Development of Video Tutorial Operating CNC Machine Using Nanjing Swansoft Simulator Based on YouTube Chanel as an Alternative Media on Network Learning

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Abstract. This study examines the limitations of CNC (Computer Numerical Control) machine facilities owned by the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan (JPTM FT UNIMED) which are obstacles for students in improving competence. From these problems, alternatives and solutions are needed, namely, utilizing the Nanjing Swansoft simulator software to improve the competence of CNC machining techniques. The lack of CNC machine facilities used in learning CNC machining engineering courses at JPTM FT UNIMED so research on this problem is still needed. This study aims to produce a video tutorial on how to operate a CNC machine using a Nanjing Swansoft simulator based on a YouTube channel. This study aims to produce a video tutorial on how to operate a CNC machine using a nanjing swansoft simulator based on a YouTube channel. The type of research used is research and development (Research and Development) from Borg and Gall. The feasibility of the product was carried out by validating media experts, material experts, learning design experts, small group tests, and field trials for students of JPTM FT UNIMED. Based on the results of product validation, the percentage of media expert assessment results is 92%, a material expert is 91%, and a learning design expert is 92%. Student responses in small group trials obtained a percentage of 92% and 93% in field trials. Based on these results, it can be concluded that the CNC Practice Video Tutorial Using the Nanjing Swansoft Simulator Based on the YouTube Channel that has been developed is feasible to be used as an alternative media for online learning for students of the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan.

1. Introduction

The use of CNC (Computer Numerical Control) machines in learning requires adequate facilities and infrastructure. A place for practice and CNC machine tools is a must that needs to be provided by the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan (JPTM FT UNIMED), especially in the Mechanical Engineering Education Study Program, Faculty of Engineering, State University of Medan (PS PTM FT UNIMED). Campuses that print students with special skills must provide adequate practical facilities and infrastructure. Students can be skilled when maximally using practical tools. Ideally, each student uses one CNC machining practice tool. Moreover, competency-based learning by producing product outputs can increase students' learning speed, learning effectiveness, student competence, creativity, and innovative learning [1]. In this way, competent graduates can be achieved.

However, in reality, the practical learning of Advanced CNC Machining Engineering Courses at PS PTM FT UNIMED still lacks practical tools. Limited availability of CNC machines so that students use one machine in groups. This makes students' skills hampered in operating CNC machines. The availability

of practical facilities from machine tools along with equipment and furniture (tables, chairs, and cabinets) as well as other supporting equipment helps students improve skills [2]. Practical facilities in the form of facilities and infrastructure are demands that must be met so that students have the appropriate competencies [3]. This need should be the basis that must be met in the practical learning process such as the CNC machining Engineering Course.

The limited need for CNC machines can be overcome in two ways, namely: collaborating with industry or training centers in practical learning and practical learning using software assistance. The tool is in the form of using Nanjing Swansoft simulator software in practical learning of CNC machining techniques. Each student can use a computer or laptop that has been installed with the Nanjing Swansoft simulator software provided by the lecturer/educator. This software is not much different from a CNC machine so that the use of this device helps students to practice their skills in operating a CNC machine. This is in accordance with what is described [5], namely learning CNC using a simulator provides an overview of operating a CNC machine. So, students can operate CNC machines individually (one man, one tool) with the help of the Nanjing Swansoft simulator software.

Information and communication technology (ICT) and we often know it in English terms, namely information communication and technology (ICT) have advanced very rapidly and have helped many activities carried out by humans [5]. Internet users in Indonesia are increasing in 2017 and 2020 according to table 1.1 which is below: Table 1.1 Total population and internet access via smartphones in Indonesia in 2017 and 2020 [6].

Table 1. Total population and internet access via smartphones in Indonesia.

Number of population and internet usage via smartphone			
2017		2020	
Total population	Internet access	Total population	Total population Users Internet
268 million	143 million	272,1 million	175,4 million

From Table 1 the total population and internet access via smartphones in Indonesia in 2017 and 2020 we can know that smartphone users are the most frequently used to access the internet and will increase every year because considering technology has advanced very rapidly at this time, it has even become a necessity for the population in Indonesia ranging from children, teenagers, to parents who have used the internet and are included among students in Indonesia [7].

Information technology is one of the factors causing changes in human lifestyles to interact with the outside world. Information technology is influential in various fields, be it in terms of social, economic, cultural, and even in the field of education, [4] can provide great opportunities for educational technologists who use it to access a number of information in the form of text, images, simulations, and sound [5]. It is used and created learning media, teaching materials, group discussions that are integrated with electronic networks. This has an impact on teaching and learning activities by using teaching materials that look more varied and not only focused on printed teaching materials [6].

