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Development of Pocket Book Based on Contextual Learning on Harmonic Vibrational Matter

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Abstract

There is one subject that is difficult for students to accept, and that is physics. In this age of technological advancement, physics must be used in the learning process. One of them is the existence of smartphone apps that improve learning opportunities. This study aims to determine the effectiveness, quality, student response, and implementation of a contextual learning-based physics paperback supported by an Android app on harmonic vibration materials. This study adopts a development methodology using the ADDIE model, which consists of five phases: analysis, design, development, implementation, and evaluation. The results of this study show that (1) the contextual learning-based planner application is effective, with an Aiken V effectiveness value of 0.93. (2) The quality of the contextual learning-based paperback application reached a percentage of 88.50% on the scale of "very good." (3) The results of the student response test showed that the percentage of "very agree" reached 87%. The implementation test results showed that the percentage of "very good" was 91%. From these results, the physics notebook based on contextual learning supported by the Android application on harmonic vibration received a really good response from students and teachers. Materials with valid, feasible, and practical categories can be used in the learning process in high school.

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INTRODUCTION

Physics is a science that includes skills, attitudes, and techniques that can be analyzed in an organized and systematic way. Physical science is closely related to daily activities. Many of the concepts in physics can be applied to students' daily activities. However, many students still have difficulty understanding abstract concepts in physics. This is evidenced in a study by Khumaidi and Sucahyo (2018), where 73% of students stated they have a limited understanding of physics concepts. Physics contains so many equations and formulas that students consider it a boring and difficult subject (Asrizal et al., 2018) ; Sofna et al., 2023; Wangchuk et al., 2023). Physics is one of the difficult subjects because of its theoretical presentation, which occasionally lacks the use of mathematical and abstract examples in real-world situations (Adams & Wieman, 2015; Rebello et al., 2017; (Yusrizal, 2016). According to the findings of the study's interviews, Gracia et al. (2022), the reasons for the challenges encountered were students' ignorance, which led them to focus on the physics description stage; their inability to comprehend the problems in the questions; and their inexperience with converting the problems into images. Students still have difficulty understanding the basic concept of harmonic vibrations, variables that affect the period and amplitude, and how harmonic vibrations are used in everyday life. In the study by Putri and

Mufit (2024), a very low category was found in students' literacy skills, with the percentage of science literacy content components varying from 34% to 56%. Literacy in science also provides an effective understanding of physics concepts, develops critical thinking and problem-solving skills, is relevant to real-world issues, and supports the quality of education. The ability of science literacy in physics is an important aspect of education and the well-being of every individual. Therefore, it is necessary to evaluate science literacy skills, especially in physics learning (Mazidah & Suwarna, 2025).

In the 2013 curriculum, the focus of learning is no longer on teacher-centered learning but on learner-centered learning, where learners are expected to become more independent and active in the learning process. Here, educators act as intermediaries. Of course, to enable self-directed learning, appropriate learning approaches must be used. An interactive and communicative approach facilitates learning while students absorb the content (Putri & Ardi, 2021). One of the strategies that can be used is learning using the approach of contextual learning. Using a contextual approach allows educators to impart knowledge to students by connecting the learning concepts with their real-life experiences, helping them understand the relationship between the knowledge learned and its application in daily life (Suantiani & Wiarta, 2022). Because contextual learning can actively and immediately involve students in seeking and discovering the notion of learning materials, students' cognitive abilities grow more optimally through contextual learning (Sudira & Wiyasa, 2020). 70% of students benefit from contextual learning because it gives them an immersive experience and engages them more during learning (Bhure et al., 2021).

In addition to the learning approach, using learning media is considered very important to support students' learning processes. The use of educational media influences how interaction between teachers and students occurs throughout the teaching-learning process. The presence of diverse and enjoyable educational media increases students' interest in learning Luh & Ekayani (2021). Using interesting instructional media can create a comfortable learning environment, minimize misunderstandings of the material, and simplify the concepts of complex material (Laksita et al., 2013). According to Sung & Putra (2018), media packaged interactively and interestingly increases students' interest in learning, allowing them to absorb the material more optimally. Currently, printed learning media is considered less effective for learning. According to a study by Wulandari et al. (2016), 20% of students do not want to take printed books to school due to concerns about their weight, as they are relatively large.

