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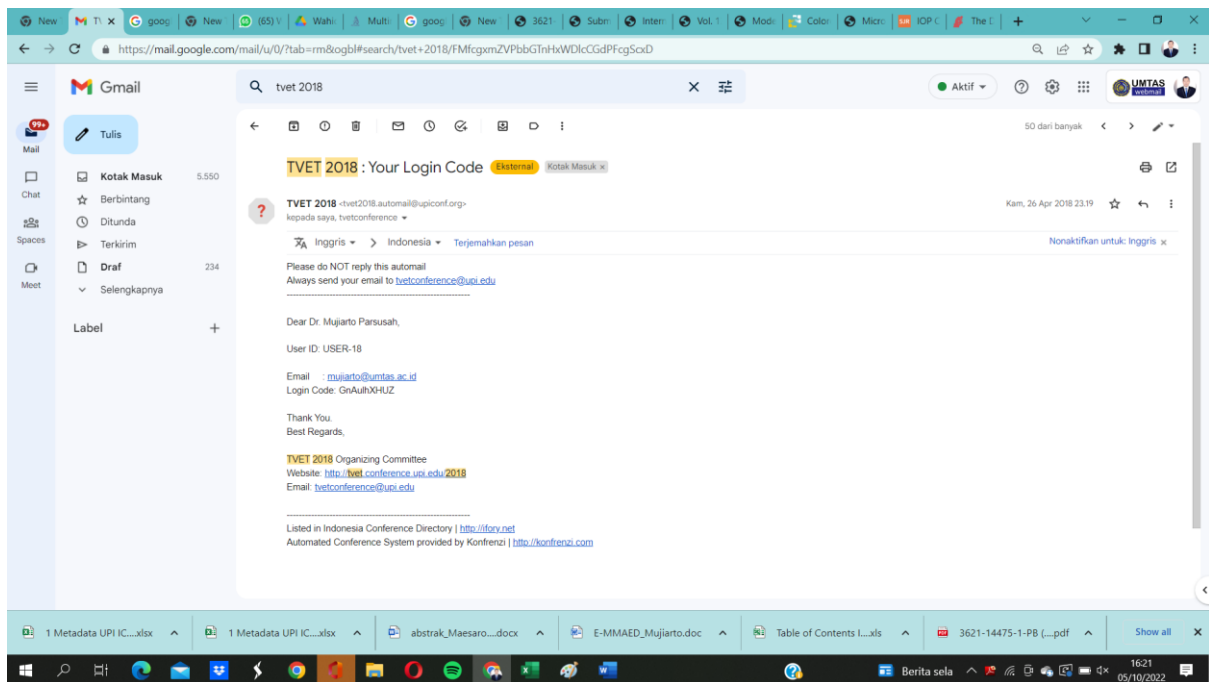
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The Development of Multimedia Engineering Drawing Animations for Increasing Vocational High School Students Competency in Indonesia

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Abstract

Entering the ASEAN Economic (AEC) which started in 2015, there has been a tight competition in ASEAN region, not only in the industrial sector, but also in the improvement of human resources. In some vocational high school focusing on technology and engineering, the teaching and learning process is still conventional. This means the process is still teacher centered. In this study, the researchers developed animation multimedia-based engineering drawing materials by using Adobe Flash Player software. After the animation multimedia-based engineering drawing materials had been designed, the researchers developed the teaching and learning process so that it became student centered. The main objective of this study is to develop innovative materials for the subject of engineering drawing for improving the competency of vocational high school students. The research method employed was research and development (R&D) which includes the design and evaluation stages. The research population include vocational high school majoring in technology and engineering. Teaching and learning processes were conducted in two different classes: class A as a control class and class B as an experiment class. The data collection instruments used were test, rubric and questionnaire. The research data were analyzed by using descriptive analysis, percentage and N-gain. The findings indicate that the developed materials have particular characteristics; the materials are accessible - they can be understood by students, particularly with regard to the subject of orthogonal projection which requires students imagination of an object or a product. Students concept mastery and understanding of the subject improved after using the designed materials, which can be categorized as high level. This research has implications for the improvement of vocational high school students competence in engineering drawing, particularly on the subject of orthogonal projection which requires students imagination of particular object or product by using animation multimedia.

