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Alternative design of android-based assessment for dynamic-statics basic on mechanical engineering education

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Alternative design of android-based assessment for dynamic-statics basic on mechanical engineering education

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Abstract. The low understanding of mechanical engineering education students on dynamic and statics basic impact on their difficulties to learn the course of statics and dynamics and machine design. For this reason, this study aims to obtain a form of dynamic-statics basic assessment design based on android that is easily accessible anywhere and anytime by students. This research was conducted with an R&D design from the Borg & Gall model consisting of research and information collecting, planning, and developing a preliminary form of product. The result of the development was the basic content of the material which consists of two parts: units and basic mathematics. Second result was product design validation indicators to assess the appropriateness of the content and products created. Finally, the main menus display which leading to learning, quizzes, and exit of assessment system. This assessment design will help students to understand the basic statics and dynamics in stages that could be accessed and studied by students through mobile technologies.

1. Introduction

The development of science and technology in the 4.0 era continues to encourage renewal efforts in the use of technological results in the learning process [1],[2]. This requires lecturers to be able to use the learning tools provided by the campus [3],[4] and allows that the device is in accordance with the developments and demands of the times [5],[6],[7],[8]. The demand for learning outcomes is in accordance with the definition of learning which states that learning is an effort made to change the behavior of learners so that they are able to adapt to increased levels of uncertainty, are intuitive and creative, and are able to take advantage of their cognitive skills in solving problems both in technical and general fields [9],[10],11.

In mechanical engineering education, Universitas Negeri Malang, one of the engineering subjects is Dynamics-Statics. This subject is a course appliying the basic cognitive abilities of science, namely basic physics, mathematics, and English language [12],[13]. The learning achievement of this subject is being able to design a system of engineering statics and dynamics in the field of mechanical engineering [14],[15].

However, this subject is still considered difficult for mechanical engineering education students to study. This condition is indicated by the low scores obtained by students. This is due to the low basic science skills (mathematics, physics, and English language) possessed by students, and their motivation.

To solve this problem, the researchers took the initiative to make an android-based learning evaluation design in the dynamic statics course in mechanical engineering education which was packaged with a serious game development based on the bloom taxonomy as an alternative to assessing dynamic learning learning. This development is based on the conditions of the industrial era 4.0 and students as the Z generation who are familiar with digital technologies [16],[17]. The purpose of this study is to obtain of dynamic-statics basic assessment design based on android that is easily accessible anywhere and anytime. Hopefully, this will strengthen students' basic science skills so that it is easy for them to follow the dynamics- statics course in mechanical engineering education, Universitas Negeri Malang.

2. Method

The design of a basic dynamic assessment based on serious game dynamics and bloom taxonomy in Mechanical Engineering Education, State University of Malang was designed with using the type of R&D research. The adapted development model was the Borg & Gall model, namely collecting research and information, planning, and developing preliminary forms of product, preliminary field testing, main product revision, and main field testing. However, this study consisted to three stages: developing a preliminary form of the product. The first stage was to determine the needs in the learning that will take place, matters to consider in determining learning needs and curriculum analysis. The second stage was to determine the core competencies and basic competencies, making a research instrument grid that is the criteria for learning resources and making research instruments to validate the game media created. The last stage was to develop a preliminary form of the product. This was carried out by preparing the material, designing a basic assessment of dynamic dynamics based on android using the serious game and bloom taxonomy through preparing story ideas, making synopsis, script and storyboard, and compiling the content of the material, background, and background music into system.

3. Results and discussion

To make it easier to understand this section, the researchers divided it into three parts. The following is the explanation.

3.1. Product Design Contents

The contents of dynamics- statics included in the assessment design for dynamics-statics basic based on android consists of two parts: units and basic mathematics. The unit section is several important words that need to be understood in studying dynamics and statics courses, for example: acceleration, angle, couple, dynamics, friction, and others. The basic mathematics section is a number of calculation techniques that need to be mastered before studying dynamics and statics courses. This section includes calculating shapes, fractions, and trigonometry

3.2. Validation Indicators for Product Design

Indicators of product design validation, assessment of dynamics and statics basic based on android are divided into two: indicators for the feasibility of content and indicators for the feasibility of products made. The content feasibility indicators were seen from the suitability of the material with the learning indicators, the suitability of the material with the learning objectives, the correctness of the material concept, the update of the material, the order of the presentation of the material, the suitability of the simulation with the material, the suitability of the sample with the material, the suitability of the image with the material, the materials oriented towards student learning outcomes, and the suitability of providing training with the material. Meanwhile, indicators for product feasibility were appearance, program, content feasibility, and presentation worthiness.

3.3. Product Design Views

The appearance of assessment product design of dynamics and statics basic based on android could be grouped into a front view (see Figure 1). The interface consists of an image section and three menus: study, quiz, and exit. The learning menu section, if this pressed, it will pop up the learning menu

which consists of material 1 regarding units and material 2 related to basic mathematics (see Figure 2). Meanwhile, the quizzes menu can be seen in Figure 3 which consists of instructions, quiz 1 to quiz 4. The quizzes are levels according to the philosophy of the bloom taxonomic level.

Figure 1. Main view

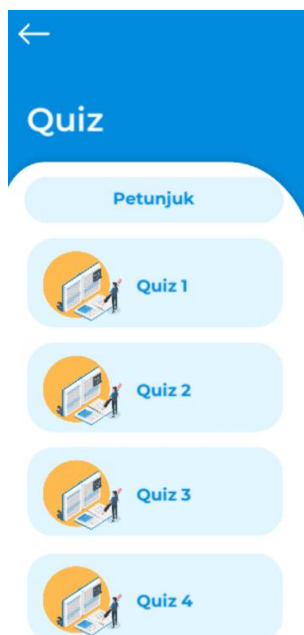**Figure 2.** Learning view

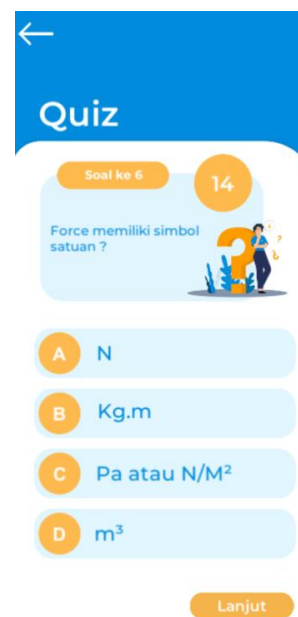**Figure 3.** Quizzes view

Figure 4. An example of quiz view

An example of a quiz question can be seen in Figure 4. This quiz is designed by researchers for students to think more because they use the same term in English language, symbols, and multiple choices' quiz with a time limit of 20 seconds. The speed of students filling in is also an indicator for making decision ability from the learning experience that has been obtained previously[18],[19] To answer correctly, students should study repeatedly, the impact is that they will quickly understand the material discussed on the basis of statics and dynamics in mechanical engineering education, Universitas Negeri Malang [20].

4. Conclusion

This android-based dynamic-static basic assessment product design could be used as an alternative assessment on the basis of statics and dynamics which prepare students to easily follow the dynamics and statics course in mechanical engineering education, Universitas Negeri Malang. This design was made by researchers based on the preliminary analysis of the students' understanding of dynamics and statics basic. In order to develop it, the content of this design needs to be added and adjusted to the needs of students. There needs to be developed not only in the form of two dimension but also in three dimension in order to it will be more interesting and fun.

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