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Increasing Student's Hots Using Mobile Technology and Scaffolding Approach on Sound Wave Material

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Abstract

The higher order thinking skills (HOTS) of students in Indonesia is still low. This study aims to determine the effectiveness of using Android-based interactive physics learning media with a scaffolding approach on Sound Wave material to increasing higher order thinking skills. This study used a Pre-Experimental with one Group Pretest-Posttest Design. The evaluation instrument developed was a higher order thinking skills test instrument in the form of reasoned multiple choice. Data were analyzed with descriptive statistics and used the Anava test. The result showed that the use of Android-based Mobile Interactive Physics Learning Media with the Scaffolding approach on Sound Waves material proved to be effective in increasing students' HOTS abilities. This can be seen from the results of the effectiveness test, size-effect, and the size of the effective contribution that has been made showing that learning with the scaffolding approach assisted by the IPMLM application has increased higher than the control class.

Key words: Android-based Interactive Physics Mobile Learning Media (IPMLM), Higher Order Thinking Skills, Scaffolding Approach.

INTRODUCTION

The Industrial Revolution 4.0 is known as a cyber-physical system, which is a combination of cyber technology and automation technology (Tjandrawinata, 2016). In this era, information technology has become the basis for human life, including in the field of education in Indonesia. In its application, it emphasizes the effectiveness and efficiency of the work environment. One of the movements launched by the government in responding to Industry 4.0 is a new literacy movement that focuses on digital literacy, technological literacy, and human literacy (Aoun, 2017). The ease that is felt in the use of digital technology is service efficiency and a wider range of connections thanks to the use of an online system (Ghufron, 2018).

In response to the literacy, the movement required a high level of thinking ability. Though in general students in Indonesia still have low-level thinking skills. They only can remember, understand, and apply concepts while the ability to analyze, evaluate, and create is still very low. This was addressed by the 2015 global creativity index Indonesian creativity ranked 115 out of 139 countries (Florida, Mellander & King, 2015). Likewise, the global innovation index value is ranked 85 out of 129 countries (Dutta, Lanvin & Wunsch, 2019). Meanwhile, in the context of science performance, Indonesian students according to PISA in 2015 ranked 65 out of 73 countries (OECD, 2015). That is, serious efforts are still needed in improving the Higher Other Thinking Skills (HOTS) of Indonesian students.

Efforts to improve the ability of HOTS of students in learning physics have not been able to produce maximum results. In the 2018/2019 Natio-

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nal Examination, physics subjects achieved a score of 45.79% for the national scale, while at the provincial level in NTB the score was 40.94%, and at the Bima regency level, it was 36.33% (Kemendikbud, 2019). Physical materials with low absorption power are waves and optics with a national presentation of 44.42% and the Bima regency level of 35.96% (Kemendikbud, 2019). Specifically, for the wave absorption power material at the Bima regency level, the indicator determines amplitude and intensity of the sound by 20.96% while nationally it is 32.13%. The second indicator determines one of the magnitude values based on the doppler effect of 33.94% at the Bima regency level and 56.06% nationally (Kemendikbud, 2019). The absorption power of this sound wave material is the lowest among other physical materials. Based on research conducted by Hasanah, Huda, and Kurniawati (2017) shows 77.7% of students stated that sound wave material is material that is difficult to learn.

Students experience a lot of misconceptions in understanding the concept of sound propagation through the medium up to the listener's ear (Sadgolu, 2013). Another factor influencing the low absorption of students in sound wave material is that there are too many equations that increase the chance of misconceptions (Sulistyarini, 2015). This condition certainly hinders the improvement of quality human resources.

In general, students in Indonesia master questions that are routine, simple computing, and measure knowledge of facts that have daily context but are not yet able to integrate information, draw conclusions, and generalize knowledge possessed to other things (Rachmayani, 2014). That is caused by the learning system which is only oriented towards the ability to think at a low level. This conclusion is supported by the fact that the assessment system in high schools only tests the ability to think at a low level, namely remembering, understanding, and applying (Istiyono, Mardapi, & Suparno, 2014). One example is a learning system that only teaches the application of formulas without analyzing, guessing formulas, memorizing example problems, and not being taught to solve complex problems (Azizah, Yuliati & Latifah, 2015). That is, the ability of HOTS greatly influences the academic quality of physics learning (Ramos, Dolipas and Vilamor, 2013). To improve HOTS capability, a HOTS-oriented learning system is needed that integrates all learning components such as the curriculum, learning objectives, teaching materials, learning media, learning process, and evaluation system.

