Validity of Android-Based Learning Media in Subject Measurement and Instrumentation

Fivia Eliza¹, Dwiprima Elvanny Myori¹, Hastuti¹, Radinal Fadli²
¹Department of Electrical Engineering, Faculty of Engineering, Universitas Negeri Padang
²Graduate Student at Faculty of Engineering, Universitas Negeri Padang

Abstract. Electrical Measurement and Instrumentation is an important thing that must be mastered by electrical engineering students. But the problem that arises is the decreased interest in reading books, so that students need the other ways of learning. Then by utilizing the development of android technology, this study aims to develop the android based learning media to assist students to understanding the material. This research was adopted 4D model that have 4 development steps (define, design, develop, disseminate). Validity of the media was measured by instrument of validity that had been validated before. The average calculation result from the validity analysis of the learning media is 85% with valid category. So it can be concluded that android based learning media on Electrical Measurement and Instrumentation course was valid to be used as a learning media.

1. Introduction
Measurement and Instrumentation is one of the compulsory subjects of electrical engineering. In this study discussed the concept of various measuring instruments and how to use measuring instruments include Ampere meter, Volt meter, Ohm meter, error theory, working principle of measuring instruments, voltage measurement electricity, resistance current, inductance, capacitance, electrical power, frequency and measurement of magnetic quantities. Measurement and instrumentation are disciplines that cover a variety of real-life applications in industrial, commercial and residential environments. Therefore, learning measurement and instrumentation is important. In this case, increasing interest in providing measurement and instrumentation learning needs to be improved. In general, the implementation of learning in higher education includes measurement and instrumentation courses, lecturers still use printed teaching materials such as textbooks and handouts/modules as media in their learning. This learning process becomes less effective, because most of the material requires the help of media that includes images, animations, videos, and simulations to visualize the material so that it can be easier understood by students. The use of learning media is a way to allow the improvement of the quality of learning measurement and instrumentation. Media and teaching materials are the supporting factors in the learning process. Teaching materials are all materials that arranged systematically, which displays a completed figure of competencies that will be mastered by students and used in the learning process, such as textbooks, modules, handouts, etc.[1]

The fact that learning process in measurement and instrumentation courses still uses conventional teaching materials, such as textbooks and print modules that are ready to use. This certainly is no longer in line with the standards of 21st century education learning needs that emphasize the use of technology to improve the learning process.
Solid material in the instrument and measurement courses resulted in several times the learning process in the class was forced to be unable to be completed due to the limited time available. Conventional learning that is only limited to meetings in college will not develop the student’s abilities and knowledge. The time available for lecturer and students to meet face to face in classrooms is very limited [2]. The process of delivering teaching materials is almost completely done in the classroom which causes the delivery of teaching material to be late or no even delivered if the meeting does not occur. Then learning media are needed that can be used by students to study independently, so that students can repeat learning wherever and whenever.

To overcome these problems, innovation needs to be carried out in the learning process of measurement and instrumentation by applying 21st century education standards, namely by utilizing technology and information tools to improve the learning process. The rapidly developing technological devices are smartphones, the smartphone market share in Indonesia increase continuously, from 11% in 2010 to 24% in 2014 [3]. The use of smartphones has penetrated various circles of society, not only used by adults but also used by teenagers and children. The age segment 17-21 years is a strong base for smartphone users, which is as much as 45%, this segment is the age segment of electrical engineering students [4].

Android smartphone is a mobile telecommunications device based on the Android operating system that has dimensions that are compact and lightweight so that it is easy to carry anywhere and the ability to use multimedia is a good attraction for users. The phenomenon of android use also occurs in students who take lectures on measurement and instrumentation, but this phenomenon has not been used by educators to make Android as a learning media. Even though its compact size is easy to carry anywhere, it makes high mobility capabilities on Android, allowing students to study independently anywhere and anytime, so learning can occur anywhere and anytime.

The ability to multimedia on Android cannot be doubted, Android is able to display text, images, animation, audio, and video properly. The ability to display multimedia allows Android to be used as a media to display abstract learning material, becoming more concrete. Learning carried out with android-based learning media can meet the standards of the 21st century education process which emphasizes the use of technology to improve the learning process and enable learning independently. Preparation of learning planning needs to be done to implement an effective and efficient learning process, so that it can improve graduate competency.

