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Didaktika: Jurnal Kependidikan Vol.13 No. 001 Spesial Issue Desember 2024

Design of Android-Based Interactive E-Module Teaching Media for Aviation Radiotelephony Course

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Abstract

This research was made to optimize the learning of Radiotelephony courses by creating new interactive learning media that can be accessed through gadgets and assessing the feasibility of Radiotelephony interactive learning media based on the assessment of media experts, material experts, and student responses. Created using the Research and Development method by Brog and Gall, this study adopts the ADDIE research model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. This research produces learning media that have undergone design and material validation tests. The percentage of validation results by material experts is 85%, and the percentage of validation results by design experts is 88%, so it is included in the very feasible category. Student acceptance of the learning media is shown through the answers to the survey responses, which were distributed where the results reached 89%.
Keywords: *E-Modul, Learning Media, Radiotelephony*

Introduction

Radiotelephony is a course that Cadets of the Diploma III Airport Management Study Program must follow. This course teaches the language standards used to communicate two-way between pilots and flight personnel. The phrases used in aviation radiotelephony were created as a standardized language used by all aviation personnel worldwide (Panji et al., 2022). There are six official languages of civil aviation, so the United Nations has created a particular language through the International Civil Aviation Organization that all pilots and aviation personnel can understand (ICAO Montreal, 2007). The phrases used in aviation radiotelephony are different from the use of everyday English, so it is necessary to create a learning medium that can directly adopt the events of what kind of events occur during the flight to be able to understand how the phrase aviation radiotelephony is used So, through optimizing the use of learning media and contextualizing the material, the expected learning objectives can be achieved (Karimi & Sanavi, 2014).

Based on previous research, it was stated that radiotelephony is aviation in the United Kingdom. Aviation is an important language to be understood by aviation personnel because the language of aviation radiotelephony (two-way radio communication) is generally agreed to consist of standard phrases and simple language. Standard phrases do not carry the same meaning as in linguistics and applied linguistics. In aviation, standard phrases are defined by the United Nations agency, the International Civil Aviation Organization (ICAO). ICAO member states adopt the standard phraseology for use by pilots, vehicle drivers, and air traffic controllers. With the creation of this module related to radiotelephony language, it is hoped that it can reduce miscommunication in the multilingual workplace, thereby improving safety in flight. (Drayton & Coxhead, 2023). Another study showed that communication difficulties were caused by a lack of United Kingdom proficiency, excessive use of simple language, fast speaking speed,

and accents that deviated from the standard United Kingdom. In addition, the results suggest that practical training, using materials such as real-life voice recordings and diverse vocabulary resources, can improve speaking skills and listening comprehension in non-routine situations. The study provides valuable insights into developing effective training programs and materials, which can help reduce communication difficulties and improve the safety and efficiency of flight operations (Kim, 2023). Indonesia is a country that does not use English as its mother tongue. Based on previous research by Embryani, it was also stated that most of the English language skills of Indonesians are only limited to reading skills (Embryany & Ratmanida, 2020). So, two-way communication requires learning speaking skills and practicing reducing accent differences to communicate with international aviation personnel. Another study stated that pilots with accents tend to be more challenged by the Aviation United Kingdom. The results of this study showed that they made more errors overall in their transmissions than native-sounding United Kingdom-sounding pilots, but also that the types of mistakes they made were different: accented pilots made mistakes, while native-accented pilots made omissions, and accented pilots made more errors with words than native-sounding pilots (Wu et al., 2019).

This research was done based on previous research by Nugraha, which stated that cadets in the nursery pattern have high motivation to learn because the selection process is strict, transparent, tiered, and long, makes a significant contribution to the learning interest of cadets in the nursery pattern including the airport management study program. (Nugraha et al., 2024). Learning media is one of the essential things that need to be developed, according to Nuritta, because with the development of learning media, an easy and exciting teaching and learning process will be implemented, learning efficiency will increase, student concentration will increase, and student learning motivation will be increased. (Nurrita, 2018). In addition, according to Mushon, in this era of Globalization and Information, the development of learning media by optimizing information technology is a demand to facilitate the learning process to be more effective and efficient. (Muhson, 2010).