Teaching higher order thinking skills has challenges. Teachers require persistent time and effort in implementation. One of the related challenges concerns a teacher's teaching skills. This is evidenced in Shukala (2016) research that the teaching skills of a teacher influence increasing the HOTS of students. In HOTS learning, the teacher must ensure that every student has mastered the basic concepts and skills before teaching new topics (Chu, Treagust, Yeo & Zadnik, 2012; Abdullah, Abidin & Ali, 2015). Learning activities that can support HOTS are student center in nature, where students are actively involveed in the discussion process to build knowledge and utilize various relevant sources to explore the desired knowledge. (Apino & Retnawati, 2017; Hugerat & Kortam, 2014).

One way that teachers can use to improve students' HOTS abilities is to choose the right learning media. An interesting choice is a mobile technology or mobile learning. Mobile learning technology has gained increasing focus in academia as a way to enable learning that is not limited by time and place (Callum & Jeffrey, 2013). Basically, mobile learning is part of e-learning that specifically utilizes mobile information and communication technology products, in this case, smartphones or tablet computers (Martono & Nurhayati, 2014; Aji & Suparno, 2021). The advantage is that mobile learning can provide convenience in the learning process, making it easier for students to learn pedagogy and content taught in schools (Pegrum, Oakley, and Faulkner, 2013). This is in line with Alfarani's (2015) research that mobile learning can improve communication with students, as well as the resources and speed of feedback available to them. Where it can increase the ability of HOTS.

Mobile devices that can be used in learning are smartphones. The use of mobile smartphones as learning media has great potential to be developed because, among other ICT products, mobile devices are the fastest-growing products (Taufiq, Amalia, Parmin & Leviana, 2016). More specifically, the most potential mobile device is a smartphone with the Android operating system, because compared to similar products, Android is the most widely used operating system (Zahid, 2018). In addition, the use of Android-based learning media is an effort to implement learning styles in the 21st century (Climag, Mugel, Conde, & Aquino, 2014). Android applications are multitasking, meaning that they can run several applications simultaneously (Safaat, 2013). This makes Android-based learning media can help students gain understanding (Ma, Gu, & Wang, 2014). Some developers provide programs in the form of learning modules that function to help manage data, analyze data through features in Android applications (Wong, Xu, & Chao, 2011). The application of android applications in learning encourages learning motivation for students so that students are actively involved during learning so that it helps the level of understanding of learning concepts (Zhao, 2016).

To improve the ability of HOTS in addition to the right learning media, an appropriate learning approach is also needed. In line with that, Vygotsky's theory of social constructivism emphasizes that children build knowledge through interactions with other people. The level of potential development can be achieved by providing scaffoldding (Schunk & Zimmerman, 2012). Scaffolding is a tool, strategy, and guide used by teachers during learning to enable students to develop understanding and be actively involved in the learning process (Musa & Abdullah, 2020). At the beginning of learning the teacher models the skills being taught, then reduces assistance slowly as students' skills increase (Dasilva at all, 2019; Scunk & Zimmeman, 2012). The aim of the scaffolding approach is that the learner not only acquires the skills necessary to perform the task independently but also assumes responsibility for the task (Belland, 2014). In the initial conceptualization, the scaffolding approach included support for developing motivation and cognition (Belland, 2017). Assistance provided in scaffolding can be in the form of probing-prompting where the teacher acts as a provider of assistance who provides assistance according to the level of potential and characteristics of the students (Septriani, Irwan & Meira, 2014). Several previous studies have stated that scaffolding can improve HOTS abilities (Belland, 2017), critical thinking skills (Susilowati, Rusdiana & Kurniawati, 2017), problem-solving (Amanah, Harjono & Gunada, 2017), and student learning independence (Tuada, Kuswanto, Saputra & Aji, 2020). In this study, the scaffolding approach used consists of three levels, namely a) environment provision, b) level of explaining, reviewing, and restructuring and c) level of developing conceptual (Anghileri, 2006).

Based on the explanation above, the researchers designed and implemented the use of mobile technology combined with the Scaffolding approach on sound wave material as an effort to improve students' HOTS. The mobile technology used is called Interactive Physics Mobile Learning Media (IPMLM). The purpose of this research is to determine the effectiveness of using Interactive Physics Mobile Learning Media (IPMLM) with a scaffolding approach in improving students' HOTS abilities. The contents of the IPMLM used to consist of 6 menus, namely Instructions for Use, Competence, Materials, LKPD, Evaluation, and Developer Profile.

METHOD

This type of research is pre-experimental. The aim is to determine the effect of using IPMLM on the improvement of students' hots ability. The research design used is one group pretest-posttest as shown in Table 1 .

Table 1. Research design

O_1	X_1	O_2
O_1	X_2	O_2

Explanation:

O_1 : Pre-test

O_2 : Post-test

X_1 : Using IPMLM with a scaffolding approach
X2 : Using PPT and Text Books

The pre-test was carried out to determine the students' initial abilities, while the post-test was to determine the students' final abilities after being given treatment.