Learning media includes something that is used in the teaching and learning process to stimulate the thoughts, feelings, interests, and attention of students so that the process of communication and educational interaction between educators and students takes place effectively and efficiently [7]. The learning media that can be used in a lesson that is presented via the internet is the video [8]. Video is a medium to show an element of auditive (hearing) and visual (sight) that can be seen or heard by us [9]. One of the media that can be used as an alternative in learning to increase the effectiveness of learning is video. This is based on the results of various theories that have been developed in this era. A video has several advantages, namely: 1) the video can display motion. Moving pictures can teach things related to a procedure, 2) videos can show a certain example, for example, can show a process of science experiments, 3) Real learning presented via the internet is video. Video is a medium to show an additive (hearing) and visual (vision) element that can be seen or we can hear the voice [8]. One of the media that can be used as an alternative in learning to increase the effectiveness of learning is video. This is based on the results of various theories that have been developed in this era. A video has several advantages, namely: 1) the video can display motion. Moving images can teach things related to a procedure, 2) videos can show a certain example, for example, they can show a process of science experiments, 3) Real facilities develop a learning channel in the form of videos, namely YouTube [10].

Based on the results of preliminary research through the Google share questionnaire form of student

satisfaction/students of the Middle Semester Mechanical Engineering Education Study Program (PS PTM FT UNIMED) conducted to 346 students of PS PTM FT UNIMED it is known that many students know YouTube. Based on the questionnaire given to students about YouTube distributed to 346 students, 99.6% of students responded that they knew what YouTube was, 99.6% of students had opened YouTube, 85.8% of students often watched YouTube, as many as 61.2% of students watch YouTube on average 10-45 minutes, as many as 27.7% of students prefer to watch music videos and 51.6% of students prefer to watch other videos than watching learning videos that only 21.7%. A total of 60.6% of students said that educators had never provided a learning video in the form of YouTube, as many as 94.8% of students wanted a CNC practice tutorial video using a Nanjing Swansoft simulator based on a YouTube channel as an alternative media for online learning, as many as 89.8% of participants students want CNC practice learning videos on YouTube to be presented in the form of CNC practice tutorial videos using the Nanjing Swansoft simulator, and 93.7% of students think that the existence of CNC practice tutorial videos using the youtube channel-based Nanjing Swansoft simulator can help students in online learning.

The results of the analysis of several questionnaire indicators that have been distributed to students of PS PTM FT UNIMED, it is known that students already know a lot, using YouTube but students have not used YouTube as a learning medium, students have also never received learning media in the form of YouTube packaged according to the needs of students of PS PTM FT UNIMED by the lecturers/educators concerned, while students want a learning media in the form of YouTube learning videos which are presented in the form of tutorial videos of CNC practice using a Nanjing Swansoft simulator to replace the practice of real CNC machining techniques at the JPTM CNC workshop UNIMED FT. Media or YouTube-based learning aids are needed for student learning and in the twenty-first century, students are now required to be up-to-date in various fields of education. The media or learning aids used should be packaged online so that the learning space of students is free and wide because online learning is not limited by space and time.

Based on the problems that have been described in the background of the problem, the researchers think it is necessary to research the development of CNC practice video tutorials using the Nanjing Swansoft simulator based on the YouTube channel as an alternative media for online learning.

2. Method

The research method in this study uses research and development methods using the Borg and Gall model with 8 steps because researchers only want to know the responses of students to the products that have been made, 8 steps include [11]:
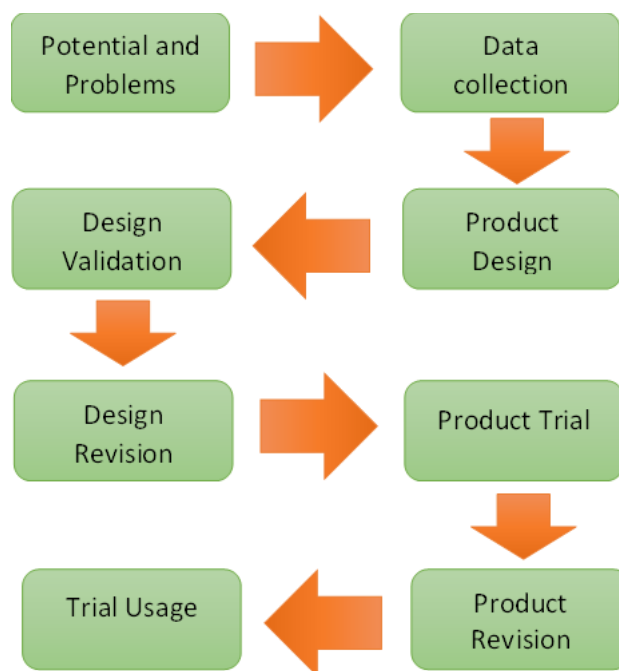

Fig. 1. Bog and Gall models.