The development of learning media in the form of android-based e-modules interspersed with interactive games is based on previous research stating that Interactive E-modules are learning materials that contain materials, methods, limitations, and ways of evaluating that are designed systematically and attractively to achieve the expected course competencies/sub-competencies following the level of complexity which helps increase the learning motivation of students. (Imansari & Sunaryantiningsih, 2017). Based on previous research by Masito, it was also found that the use of Project-Based Learning-based E-Modules can significantly increase students' understanding of concepts. (Masito et al., 2023). Previous research found that Android-based interactive E-learning can increase the effectiveness of teaching and learning with a minimum amount of human resources. (Sidiq & Najuah, 2020). Android-based e-modules based on Sarjono's research will be easier to use and learn if using the React Native framework. According to Malahella, developers widely use the React Native Framework because it is easy to learn, has a simple code structure, and has a live reload feature without a building process; therefore, many developers use React Native for a faster mobile development process, and also React Native was chosen because in one coding the application can be made into android or IOS which will make it easier for users to use it according to the OS of each smartphone. (Malahella et al., 2020; Nurhidayah et al., 2023; Sardjono & Sanjaya, 2023). The ADDIE model was chosen because each step is systematic and easy to understand, making it easy to use (Ike Purwanti et al., 2024). In the study, the researcher chose to develop a learning medium as an interactive e-module with a game interlude so that students can feel the atmosphere of a ground handler who will communicate directly with an air traffic controller. This learning media will also

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be accessible through the students' mobile phones, making it easier to learn this material anywhere and anytime.

This research presents a solution in the form of interactive media design for the radiotelephony course to increase the understanding of cadets in the radiotelephony course. This research uses the Research and Development (R&D) research method. The researcher first researches to collect some data needed, then makes a development design, then tests and evaluates the media made.

Method

The method used in this study is R&D. By using the Borg and Gall development model, the ADDIE model because this research model is considered systematic and easy to understand (Davis, 2013). The steps in this study include first (Analysis) preliminary research (preparation, deepening survey, needs analysis), second (Design) product development planning (data collection, identification of the product being developed), third (Development) product validation and revision (expert review, small group trial, large group trial), fourth; (Implementation) product implementation, fifth; (Evaluation) Product evaluation and refinement. (Sugiyono, 2013). This study explains how to design the development of an Android-based Interactive Module program for Radiotelephony Courses to increase learning effectiveness and efficiency. The population of this study is 48 students of the Airport Management study program Batch 3. Data collection in this study uses observations, interviews, and questionnaires. The observation method is a method of assessment that conducts direct observations systematically to collect actual data. The interview method collects data through systematic questions and answers, and the results are carefully recorded. The questionnaire method collects data by providing a list of questions to respondents that are answered in writing. (Yuniar et al., 2023).

The development procedure used in this study includes the Analysis Stage (1) Needs analysis; the author carries out the analysis by observing and comparing the learning media that is currently used; the analysis will be used as the basis for the development of learning media. (2) Situation analysis is carried out by interviews with teachers about the learning media used and the condition of students during the learning process. (3) Material analysis aims to analyze the material to be processed. Radiotelephony material, which is a material that requires much practice, will present practice with learning media that will be developed. Next is the Design Stage; at this stage, the design of the Interactive E Module to be developed is adjusted to the results of the previous analysis. In addition, identifying the components of the E-Module, such as the application display flowchart, is how the design phase is completed. Here, the researcher also compiled an instrument that will be used to assess the Android-based E-Module. Some of the research instruments are content, language, and feasibility of presentation. After that, the development stage is where the activities carried out are making products. The steps are carried out: (1) Creating a flowchart. (2) Preparation of material to be included in the e-module. (3) Search for images, illustrations, and animations to clarify the material's content. (4) Design interactive games to be integrated into e-module applications. (5) Compile e-module applications. After the e-module was completed, implementation was carried out, namely a trial on MBU 3 cadets, and then they filled in a questionnaire regarding their responses to this module. A validation process is also carried out with a validation sheet of material experts and design experts to determine the feasibility of the E-Module that has been designed. Data from research studies of subject matter experts, learning media experts, and small group test subjects were processed using this method. Information in the form of input, criticism, and suggestions in the questionnaire is used to evaluate E-module products (Arofah & Cahyadi,

2019). The quantitative descriptive analysis method systematically processes data in numbers to obtain general conclusions. In decision-making regarding the development of E-modules with the PBL model, the reference is when the achievement rate of 90%-100% is excellent quality and does not need revision, 75%-89% is good quality and needs little revision, 65%-74% is sufficient qualification and needs more revision, 55%-65% is less qualification and needs much revision, and when 0-54% is severely lacking in qualifications and has to be repeated to make the product.

