The development of turning machine module in vocational high school 2 Yogyakarta

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Abstract. This study has been conducted in order to produce a learning module of lathe machining in vocational high school 2 Yogyakarta. Furthermore, the feasibility of the module and the user response are also evaluated. The method that used in this research was research and development using 4D model. The instrument collection data used in this research was questionnaire. Questionnaire is used at the stage of validation and assessment product by experts and students as product user. From the feasibility test, it could be concluded that the learning media produced is in very feasible level based on all validation score from material expert lecture, material expert teacher, learning media expert lecturer, and students as users.

1. Introduction

Education plays an important role in spurring human performance so that it can adapt to the needs of an increasingly advanced and rapidly developing era. The benchmark of whether a country is progressing or not can be viewed from the quality of education in that country. Humans as residents of a country must always develop themselves, both from knowledge and skills through education by learning throughout their lives. As explained by the Ministry of Education and Culture in Law Number 20 of 2003 concerning the National Education System in Article 1, education is a conscious and planned effort so that students can be actively involved in the learning atmosphere and the learning process to develop self-potential that is useful and beneficial to their life, the nation and country.

Vocational high school (VHS) as one of the educational service providers also has an important role in improving human resources, such as preparing students to become a workforce that is ready to compete with the ability to properly acquire knowledge and skills in certain areas of expertise. According to Pavlopa VHS is defined as secondary education which studies training in certain fields that are more specific and can be used in the world of work [1]. In addition, VHS is also required to be able to create human resources (HR) who could adapt to advances in science and technology [2].

VHS also has special objectives as stipulated in Law Number 20 of 2003 concerning the National Education System which are preparing students to become productive human beings, to work independently, to be able to fill job vacancies with work attitudes, knowledge and skills in accordance with the selected competency well. The development of science and technology as well as the era of the industrial revolution 4.0 requires vocational students as prospective workforce to be able to prepare well. In addition, the existence of the ASEAN Economic Community (AEC) has made the conditions for competing skilled workers tighter, which means that prospective domestic workers must be able to compete with skilled workers from abroad. Therefore, the goals of VHS must be able to be realized by every school.

The learning process in VHS should be carried out to fulfill three balanced domains, i.e. cognitive, affective, and psychomotor. Learning orientation should not only be limited to transferring knowledge from teachers to students. The benefits of these three domains must be directly felt by students in their daily activities. The success of students in achieving these three domains must be supported by many factors, both from teachers and students. A teacher must be able to plan learning, apply models, use
instructional media, and determine learning strategies in realizing learning objectives. Especially in the 2013 curriculum learning a teacher must be a good facilitator so that learning interactions remain active, not monotonous and boring through the learning design that has been designed by the teacher. Students must be able to grow independently and become the center of the learning process (student center).

Based on the results of observations and interviews during the theoretical learning process in the subject of lathe machining techniques at VHS 2 Yogyakarta, there are several problems, such as limited learning resources and the absence of handbooks, learning with the student center system has not yet been implemented, citation or citation by students still using less valid sources, low knowledge and a culture of curiosity among students that have not been formed, teachers still use conventional methods in delivering material, the load of material content is large but the allocation of learning hours is small, and the low motivation for student learning requires teachers to be able to develop learning media which are interesting.

According to Paryanto and Asnawi problems that arise in learning require serious efforts in handling them so that quality learning can be achieved [3]. With the description of the problem above, the researcher analyzes that there is a need for the development of learning media. This is also supported by the need for teachers from the interview results. According to Suryani learning media is interpreted as all forms and channels of information delivery from message sources to recipients that can stimulate thoughts, arouse enthusiasm, attention and willingness of students so that students are able to acquire knowledge, skills, or attitudes that are in accordance with the objectives of the information conveyed. Through the media, it is hoped that learning will be more active and communicative, so that the conventional method that is often used by teachers in the form of lectures that seem monotonous and makes student learning motivation unchanged can be trimmed through the use of learning media [4].

