Journal of Engineering Education Transformations ,
Volume 34 , No. 4, April 2021, ISSN 2349-2473, eISSN 2394-1707

E-Learning Based AutoCAD 3D Interactive Multimedia on Vocational Education (VE) Learning

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Abstract: ICT is an important part of the development of secondary education in many countries and becomes a debate subject for its impact on behavior, culture, and society. The addition of new technologies in learning process, especially Vocational Education (VE) can attract attention and even increase the learning speed. However, attentions must be placed to avoid excessive use and accomplishment of material delivery according to the requirements framework. The research focus is to develop an E-Learning based interactive multimedia AutoCAD 3D as an effective learning strategy in VE. The method used in this research is Research and Development (R&D). The instruments of this study are feasibility questionnaire for the expert team and the responses questionnaire for students after using E-Learning interactive multimedia. The study was conducted on 34 students of ± 18-20 years old. Material experts and media experts recommend that AutoCAD 3D Interactive Multimedia meet the " Very Good" criteria. Acknowledgement is given by the opinions of students expressing the same thing, that this media is "Very Good" and can meet the current learning criteria. E-Learning based interactive multimedia becomes a reference to be developed at VE especially on abstract and concrete skills competencies.

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Keywords: Interactive Multimedia, AutoCAD 3D, E-Learning, Vocational Education

1. Introduction

Learning of 21st century has shifted and abandoned traditional learning that is oriented and centered on educators. Technology comes in new forms and what become interesting conversation topics are changing behavior, culture, and society (Larose, 2017). From another point of view, technology is considered to be part of change that results in high-quality, active and in-depth learning . Thus, the presence of technology in learning (Cairncross & Mannion, 2001) needs to be limited and becomes awareness of all parties, so that the usage is effective and not building complete dependency on the technology itself. In the future, internet-based technology will become a primary need that's urgent, massive, and fast, even all data will be stored on the internet in large numbers. All work will be integrated by the internet. Conventional systems will begin to be abandoned gradually. In the context of learning, black boards will be hard to find. Almost all schools will use LCD projectors in the learning process, only occasionally will they be using a whiteboard in a small percentage, even smart projectors. This is part of the change brought by new technology in learning. The same thing has become an inseparable part of millennial generation, the use of social media in large numbers and still increasing in the recent years. Survey results in 2017 reported that 87.13% of internet users are social media users and it became a lifestyle. Society's civilization towards technology in

media literacy, and reading literacy (Islami et al., 2019; Nurtanto et al., 2019) on all services and learning, shifted to social media using ICT. Some of the controversies are in user's age and excessive dependence without parental control that may damage one's psychic. In learning it is necessary to provide mentoring in order to be effective and to have the right boundaries.

Learning in Vocational Education (VE) requires strategies that match the characteristics, appropriate targets, clear goals, measurable competencies and indicators. Specifically, learning that requires skills and critical thinking must be improved properly, from various existing sources, to facilitate the learning process. Improving the quality of learning is influenced by three important aspects, namelylearning models, multimedia, and student-centered learning (Leow & Neo, 2014) . Researchers argue that learning that involves new technology, which was originally two dimensions into three dimensions is more interesting (Hamidi, Kharamideh, & Ghorbandordinejad, 2011) , efficient and fun (García, Quirós, Santos, González, & Fernanz, 2007) , and also have better quality. Interactive multimedia is a savior technology in vocational education. Conventional vocational education materials are translated in interactive electronic form (Neo & Neo, 2004). Some researchers argue that interactive multimedia used in learning can generate interest, motivation, participation, stimulation (Krismadinata, Elfizon, & Santika, 2019) , critical dimensions (Buckingham, 2007) , the improvement can be more than 60% compared to traditional learning — .