The research began with: (1) making observations at school and formulating the problems obtained; (2) analyzing the curriculum and determining basic competencies; (3) making learning tools that will be used during the research; (4) making research instruments; (5) validating the learning tools and research instruments that have been made to the experts; (6) revising learning tools and research instruments from the validation results; (7) conduct an empirical test of the instrument to see its validity and reliability, (8) instruments and learning tools that have been validated are used to conduct research, (9) perform data processing and analysis, and (10) conclude the research results and write them in the form of articles.

There are three levels in the scaffolding approach. The first level is environment provision where teachers condition the learning environment for students. The teacher divides students into groups so that they can solve problems together. This level does not involve direct interaction between teachers and students. The second level is explaining, reviewing, and restructuring. At this level, it involves direct interaction between teachers and students about the material being studied. At the Explaining stage, the teacher tells the ideas to be studied. Reviewing deals with interactions where the teacher encourages experiences to focus students' attention on the concept of sound waves. Meanwhile, restructuring is a teacher who makes adaptations to modify experiences and relates physics concepts to the experiences of students.Then, the final stage is to develop conceptual thinking. At this level, the teacher and students conclude about the sound wave material that has been studied. The IPMLM display is shown in figure 1 until figure 5:

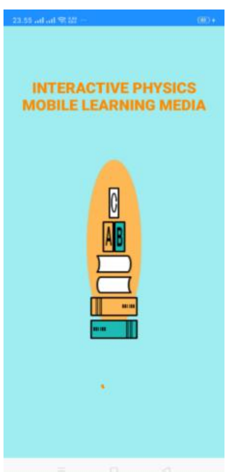

Figure 1. Start Page View

Figure 2. Main Menu Display

Figure 3 Material Menu Display

Figure 4. LKPD Menu Display

Figure 5 Evaluation Menu Display

Figure 1 is an initial display of the IPMLM learning media, there are an icon and application name. The main menu of the IPMLM application is presented in Figure 2. There are 6 main menus which are instructions for use, basic competencies, materials, LKPD, evaluation, and developer profile. The user manual menu contains instructions for using the IPMLM application and the features contained therein. This helps students in operating the IPMLM media. The Basic Competencies menu contains the basic competencies of the material presented along with indicators and learning objectives about sound waves. Students can focus on learning according to the goals to be achieved.

Figure 3 shows a menu item display of one of the sound wave subjects, namely the Doppler effect. Discussion The doppler effect consists of 3 submenus, namely material, video, and teacher chat. Submenu material displays discussion of Doppler effects in the form of text and images. The material is arranged based on the Problem Based Learning (PBL) learning model so that students can hone their ability to analyze (C4) based on the problems presented. The video feature can help students understand the material more deeply with a more detailed review concept. The chat teacher provided is more interactive and students can get feedback when learning to use IPMLM media where the material is difficult to apply.

Figure 4 presents a display of the *LKPD* menu where there is a simulation sub-menu and *upload hasil*. The simulation feature is used for experimental activities in visualizing sound waves to make them look real. These activities can assist students in conducting analysis (C4) and evaluation (C5) of the results obtained. The experimental results obtained can be uploaded via the upload results feature.

Figure 5 shows the appearance of the evaluation menu, which contains 4 submenus, namely practice questions, discussions, HOTS questions, and questionnaires. The exercise contains examples of HOTS questions regarding sound waves and their discussion, in addition to training students' abilities in analyzing (C4) and studying (C5) which are given HOTS additional exercises. The discussion feature is provided so that students can connect both in discussing questions and material that are deemed difficult. Features of HOTS Questions which contain 2 packages of final evaluation questions of student learning regarding the material that has been studied.

Students who are selected as research subjects have not yet studied sound waves.The research subjects were class XI natural sciences of 3 schools, namely SMAN 1 Woha, SMAN 1 Palibelo, and SMAN 1 Belo. The total number of students was 178 students consisting of 88 experimental class students and 90 control class students.

Learning tools and instruments that have been developed are then tested for their validity. Validity testing uses expert opinion (expert judgement). The validity was tested by two expert lecturers. The results of the validity test indicate that the learning tools and research instruments are suitable for use in the very good category. The next stage is the implementation of research which includes a pre-test and post-test activities, the implementation of learning using ipmlm with the scaffolding approach for sound wave material. The study ends by analyzing research data, drawing conclusions, and compiling articles. The data were collected using hots questions which consisted of 2 question packages. The data were then analyzed by descriptive statistics and anava test using SPSS.

Descriptive analysis was carried out to explain the hots data summary of students before and after learning. The categorization of student scores before and after learning is known by referring to the four scale assessment criteria (Mardapi,2008) as shown in Table 2.