One of the appropriate learning media based on the results of observations and interviews at VHS 2 Yogyakarta, especially in learning lathe machining techniques, is a module. The module is basically a teaching material that is arranged systematically in language that is easily understood by students according to their level of knowledge and age, so that they can learn independently with minimal help or guidance from the teacher [5]. According to Nasution learning using modules provides many advantages and benefits, namely the module provides a lot of feedback and immediately so that students can know the level of learning outcomes, each student has the opportunity to achieve the highest score by mastering the subject matter completely, the module is also arranged in such a way that the goals are clear, specific and achievable by each student so that students can be required or accustomed to independent learning [6].

In making the learning module, there are several factors that must be considered including the material being taught, the subject being studied and the learning environment. In order to produce a module that is able to increase the motivation of its users, the module must include the necessary characteristics such as being able to teach oneself, not depending on other parties, the integrity of the learning material coverage, not depending on other media, adaptive interactive to the development of science and technology, and friendly or familiar with the wearer [7].

According to Widodo who has developed a module as one of the solutions in improving the quality of learning lathe machining techniques at Muhammadiyah 3 Yogyakarta vocational high school, stated that by using a module, student learning outcomes could increase by 57.14% when compared to classes that do not use modules. In a class without using modules, only 36% of students could complete their learning outcomes [8]. In addition, Fariz also states, through the results of module trials that have been developed in learning grinding machining techniques at VHS Muhammadiyah Prambanan, the mean value of students could increase by 97.38% and the level of student active participation also increased by 33.3% before using the module [9]. The development of interactive learning media by manufacturing helical gear using milling machine for vocational high school students has been done by the other researcher. They found that the learning media is suitable to be used in learning process on helical gear material [10]. There was also a study on the influence of improved engineering mechanic module in vocational high school. The results indicated that there was a significant increase in achievement in the
experimental group students after using improved learning media [11]. The other research found that it is important to develop tungsten inert gas welding practical manual for vocational high school [12].

Based on the discussion above, research related to the development of learning media in the form of modules needs to be carried out with the aim of extracting information related to how to develop a lathe machining technique module for VHS 2 Yogyakarta, what is the feasibility level of the module that has been developed, and how students respond as users of the learning module. With the existence of the learning module, it is hoped that the learning process will be more active and communicative, learning is not only teacher-centered but also student-centered and availability of good literature sources could support students to broaden their horizons so that the results of the quality of learning could be improved.

2. Methods
The type of research used is research and development with a 4D development model. The main stages of the 4D development model are define, design, development and disseminate [13]. This research was conducted in VHS 2 Yogyakarta. The targets or subjects in this research and development are experts consisting of material experts, media experts and 25 students.

The first stage in this research is the define stage. In this stage, the activities consist of analysing the curriculum, student characteristics, material and learning objectives. The second stage is design, which was choosing the media to be developed, choosing the form of presentation/ format, and starting to design or simulate the media that has been selected. The third stage of development activities carried out was producing draft module and then validated. Module validation was conducted by material experts and media experts to obtain suggestions and input on modules that have been developed. The product revision stage is the repair or refinement of the product in accordance with the suggestions and input from the validator. The development trial stage is carried out to determine the response of students as users of the modules that have been developed. The fourth stage is disseminate. At this stage the finished product for development began to be disseminated to teachers and students.

The data collection techniques used consisted of observation, interviews, and questionnaires. Observations were conducted for pre-research data related to observations of student characteristics, use of media, application of learning methods, and use of learning tools such as curricula, etc. Interviews were used to gather information to subject teachers with regard to the problems experienced and the needs required by the teacher during the learning process, and questionnaires are used for validation given by material experts and media experts, as well as students during development trials.