In this era, technological advances can be used to support learning. One of them is using smartphones in various learning media (Burisi, 2015). Android is a very popular operating system among all demographics due to its comprehensive features and ease of use. This is in line with Pradana, (2020) study, where six out of ten learners use their smartphones only to chat on social media, watch entertainment programs, and play games instead of accessing study materials. Utilizing Android smartphone technology, which has many features, can help teachers develop the practical functions of smartphones in learning (Lesmanawati et al., 2024).

The use of smartphones can be used as a learning tool by students. One of them is the use of digital paperbacks as a learning medium. A learning tool that influences student knowledge and learning outcomes is the mobile pocketbook; students who use mobile pocketbooks achieve better knowledge-learning results than those who do not (Sarwanto et al., 2024). According to Noviatika et al. (2019), digital paperbacks stimulate students' interest in learning and reading, as the content is not only in the form of stories but also contains images, audio, and video. The advantages of these media are that paperbacks are in software form, are not easily damaged, are relatively small, and can be easily used anywhere.

According to observations in one of the junior high schools related to physics classes held face-to-face (offline), students still find it difficult to learn physics despite the increase

in lectures as a teaching method. Interviews with physics teachers show that harmonic vibrations are still difficult to teach because they contain many equations that make it difficult for students to understand the content.

Fast-expending communication technology is extremely useful and beneficial to human life. For instance, many students in the educational field use their phones while participating in class activities. Furthermore, modern mobile phones are utilized for more than just sending brief messages; they are also used for gaming and internet access, particularly for social media. Because of this, pupils would rather play on their phones than study (Bani & Masruddin, 2021). Given this background, this study aims to develop an Android application for physics libraries based on contextual harmonic vibration material learning, describe the validity of the product, and consider the quality and implementation of the developed product. This research is limited to harmonic vibration material conceptualized in an Android application that can be used independently anytime and anywhere without requiring internet network access. The product developed implements a contextual learning approach in every material, practice question, and simple practicum.

METHODS

The ADDIE (Analyze, Design, Development, Implementation, and Evaluation) model, proposed by Raiser and Mollenda in the 1990s, was used in this development study, also known as R&D (Research and Development) research. This research was conducted in high school. The product developed is an Android pocketbook application based on contextual learning on harmonic vibration material for high school grade X.

In this research, the first step is analysis. Several analyses were carried out at this stage, including needs, student, and material analyses. After getting the analysis results, we proceeded to the design stage, where product selection and concept design were carried out. The third stage is development, where the product and instrument validation process and product quality assessment are carried out. After the product is assessed, it enters the implementation stage, where the product is tested in limited trials, extensive trials, and product implementation tests. The final stage is product evaluation, which becomes the final product.

This research model has systematic stages, and there is always an evaluation and revision in every stage, so that it can produce a valid product (Mutia et al., 2018). The instruments used in this study include validation sheets filled in by one material expert and one media expert, a quality assessment sheet filled in by two material experts, two media experts, and one physics teacher, a student response sheet filled in by 35 students, and an implementation test completed by one observer. Validation was calculated using *Aiken's V*. The criteria for the level of validity (Rahmawati, 2016) are shown in Table 1.

Table 1 Validity criteria

Score Range (V)	Criterion
$V \leq 0.4$	Less Valid
0.4 – 0.8	Quite Valid
$V \geq 0.8$	Highly Valid

Product quality, implementation, and student response were assessed using a *Likert* scale of 1-4. Table 2 shows the criteria for assessing product quality and implementation (Widoyoko, 2012).

Table 2 Quality and implementation assessment criteria

Average score	Criterion
3.36 to 4.00	Very Good
2.51 to 3.25	Good
1.76 to 2.50	Not Good
1.00 to 1.75	Very Not Good

The response criteria of (Widoyoko, 2012) can be shown in Table 3.

Table 3 Student response criteria

Average score	Criterion
3.36 to 4.00	Strongly Agree
2.51 to 3.25	Agree
1.76 to 2.50	Disagree
1.00 to 1.75	Strongly Disagree