Table 2. Four Scale Assessment Criteria

Score	Value	Category
$X \geq Xi + 1.0\ Sbi$	A	Very Good
$Xi + 1.0\ SBi > X \geq Xi$	B	Good
$Xi > X \geq Xi - 1.0\ Sbi$	C	Moderate
$X < Xi - 1.0\ Sbi$	D	Less

Explanation:

X : Score Achieved

Xi : Mean Ideal

Sbi : Ideal Standard Deviation

RESULT AND DISCUSSION

This study implements the use of mobile technology, namely IPMLM with a scaffolding approach to increase students' HOTS. IPMLM contains material that is presented in the form of the text includes pictures, as well as videos that can help students develop thinking skills. In this case, the HOTS aspects that will be improved are the levels of C4 (analyzing) and C5 (evaluating). Aspects of analyzing can be honed by linking materials and videos on the IPMLM feature with everyday life. In addition, the teacher chat feature allows students to interpret and provide opinions about the content of the video presented to hone their evaluation skills. Another feature in IPMLM that can hone HOTS skills is the practice menu which makes students practice their skills in analyzing and evaluating questions. In addition, there is a Simulation menu and discussion sheet contained in the LKPD to train students in developing scientific skills, where these abilities are included in the HOTS category.

In its application, the use of mobile technology is combined with a scaffolding approach. Scaffolding is the provision of gradual assistance to students and is reduced slowly. The stages of the Scaffolding approach can assist in developing HOTS. The first stage of the scaffolding approach is the environment provision, where the teacher prepares the conditions of the learning environment for students. A good and interesting learning environment will make students motivated in learning and confident in accepting the lessons to be carried out. The second stage in scaffolding is telling, reviewing, and restructuring where one of the things that are done is the teacher gives probing questions so that students can develop their thinking skills. At this stage, students also carry out activities such as observing and straightening what they are thinking. These activities facilitate students in honing their HOTS skills. The last stage in the Scaffolding approach is developing conceptual where students are assisted by teachers to conclude the learning outcomes that have been carried out and the concepts of the material obtained. This stage can help train the ability to analyze and evaluate. The relationship between scaffolding approach and mobile technology (IPMLM) in increasing HOTS can be seen in Table 3.

Table 3. Relationship Between Scaffolding Approach, Mobile Technology (IPMLM) and HOTS

Scaffolding	IPMLM		HOTS
environmental provisions	Materials	Text	Analyze (C4)
explaining, reviewing, and restructuring		Videos	Analyze (C4)
		Teacher Chat	Analyze (C4), Evaluate (C5)
	LKPD	Simulation	Analyze (C4), Evaluate (C5)
		Discussion Sheet	Analyze (C4), Evaluate (C5)
Developing conceptual thinking	Evaluation	Exercise	Analyze (C4), Evaluate (C5)
		Discussion	Analyze (C4), Evaluate (C5)

The experimental class is a class that conducts learning using IPMLM media with a scaffolding approach about sound waves. Meanwhile, the control class is a class that conducts learning using PPT and Physics textbooks as learning resources. The experimental class and control class each consisted of 3 classes from SMAN 1 Woha, SMAN 1 Palibelo, and SMAN 1 Belo. Overall, the total number of students was 178, with details of 88 students in the experimental class and 90 students in the control class. The high order thinking skills of students in the control class and the experimental class were measured before learning (pre-test) at the first meeting and after learning (post-test) at the last meeting about sound waves. The measured ability is the ability to analyze (C4) and the ability to evaluate (C5). HOTS questions are contained in the IPMLM which is integrated with a google form. Sample of student answers are shown in Figures 6.