Keywords: Engineering drawing; Orthogonal projection; Innovative; Animation multimedia

The Development of Multimedia Engineering Drawing Animations for Increasing Vocational High School Students Competency in Indonesia

Mujiarto^{1*}, A Djochar², M Komaro², Anggia Suci Pratiwi³, Taofik Muhammad⁴

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Abstract. Entering the ASEAN Economic (AEC) which started in 2015, there has been a tight competition in the ASEAN region, not only in the industrial sector but also in the improvement of human resources. In some vocational high school focusing on technology and engineering, the teaching and learning process is still conventional. This means the process is still teacher centered. In this study, the researchers developed animation multimedia-based engineering drawing materials by using Adobe Flash Player software. After the animation multimedia-based engineering drawing materials had been designed, the researchers developed the teaching and learning process so that it became student-centered. The main objective of this study is to develop innovative materials for the subject of engineering drawing for improving the competency of vocational high school students. The research method employed was research and development (R&D) which includes the design and evaluation stages. The research population includes vocational high school majoring in technology and engineering. Teaching and learning processes were conducted in two different classes: class A as a control class and class B as an experiment class. The data collection instruments used were the test, rubric, and questionnaire. The research data were analyzed using descriptive analysis, percentage, and N-gain. The findings indicate that the developed materials have particular characteristics; the materials are accessible - they can be understood by students, particularly with regard to the subject of orthogonal projection which requires students' imagination of an object or a product. Students' concept mastery and understanding of the subject improved after using the designed materials, which can be categorized as a high level. This research has implications for the improvement of vocational high school students' competence in engineering drawing, particularly on the subject of orthogonal projection which requires students' imagination of a particular object or product by using animation multimedia.

1 Introduction

Entering the ASEAN Economic Community (AEC), competition in the labor market is increasing, including industry and education in the ASEAN region. This requires the existence of modern technology education to improve human resources that have competitiveness, including in vocational high school (SMK) engineering drawing [1]. In general, vocational learning is still centered on teachers in Indonesia. Another problem faced by many is the lack of teaching materials so that the learning objectives are not in accordance with the expected objectives [2]. Therefore, innovative teaching materials are needed to improve the Engineering drawing competence of vocational students.

The use of technology is highly developed in this century. The use of technology is very helpful in increasing understanding of the subjects taken by students so that their values become increasingly [3]. Students today, often referred to as millennials, are very familiar with digital technology such as computers, the internet for communication, entertainment, and access to information. Therefore, the teacher must apply student-centered learning methods using information and communication technology (ICT) in the learning process [4]

Mujiarto et al's research results show that the use of E-MMAED increases learning motivation and

improves student learning outcomes/student competencies [5]. The use of multimedia technology has overcome the constraints of space and time when learning. Multimedia technology empowers the educational process through interaction between teachers and students so that it can be said to be an advantage of educational technology [6]. Another advantage of using multimedia in the learning process is an important contributor to accreditation [7]. Even in Malaysia, the use of multimedia has an effect on students' imagination and visualization [8]. This research is a development from previous research. The purpose of this study was to develop a multimedia animation of Engineering drawings.

2 Methods

This research method used research and development (R & D) methods. R & D in education as a process used to develop and validate educational products [9]. The product developed in this study is in the form of innovative teaching materials for Engineering drawings for vocational high school students of technology and engineering expertise, mechanical engineering expertise programs. The use of the R & D method in this study is to create, develop, and implement innovative teaching materials for vocational high school students from mechanical engineering expertise programs.

* Corresponding author: mujiarto@umtas.ac.id

3 Results and Discussion

The development of the times demands the production of quality human resources. Indonesia's competitiveness in the face of competition between countries and free trade is largely determined by the outcome of human resource development. One of the country's efforts in meeting high-quality middle-level human resources is the development of vocational education. Productive subjects are needed by students of vocational high school (SMK). This is because vocational education is directed to prepare students to enter the workforce [10].

Engineering drawing subjects are needed by engineering students. The student-centered learning process will be helped by the existence of interactive teaching materials such as multimedia animation Engineering drawings. The development of this multimedia animation engineering drawing (MMAED) is the result of research with the R & D method from the previous research in the form of an multimedia animation engineering drawing [5], as shown in Figure 1.

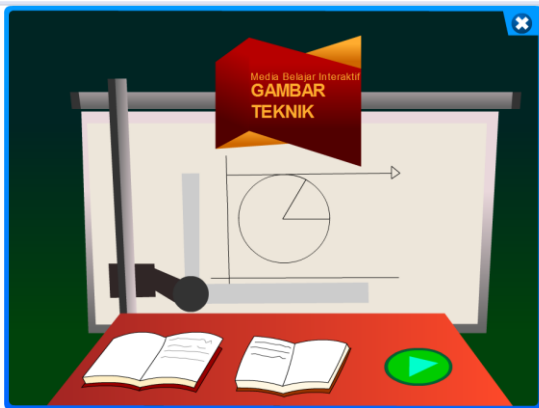


Fig. 1. Multimedia animation of Engineering drawings before development

After development (Figure 2), the results can increase learning interest and learning outcomes/student competencies [3]. The use of multimedia can increase students' interest and interest during the learning process in Malaysia [11]. In addition, multimedia use also helps students increase grades in Switzerland [12].