Results

The results of this study will discuss two main things: describing the design of android-based E-Module Interactive Learning Media and the validity of learning media. From research and development, the following results were obtained: The first stage, namely the Analysis Stage, includes (1) analysis of learning activities, which found that some cadets have not been able to learn independently due to the lack of interactive media in the learning process; (2) analysis of facilities and infrastructure to review educational facilities, which found that facilities such as mobile phones, laptops, and internet networks were not used optimally. Adequate learning facilities, such as independent study, can be used by cadets in learning. The observation sheet determines the learning facilities owned by the school and cadets and looks at the learning process in the classroom. The observation sheet grid is in Table 1

Table 1. Observation Sheet Grid

Question	
1.	What learning media are used by lecturers to support the learning process?
2.	How do we motivate cadets in the learning process?
3.	Do cadets face obstacles in participating in classroom learning activities?
4.	How many cadets are active in the learning process?
5.	How many cadets feel bored while participating in classroom learning?

Instruments in the form of interview sheets are used to find information media and models used in the learning process, facilities owned by cadets in the learning process, obstacles faced by lecturers in teaching, and student cadet learning outcomes. The interview sheet grid is in Table 2

Table 2. Interview Sheet

Question		
1.	Are you having trouble in the learning process?	Lecturer
2.	Are media modules needed to support learning activities?	Lecturer
3.	Can the media you use make learning more accessible for you?	Lecturer
4.	Can cadets operate mobile phones on campus?	Cadet
5.	Are there any obstacles when practicing in the field?	Cadet
6.	Do students get other learning resources besides textbooks?	Cadet

The second stage is design. In the design stage, (1) the creation of a flowchart and storyboard of the E-module. Flowcharts are created to know the workflow of the developed E-

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modules. (2) designing use case diagrams and collecting materials that will be developed into simple games. (3) Set the design of the app's display. This design determination aims to make the application attractive. (4) Prepare assessment instruments. Instruments are developed to determine the validity of the developed product.

The third stage is development. During the development phase, the tasks completed were (1) Development of Android-based Interactive Learning Media. This activity is carried out by developing applications made with the React Native framework using the design that has been made. (2) Fill in the material on the application that has been made to become an Android-based interactive e-Module application. The results of application development can be seen in the following figure.