E-learning integrated interactive multimedia has become manifestation of 21st century learning (Bormans, Gelissen, & Perkis, 2003; Furht, 1997) . AutoCAD 3D material is the basic applied knowledge for technical drawing and other drawing technologies such as: Autodesk inventor, Autodesk 3dsmax, solid work, Catia. Competencies in 3D AutoCAD require high and critical reasoning. The difficulty of students in general is to construct real objects into abstract in the software. Important competencies that must be possessed are: (1) understanding the use of CAD (DDV Points, Plans, 3D Primitive Objects, Direct Modifications, EDGE and FACE Modifications, Regions, and Extrude); (2) technical drawings (Isolines, FaceTress, Dillet, Chamfer, PolySolid, Revolve, Sweep, Helix, Subtract, Union); and (3) Modification of 3D working drawings (UCS, Rotated 3D, 3D Mirror, 3D Array, Slice, Dynamic UCS, Imprint, PressPull) (Shih, 2014). In 3D drawing, tools integration is needed to form objects (workpieces). The failure rate for beginners is very high, many are not successful. Multimedia is needed in the form of text and images (Mayer & Mayer, 2005) to help students understand. Interactive multimedia that will be developed by researchers is integrated into a website that can be accessed anywhere and anytime, containing tools usage and their implementation to form the finished product, so users can experiment according to instructions on that interactive multimedia. This interactive multimedia is expected to be a solution for VE learning as a form of initial simulation. Therefore, this research will focus on the theme of "E-Learning based AutoCAD 3D Interactive Multimedia on VE learning".

2. Research Methodology

This study is a research and development (R&D) that is oriented to the development of new products. The product developed is AutoCAD 3D interactive multimedia for E-Learning. The research design is 4-D model (Define, Design, Development, and Disseminate), because this development model is arranged systematically and can be used as the appropriate problem solver on learning instrument. The 4D model (Fig. 1.) can be adjusted to the needs and characteristics of students in VE, so that it is flexible and conditional. This research is only carried out until the development stage, which is a limited test on students to gather responses after using the developed interactive multimedia.

Development research was conducted in second semester of 2018/2019. Research location in one of the universities in Yogyakarta province, Indonesia. The test subjects of the research development of AutoCAD 3D interactive multimedia using E-Learning are 34 students of class XI, second semester, with age ± 18-20 years old. This stage is used to determine students' responses on interactive multimedia reception. The object of research is AutoCAD 3D interactive multimedia.

Next, after the data is collected, it is time for data analysis. Research will establish criteria to indicate the assessment level of this development research results. The procedure for taking criteria follows these stages:

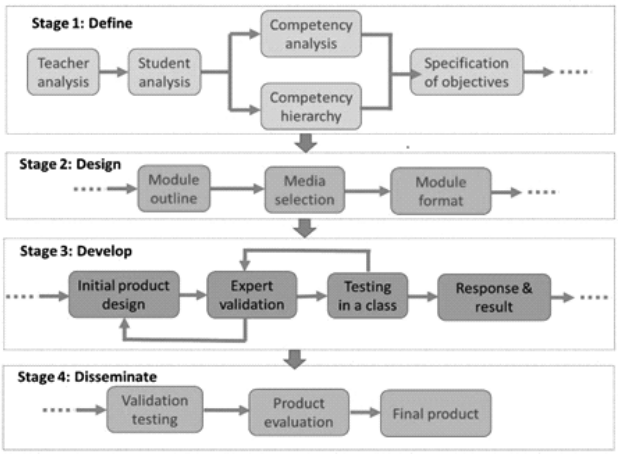

Fig. 1: AutoCAD 3D Education Product Development using 4-D Model

(1) Find the Mid-point of the interval (upper level Likert scale - lower level Likert scale 4-1 = 3)

(2) Divide the Mid Point by the number of levels Likert scale that is 3/4 = 0.75 in

