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DEVELOPMENT OF PHYSICS BASED ON PHYPOX APPLICATION WITH SMARTPHONE ACOUSTIC SENSOR ON FREE-FALL MOTION MATERIALS

Handoyo Saputro*, Rio Sebastian, Eko Budiyono, Hidayati, Puji Hariati Winingsih
Department of Physics Education, Faculty of Teacher Training and Education, Universitas Sarjanawiyata Tamansiswa, Batikan Street, Tuntungan UH.III-1043 Yogyakarta, 55167, Indonesia

*Email: hansputro@ustjogja.ac.id

Abstract

This study aimed to produce and determine the feasibility and response of Physics Props Based on the Phypox Application with a Free Fall Motion Material Smartphone Acoustic Sensor. This type of research is research and development according to Sugiyono, (2017) which is simplified into eight stages which include potential and problems, information collection, product design, product validation, product revision, product trials, product revision, and the final product. The subjects of this study consisted of 3 validators and 15 learners. Data analysis was carried out by descriptive analysis according to Setyo Budiwanto, (2017: 18) which used a Likert scale to determine the response criteria. The results of this study were obtained including: (1) Phypox Application-Based Physics Props with Smartphone Acoustic Sensors on Free Fall motion materials therewith the manual book; (2) The feasibility test of props with a media expert assessment of 25% is very good, 67% is good, and 8% is bad, the material expert assessment is 33% very good and 67% good, and the teacher's assessment is 57% very good, 33% good, and 10% bad (3) The readability test of the learners' response to the props obtained 21% strongly agree, 72% agree, 7% disagree, and 1% strongly disagree. Based on the results of the study, it can be concluded that the props developed are suitable for learning physics

***Keywords**: Development, Props, Phypox, Smartphone Acoustic Sensor, Free Fall Motion*

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INTRODUCTION

In the world of learning, the physics paradigm is still a difficult subject for students, this is a classic problem of learning in schools (Saputro, 2016). Based on the results of the Tsabit Bisma Yunas research survey in 2017 at 1 Pakem Yogyakarta High School, it was reported that 23 out of 32 students reported not liking physics, almost 72% (Yunas, 2018). The low level of innovation in the educational process causes student interest in learning to continue to decline (Saputro, 2016). Therefore, teachers are required to have the expertise to innovate in teaching students to be interested in what is conveyed. In its delivery, physics learning must bring students into real life, because students will find physics more relevant so that students are more active and motivated in the learning process (Migdes, 2019). Hence, appropriate props are needed, are easy to understand and attract students' attention as well as practicum tools or props so that students can demonstrate real physical phenomena. Props are learning media that contain characteristics of concepts that will be presented visually and real (Sudjana, 2011). In high school, the use of physics props is carried out during practical activities. However, in reality, practicum activities, one of which is free fall motion material in schools, are still rarely carried out so students do not have the experience and skills of the free fall motion concept directly (Sebastian, 2020). This is supported by a survey of several schools in the Singkawang area that 33% of schools conduct practicum activities less than twice per semester and about 65% of schools do not do practicum every semester (Rosdianto, 2017).

Free fall motion is a motion on an object from a certain height with a straight path down towards the center of gravity of the earth without the initial velocity of the object. (Afriyanti, 2018). The free fall motion practicum method can be used to determine the acceleration of gravity at a location (Boimau, 2021). Theoretically, the acceleration of gravity of the earth can be calculated using altitude and time to obtain a theory of acceleration due to gravity of 9.8 m/s^2 (Maulani et al., 2021).

Smartphones that use the Phypox application can develop a timer tool automatically in the Free Fall Motion experiment. The working principle of these props are to use an acoustic sensor on a smartphone which requires the first sound trigger as a response to start time and the second sound trigger as a response to stop time. These props can obtain experimental results with a good level of accuracy compared to using a stopwatch because it is digitally based and automatic (Novitasari et al., 2021). By developing props using the Phypox application, it is more practical to manufacture, because in smartphones there are already various sensors such as light sensors, magnetometers, gyroscopes, accelerometers, and microphones (Mahardika et al., 2022). Based

on Gibbs' research, (2019) entitled Proposal of Experimental Activities in Physics Class through the Use of Smartphones, the use of smartphones as a practical medium can develop students' skills, creativity, and scientific thinking.