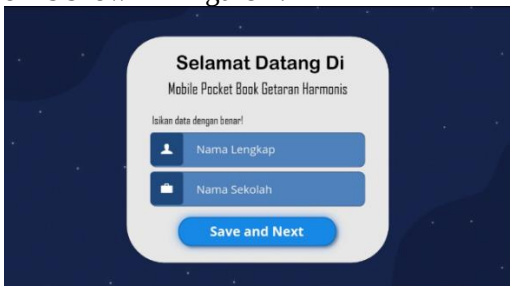
RESULTS AND DISCUSSION

Developing a notebook application based on contextual learning of harmonic vibrational materials uses a research methodology of R&D with the ADDIE model. This model consists of five phases. The first phase is analysis. In this phase, we identify the research gaps in the school and perform a needs analysis. Here, interviews with the 10th-grade physics teachers were conducted. The interviews made it clear that physics is mainly taught through lectures, the technology is only used in PowerPoints, and there is no application-based learning media. Moreover, students still have difficulty learning the physics of harmonic vibrational matter. The following analysis is based on the interviews with students. The interviews showed that all students use smartphone technology for learning. However, students still find it difficult to learn physics because many equations are used. The application of physics equations still confuses students. Students also consider physics to be an uninteresting subject. Students do not prefer to learn from paper books. This can be seen from the fact that there were 35 students in the classroom, and only 15 brought printed books. From the problem and needs assessment, a solution was obtained by developing a Physics paperback based on contextual learning supported by an Android application for Harmonic Vibration Materials.

The second phase is design. The media to be created in this phase is pre-designed. Design includes the selection of fonts, colors, and illustrations, the creation of the application framework, and the design of materials. Apart from the design, this phase also creates validation tools (material experts, media experts), product quality assessment for material experts, media experts, physics teachers, student answer sheets, and product implementation test sheets.

The third phase is development. The creation of the application, which takes place in this phase, is naturally based on the design created in the previous phase. The production of educational media products follows the development process. The instructional medium is tailored to the competencies and skills that students are expected to master. This pocketbook application comprises eight menus: usage instructions, competencies and indicators, materials, sample questions, practice questions, simple practicals, and a reading list. And developer information. In the materials menu, it is intended to facilitate students ' understanding of the material. The practice questions and practicals menu has a column feature that is used to input answers directly into the pocketbook application. The initial product display is the application title, and an open button is used to open the application home screen. The initial view of the application is shown in Figure 1.

(a)



(b)

(c) (d)

Figure 1 (a) App initial view, (b) Login page, (c) Home page, and (d) Content of material

After the application product is developed, the next stage is to validate the planner application and evaluate the quality of the product by experts. The goal is to create an application product that is valid and accessible to students. Experts in the field of materials and media perform the validation. This phase yields the validation results shown in Table 4.

Table 4 Application validation results pocket book

Validators	Average Score	Criterion
Material Expert	1	Highly Valid
Media Expert	0.87	Highly Valid

Table 4 shows that the product is in the "valid" category and, therefore, can be used. This validation includes several aspects. Material validation evaluates material feasibility, presentation, and linguistic aspects. Media validation evaluates two aspects: software development and visual communication.

Furthermore, quality evaluation follows the validation of the Pocket Book application product. The objective is to determine the quality of the created application product. Experts in their respective fields conducted the evaluation: two material experts, two media experts, and one physics teacher. The evaluation uses a Likert scale of 1 to 4, which the experts complete. This phase produces a quality rating, as shown in Table 5.

Table 5 Application quality assessment results pocket book

Assessment	Average Score	Criterion
Material Expert	3.33	Excellent
Media Expert	3.60	Excellent
Physics Teacher	3.71	Excellent
Overall average	**3.55**	**Excellent**

Table 5 shows the results of the product quality of the Pocketbook application, which was rated as "very good" by material experts, media experts, and physics teachers. This shows that a situational learning-based pocketbook application can be implemented in students learning.

The fourth phase of the study is implementation. After that, a working product is demonstrated to students and used in their learning process. The implementation was carried out in class X MIPA, which consisted of 35 students. Students will fill out a questionnaire to indicate the results of their application. It is a descriptive questionnaire on a Likert scale of 1 to 4. It contains 13 points with three dimensions each. The results of learners' responses are shown in Figure 2.

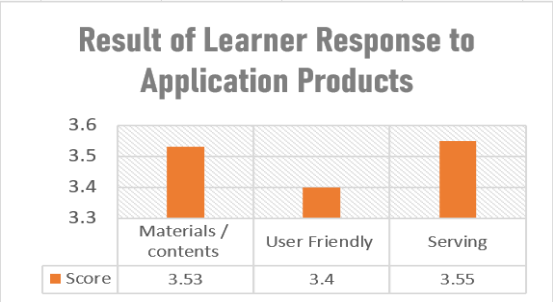


Figure 2 Results of student responses to application products pocket book

Figure 2 shows that the mean result across the dimensions using the criterion (strongly agree) is 3.47, which indicates that the materials and content of the paperback application are understandable to students and correspond to their abilities. The application is easy for students to use, and the presentation within the application is attractive.