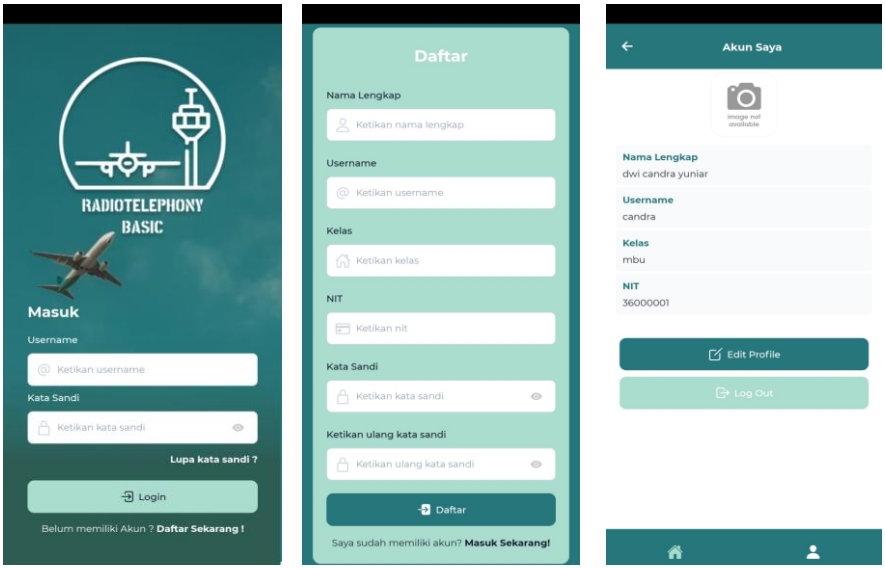


Figure 1. Login Menu Display

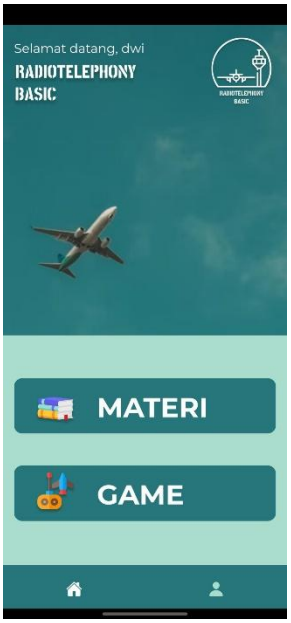


Figure 2. Main Menu Display

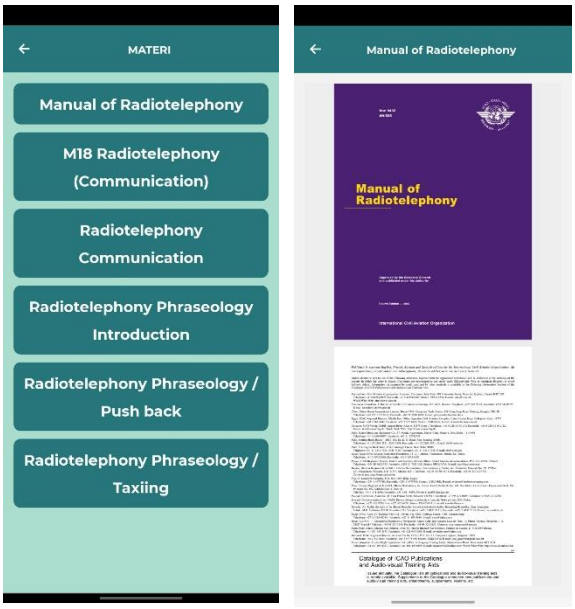


Figure 3 Material Menu Display



Figure 4. Game Menu Display

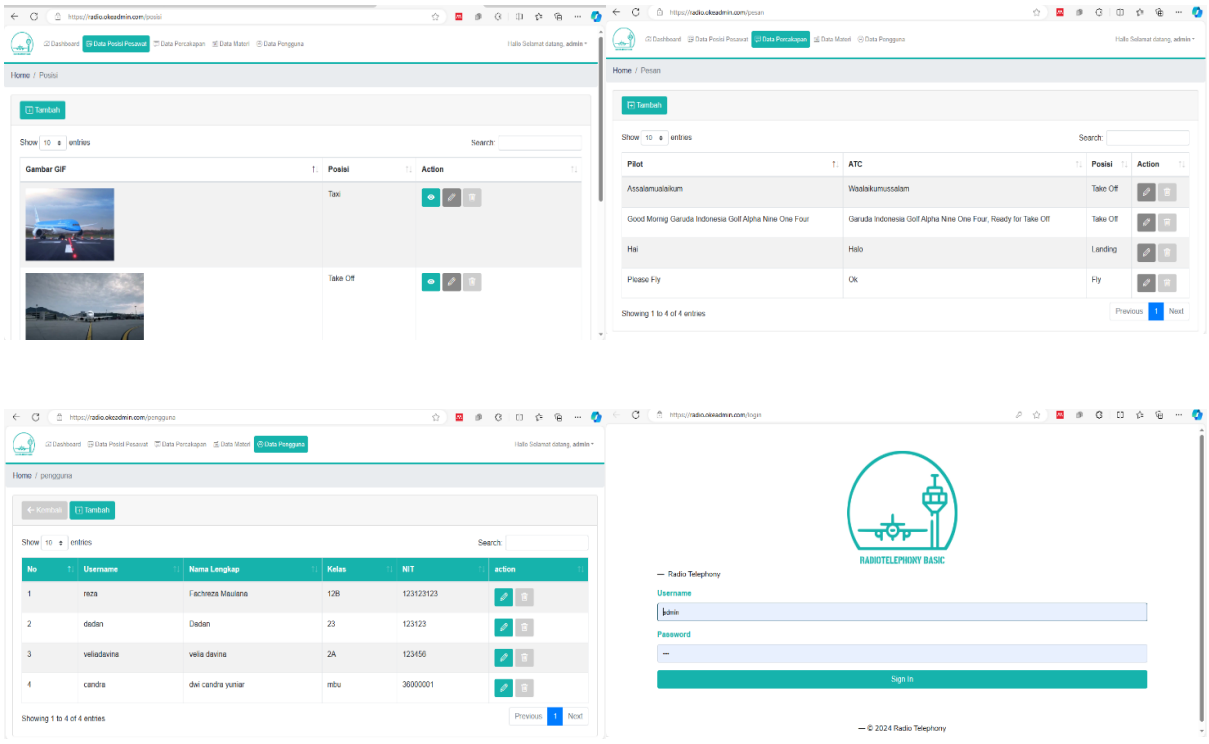


Figure 5 Admin Web View Organizer

The fourth phase is the implementation phase. One activity during this stage is to ask learning media experts and experts in air traffic guidance to conduct product validation tests—a small group trial with 48 cadets. Product trials evaluate the feasibility and attractiveness of the developed E-modules.

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Table 3 Subject Content Expert Grid

Aspects	Indicator	Item Number	Number of Items
1. Curriculum	1. Learning Indicator 2. Learning Objectives 3. Learning Achievement	1,2,3	3
2. Method	1. Suitability if the content of the material 2. Systematic of the material	4,5	2
3. Language	1. Clarity of Information 2. Language Use	6,7	2
4. Game	1. Clarity of the conversation 2. Diversity of conversations 3. Clarity of question formulation	8,9,10	3

Table 4 Learning Media Instrument Grid

Aspects	Indicator	Item Number	Number of Items
1. Text Design	1. Accuracy of type, font size, and punctuation 2. Accuracy of word selection 3. Text and background color accuracy	1,2,3,4	3
2. Image Design	1. Suitability of images and materials 2. Image caption availability 3. Image layout precision	5,6,7	2
3. Game Organizing	1. Easy-to-use modules 2. Consistency of navigation 3. Clarity of instructions for use	8,9,10	2

Table 5 Small Group Instrument Grid

Aspects	Indicator	Item Number	Number of Items
1. Learning Media	1. Ease of use 2. Highlights 3. The accuracy of learning media	1,2,3,4	4
2. Material	1. Ease of use 2. Highlights 3. The accuracy of learning media	5,6,7	3
3. Benefit	1. Interest 2. Learning Motivation	8,9,10	3