The use of props in the learning process in schools can increase student interest. This is supported by previous research, Rio Sebastian (2021) stated that the use of sensor-based Props in uniformly changing straight motion material obtained a student response of 2.91 with agreed criteria. Then, the research of Eka Diah Damayanti (2022) stated that the digital practicum tool developed for free fall motion material can help students to be interested in learning physics and understand the concept of free fall motion. In addition, Susilawati's (2013) research argues that props produced with various electronic components can help students increase interest in learning, innovation, and creativity abilities. In addition to the benefits of props that can increase student interest, the use of Phypox-based props can increase critical thinking skills, and get to know more about digital technologies. This is confirmed in Isma Yunita's research stating that the use of props can develop students' critical thinking skills, even in the learning process can help students be more active (Yunita, 2019). Therefore, researchers conducted research to produce and know the feasibility and student responses to the Phypox application-based Physics Props with Smartphone Acoustic Sensor Free Falling Motion Material.

RESEARCH METHODS

This research is included in the type of research and development developed by Sugiyono, but due to time and cost limitations, it is simplified into eight stages (Sugiyono, 2017). The eight stages are shown in Figure 1.

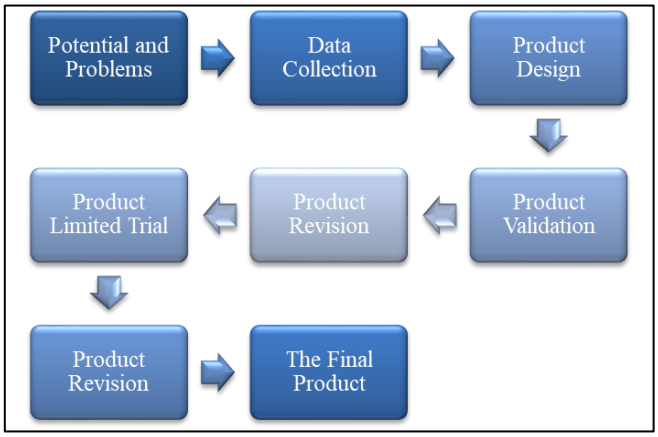


Figure 1. Research Stages

The feasibility test for props and props guides was tested using a validation questionnaire. The components of the validation questionnaire assessment include quality, implementation, and appearance. This validation questionnaire is aimed at media experts, material experts, and teachers. Test the student's response to the props and props guide, then a limited trial was carried out. In the limited trial, the research subject was class X MIA Budi Mulia 2 Yogyakarta High School as many as 15 students. The assessment components of the participant response questionnaire include quality, implementation, and appearance.

The data analysis technique used in this study is descriptive statistical analysis according to Setyo Budiwanto (2017: 18). This descriptive analysis is carried out by presenting a frequency distribution table whose contents are Likert scale and then abstracted using a pie chart. On the Likert scale, the answer can be converted into a qualitative criteria assessment shown in Table 1.

Table 1. Description of Validation and Response Questionnaire Answers

Score	Eligibility Criteria	Response Criteria
4	Very Good	Strongly Agree
3	Good	Agree
2	Bad	Disagree
1	Very Bad	Strongly Disagree

RESEARCH RESULTS AND DISCUSSION

Development

The steps in the process of developing physics props based on the Phypox application with Smartphone Acoustic Sensors on Free Fall Motion materials are as follows:

a. Researchers conducted interviews to obtain data on potential problems in the learning process. The interviews conducted included laboratory observations and tools used during the practicum. The results of the interview are that the learning of free fall motion material is still glued to the material and books because there are no Props in the learning process. The physics laboratory is available complete with a practicum schedule, but there is no free fall motion material for practicum tools. The lack of practical activities on free fall motion material causes students' understanding of the concept of free fall motion to not be implemented and it is difficult to get practical experience.
b. From the potential and problems obtained in the results of interviews at school, it was concluded that it was necessary to develop props to support direct learning activities so that students take an active role in the learning process. The props in question are physics props for free fall motion materials complete with the instructional props.
c. The design of the props in this study is different from other studies because the props were developed to use an acoustic sensor on a smartphone to respond to the start and stop buttons on the stopwatch. Several tools must be used in designing props, namely, Smartphones that have been integrated with the Phypox application, statives, balloons, clamps, needles, and weights. The tool design is shown in Figure 2.