(3) Adding lower values from the lowest scale level and so on,

≤ 1,00 Very low

1,01 – 1,75 Low

1,76 – 2,50 Average

2,51- 3,25 High

3,26 – 4,00 Very High

3. Results

3.1. Development of AutoCAD 3D Interactive Multimedia The initial work in this study was analysis about the needs of educators and students to analyze the competence in AutoCAD 3D. Educator inputs during learning and experience or even students' difficulties became inputs in product development. Analysis of needs was adjusted to the competencies to be achieved, and it lead to interactive multimedia specifications as outlined in a flowchart. In addition, tools panel that make students comfortable in learning had been added as options, such as: music buttons, navigation, zoom in and out areas, reload, etc. Next was collecting material sources from modules, live video recording, clip art images, animations, pictures, and sounds to be packaged in the form of story boards and then developed using flash media, HTML, Java Script, and CSS. Other devices were also used at the end of development, namely: mozilla firefox or chrome. Storyboarding objective was to explain a complete description of the interactive multimedia development which was made in the form of tables with several components such as numbers or frames code, page names, descriptions, media tools, user interface and display indicators. Flowcharts and storyboards packed in Media Content Outlines (GBIM) were an absolute requirement in thedevelopment of this interactive multimedia. The internet was a source for links from developed media. This limited the need for CDs, flash drives and more flexible and practical to access. The media initial display in the form of information about the AutoCAD 3D interactive media and the work menu of the developed learning media is shown in Fig. 2.

Fig. 2: Initial Display of AutoCAD 3D Interactive Multimedia

This page was equipped with several side bar menus including home, competencies, competency maps (Fig. 3.), materials, and simulations as the core of media development, also it is equipped with several additional menus namely testing, library, assistance,