The data collected in this study is the validation of media experts, material experts and IT experts as well as student responses. The response data on the product test from the questionnaire assessment were analyzed statistically with the provisions of the assessment using a Likert scale with a scoring rule of 1 to 5, with a score of 1 for the lowest score and 5 for the highest score [12]. So that the average score of each question can be seen by the formula: [13].

$$P = \frac{\sum x}{\sum xi} \, x \, 100\%$$

Information:
P   = Percentage
$\sum x$ = Number of respondents' answers in 1 item
$\sum xi$ = the number of ideal values in the item

The results of the analysis of the instrument sheet are used to determine the responses of the participants validators and student responses to determine the percentage criteria for the feasibility and attractiveness test can be seen in the Table 2.

Table 2. The Feasibility and Attractiveness Interpretation Scale [14].

Interval	Criteria
0% - 20 %	Not good / Dissatisfied
21% - 40%	Less Good / Less Satisfied
41% - 60%	Fairly Good / Fairly Satisfied
61%- 80%	Good / Satisfied
81% - 100%	Very Good / Very Satisfied

3.   Findings and Discussion

3.1 Collecting Initial Information

1.   Theoretical Foundation
Based on a literature review, that the use of video as a learning medium can clarify learning materials by presenting material that is concise and can be used easily so that it is practical to carry and open at any time.

2.   Pre-Research Results (Field Observations)
Pre-research was conducted to determine the needs of students regarding learning media in the form of video tutorials on CNC practice using the Nanjing Swansoft simulator based on the YouTube channel. The results of the pre-research or field observations obtained are, many students already know and use YouTube but students have not received learning media in the form of CNC practice tutorial videos using a YouTube channel-based Nanjing Swansoft simulator while students want learning media in the form of practical tutorial videos. CNC uses the Nanjing Swansoft simulator based on the YouTube channel.

3.2 Planning

After the problem is identified, the next step is research planning based on the stages according to Borg and Gall. This matter carried out by considering the ease of development.

3.3 Product Design Results

Based on the pre-research data, the product specifications to be developed are learning media that students can use in the learning process and learn independently. The following is a plan for developing learning media in the form of a CNC practice tutorial video using the Nanjing Swansoft simulator based on the YouTube channel in the CNC machining engineering course. 1) Initial design of CNC practice tutorial

videos using Nanjing Swansoft simulator based on YouTube channel; 2) Next, create a video tutorial scenario of CNC practice using Nanjing Swansoft simulator based on YouTube channel; 3) prepare tools and materials to make CNC practice tutorial videos using Nanjing Swansoft simulator based on YouTube channel; 4) then take/make a video according to the scenario that has been made; 5) edit the video using the Camtasia and Wondershare Filmora applications and the next step is to upload it to the YouTube channel.

3.4 Storyboard Videos

Table 3. CNC practice tutorial video storyboard using nanjing swansoft simulator based on YouTube channel.

No.	Scene	Time	Video Narrative
1.	Opening	20 second	The opening of this video shows the narrator greeting and explaining the video that will be made
2.	Discussing Swansoft Software Materials	01 second	The video shown is an explanation of the software developed by Nanjing Swan Software Technology Co., Ltd. The software developed by this company includes: FANUC, SINUMERIK, MITSUBISHI, GSK, HNK, KND, DASEN, and other software. This software was developed with the aim of facilitating the learning process in the CNC field without having to incur relatively large costs
3.	Discussing Swansoft Software Materials	01.45 second	This video presents the Steps on how to install the swanfot software
4.	Discussing Lathe Operation Simulation Material with Swansoft Software	04.35 second	This video presents program input material from the mastercam, NC code verification or program editing from the mastercam, operating steps of the Fanuc oi-t CNC turning machine, tool settings, Stock size settings, offset settings, and program simulation steps.