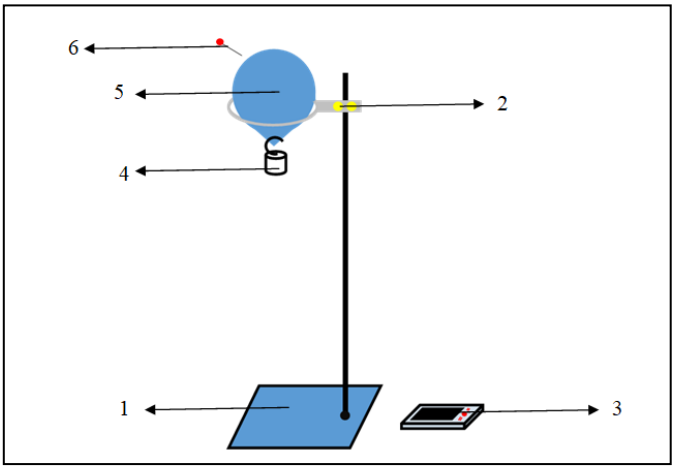


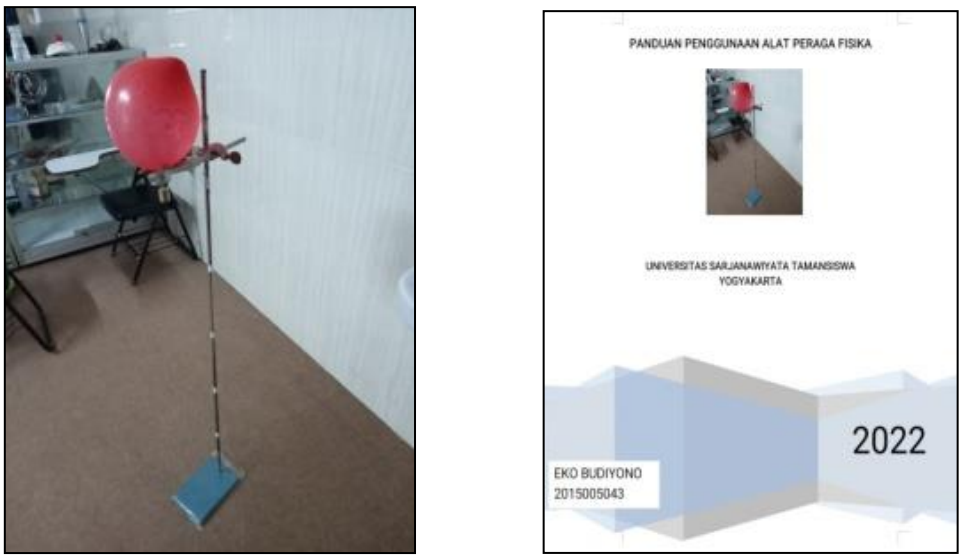
Figure 2. Props Design

Information:

1) Stative
2) Clamp Stative
3) Smartphone with phypox app
4) Weights
5) Balloon
6) Needle

d. The product was validated by two physics education lecturers consisting of media and material experts, and one physics teacher at Budi Mulia 2 Yogyakarta High School. After being validated, the three validators provided suggestions and inputs to correct the deficiencies found in the Props and the Free Fall Motion physics Props guide that was developed.
e. After validating the props and props guide for the Free Fall Motion material to the validator, then repairing the props and props guide by the suggestions and input from the three validators. Product improvement is carried out in the props section which still does not have a table of contents, core competencies, basic competencies, and learning objectives as well as good and correct EYD improvements, while in the props there are improvements in the stative section, more accurate measuring tools are provided by installing a scale measure on the stand.
f. After the props and props guide was repaired then a response test was conducted on 15 students at Budi Mulia 2 Yogyakarta High School by using a readability test on the props guide while the props were demonstrated in front of students and then students participated in the experiment using the manual that had been made.
g. The next step was to revise the props and props guides based on the responses of 15 students at Budi Mulia 2 Yogyakarta High School. At this stage, only minor revisions were made to the product as an improvement in the Props and props guide.