The last phase is evaluation. In the evaluation stage, the data collected during the implementation is evaluated. Formative evaluations aimed at assessing the validity of E-module products developed include the validity of experts and small groups. Based on these stages, Android-based E-modules have been successfully developed by applying the ADDIE model. The validity test of this Android-based E-module aims to test the feasibility level of Android-based Interactive E-modules. The instrument used is a questionnaire prepared to determine the validity of the E-module product. The results of assessments from subject content experts and learning media experts, as well as small group trials, are presented in Table 8.

Table 6.Results of the Product Validity Test

Types of Validity	Hasil	Qualification
Subject Material Expert Test	88%	Excellent
Design Media Expert Test	85%	Excellent
Small Group Trials	89%	Excellent

The test conducted by the content expert of the Radiotelephony course uses a questionnaire data collection method. The calculation results are converted through the achievement level scale 5; the achievement percentage is 88% to get an excellent qualification. The test was carried out by learning media experts using the questionnaire data collection method. The calculation results are converted through the achievement level of scale 5; The achievement percentage is 85% to get an excellent qualification. The small group trial used the questionnaire data collection method. The calculation results are converted through the achievement level of scale 5. The achievement percentage is 89%, so getting qualified is excellent. Based on these results, it can be implied that Android-based interactive e-modules are worth using and need a little refinement. Input provided by influence subjects, learning design, and learning media experts is considered to perfect the development of Android-based E-modules. Product revisions are presented in Table 8.

