Development of Android-Based Interactive Multimedia for Secondary School Physics Study

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Abstract *- This research aims to produce valid and practical learning products for physics education. The developed learning products consist of interactive multimedia based on Android, lesson plans (RPP), and test instruments for the topic of elasticity in physics. This study follows a Research and Development (R&D) approach, adapting the 4D model developed by Thiagarajan. The research stages include defining, designing, developing, and disseminating. The research subjects were 32 students in grade XI. Data collection techniques involved validation sheets, student response questionnaires, and pretest and posttest sheets for assessing conceptual understanding. The validation results indicate that the learning products fall under high validity. The average scores of expert and practitioner validators were 3.49 and 3.67 for interactive multimedia based on Android, 3.48 and 3.69 for the lesson plans, and 3.38 and 3.81 for the test instruments, respectively. The analysis of the response questionnaires showed that the products were convenient, with an average percentage of 82.27%. Therefore, the developed learning products are valid and highly practical for secondary school physics activities.*

Keywords*: Android Based Interactive multimedia; Concept Mastery; Elasticity*

INTRODUCTION

The developing technology today has made it easier for humans to carry out various daily activities. Alismail & McGuire (2015) stated that education in the 21st century should integrate knowledge, thinking, innovation, skills, media, information, communication technology, and real-life experiences in the learning process.

Physics is a branch of science that focuses on studying matter, energy, and the relationship between them (Gunawan et al., 2015). Physics learning at various educational levels still faces several challenges, particularly in using learning media. The evolving technology demands educators to be more creative in creating an enjoyable learning environment to attract the attention and interest of students in the learning process using models and learning media (Awwaliyah, 2018).

The selection of learning media is one of the influential factors in learning success, including improving conceptual understanding. Teachers need to combine visual, auditory, and practical-based media into a single interactive multimedia learning approach to deliver learning materials that students with different information processing styles can absorb. Wibawanto (2017) stated that interactive multimedia learning is a learning product that combines texts, images, graphics, sounds, animated videos, and simulations in an integrated and synergistic manner, with the help of computers or similar devices to achieve specific learning goals, where users can actively interact with the program.

One of the efforts researchers can make to optimize the use of technology (smartphones) in learning activities is developing interactive multimedia based on Android. By integrating interactive multimedia into Android-based smartphones, it is highly expected to encourage students to optimize the use of their smartphones for educational purposes

in a much more positive direction, namely learning (Maulina, et al., 2022).

Several previous studies have shown the advantages of interactive multimedia in learning. The research conducted by Husein, et al. (2015) demonstrated that interactive multimedia impacts students' mastery of concepts. Similarly, a study by Novitasari (2016) showed that the final achievement of systematic conceptual understanding of students who received learning through interactive multimedia was better than those who received conventional teaching methods.

These previous studies have some similarities and differences compared to the research conducted. The similarity is that both studies aim to produce learning products in the form of interactive multimedia. The difference lies in the presentation of the developed product, whereas the previous studies presented interactive multimedia using laptops. In contrast, in this research, interactive multimedia can be accessed through owned Android smartphones. This research is conducted with students in one of the high schools in Mataram City, who undoubtedly have different characteristics compared to the participants in the previous studies. This research also focuses on the topic of elasticity as the main subject in the developed product.

Initial interviews and observations in one of the public high schools in Mataram City showed that students' conceptual understanding abilities tend to be low, resulting in low learning outcomes in physics. The physics learning process involves limited active participation of students and is still teacher-centered, focusing on information transfer. Learning media that can assist students in learning independently still needs improvement. In addition, students during the endemic period (post-COVID-19) are already accustomed to Android smartphones. An article on smartphone usage in Indonesia stated that Indonesia ranks fourth highest with 170.4 million users, accounting for 61.7% of the total population (Pusparisa, 2021). Smartphones are often used for gaming and social media, disrupting students' learning concentration. Based on the mentioned issues, the researcher is interested in developing interactive multimedia based on Android for the subject of physics, specifically the topic of elasticity for grade XI in high school.