h. After minor improvements have been made from student input and responses, a product in the form of Props and props guides that are suitable for use in learning physics at school has been produced. The products of Props and props guide that have been produced are shown in Figure 3.



(a) (b)

Figure 3. Produced Product (a) Props (b) Manual Book

Feasibility test

The feasibility test is carried out by filling out a validation questionnaire by the validator. The validator assesses the product from the components of quality, performance, and appearance. The results of the validation of props by the validator are presented in a pie chart diagram which includes media experts shown in Figure 4, material experts shown in Figure 5, and teachers shown in Figure 6. The validation results obtained from the three validators include media experts who provide an assessment of most of the criteria Good 67%, material experts who give most of the criteria Good 67%, and the teacher who assesses most of the criteria Very Good is 57%. Therefore, the validation of the Physics Props based on the Phypox application with the Smartphone Acoustic Sensor for Free Falling Motion Material obtained appropriate results for use in learning, however, with the revision given in the suggestions and input of the validator.

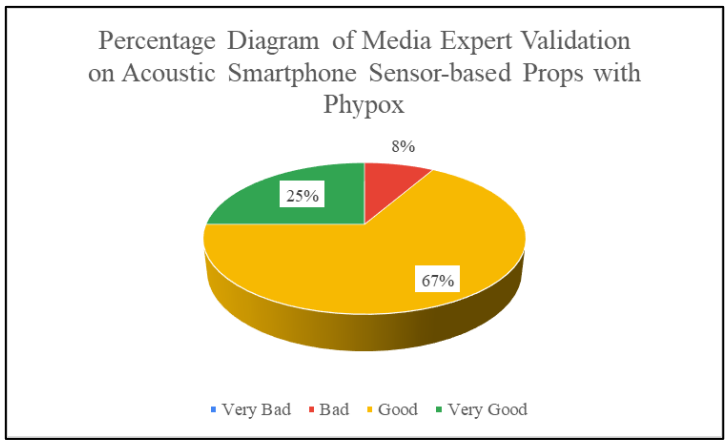


Figure 4. Media Expert Validation Results

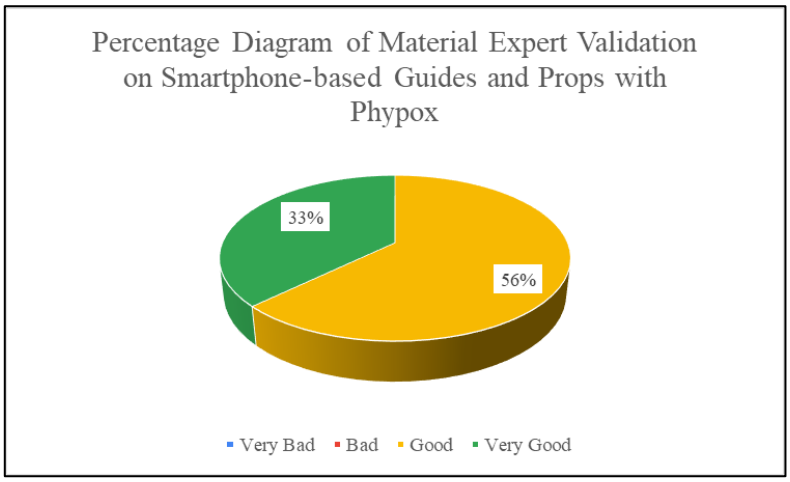


Figure 5. Material Expert Validation Results

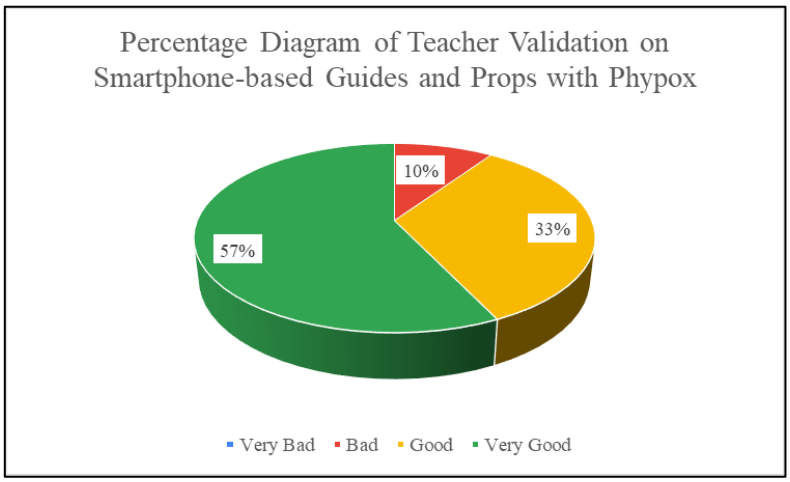


Figure 6. Teacher Validation Results

Student Response Test

This response test was conducted by researchers at Budi Mulia 2 Yogyakarta High School with as many as 15 students as respondents. The assessment components in the response questionnaire include quality, implementation, and appearance. The results of student responses are presented in a pie chart to