The data collection instrument consisted of an assessment instrument for experts as validators and students as product users. The material expert assessment instrument contains a module's feasibility test grid on the material aspects consisting of self-instructional, self-contained, stand alone, adaptive, and user friendly aspects. The media expert's instrument contains a grid of module feasibility tests on media aspects consisting of aspects of format, organization, attractiveness, shape and size of letters, blank space (space), and consistency. As well as the assessment of students as users contains a feasibility test consisting of aspects of material presentation, appearance, learning and benefits. The assessment instrument which is composed of a questionnaire / questionnaire is based on the Likert theory with a scale of four. The explanation regarding the four-scale Likert can be seen in table 1.

| Category          | Score |
|-------------------|-------|
| Strongly agree    | 4     |
| Agree             | 3     |
| Disagree          | 2     |
| Strongly disagree | 1     |

Table 1. Four-scale Likert used in this study [14]
The data analysis technique used is descriptive analysis technique. The data obtained from the agket is in the form of numerical data (quantitative) and then described or described in the form of a description (qualitative). The distribution of the eligibility criteria can be seen in table 2.

| Scale    | Eligibility criteria |
|----------|----------------------|
| 0-25%    | Not feasible         |
| 26-50%   | Less feasible        |
| 51-75%   | Feasible             |
| 76-100%  | Very feasible        |

3. Results and Discussion

The result of the research and development that has been carried out was the lathe machining technique learning module which is printed in color ink on A4 paper size (210 x 297 mm). The module components consist of a cover page, a francais page, a foreword, a table of contents, a module position map, learning activities, a closing section, attachments and bibliography. The cover contains the title, author's identity, module user subject, and the 2013 curriculum as a forum for developing subject matter in the module.

The material in the module consists of 9 basic competencies. The material is divided into 4 learning activities to make it easier for students to master the competencies they want to achieve. In general, students would learn about the parts of a lathe, cutting parameters, cutting tools, and any work that can be done on a lathe. The learning activity section consists of description, the objectives of the learning activity, description of the material, summary, assignment and formative test.

A more detailed explanation of the introduction section consists of a description of the module as a whole and checks the students' initial abilities before learning using a module consisting of indicators of knowledge questions. The learning activity chapter consists of four parts. The four sections study the lathe material from basic competencies 3.1-3.9 could be seen in table 3. Learning activities consist of descriptions of learning activities, terms and objectives of learning, material content, and formative tests. Learning objectives and materials have been adjusted to the 2013 curriculum and the syllabus used in VHS 2 Yogyakarta. Formative tests in learning activities were used to determine the extent of student learning outcomes in each chapter of learning activities through multiple choice questions. The closing section consists of the final test, final ability check and glossary. The final test contains multiple choice questions to determine the ability of the module after studying the four parts of learning activities. The final proficiency check is a benchmark for comparing the success of using the module by checking the initial ability, glossary for foreign vocabulary. The answer key functions for students in knowing the level of student success in the formative test and final test.

| Topics |
|--------|
| Turning machine components (Basic competency 3.1-3.3) |
| Cutting parameters (Basic competency 3.4, 3.5 and 3.8) |
| Cutting tools in turning machine (Basic competency 3.6-3.7) |
| Truning machine job (Basic competency 3.9) |
The results of the validation of the lecturer material expert can be seen in table 4. Based on the results of the validation of the lecturer material expert, it was found that an average rating of the five aspects of the assessment was 85.41% which was categorized as very feasible to use. The highest score was obtained in the user friendly aspect of 93.75%, which means that explanation instructions, use of language according to spelling enhanced, use of terms that are easy to understand and are the advantages of the modules that have been compiled. Meanwhile, based on the lowest assessment results, namely the stand alone aspect of 75%, the module according to material experts cannot be used without the use of other media to make it more optimal. Meanwhile, in the self-contained module aspect, it scores 83.3%, adaptive 87.5% and cell-instructional 87.5 %%, which means that the feasibility indicators for each aspect fall into the very feasible category.

| Aspect               | Score     | Category      |
|---------------------|-----------|---------------|
| Self-instructional  | 87.5%     | Very feasible |
| Self-contained      | 83.3%     | Very feasible |
| Stand alone         | 75%       | Feasible      |
| Adaptive            | 87.5%     | Very feasible |
| User friendly       | 93.75%    | Very feasible |