RESEARCH METHODS

The research method used in this study is the Research and Development (R&D) method, which adapts the 4D research and development model by Thiagarajan et al. (1974), consisting of four main stages: define, design, develop, and disseminate. The define stage is conducted to identify the problems in learning. The design stage involves designing the initial draft of the learning products, including interactive multimedia based on Android, lesson plans (RPP), and concept comprehension assessment instruments. The development stage includes developing the learning products, validation, revision, and limited trials.

The research subjects in this study are 32 students from Class XI Science 3. The research was conducted at one of the public high schools in Mataram City during the odd semester of the 2022/2023 academic year. The data collected in this study include quantitative and qualitative data. Qualitative data are obtained from suggestions and inputs provided by three physics lecturers as expert validators and three physics teachers as practitioner validators in the form of comments or suggestions for revising the developed products. Quantitative data in this

study are obtained from the analysis of validation results by expert lecturers and physics teachers and the analysis of responses during the limited trials. Data collection instruments include validation sheets and student response questionnaires.

The validation results by expert and practitioner validators are analyzed using the following equation.

$$\text{score} = \frac{\text{total score on the instrument}}{\text{overall score on the instrument}} \times 4$$

The scores of the instrumented assessment are converted into several levels of feasibility according to Pangestika et al. (2013), as shown in the following Table 1.

Table 1. Levels of Instrument Feasibility

Score	Average range	Category
4	3,26 – 4,00	Very Good
3	2,51 – 3,25	Good
2	1,76 – 2,50	Not Good
1	1,01 -1,75	Bad

The practicality data of the instrument and Android-based interactive multimedia are obtained from student response questionnaires, which will be analyzed using the following equation.

$$Practicality = \frac{\text{total score validator}}{\text{overall score}} \times 100\%$$

Then, data interpretation will be conducted based on the practicality criteria according to Nurjannah (2021) as presented in the following Table 2.

Table 2. Practicality Level

Range value (%)	Criteria
0-20	Very unpractical
21-40	Not practical
41-60	Moderate practical
61-80	Practical
81-100	Very Practical

RESULTS AND DISCUSSION

Results

1. Define Phase

The define phase is an initial stage aimed at obtaining information about the characteristics of students, problems that arise during learning activities, the teaching models used by teachers, and the curriculum being implemented. Based on the analysis in this phase, it is known that students tend to use Android smartphones frequently, but their usage has yet to be maximized in learning activities. The tendency of students toward technological advancements, especially using smartphones in daily life, dramatically influences their interest in learning and reading books. Classroom learning activities still revolve around teachers primarily transferring information, and the utilization of technological advancements in creating learning media still needs to be improved. It demands teachers to create innovative teaching methods involving technology, such as developing Android-based interactive multimedia for physics, specifically on the topic of elasticity. Learning through Android smartphone applications is considered practical compared to using computers. Android phones' compact and portable nature allows users to access them anytime and anywhere. With this innovation, learning will become more accessible and more enjoyable.

2. Design Phase

In the design phase, the development of learning products takes place. The designed learning products comprise Android-based interactive multimedia, lesson plans (RPP), and concept comprehension assessment instruments. The design of Android-based interactive multimedia is carried out with the help of several applications. Kinemaster is used for video editing, and PowerPoint integrates

videos, images, texts, and graphics into presentation slides. To add interactive quizzes and convert PowerPoint into HTML pages, the researcher utilizes iSpring Suite software. Additionally, the researcher employs the Web 2 APK Builder application to convert HTML pages into Android applications that can be run on Android devices.

The first step in designing Android-based interactive multimedia is to create a flowchart to illustrate the program flow and serve as a guide in drafting the design of Android-based interactive multimedia. The resulting flowchart can be seen in Figure 1 below. The Android-based interactive multimedia is designed following the tutorial model format, similar to tutorials conducted by teachers or instructors. Information containing a concept is presented through text, still or moving images, and graphs (Daryanto, 2016). The outcome of Android-based interactive multimedia can be seen in Table 3.

