A model of serious game-based learning media on the basic material of statics and dynamics

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Abstract. Purpose of this paper is to explain a serious game based learning media model on the basic material of statics and dynamics for students of mechanical engineering education, Universitas Negeri Malang. This study carried out by research and research (R&D) with the waterfall research model. In the first stage, the design of this model is based on a low understanding of the basic material of statics and dynamics. Through discussions with the lecturers of the course, the authors developed this design to be prepared for trials for mechanical engineering education students at Universitas Negeri Malang. Furthermore, this media model contains two menus, namely materials and quizzes. The material consisted of unit material and mathematics. Meanwhile, the quiz material consisted of four quizzes with Bloom’s taxonomy levels. Through this media model, it is concluded that it will assist students in understanding basic statics and dynamics in the field of mechanical engineering.

1. Introduction

Statics and dynamics are one of the basic engineering subjects for designing a technique mechanism system. Statics and dynamics courses are taught in both mechanical engineering, automotive and mechanical engineering education courses which have 2 credits and 2 hours. The scope of material includes: analysing the basic concepts of statics, analytical kinematics, basic concepts of dynamics, and analytical dynamics [1]. The purpose of learning statics and dynamics is that students are able to apply the basic principles of engineering mechanics related to force systems, the concept of rigid bodies, balance, internal forces and friction to calculate and design simple constructions in certain static engineering mechanics [2]. It can be assumed that success in studying statics and dynamics needs to be supported by the ability to understand the definition of terms and the ability to understand mathematical equations, so that the higher the understanding and mastery of the material, the higher the success rate of learning activities.

The learning process carried out at the university is a major highlight in improving the quality of education. Lecturers are expected to be able to provide an increase in the quality of education, both in terms of thinking skills, personality, character, and a sense of responsibility. In the learning process, lecturers are also expected to provide encouragement and motivation to students to continue learning by utilizing the facilities and infrastructure owned by the university. Underutilized facilities and infrastructure, especially media in learning, it can cause the learning process to be less effective, so that students find it difficult to understand the material taught by the lecturer [3-4]. Based on the results of observations in the Department of Mechanical Engineering, Universitas Negeri Malang, students’ interest and motivation in learning statics and dynamics is low. This is indicated by the low
scores of basic science skills (mathematics, physics, and English Language) obtained during the exam. Generally 40% - 80% of them passed the remedial exam. They consider the subjects of statics and dynamics difficult for students to learn and understand. In addition, the delivery of material by the lecturer is only conveyed through the delivery of information without using tools or learning media, this can cause students to find it difficult to understand the material so that students tend to feel bored when the learning process takes place.

Based on above explanation, the serious game-based learning media model is expected to make it easier for students to better understand the units and basics of mathematics through the serious game-based learning media used. The learning media based on the serious game used are expected to be able to attract students' attention and be able to foster student interest or motivation in the basic material of statics and dynamics. So, the purpose of this study is to explain the serious game-based learning media model on the basic materials of statics and dynamics for mechanical engineering education students at Universitas Negeri Malang.

2. Methods

The type of this study used research and development (R&D) development research with the waterfall model development design [5-6]. However, this paper only discussed the stage of designing the serious game media. Through discussions with the lecturers of the course, the authors developed this design to be prepared for implemented to mechanical engineering education students at Universitas Negeri Malang.

3. Results and Discussion

The research carried out resulted in a product in the form of learning media, namely learning media based on serious games on the basic materials of statics and dynamics for first semester mechanical engineering students. The learning media developed consisted of text, numbers and pictures.

The instructional media design developed is divided into several parts, namely the main menu, supporting icons and the exit button. Inside one of the icons there is a learning menu which is broken down into several sub-chapters according to the learning objectives. The following is the appearance of the serious game-based learning media design.

3.1. Main page

The main page of the serious game is the initial appearance that appears when students open the application of the serious game-based learning media. On the main page there is also an exit button which functions to close the application automatically (see Figure 1).

3.2. Learning menu

The display of the learning menu on the serious game contains learning material about basic statics and dynamics that can be learned by students (Figure 2).
Figure 1. Main page.

Figure 2. Learning menu.
3.3. Quiz questions
The display of quiz questions on the serious game, consists of quiz questions with several question levels, low, medium and high. It aims to determine students' understanding of the use of learning media based on serious games on the basic material of statics and dynamics (Figure 3). Then, the example of quiz can be seen in Figure 4.

![Figure 3. Menu of quiz questions.](image)

![Figure 4. Example of quiz.](image)

3.4. Results of quiz answers
The display of quiz questions on the serious game consists of quiz questions with several question levels, low, medium and high. It aims to determine students' understanding of the use of learning media based on serious games on the basic material of statics and dynamics (Figure 3). Then, the example of quiz can be seen in Figure 4.

Through the use of learning media based on serious games on the basic material of statics and dynamics, this can made it easier for students to understand the material and can make students more interested in learning [7,8], so that student learning motivation increased [9]. This was reinforced by the results of research by previous researchers that the application of serious game-based learning media results in the development of learning media that is more attractive [8,10,11] and improves student learning abilities [12,13,14]. Figure 5 shows the results of quiz answers
Figure 5. Result of quiz answers.

Another study [15] regarding understanding the reception of a serious game by analysing App store data showed that with the development of serious game media on smartphones it can help public awareness and concern for human trafficking and its impact on individuals and society. This proves that the use of serious games is very worthy of being used as learning media [16,17].

4. Conclusion

The development of learning media based on the serious game developed by the researcher was used for basic statics and dynamics for students of mechanical engineering education at the Universitas Negeri Malang to solve the problem of gradual understanding of unit material and mathematics. This media is very easy and prepared in applications for computers and android applications that can make it easier for students to study anywhere and anytime.

5. References

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