illustrate the average percentage of student responses to the Props and their guides which are shown in Figure 7. The results of student responses from 15 students of class X MIA at Budi Mulia 2 Yogyakarta High School to the props developed in this study were obtained. most of the criteria Agree by 72%. Therefore, the student's response to the Phypox application-based Physics Props with Smartphone Acoustic Sensor Free Fall Motion Material agrees if it is used as a Props that support physics learning in schools.

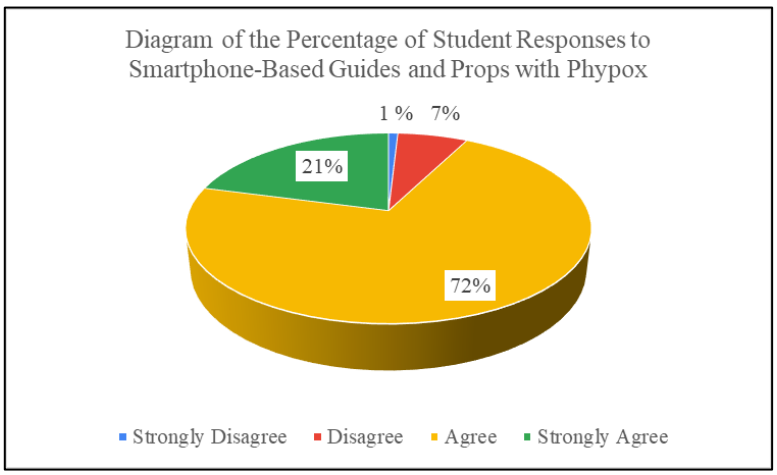


Figure 7. Student Response Results

CONCLUSION DAN SUGGESTIONS

A. Conclusion

Based on the results and discussion of this research, it can be concluded that a product has been produced in the form of a Phypox Application-Based Physics Props with Smartphone Acoustic Sensors on Free Fall Motion Material along with its appropriate guidelines for learning physics in schools with a media expert assessment of 25% very good, 67 % good, and 8% bad, the assessment of material experts is 33% very good and 67% good, and the teacher's assessment is 57% very good, 33% good, and 10% bad and the response agrees from students with the acquisition of 21% strongly agree, 72% agree, 7% disagree, and 1% strongly disagree.

B. Suggestion

Researchers hope that in the future this research can do better developments such as the sound sensor on the start time response does not use a balloon, but is developed automatically using a button that sounds to be more effective. In addition, it was developed on the technology side based on the internet of things so that it is more practical when adjusting the height of dropped objects using a remote control using a smartphone and making it easier to analyze the movement of objects when dropped specifically through an interface with a smartphone.

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