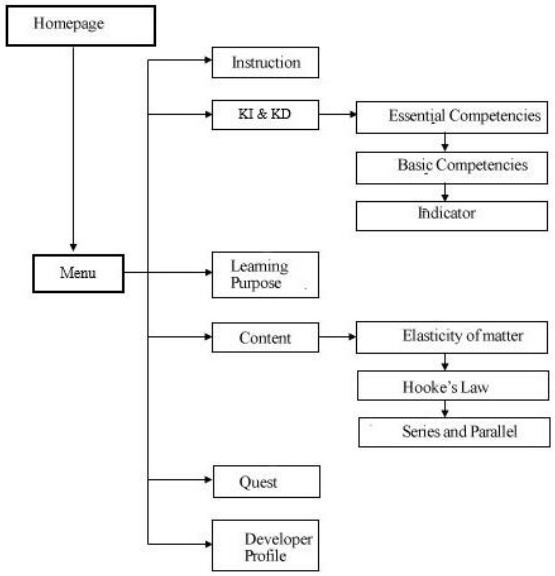


Figure 1. Flowchart Android Based Interactive Multimedia

Table 3. Final Display of Android-based Interactive Multimedia

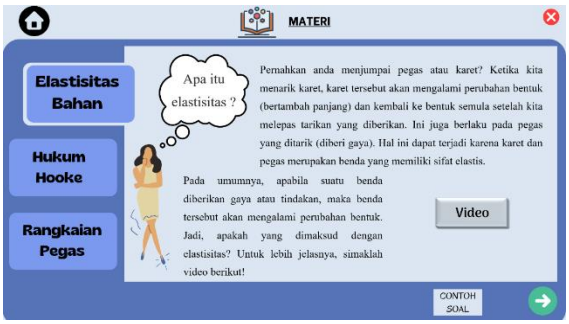
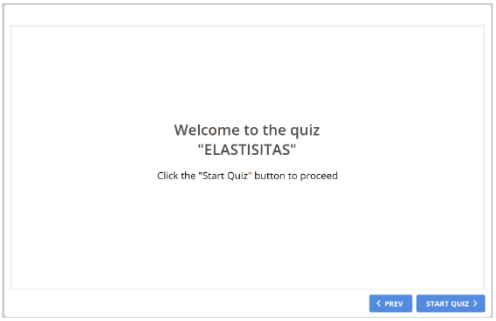
	
Homepage	Main Menu
	
Content menu	Content

Table 3. Final Display of Android-based Interactive Multimedia (**Continue)**



Quiz

About developer

3. Develop Phase

The develop phase is the stage to produce the developmental product through product validation, revision, and limited testing. Validation is conducted by three expert and three practitioner validators, resulting in assessment scores and suggestions or input from the validators. Revision is carried out based on the suggestions and input from the validators. The revised product is then distributed to the students to assess its practicality. The analysis results of the developed product's validity by expert and practitioner validators can be seen in Table 4.

Table 4. The validity of Product

Aspects being assessed	Experts Validator	Criteria	Practitioner validators	Criteria
Android Based Interactive Multimedia	3,49	Very Good	3,67	Very Good
RPP	3,48	Very Good	3,69	Very Good
Test Instrument	3,38	Very Good	3,81	Very Good

The practicality of the Android-based interactive multimedia was obtained from the student's response questionnaire regarding the learning activities conducted in the classroom. The response questionnaire consisted of a sheet assessing the implementation of learning activities given to 32 class XI MIPA 3 students at SMAN 7 Mataram through Google Forms. The practicality of the instructional materials was analysed using a Likert scale. The average practicality score obtained was 82.27%, which falls under the category of highly practical. The analysis results of the students' response questionnaire regarding the Android-based interactive multimedia used in the learning activities can be seen in Table 5.

Table 5. Analysis of Student Questionnaire Response Results

	Student Response (%)			
	Very Agree	**Agree**	**Moderate**	**Not Agree**
Percentage Average	40,62	36,24	5,18	0,12
	82,27			
Criteria Practicality	**Very Practical**			

Discussion

1. Product Validation

Product Validity Based on Table 5, it is known that the average validity of android-based interactive multimedia as assessed by expert validators and practitioner validators is 3.49 and 3.67, respectively, which falls into the category of very good. Furthermore, the average validity of Lesson Plans (RPP) assessed by expert and practitioner validators is 3.48 and 3.69, respectively, also falling into the very good category. The validity of the assessment instruments assessed by expert and practitioner validators is 3.38 and 3.81, respectively, falling into the very good category. These results indicate that the developed instructional products are valid for learning activities. It is consistent with several previous studies that have found that smartphone-based interactive multimedia products are considered suitable for use as a learning medium for students following the development, revision, and testing of the products and have been evaluated as effective learning media by students (Muzakkir et al., 2022). Interactive multimedia development has met the criteria of being valid, practical, and positively impacting students' learning outcomes (Wiyono, 2015).