Based on the phenomena that have been explained, for this reason the author feels the need to contribute so that instrumentation and measurement learning is more optimal so that it can improve Indonesia's competitiveness globally. One solution to the problem is to innovate learning with android-based media on Instrumentation and Measurement course of the Electrical Department, Faculty of Engineering, Universitas Negeri Padang.

2. Learning Media Review
If the media carries messages or information that is appropriate instructional or contains teaching purposes then the media is called learning media [5]. Media is defined as a means whose functions can be used as a goal [6]. If we want to select learning media, we need to consider several things. It could be the media used even complicate the achievement of learning objectives. The use of appropriate media will greatly support the success in the learning process. Conversely, improper use of media will only squander costs and energy, especially for the achievement of learning goals will be far from what is expected. In order to use media in accordance with their needs, it is necessary to know the criteria of media selection in learning. Criteria of media selection as follows:
In accordance with the goals to be achieved. Media is selected based on predetermined instructional goals that generally refer to one or a combination of two or three cognitive, affective, and psychomotor domains. It is appropriate to support the content of the lesson in terms of facts, concepts, principles, or generalizations. In order to help the learning process effectively, the media must be aligned and in accordance with the needs of learning tasks and mental abilities of students. Practical, flexible and enduring. The selected media should be used anywhere and anytime with the equipment available in the vicinity, as well as easy to move and carry around. Skilled teachers use it. Whatever the media, teachers should be able to use it in the learning process. The value and benefits of the media are greatly determined by the teachers who use them. Grouping of goals. Effective media for large groups is not necessarily equally effective if used in small groups or individuals. Technical quality. For example, the visuals on the slides should be clear and the information or messages that are highlighted and want to be submitted should not be interrupted by other elements of the background [6].

Measurement and Instrumentation Review
Measurement and Instrumentation is one of the compulsory subjects for electrical engineering students at the Department of Electrical Engineering Faculty of Engineering Universitas Negeri Padang. The purposes of this course is the students mastered about the basics of concept of various measuring instruments and how to use measuring instruments include Ampere meter, Volt meter, Ohm meter, error theory, working principle of measuring instruments, voltage measurement electricity, resistance current, inductance, capacitance, electric power, frequency and measurement of magnetic quantities. This course provides an understanding of how to measure tools and how to measure, starting from recognizing types of measuring instruments, understanding the working principles of measuring instruments, to explaining how to use measuring instruments. [7].

3. Methodology
The research uses a research and development approach (R&D). The R & D approach is a process used to develop and validate educational products, such as modules and instructional media. Research and Development is a research method used to produce certain products and products of that effectiveness [8]. The research step of R & D according to the following figure:

![Figure 1. 4D Models](image)
4. Results
The defining stage is carried out to see an overview of how the conditions in the field relate to the learning process of measurement and instrument in the Department of Electrical Engineering FT UNP. This stage is carried out with the following description:

4.1. Needs Analysis
Based on the results of observations found several obstacles in the learning process that is the media prepared by the lecturer in the form of power point slides that displays points of learning material only, power point only displays text and images, not yet available, video, audio, animation, and simulation. Submission of material is still one-way, lecturers deliver material and students listen to explanations, so learning becomes monotonous.

Lecture time in class is limited to 2 credit hours, while the understanding ability of each student are different. Based on the problems described, learning media are needed which can be used anywhere, can attract students' interest, media that can be used by every student with different understanding speeds. There are evaluations that students can use to find out their abilities.

4.2. Student Analysis
Cognitive development of students aged over 11 years is at the stage of formal operational growth. In this period, ideally students already have their own mindset in an effort to solve complex and abstract problems, and can imagine many alternative solutions to problems and possible consequences or results. Images and animations contained in android-based learning media can help students understand abstract concepts to be more easily understood. With the use of Android-based interactive learning media, students are more easily mastered the material presented because the material is presented with interest in the form of applications on Android and can be seen repeatedly [9].

4.3. Task Analysis
In this task analysis, an analysis of the material will be developed to create an Android-based learning media. In this case, the material specified is material about the basic concepts of measurement and measuring devices for electrical quantities.

4.4. Concept Analysis
Concept analysis is carried out to identify the main concepts that will be used and identify supporting concepts that are relevant and related to the material in the development of android-based interactive learning media. The main concept in this lecture is that students understand the working principle of a measuring instrument and can use an electric meter.

4.5. Formulation of Learning Objectives
Formulation of Learning Objectives is intended to determine the materials that will be developed on learning media. This stage begins by analyzing the learning outcomes of the course, then explaining the learning objectives followed by describing the learning material that must be mastered.