Paperback application products are used in the learning process. Two observers evaluated the product implementation test in this process. The aspects evaluated are the steps of contextual learning during the learning and teaching process. The first aspects evaluated are the stages of constructivism, questioning, investigation, learning community, reflection, modeling, and authentic evaluation. This evaluation uses a questionnaire with a Likert scale of 1 to 4. The evaluation results of the implementation test are shown in Figure 3.

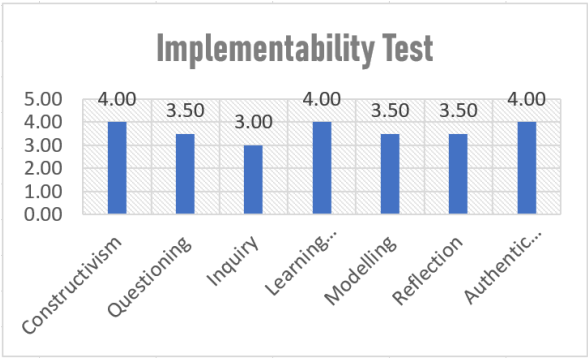


Figure 3 Results of the implementation test assessment

The implementation test achieved an average score of 3.64, corresponding to the "Very Good" (SB) standard. These results show that contextual learning can be used in the learning process in combination with paperback learning media.

The last phase is the evaluation. The developed application is evaluated based on suggestions and input from students. The "strongly agree" answer was determined from the average answer of the students, so no further evaluation was carried out.

Validation of Pocket Book Physics Based on Contextual Learning Assisted by an Android Application on Harmonic Vibrational Material

Material experts and media experts carry out the validity of the paperback application product. Each validator assigns a value from 1 to 4 to the specified aspect. The three aspects evaluated by the validation by material experts include the feasibility of the material, which includes the suitability of the material to the competencies that students should achieve, the truthfulness of the writing of the material, and the truthfulness of the related theory, and everyday life (context). Contextual learning is an educational approach that attempts to assist students in understanding the significance of the material they have learned by teaching them how to relate the academic subjects they have studied to the context of their everyday lives, specifically their social and cultural contexts and personal circumstances

(Tamam et al., 2021). Then, there is the aspect of presentation, which describes the systematicity of the creation of the material; the last aspect is the linguistic aspect, which includes the accuracy of using language according to the language rules and the construction of understandable sentences. The results of this material validation are shown in Table 4, with a mean value of 1 as the criterion for "very valid." This indicates that the materials used in the paperback application are good and valuable.

The second validation is by media experts. This validation evaluates two aspects. The first is the software development aspect. In this aspect, the application specifications in terms of application packaging, application file size, and ease of use are evaluated from the perspective of application usability. The second is the visual communication aspect. This aspect includes two indicators. The first is the design of the application. This includes the appearance of the developed application, such as the choice of colors, fonts, font size, images, and videos used. The next indicator is the icon functionality, which includes statements about the functionality of the application's buttons. The validation results by media experts, shown in Table 4, have a very valid criterion with a mean score of 08.7. Students can study and review Android-based pocketbooks. The lessons are more extensive because they can be done anytime and anywhere offline (Mirnawati et al., 2023).

The average value of the validation of materials and media reached a score of 0.93, with a very valid criterion indicating that the paperback application is valid and ready for students. According to a study by Khumaidi et al. (2018), mobile paperback media with a very good category are useful.

Quality of Pocket Book Physics Based on Contextual Learning Assisted by Android Application on Harmonic Vibrational Material

Two material experts, two media experts, and one physics teacher evaluated the paperback application's product quality. The aim is to judge the quality of the product, and the evaluation uses a Likert scale of 1 to 4. The first evaluation by the material experts evaluates the feasibility aspect (6 statements), the presentation (2 statements), and the linguistic aspect (2 statements). The mean score of the material evaluation is 3.33 (see Table 1.5), which corresponds to a very good standard. The second evaluation is a media evaluation by the two media experts. Four aspects are rated with four statements, and the visual communication aspect has seven statements. The result of this average rating is shown in Table 5, with a score of 3.60 for "very good." Subsequent quality evaluations by physics teachers, with six aspects, are rated. This includes the practical feasibility aspect with six statements, the presentation aspect with two statements, the language aspect with two statements, the software technology aspect with four statements, the visual communication aspect with seven statements, and the usability aspect with three statements. According to Table 5, the result of this rating is 3.71 for "very good". The average result of the quality assessment by material experts, media, and physics teachers was 3.55 on the scale of "very good." The overall percentage of media assessments of paperback applications was 88.50%, in the category of "very good." According to Wahyuni et al., (2017), the learning medium of the contextual learning-based paperback application is sufficiently available. According to the 30 journal analysis, creating digital pocketbooks for physics education based on Android or mobile enhances student learning. These e-pocket books are among the alternative educational resources that can grab students' interest and focus (Saphira et al., 2023).