3.5 Expert Due Diligence
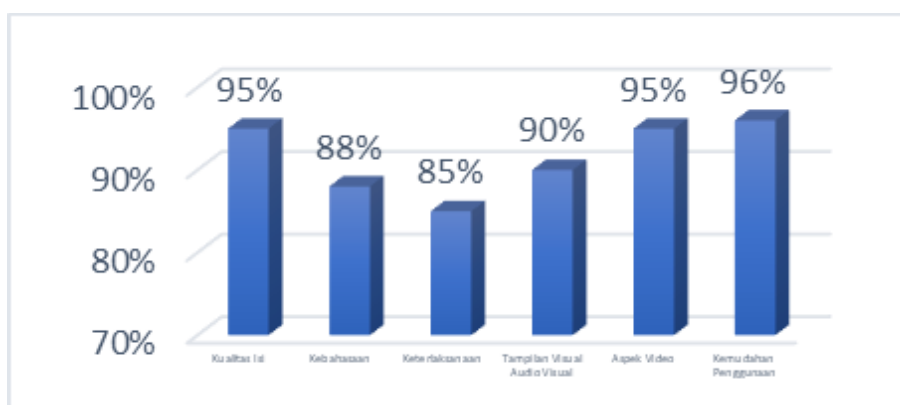
1. Learning Media Expert Validation

Fig. 2. Diagram of the Validation Results of Learning Media Experts.

In the diagram above is the value obtained from the two media experts, then the researcher calculates the percentage of the feasibility score for each aspect of the CNC practice video tutorial media using the Nanjing Swansoft simulator based on the YouTube channel as an alternative media for online learning

using the Likert scale formula with 95% assessment results for a Quality aspect of content, 88% for Language aspect, 85% for Implementation aspect, 90% for visual-audio-visual display aspect, 95% for video aspect and 96% for ease of use aspect. So that the average assessment for all aspects of the CNC practice tutorial video media using the Nanjing Swansoft simulator based on the YouTube channel as an alternative media for online learning is 95%. This shows that video media according to media experts is included in the "Very Good" category.
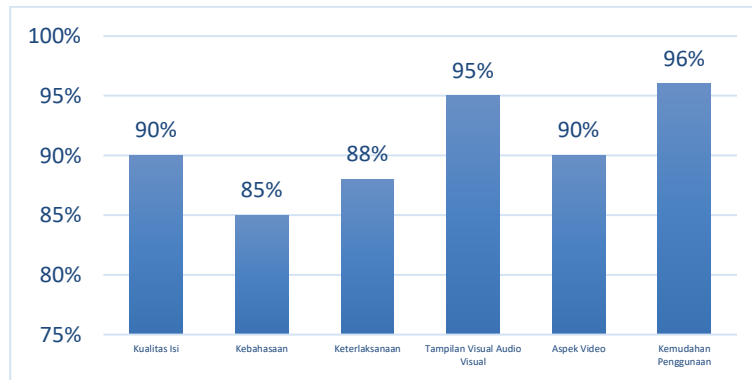
2. Material Media Expert Validation

Fig. 3. Diagram of the Validation Results of Learning Material Experts.

In the diagram above is the value obtained from the two material experts, then the researcher calculates the percentage of the feasibility score for each aspect of the CNC practice video tutorial media using the Nanjing Swansoft simulator based on the YouTube channel as an alternative media for online learning using the Likert scale formula, with an assessment result of 90 % for the quality aspect of content, 85% for the linguistic aspect, 88% for the implementation aspect, 95% for the visual-audio-visual display aspect, 90% for the video aspect and 96% for the ease of use aspect. So that the average assessment for all aspects of the CNC practice tutorial video media using the Nanjing Swansoft simulator based on the YouTube channel as an alternative media for online learning is 90%. This shows that the CNC practice video tutorial media using the Nanjing Swansoft simulator based on the YouTube channel according to the material expert is in the "Very Good" category.
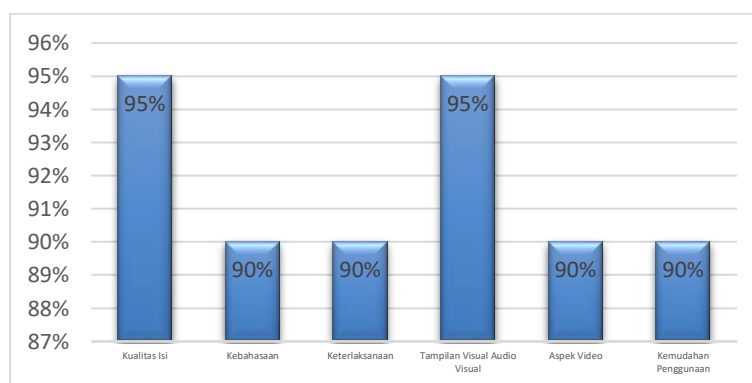
3. Learning Design Expert Validation

Fig. 4. Diagram of the Validation Results of Learning Material Experts.