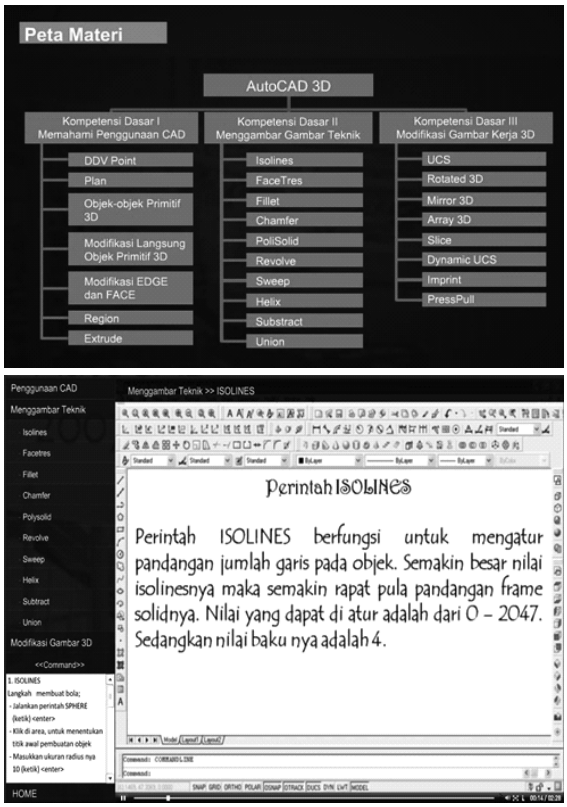

Fig. 3: Display of Material Map and Working Space of AutoCAD 3D Multimedia

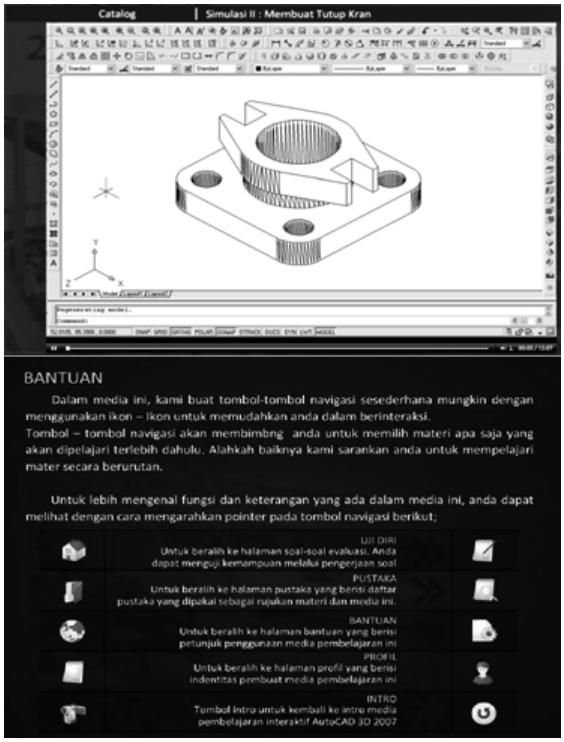

Fig. 4: Display of Material Map and Working Space of AutoCAD 3D Multimedia

profiles, and intros. The material display is in the form of theories from the material map, that are understanding the use of CAD, Drawing Engineering Drawings, and Modifying 3D Working Drawings (Fig. 3). As a media that needs to display the real working space, the display instructions are adjusted to the AutoCAD 2007 work area (Fig. 3). Good media must resemble or equal to the actual conditions. The material menu is an explanation of each branching of the material map that can be directly tested. Higher competence lies in the simulation (Fi. 4.), which is a combination of several tools to make a finished product. There are three views offered and the steps are in the form of video that can be paused or repeated as desired by the user. In this process, competencies are flexible according to the ability of students, so that learning objectives are achieved even though the speed of reasoning is different.

This interactive multimedia is equipped with help menu (Fig. 4.), complete information on the use of each button. One of the requirements for every learning media is that there are media usage instructions or stages, so that novice users are still able to operate and use the media. Media access can be done anytime and anywhere even without being accompanied by educators in the study room. Each media must be equipped with a competency test for both practice and knowledge (Fig. 5.). The success of the learning media is an important reason the media was developed in addition to being a recommendation for media improvement if the results are not suitable.

Fig. 5.: Competency Test Menu Display

3.2.AutoCAD 3D Interactive Multimedia Product Evaluation by Media Experts and Material Experts

Media products that have been developed and declared to be operational, are then tested by professional experts in their fields, they are material

experts and media experts. Assessment is intended to evaluate the feasibility of the media as well as input, opinions, suggestions and evaluations according to the requirements of VE learning media. A total of 3 experts of AutoCAD material and 3 media experts evaluated the media based on the instruments that had been prepared. The assessment recapitulation results are shown in table 1.

Table 1. : Learning Media Evaluation Result by AutoCAD 3D Material

No	Evaluation Aspects	Score Rating			Average	Criteria
1	Educational criteria: material content, interaction, feedback	3,4	2,8	3,0	3,06	Feasible
2	Program Display Criteria: colouring, grammar, interactive buttons, images, animation, sound, buttons, interface design	3,6	3,4	3,6	3,53	Very Feasible
3	The technical quality criteria : program operations, usage and security, errors and facilities	3,0	3,4	3,2	3,20	Feasible
	Total	**3,33**	**3,20**	**3,27**		
	Average all aspects	**3,27**				
	Aspect Category from Material Experts Evaluation	**Very High/ Very Good**				

Based on the validation results in table 1, the interactive multimedia that has been developed is in accordance with the 3D AutoCAD material with "very good" material suitability to meet the curriculum needs in vocational education. Material experts reported that the developed media is very helpful in learning AutoCAD 3D as a whole. The feasibility evaluation from media experts gives better judgment than material experts. The preparation and development of media requirements have met the complete aspects of media for vocational education. Data analysis categorizes learning media in the form of E-Learning integrated AutoCAD 3D Interactive Multimedia is able to provide appropriate competency clarity. All contents in the display have been assessed starting from interface, buttons, errors, material and language are considered "Very Good" with the acquired score of 3.40 (point scale 1-4). 3.4 Students Response in Using Interactive Multimedia AutoCAD 3D The validation phase and some minor improvements have been made by professional experts, then limited tests were conducted to 34 students. The purpose of this test is to determine students' responses after using the media for learning in the classroom. The results of the instruments tested as a whole were 3.53 in the category of Very High or Very Good (Table. 3)