5. Design
5.1. Preparation of Test Standards
At this stage, the preparation of tests is used as a tool to determine the ability of students and as an evaluation tool after the implementation of activities. The test in question is a pretest and posttest, which is arranged in the form of a multiple choice objective test.

5.2. Media Selection
Media selection is done to identify the right learning media to present the material presented. As for this activity selected Android-based learning media designed using the Adobe Flash CS 6 program application, because this software is very supportive for creating animations, making buttons and can integrate text, images, animation, sound, and can be run on Android to become a media learning.
5.3. Format Selection
The choice of format in the development of learning media is intended to design or design learning content, and presentation of material in learning. The format chosen is the writing of material in the form of media presented starting from the learning objectives, material descriptions, and evaluations.

5.4. Develop (Product Results)
5.5. Product Validation

The media validation test phase is carried out so that the developed android-based learning media can be identified based on the assessment of material experts and media experts. Media validation is a validation of the product. This media has been validated by two expert validators and this media validation had three aspects of assessment requirements, namely didactic requirements, construction requirements and technical requirements.

The results of the evaluation of each aspect given by the validator were analyzed using the Aiken’s formula. [10]

\[ V = \frac{\sum s}{n(c-1)} \]  
\[ S = r - l_o \]

\( L_o \) = lowest validity score (for example 1)  
\( C \) = highest validity rating (for example 5)  
\( R \) = the number given by the appraiser

The results obtained were validation values for the product. The results of the validation recapitulation are summarized from the aspects of the learning media that are assessed as shown in Table 1.

**Table 1. Results of Validation on Android-based Learning Media**

| No. | Validation Aspects        | Validator 1 | Category 1 | Validator 2 | Category 2 |
|-----|---------------------------|-------------|------------|-------------|------------|
| 1.  | Didactic Terms            | 0.88        | Valid      | 0.92        | Valid      |
| 2.  | Construction Terms        | 0.75        | Valid      | 0.75        | Valid      |
| 3.  | Technical Requirements    | 0.85        | Valid      | 0.88        | Valid      |
|     | Average                   | 0.82        | Valid      | 0.85        | Valid      |

Based on Table 1, the results of the validation indicate that this android-based interactive learning media has a validity value of 0.82> 0.66 given by the 1st validator, and a validity value of 0.85> 0.66 given by the 2nd validator, the learning media Android-based interactive is included in the valid category.

6. Conclusion

In this paper, a media for teaching measurement and instrumentation was presented. The novelty of the R&D research is that it is making the students centered learning and increasing student interest about measurement and instrumentation. Furthermore, the material measurement and instrumentation learning process can be students centered learning.

The main benefit is that media was valid to be used as a learning media. The result of research and development is expected to provide new innovations in education or provide solutions to existing problems. So that can be conclude that the android based media can be used to specify quality models that provide valid automated quality assessments of learning. Future work will be focused on developing the media for other basic courses (e.g. basic power electronics and electrical circuit) to refine the impact evaluations in order to achieve better results with regard to diversification among practice materials measurement and instrumentation. Moreover, we plan to extend the quality of media to include more quality characteristics and measurements.
7. References
[1] Prastowo, Andi. 2015. Creative Guide to Making Innovative Teaching Materials. Yogyakarta: Diva Press
[2] Sukamto and Shalahuddin. 2012. *Structured and Object Oriented Software Engineering*. Bandung: Informatics
[3] Yudistira Yuan, 2011. Making the BlackBerry Android iPhone Application is Easy. South Jakarta: Mediakita
[4] Andary, Ria Wuri. 2015. Media Communication and Student Behavior (Correlational Study On The Use Of Smartphone On Student Behavior Of Senior High School 1 Medan). Repository.usu.ac.id
[5] Arsyad, Azhar. Learning Media. Jakarta: PT Rajagrafindo Persada. 2010.
[6] Killis, Billy M.H. Relationship Ability to Use Trainer Facilities With Learning Outcomes in Productive Training Activities at SMKN 2 Manado. Ed Vocation, Journal of Technology and Vocational Education Volume 2, Number 2, 2011. Page 1 – 9
[7] Buku pedoman akademik UNP 2016/2017.
[8] Sugiyono, 2014. Metode Penelitian Kuantitatif, Kualitatif dan R & D. Bandung: CV. Alfabeta.
[9] Trianto, 2010.
[10] Azwar, S. 2012. Reliabiltas dan Validitas. Edisi 4. Yogyakarta : Pustaka Pelajar.