These android-based interactive multimedia has several advantages. It includes content descriptions, instructional animation videos, and exercise quizzes to assess students' understanding. The developed android-based interactive multimedia is equipped with interactivity that allows students (users) to control all activities within the program through the provided navigation buttons, enabling students to have a direct and independent learning experience. The interactivity of the developed interactive multimedia is also evident when students take quizzes, as the multimedia provides responses to students' chosen answers and presents final scores obtained during the quiz. These final results are then sent directly to the researcher (teacher) via email, which is entered into the program. Furthermore, this android-based interactive multimedia can be accessed by students offline or online, facilitating ease of use for students.

In addition to its advantages, the developed Android-based interactive multimedia application has a few limitations. It cannot be installed on devices that do not have the Android operating system (such as iOS, Windows, etc.), and it requires the assistance of other applications to operate on devices without the Android operating system (e.g., laptops). Furthermore, the application must still include the Student Worksheets (LKPD) used in the learning activities.

2. Practicality

Based on the practicality analysis in Table 6, it is shown that 40.62% of students stated that they strongly agreed, 36.24% of students agreed, 5.18% of students disagreed, and 0.12% of students strongly disagreed. The average percentage of students' responses to the learning activities was 82.27%. According to Nurjannah (2021), a percentage above 81% is interpreted as falling into the category of very practical. Based on this, the practicality analysis indicates that the developed product meets the very practical criteria.

More than 50% of students provided positive responses regarding using Android-based interactive multimedia, particularly in easy-to-use learning media and the ability to engage students' desire to learn. Android-based interactive multimedia can make the learning process more engaging and interactive, preventing it from becoming monotonous. The practicality of the developed android-based interactive

multimedia is consistent with several previous studies, which have found that android-based interactive multimedia is practical due to its simple interface, comprehensive content presentation, the practicality of use anytime and anywhere, and flexible learning time (Tabrani et al., 2021). Android-based interactive multimedia can actively involve students, reducing the teacher's intervention in the learning activities (Astuti et al., 2021).

CONCLUSION

This study developed a learning product in the form of android-based interactive multimedia, lesson plans (RPP), and assessment instruments to enhance students' understanding of physics concepts. Based on the research findings, the developed android-based interactive multimedia, lesson plans, and assessment instruments are valid and highly practical for enhancing physics learning in secondary schools. For future research, the researcher hopes to expand the development of Android-based interactive multimedia to include similar learning media that can be operated on devices with different operating systems (other than Android) and cover different content areas. Additionally, it is recommended to incorporate student worksheets (LKPD) within the multimedia application.

REFERENCES

Alismail, H.A, & McGuire, P. (2015). 21st Century Standards and Curriculum Curent Research and Practice. *Journal of Education and Practice*. 6(6): 150-154.

Astuti, D. P., Nuraini, N. L. S., & Roebyanto, G. 2021. Pengembangan Multimedia Interaktif Berbasis *Android* dengan Model Problem Based Learning Muatan Matematika Materi Bangun Ruang Kelas V SD. *Jurnal Pembelajaran, Bimbingan dan Pengelolaan Pendidikan*. 1 (8): 653-659.

Awwaliyah, R. (2018). Pendidikan Islam Dalam Sistem Pendidikan Nasional. *Jurnal Ilmiah Didaktika*, (19)(1), 34-49.

Daryanto. 2016. *Media Pembelajaran*. Yogyakarta: Gava Media.

Gunawan, G., Harjono, A., & Sutrio, S. (2015). Multimedia Interaktif Dalam Pembelajaran Konsep Listrik Bagi Calon Guru. *Jurnal Pendidikan Fisika dan Teknologi*. 1(1): 9-14.