In the diagram above is the value obtained from the two material experts, then the researcher calculates the percentage of the feasibility score for each aspect of the CNC practice video tutorial media using the Nanjing Swansoft simulator based on the YouTube channel as an alternative media for online learning using the Likert scale formula, with an assessment result of 90 % for the quality aspect of content, 85% for the linguistic aspect, 88% for the implementation aspect, 95% for the visual-audio-visual display aspect, 90% for the video aspect and 96% for the ease of use aspect. So that the average assessment for all aspects

of the CNC practice tutorial video media using the Nanjing Swansoft simulator based on the YouTube channel as an alternative media for online learning is 90%. This shows that the CNC practice video tutorial media using the Nanjing Swansoft simulator based on the YouTube channel according to the material expert is in the "Very Good" category.

4. Learning Media Trial

The trial of the revised learning media was carried out at the Department of Mechanical Engineering Education, FT UNIMED. The trials included small group trials and field trials. The trial was carried out during the learning process, after learning with learning media students were asked to fill out a response questionnaire. The results obtained from these trials are described as follows:

a. Small group trial results

Data from the google form questionnaire obtained during the small group trial consisting of 9 students at JPTM FT UNIMED, can be seen in the following diagram:
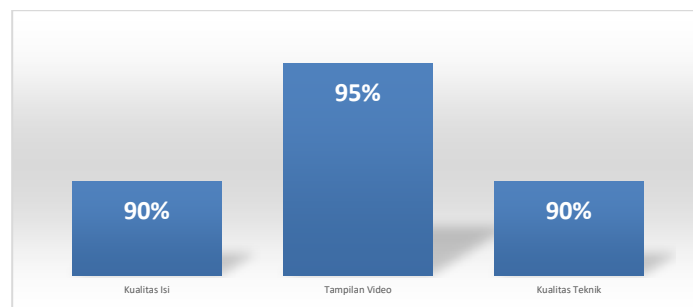

Fig. 5. Small Group Trial Validation Results.

Based on the results of a small group trial of JPTM FT UNIMED students. The results obtained from the small group test are the total value of the percentage of the quality of the content quality of the CNC practice tutorial video media using the Nanjing Swansoft simulator based on the YouTube channel 87%. In the second aspect, the assessment of the video display gets a total score of 87% percentage and on the technical quality aspect, it gets a percentage score of 85%. The average number is 87% with the category Very practical.

b. Field Trial Results

This field test was given to 35 students of JPTM FT UNIMED who were. The field trial procedure is the same as the small group trial, namely by filling out research questionnaires. The results of the Google Form questionnaire distribution are presented in the following diagram:
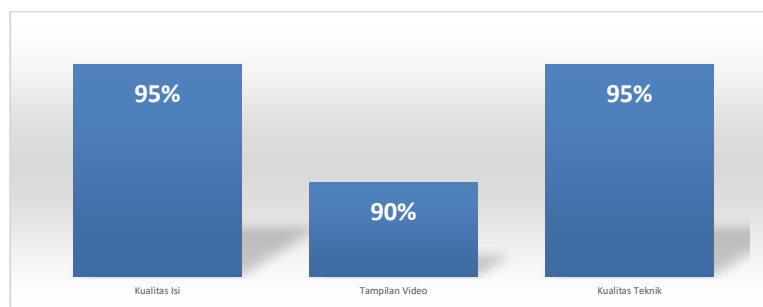

Fig. 6. Field Trial Validation Results.

The results obtained from the small group test are the total value of the percentage of the quality of the content quality of the CNC practice tutorial video media using the Nanjing Swansoft simulator based on the YouTube channel 87%. In the second aspect, the assessment of the video display gets a total score of 87% percentage and on the technical quality aspect, it gets a percentage score of 85%. The average number is 87% with the category Very satisfied.

4. Conclusion

Product feasibility is carried out by validating material experts and media experts. After that, the researchers conducted a small group product attractiveness test on 9 students of the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan, and a field trial by 35 students to see the students' responses. This research will produce a product in the form of a CNC Practice Tutorial Video Using a Nanjing Swansoft Simulator Based on a YouTube Channel. Based on the results of product validation, the percentage of media expert assessment results is 92%, material expert is 91%, and learning design expert is 92%. Student responses in small group trials obtained a percentage of 92% and 93% in field trials. Based on these results, it can be concluded that the CNC Practice Video Tutorial Using the Nanjing Swansoft Simulator Based on the YouTube Channel is appropriate to be used as an alternative media for online learning for students of the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan.

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