Table 2 :AutoCAD 3D Media Experts Evaluation Result

No	Evaluation Aspects	Score Rating			Average	Criteria
1	Ease of using the navigation key and main menu button	4	3	3	3,33	Very Feasible
2	Clarity and function of buttons on other pages	3	3	4	3,33	Very Feasible
3	The presence or absence of error level that is acceptable to the user	3	3	3	3,00	Feasible
4	Ease of material structure	4	3	4	3,67	Very Feasible
5	Usage of simple and clear language	3	4	3	3,33	Very Feasible
	Total	**3,4**	**3,2**	**3,6**		
	Average all aspects	**3,40**				
	Aspect Category from Media Experts Evaluation	**Very High/ Very Good**				

Table 3 : Students Response Result after Using AutoCAD 3D Media

No	Evaluation Aspects	Average	Criteria
1	I feel that learning with interactive multimedia enhances new understanding and ease of learning AutoCAD 3D	3,40	Very Feasible
2	I feel that this interactive multimedia makes it easy for me to understand functions to make other machine products	3,46	Very Feasible
3	I feel that interactive multimedia can increase my interest, talent, and motivation in using AutoCAD 3D	3,62	Very Feasible
4	I feel that interactive multimedia is easy to understand and can be used any time	3,62	Very Feasible
5	I feel that interactive multimedia is fun to learn	3,58	Very Feasible
6	I feel that interactive multimedia enhances knowledge and practice competencies	3,48	Very Feasible
	Average all evaluation aspects	**3,53**	
	Aspect Category from Students Response Evaluation	**Very High/ Very Good**	

4. Discussion

The learning atmosphere is experiencing a rapid shift (Aljabar et al., 2011; Morgan, 2016) it takes educators who are creative to present learning materials. New technology has a positive influence in

the learning process, this replaces the conventional role which is seen as monotonous. Learning acceleration is needed in vocational education, access to information as a source of learning is very easy, but the source that is in accordance with the characteristics of the curriculum or competence characteristics of students are not easy to come by. It needs requirement analysis that is able to replace students' habits in using the internet into the form of E-learning media.

The researcher concludes that media development must meet several requirements including: (a) flowchart of requirements; (b) development design in the form of storyboards; and (c) Media Content Outline (GBIM). The approach taken will result in a high level of success in interactive multimedia. The selection of experts is crucial to the success of learning in vocational education. Experts must have experience in their respective fields, appointing experts who do not meet the criteria makes the media get low score in assessment.

Learning media is tool to achieve learning competence objectives. AutoCAD 3D material is considered difficult to implement, although it has been assisted with modules. In addition, the direct training methods require a relatively long time, this is due to the diverse abilities of students. So, the development of interactive multimedia becomes a solution in learning AutoCAD 3D. Students can follow the material that has been delivered, or repeat the competencies as needed. With the concept of E-Learning, it is expected that interactive multimedia is easier and more flexible in its use and can be accessed by anyone. In the future, vocational education will further utilize the internet network widely in using new technology.

The validation results carried out by material experts and media experts stated that the E-Learning based AutoCAD 3D interactive multimedia really met the criteria tested. And it was supported by the response of students who are very satisfied and feel helped by this interactive media

5. Conclusions

This product development research concludes that assessments from material experts and AutoCAD media experts give the scores with the category of "Very Good or very appropriate". The average score is 3.27 and 3.40 (Scale 1-4). The category of "very good or very appropriate" has also been submitted by 34 students with the score of 3.53 (Scale 1-4). Students in open expressions are satisfied in the simulation training and all the tools have been delivered properly with more targeted videos. In addition, with limited learning space, it gives more opportunity for E-Learning. It is recommended that excellent media development should employ flowcharts, storyboards, and GBIM.

Acknowledgement

This research is a condition of taking the Postgraduate Program at the Yogyakarta State University.

Noted

The authors of this article, have the same contribution.

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