Fig. 2. Multimedia animation of Engineering drawings from the development of

4 Conclusions

The findings indicate that the developed materials have particular characteristics; the materials are accessible - they can be understood by students, particularly with regard to the subject of orthogonal projection which requires students imagination of an object or a product. Students concept mastery and understanding of the subject improved after using the designed materials, which can be categorized as a high level. this research has implications for the improvement of vocational high school students competence in engineering drawing, particularly on the subject of orthogonal projection with requires students imagination of particular object or product by using animation multimedia.

This research was funded by the Inter-University Cooperation Research Grant (Penelitian Kerjasama Antar Perguruan Tinggi/KPT) from the Ministry of Research Technology and Higher Education (Kemenristekdikti), Republic of Indonesia.

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Tasikmalaya, Indonesia

Abstract—Entering the ASEAN Economic (AEC) which started in 2015, there has been a tight competition in the ASEAN region, not only in the industrial sector but also in the improvement of human resources. In some vocational high school focusing on technology and engineering, the teaching and learning process is still conventional. This means the process is still teacher centered. In this study, the researchers developed animation multimedia-based engineering drawing materials by using Adobe Flash Player software. After the animation multimedia-based engineering drawing materials had been designed, the researchers developed the teaching and learning process so that it became student-centered. The main objective of this study is to develop innovative materials for the subject of engineering drawing for improving the competency of vocational high school students. The research method employed was Research and Development (R&D) which includes the design and evaluation stages. The research population includes vocational high school majoring in technology and engineering. Teaching and learning processes were conducted in two different classes: class A as a control class and class B as an experiment class. The data collection instruments used were the test, rubric, and questionnaire. The research data were analyzed using descriptive analysis, percentage, and N-gain. The findings indicate that the developed materials have particular characteristics; the materials are accessible - they can be understood by students, particularly with regard to the subject of orthogonal projection which requires student's imagination of an object or a product. Students concept mastery and understanding of the subject improved after using the designed materials, which can be categorized as a high level. This research has implications for the improvement of vocational high school student's competence in engineering drawing, particularly on the subject of orthogonal projection with requires student's imagination of particular object or product by using animation multimedia.

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I. INTRODUCTION

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development from previous research. The purpose of this study was to develop a multimedia animation of Engineering drawings.

II. METHOD

This research method used research and development (R & D) methods. R & D in education as a process used to develop and validate educational products [9]. The product developed in this study is in the form of innovative teaching materials for Engineering drawings for vocational high school students of technology and engineering expertise, mechanical engineering expertise programs. The use of the R & D method in this study is to create, develop, and implement innovative teaching materials for vocational high school students from mechanical engineering expertise programs.

III. RESULTS AND DISCUSSION

The development of the times demands the production of quality human resources. Indonesia's competitiveness in the face of competition between countries and free trade is largely determined by the outcome of human resource development. One of the country's efforts in meeting high-quality middle-level human resources is the development of vocational education. Productive subjects are needed by students of vocational high school (SMK). This is because vocational education is directed to prepare students to enter the workforce [10].

Engineering drawing subjects are needed by engineering students. The student-centered learning process will be helped by the existence of interactive teaching materials such as multimedia animation Engineering drawings. The development of this multimedia animation engineering drawing (MMAED) is the result of research with the R & D method from the previous research in the form of a multimedia animation engineering drawing [5], as shown in Figure 1.



Fig. 1. Multimedia animation of Engineering drawings before development.

After development (Figure 2), the results can increase learning interest and learning outcomes/student competencies [3]. The use of multimedia can increase students' interest and interest during the learning process in Malaysia [11]. In addition, multimedia use also helps students increase grades in Switzerland [12].



Fig. 2. Multimedia animation of Engineering drawings from the development.

IV. CONCLUSION

The findings indicate that the developed materials have particular characteristics; the materials are accessible - they can be understood by students, particularly with regard to the subject of orthogonal projection which requires student's imagination of an object or a product. Students concept mastery and understanding of the subject improved after using the designed materials, which can be categorized as a high level. This research has implications for the improvement of vocational high school student's competence in engineering drawing, particularly on the subject of orthogonal projection with requires student's imagination of particular object or product by using animation multimedia.

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