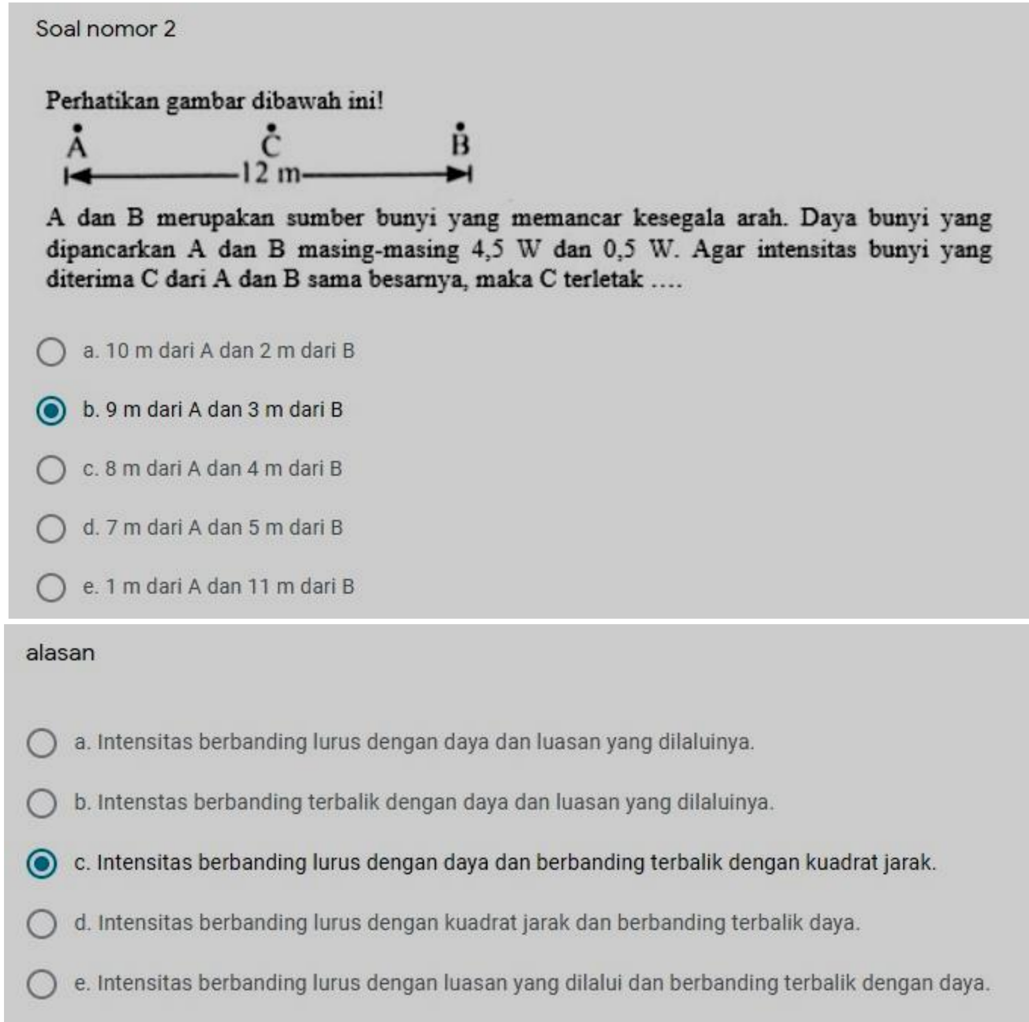

Figure 6. Sample of student answers

The difference between HOTS in the experimental class and the control class can be seen by looking at the differences in each variable in the SPSS Test of Between-Subject Effect Output as shown in Table 4.

Table 4. Result Test of Between-Subject Effects for HOTS

Source	Dependent Variable	df	Mean Square	F	Sig.
Corrected Model	HOTS	3	22506.955	697.758	0.000
Intercept	HOTS	1	1063475.524	32969.732	0.000
Kelas	HOTS	1	5914.428	183.358	0.000

Table 3 shows that the HOTS difference between the experimental class and the control class obtained a significance of 0.000 <α (0.05), which means that H_0 is rejected. So, it can be concluded that there is a significant difference in HOTS of students in the class using IPMLM with the scaffolding approach with students who do not use PPT and textbooks.

The increase in HOTS ability can be seen by looking at the significance of the hypothesis test results on the GLM output analyzed with the help of the SPSS program. Table 5 shows the results of pairwise comparisons for students' HOTS abilities.

Table 5. Pairwaise Comparisons Kemampuan HOTS

Kelas	(I) Waktu	(J) Waktu	Mean Difference (I-J)	Std. Error	Sig.
Experiment	Pre-Test	Post-Test	-32.614*	0.923	0.000
Control	Pre-Test	Post-Test	-18.139*	0.777	0.000

Table 5. shows that the increase in the pretest-posttest ability of HOTS in the experiment-tal class and control class obtained a significance of 0.000 <α (0.05), which means that H0 is rejected. This shows that there is significant increase between the pretest-posttest scores of HOTS abilities in the two classes. Table 3 also shows the mean difference (MD) value for the experimental class of MD = -32.614 and for the control class MD = -18.139. The mean difference indicates that the pretest score minus the negative posttest score for each group. This explains that the mean posttest score is higher than the pretest score. The mean difference (MD) value also shows that the pretest-posttest score increase in HOTS ability in the experimental class is greater than the control class.

The use of IPMLM media with sound wave material with a scaffolding approach contributes effectively to HOTS abilities and students' learning independence. Table 6 shows the GLM test results regarding the amount of treatment contribution in each group.

Table 6. GLM test results regarding the amount of treatment contribution in each group.