Table 7. Product Improvement by Subject Content Experts

Number	Comments and Suggestions	Revision
1	It is necessary to add a speech-to-text feature so that cadets practice speaking in the radiotelephony language.	Added speech-to-text feature
2	It is necessary to add many conversation options so that they can be used more often.	Added many conversation options
3	More detailed images of the airport layout are necessary so that cadets can practice the application more thoroughly.	Added airport layout image

Furthermore, after the media is repaired and revised again, it can be concluded that Android-based Interactive E-Module learning media can be used appropriately by the Airport Management Study Program cadets.

Discussion

Android-based Interactive E-Modules' research and development results in the Radiotelephony course were declared valid. The following is the procedure for developing E-Modules based on the simplified ADDIE model. This is because of the limited time the research is carried out up to the product development stage. (a) The analysis stage, i.e., literature review and field research, is used to collect preliminary data. Field studies are conducted to determine the problem, gather information, and choose one of the more challenging topics. Requirements

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analysis is a type of analysis that is carried out during field research. (b) Planning or design level. During the design stage, materials are mapped, titles are decided, learning indicators and objectives are created, the framework of the E-Module is designed, the content of the parts of the E-Module that need to be developed is decided, and materials are collected from various sources to create an Android-based Interactive E-Module product. (c) Develop Preliminary of Product. The component in question is assembled and developed into the first concept of the product (concept 1). (d) The product implementation is tested on airport management students in batch 3, and then student comments and inputs are collected, which will later be revised at the revision stage. (d) Product Revision. After the validation of two expert validators on the product, the E-Module will be updated/revised based on their recommendations and inputs. Twice, revisions were made. To produce E-Module products that are valid and suitable for use in the learning process.

The android-based Interactive E-Module Expansion Media has a final percentage for media feasibility; subject matter experts get a percentage of 85% with the "feasible" category. Furthermore, validation from design experts got 88% in the "feasible" category; the last is the test results on students, which got 89% in the "feasible" category. These results show that the interactive communication media of the android-based Radiotelephony course can be used appropriately by cadets of the air bandra management study program. The results of the study were supported by the research results of Anton et al. with the title "Learning Media Development: FireDroid Application Base on the Android System and Distance Learning," where the results of the study stated that the validators of media experts received a percentage of 88.9% for the clarity of the material and 89.13% for the ease of language, while the responses from users resulted in a percentage of 86.91%. Based on these findings, it can be concluded that android-based learning media is legitimate and valuable for use in the classroom. (Abdullah et al., 2021)The author found value in the research findings because they relate to product validation and the product type produced, which is also a learning medium.

According to the summary given above, this study created an Android-based Interactive E-Module Learning media. Using problem-based learning E-Modules as learning aids that can inspire learning so that students can improve the learning process to be more effective and meaningful, the E-Modules that have been created already include problem-based learning stages and updated research.

This research still has limitations and needs improvement. This research only uses small group trials and simple trials are carried out due to time constraints. Suggestions for further research, namely the need for research improvement by implementing the five stages of the ADDIE model so that large-scale trials and game improvements so that it becomes a more perfect and complex game, educators can make E-Modules in other subjects, and further research is needed on E-Modules that are used mainly for teaching.

Conclusion

The development process resulted in creating the Interactive E-Module of the Radiotelephony Course for Cadets of the Airport Management Study Program. This E-Module has been validated and is considered valid and acceptable for use. The research output is an Interactive E Module for Android-based Radiotelephony courses that can be used in the classroom. The feasibility of this E-Module can be seen from the average assessment score of material experts, getting a percentage of 85% with the category "feasible." Furthermore, validation from design experts gets 88% of the "feasible" category, and the last is student response to the product results, which gets 89% of the "feasible" category.

Acknowledgment

We want to thank the Palembang Aviation Polytechnic for supporting the implementation of this research and continue to express our extraordinary appreciation to all parties willing to help with it.

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