Student Response and Implementation of Contextual Learning-Based Physics Pocket Book Assisted by Android Application on Harmonic Vibration Material

After creating a valid and usable product, the Pocket Book application was tested on students. The objective was to see the students' reactions to the Pocket Book application. This reaction test was conducted by MIPA Class X, which consisted of 35 students.

Students rate the response questionnaire from 1 to 4 using a Likert scale. The response sheet has 15 positive statements with three dimensions, including material/content aspect, ease of use, and presentation. The results for each dimension are shown in Figure 2. The overall dimension average scored 3.47 in the "Strongly Agree" (SS) category. The achievement rate of the answer test was 87%, which is classified as very good. According to research by Agustina et al. (2019), the positive response from students to digital pocketbooks, with an achievement index of 4.57, is categorized as very good. Most students commented that accepting learning using the pocketbook application based on contextual learning was very clear. Some responded to enlarging some fonts in the practicum section. This is for the improvement of the final product. In line with the study of Setyono et al. (2013), Pocket Book meets fairly high standards in content, structure, language, and students' interest in reading. The implementation test was conducted by two observers who observed the learning process in the classroom using the Pocket Book application medium. The observers evaluate the contextual learning aspects. Situated learning has seven phases: constructivism, questioning, exploration, learning community, modeling, reflection, and authentic evaluation. In this evaluation, a Likert scale of 1 to 4 was used, and the evaluation results shown in Figure 3 were obtained, with the average score across observers being 3.64, which meets the Very Good standard. In this implementation test, we achieved an achievement rate of 91%, which means that situated learning can be integrated into the Pocket Book application medium. The observers responded well to implementing contextual learning using this pocketbook application. Suggestions from observers to convey this learning must bring more concrete objects that students can see during learning; this is to support the use of the Pocketbook application, so that learning is of higher quality. Students can enhance, broaden, and apply their knowledge and abilities through contextual learning in various classroom and everyday activities (Bustami et al., 2018). According to a survey by Agustine & Lathiifah (2022), the development of a CTL (Contextual Teaching and Learning)--based notebook is very easy to use at a rate of 70%. According to a study's findings by Juwantara et al. (2023), the efficacy of contextual learning-based electronic teaching resources received an average score of 91%, falling into the "Very High" effectiveness category. This study demonstrates the importance of contextual learning-based product development and its deservingness of dissemination.

CONCLUSION

A contextual learning-based paperback Android application on harmonic vibrations was developed using the ADDIE research model with an evaluation of validity quality, a student response test, and an implementation test. In the validity analysis, an Aikens'V value of 0.93 was achieved with the criterion of "very valid." In the quality evaluation, 88.50% was achieved with the criterion of "very good." The "very agree" percentage reached 87% in the student response test. In the product implementation test, 91% of the results were achieved with the criterion of "very good." This indicates that the contextual learning-based physics paperback learning medium with an Android application on harmonic vibration materials is valid, feasible, and practical for secondary school physics education. The development of Pocket Book teaching materials assisted by this Android application is generally used as student teaching material and as a reference for learning. The design of this teaching material is an innovation that updates teaching materials so that they can be accessed anytime and anywhere independently. However, the development of Contextual Learning pocket book applications is still limited to the broad test implementation stage, which is limited to product feasibility tests with limited formative evaluation. The sample of respondents used one class of 35 students, and it was focused on Harmonic Vibration material, so it is expected to be developed on a wider range of materials and with the advanced stage of summative evaluation.

CONFLICTS OF INTEREST

The author declares that there is no conflict of interest.

AUTHOR CONTRIBUTIONS STATEMENT

All authors contributed significantly to the completion of this study. The first author conceptualized the research design, developed the pocketbook, analyzed the data, created a contextual learning framework, conducted the literature review, and conducted the data collection process. The second author contributed to validating the learning material, facilitated its implementation, provided critical revisions to the manuscript, and reviewed and approved the final version.

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