Husein, S., Herayanti, L., & Gunawan. (2015). Pengaruh Penggunaan Multimedia Interaktif Terhadap Penguasaan Konsep dan Keterampilan Berpikir Kritis Siswa Pada Materi Suhu dan Kalor. Jurnal Pendidikan Fisika dan Teknologi. 1(3): 221-225.

Maulina, M., Andriyani, A.S., Amin, S., Nasrullah, R., Asdar, A., & Hamsiah, A. (2022). Students' Perception in Learning English through Blended Learning. *Journal of Education and Teaching (JET)*. 3(1): 50-68.

Muzakkir, M.A., Pomalato, S.W.Dj., & Katili, M.R. (2022). Efektivitas Multimedia Interaktif Berbasis *Smartphone* untuk Pembelajaran Matematik. *Jambura Journal of Mathematics Education*. 3 (2): 81-92.

Novitasari, D. (2016). Pengaruh Penggunaan Multimedia Interaktif Terhadap Kemampuan Pemahaman Konsep Matematis Siswa. Jurnal Pendidikan Matematika & Matematika. 2(2): 8-18.

Nurindah, N., & Kasman, K. (2021). Implementasi Media Pembelajaran Berbasis *Android* Terhadap Hasil Belajar Bahasa Indonesia. *Akademika*, 10(01), 1–12.

Nurjannah, E., Ayub, S., Doyan, A., & Sahidu, H. (2021). Pengembangan

Perangkat Pembelajaran Model Inkuiri Terbimbing Berbantuan Media PhET untuk Meningkatkan Kemampuan Pemecahan Masalah dan Keterampilan Generik Sains Fisika Peserta Didik. *Jurnal Pendidikan, Sains, Geologi, dan Geofisika*. 2(1): 21-25.

Nurmaya, Y., Susilawati, S. Zuhdi, M., & Hikmawati, H. (2021). Pengembangan Perangkat Pembelajaran Model Inkuiri Terbimbing Pada Materi Alat-Alat Optik untuk Meningkatkan Penguasaan Konsep Fisika. *Jurnal Hasil Kajian, Inovasi, dan Aplikasi Pendidikan Fisika*. 7 (1): 147-154.

Pangestika, M. W., Suyanto, E., & Viyanti, V. (2013). Pengembangan Lembar Kerja Peserta didik Berbasis Keterampilan Proses Sains pada Kompetensi Dasar Menyelidiki Sifat-Sifat Zat Berdasarkan Wujudnya dan Penerapannya dalam Kehidupan Sehari-Hari. *Jurnal Pembelajaran Fisika*, 1(1), 55-65.

Pubian, Y. M., & Herpratiwi, H. (2022). Penggunaan Media Google Site Dalam Pembelajaran Untuk Meningkatkan Efektifitas Belajar Peserta Didik Sekolah Dasar. *Akademika*, 11(01), 163–172.

Pusparisa, T. (2021). *Daftar Negara Pengguna Smartphone Terbanyak, Indonesia Urutan Berapa*. Diakses dari (https://databoks.katadata.co.id/datapublish/2021/07/01/daftar-negara-pengguna-*smartphone*-terbanyak-indonesia-urutan-berapa).

Tabrani, M. B., Rini, P. P., & Junedi, B. 2021. Pengembangan Multimedia Interaktif Berbasis *Android* pada Materi Kualitas Instrumen Evaluasi Pembelajaran Matematika. *Jurnal Inovasi Teknologi Pendidikan*. 8 (1): 163-172.

Thiagarajan, S., Semmel, D. S. & Semmel, M. I. (1974). Intructional Development for Training Teachers of Exeptional Children. Minnesota: University of Minnesota.

Wibawanto, W. (2017). *Desain dan Pengembangan Multimedia Pembelajaran Interaktif*. Jawa Timur: Penerbit Cerdas Ulet Kreatif.

Wiyono, K., & Khamzawi, S. (2015). Pengembangan Multimedia Interaktif Berbasis Model Pembelajaran Problem Based Leaning Pada Mata Pelajaran Fisika Pokok Bahasan Fuida Dinamis Untuk SMA Kelas XI. *Jurnal Inovasi Dan Pembelajaran Fisika*. 2(1), 100–108.