Student Abilities	Class	F	Sig.	Partial Eta Squared
HOTS	Experiment	1249.327	0.000	0.88
	Control	544.963	0.000	0.75

Table 6 shows that the effective contribution of the experimental class using Android-based IPMLM media with the scaffolding approach in increasing HOTS ability is 88%. Meanwhile, the contribution of the control class using PPT media and textbooks in increasing HOTS ability was 75%. Based on the size of the contribution, it can be concluded that the use of IPMLM with the scaffolding approach provides a greater effective contribution to increasing HOTS capabilities compared to PPT media and Physics textbooks.

The pretest and posttest results of students were grouped according to the four scale assessment criteria. Figure 5 shows the results of the students' initial HOTS abilities in two classes.

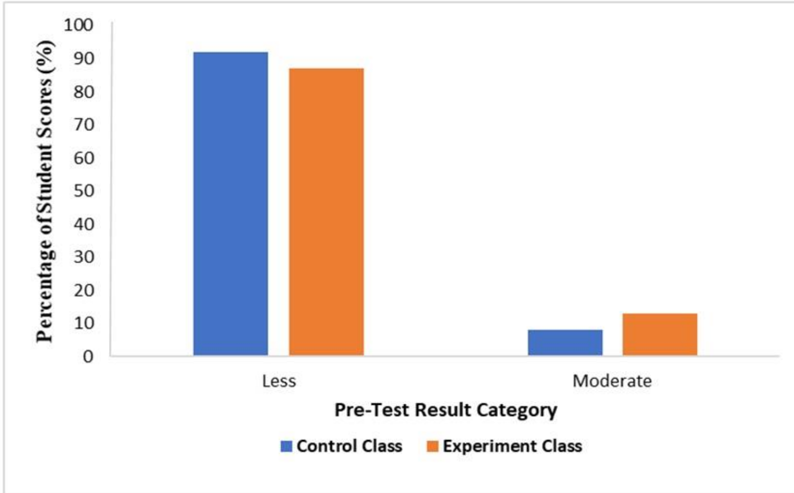

Figure 7 the results of the students' initial HOTS abilities.

Based on Figure 7, it is shown that the HOTS ability of control class students is 92% in the less category (D) and 8% in the moderate category (C) This is not much different from the experimental class where 87% of students were in the less category (D) and only 13% reached the moderate category (C). None of the students achieved good (B), or very good (A). Furthermore, students in the control class and experimental class were given different treatments. Control class is in the form of learning using PPT and physics textbooks, while experimental class in the form of learning using IPMLM with scaffolding Approach. After participating in learning, it is expected that there will be an increase in students' higher order thinking skills. Figure 6 shows the high order thinking skills of students after participating in learning.

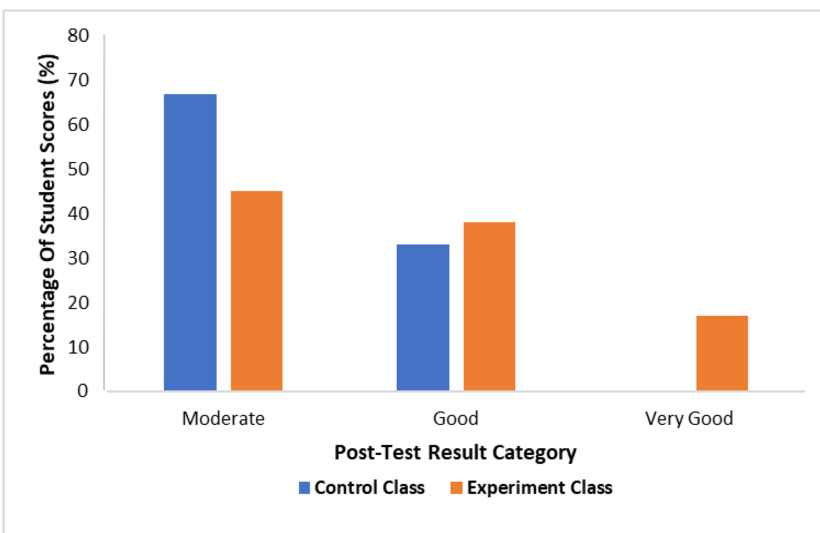

Figure 8. the results of the students' final HOTS abilities.

Figure 8 shows that 67% of the control class students who achieved moderate category (C) and good category (B) were 33%. Meanwhile, students in the experimental class who reached the moderate category (C) were 45%, the good category (B) was 38% and the very good category (A) was 17%. The complete test results of students in the control class and experimental class are shown in Figure 9.

