards are obtained from comparing teacher devices with devices that have been validated by experts on the same topic.

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**Author Contributions**

Lalu Usman Ali: preparation of the original manuscript, results, discussion, methodology, conclusions; Muhammad Zaini; proofreading, reviewing, and editing.

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**Conflicts of interest**

The authors declare no conflicts of interest with respect to the publication of this paper.

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