The results of the teacher material expert validation can be seen in table 5. Based on the results of the validation of the teacher material expert, it was obtained that an average rating of the five aspects of the assessment was 85.19% which was categorized as very feasible to use. The highest score is obtained in the self-instructional aspect of 96.87% which means that related to the suitability of the material, learning activities, learning objectives to be achieved in the module according to the material expert is very in accordance with the conditions and needs of students and teachers in the learning process of lathe machining techniques. Meanwhile, based on the results of the lowest assessment, which is user friendly, it gets a score of 75%, meaning that the use of language, the use of foreign terms is still difficult for students to understand in particular. Meanwhile, in the self-contained module aspect, it scored 83.3%, stand alone 83.3%, adaptive 87.5%, which means that the feasibility indicators for each aspect fall into the very feasible category.

| Aspect               | Score     | Category      |
|---------------------|-----------|---------------|
| Self-instructional  | 96.87%    | Very feasible |
| Self-contained      | 83.3%     | Very feasible |
| Stand alone         | 83.3%     | Very feasible |
| Adaptive            | 87.5%     | Very feasible |
| User friendly       | 75%       | Feasible      |

The results of the media expert validation can be seen in table 6. Based on the results of the media expert's validation, it was found that an average rating of the six aspects of the assessment was 89.54% in the very suitable category. The highest score was obtained in the consistency aspect of 93.75%, which means that according to the expert, the module media is very feasible to use for consistency problems in the use of letters, spacing, layout and the writing itself. Meanwhile, the lowest score is in the organizational aspect of 84.61%, which means that the module must be improved with regard to completeness, readability and layout. Meanwhile, the aspects of format, attractiveness, and free space
each obtained a value of 90% which were included in the very feasible category on each of the assessment indicators.

| Table 6. Validation result of media expert by teacher |
|-----------|-----------|-----------|
| Aspect    | Score     | Category  |
| Format    | 90%       | Very feasible |
| Organisation | 84.61%     | Very feasible |
| Attractiveness | 90%       | Very feasible |
| Font shape and size | 88.89%   | Very feasible |
| Space used | 90%       | Very feasible |
| Consistency | 93.75%    | Very feasible |

The module development stage was also tested to find out the responses or responses of students as module users. In this trial, the module obtained a score of 2889 from the maximum expected score of 3300. The total value is then percentaged with a total percentage result of 87.50% which is included in the very feasible category based on several aspects of assessment i.e. material presentation, appearance, learning and benefits. The last stage, namely the dissemination of the module as a finished product began to be disseminated. The modules are printed in limited quantities of color ink. Apart from that, the distribution was also carried out by distributing modules in the form of soft files so that they could be used by teachers and students in VHS 2 Yogyakarta.

4. Conclusion

The result of this research and development is a product in the form of a module developed through the 4D model procedure. The modules are printed on A4 size paper (210 x 297 mm) with colored ink. The module components consist of a cover page, a francais page, a foreword, a table of contents, a module position map, learning activities, a closing section, attachments and bibliography. The material in the module consists of nine basic competencies which are divided into four learning activities. Learning activities consist of descriptions, objectives of learning activities, material descriptions, summaries, assignments and formative tests. The content of the material has been adjusted to the 2013 curriculum applied in vocational high schools majoring in mechanical engineering, with adjustments to the available lesson hours and the syllabus used by teachers in schools.

The results of the module feasibility test validation conducted by material experts and media experts. The results of the validation from the material expert by lecturer obtained a total value of 85.41% in the very feasible category. The results of the validation from material expert 2, which was a teacher majoring in engineering in VHS 2 Yogyakarta, obtained a total value of 85.19% in the very feasible category. The average module feasibility test of the two material experts is 85.30% which is in the very feasible category. Meanwhile, the results of the validation from the media expert which is the lecturer in the media expert department Universitas Negeri Yogyakarta obtained a total score of 89.54% which is in the very feasible category. Student responses in the form of assessment as module users get a total value of 87.50% which falls into the very feasible category.

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