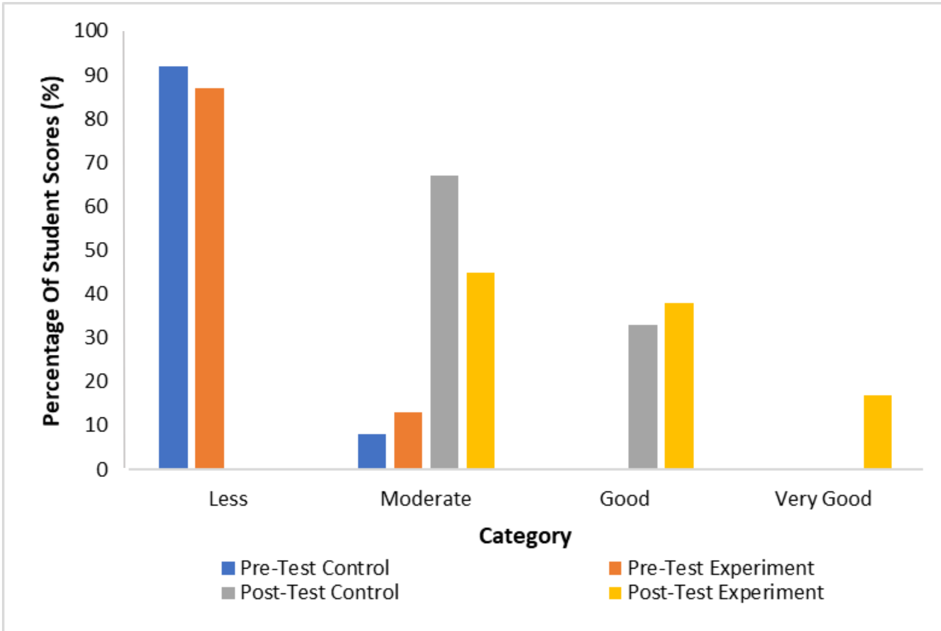

Figure 9. The percentage of HOTS in the control class and experimental class before and after learning

Figure 9 shows that the HOTS ability of students in both classes has increased. This increase can be seen in every aspect of HOTS. The HOTS aspects measured in this study were the aspects of the ability to analyze (C4) and the ability to evaluate (C5). The HOTS achievement results of students in the experimental class and control class for each aspect of ability are shown in Figure 10.

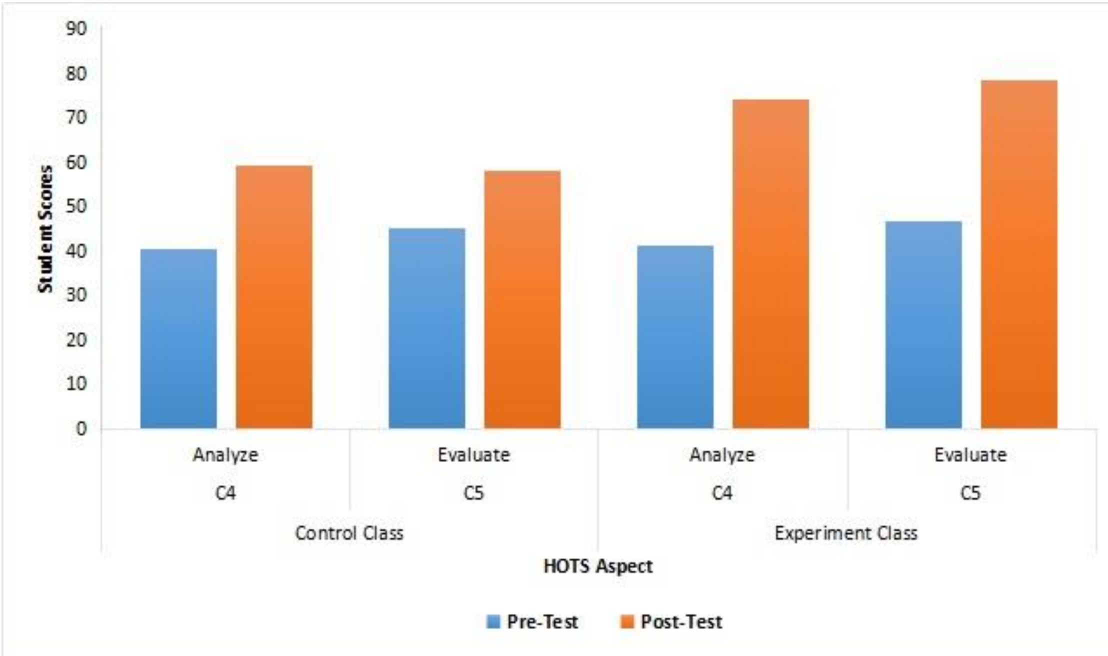

Figure 10 The Average Ability of Students in Control Class and Experiment Class in Each Aspect of HOTS.

Figure 10 shows that the HOTS ability of students in every aspect increases. the ability to analyze in the control class has increased by 18.54 and in the experimental class by 32.76. the ability to evaluate in the control class has increased by 12.99 and in the experimental class by 31.96. These results indicate that the increase in HOTS in the experimental class is better than the control class.

The results of the effectiveness test show that the use of Android-based IPMLM with the approach scaffolding can increase the HOTS of students. These results cannot be separated from the benefits of using technology, where through learning media, abstract and complex materials can be made concrete and simple (Mardiana & Kuswanto, 2017). The concept of science is difficult to understand when explained orally, so the use of media to provide concrete images and visualize concepts is important (Korganci, Miron, Dafinei, and Antohe, 2015). Learning using mobile devices provides benefits for students and also helps teachers in learning. The developed IPMLM is equipped with animated illustrations and videos to make it easier for students to understand the material and relate it to everyday life. It can train students to develop higher-order thinking skills. Where developing thoughts in interpreting and connecting information can improve the high-order thinking skills of students in various learning domains (Cañas, Reiska, and Möllits, 2017). This is in line with the opinion of Sakat, et al. (2012) which states that learning using media technology has a significant effect on increasing students' thinking skills.

The use of interactive media is very necessary for achieving the maximum learning process. In the IPMLM application, there is a teacher chat feature that makes learning media interactive. Students can ask the teacher directly through this feature if they find material that is difficult to understand. The presence of interaction and active users has a considerable effect on the success of learning (Chavosh & Hamidi, 2019) and can increase the closeness between students and teachers (Bansal & Dhananjay, 2014). The discussion feature is also embedded in the IPMLM application. This feature involves interaction between teachers, students, and classmates, thereby increasing collaboration between students. Where they can exchange ideas in solving a problem. This is in line with the opinion of Ally & Blázquez (2014) that mobile learning supports learning where students can collaborate to solve a problem to improve higher-order thinking skills. Besides, two-way interactions between students and teachers as well as students and classmates can effectively improve student achievement (Almaiah, Jalil & Man, 2016; Cheng, 2012).

The increase in HOTS abilities of students in the experimental class cannot be separated from the help of the teacher. The assistance provided is through interaction scaffolding. The use of scaffolding has a significant impact on student knowledge (Kim, Belland, and Walker 2018), increases student active involvement (Serife, 2016), and improves understanding of abstract concepts (Fernando, 2018). The approach scaffolding used in the experimental class is combined with a model problem-based learning. In the approach, the scaffolding teacher provides probing questions so that students can develop their thinking skills. For example, in the experi-menttal class, the teacher gave problems regarding sound wave material related to everyday life from simple to complex. This can make stu-dents think independently so that they practice higher-order thinking skills. This is in line with the results of the research that PBL implementation and scaffolding support student problem solving, effective communication, teamwork, and the use of reasoning skills in problem-solving (Ismail, Harun, Zakaria & Salleh, 2018; Peng, Wang & Sampson, 2017). Where this is part of higher-order thinking skills.

IPMLM application is equipped with LKPD. The activity steps in LKPD are arranged based on the PBL model and are assisted by the scaffolding approach. In the developed LKPD, students are trained to formulate a hypothesis of a problem related to sound wave material. Students are trained to think scientifically in solving these problems. In addition, students are also trained to draw conclusions from experiments that have been carried out and relate them to the actual concept. The HOTS that is sharpened in this process is the ability to organize (C4). Students are trained in identifying the relationships between the character-ristics of sound waves to the speed of sound propagation, the intensity, and level of sound intensity, as well as their use in technology. Through the process of testing hypotheses to reach conclusions, the ability to evaluate (C5) students are also sharpened. the use of the PBL model with scaffolding can increase achievement and encourage active student involvement in learning (Kim & Lim, 2019). This is related because students are used to thinking and analyzing problems, providing assessments, and creating solutions (Husamah, Fatmawati, and Setyawan, 2018; Narayanan & Adithan, 2015). The development of problem-based student worksheets can improve the HOTS abilities of students (Ichsan, Sigit, and Miarsyah, 2019). Besides, there is an evaluation feature to determine the extent to which students have developed in honing HOTS skills. The function of this evaluation is to provide more information to students about current problems in the form of questions so that they can increase the HOTS of students (Ichsan, Sigit, and Miarsyah, 2019).

CONCLUSION

The use of Android-based Mobile Interactive Physics Learning Media with the Scaffolding approach on Sound Waves material proved to be effective in improving students' HOTS abilities. This can be seen from the results of the effective-ness test, size-effect, and the size of the effective contribution that has been made showing that learning with the scaffolding approach assisted by the IPMLM application has increased higher than the control class. Researchers suggest that educational elements can use IPMLM learning media for the benefits of students in order to achieve learning objectives. further research can develop learning media in other topic.

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