DEVELOPING A LATHE-MACHINING MODULE FOR THE GRADE XI STUDENTS OF MACHINING ENGINEERING STUDY PROGRAM AT SMK N 2 KLATEN

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Abstract. This study aimed to identify the stages or procedures in developing a lathe-machining module and examine the appropriateness level of the developed module. This was a Research and Development study employing the modified version of Thiagarajan’s 4D model, consisting of defining, designing, developing, and disseminating stages. This study was carried out in a state vocational high school SMK N 2 Klaten, particularly in Machining Engineering study program. The developed module proved appropriate based on the results of expert judgments and a user response test. Material expert I and II assessed the module in five aspects and gave a mean score of 3.53 and 3.56 respectively, indicating that the module was highly appropriate. A media expert validated the module in seven aspects and yielded a mean score of 3.74 (highly appropriate). Meanwhile, the user response test in two aspects resulted in a mean score of 3.41 (appropriate).

Keywords: development, module, lathe-machining engineering

1. INTRODUCTION
Education is important for many reasons, and one of which is to produce quality, excellent, and dignified human resources in every aspect of life. Vocational High School (VHS) as one of vocational education institutions aims to produce human resources that are ready to work and have quality skills. Therefore, the quality of education in VHS, particularly in the aspect of learning process, must always be improved by referring to the latest development of science and technology so that the learning outcomes can be optimized and meet the targets.

As observed in the teaching and learning process of Lathe Machining Engineering subject in Grade XI of Machining Engineering study Program, SMK N 2 Klaten, there were some problems encountered by both the teacher and the students. The teacher used a lecture method in delivering the materials and wrote down the materials on the whiteboard, while the students tended to be passive as they listened to the teacher’s explanation and copied what the teacher wrote. In addition, the students were less independent in their efforts to understand the subject matter. When they were asked to do a task, they...
could not make it for they did not understand the materials. Another constraint was caused by the inappropriate media used in the teaching and learning process, leading to learning ineffectiveness. Therefore, a learning media in the form of module was needed to enable the students not only to prepare themselves before the lesson began but also to learn independently without much guidance from the teacher.

In delivering the materials, teachers are expected to use media. Sadiman et al. (2012: 14) assert that learning media as one of the resources that can be used to deliver messages can help overcome differences in learning styles, interests, intelligence, limited sensory abilities, disabilities, geographical and time distance, etc. Modules are printed learning media, consisting of learning objectives, materials, learning resources, activities, worksheets, and evaluation tasks that are systematically arranged to be learned by the students. Similarly, Daryanto (2013: 9) defines modules as learning materials that are developed in a complete and systematic manner, covering a set of planned learning experiences designed to help students achieve specific learning goals. A module must at least contain learning objectives, materials, and evaluation.

The Directorate of Vocational Education, the Ministry of Education of Indonesia, sets five characteristics of a module, namely self-instructional, self-contained, stand alone, adaptive, and user-friendly. In addition, to function effectively, a module has to be designed and developed in accordance with the predetermined quality elements. Arsyad (2001: 85 – 87) mentions six elements that must be fulfilled to ensure the quality of a module, namely format, organization, attractiveness, font type and size, space, and consistency.

Yuwono and Suprapto (2011) developed a microcontroller (AVR) module using Proteus Professional V7.5 Sp3 software. The developed module could meet the targeted competences and was appropriate to be used. In the same vein, Avianto (2016) successfully developed a Basic Mechanical Engineering module for Grade X students using the 4D model proposed by Thiagarajan.

The relevance of Avianto’s research (2016) to the current study was that both developed a learning medium in the form of a module using the 4D model.

Based on these problems, this study focused on identifying the stages or procedures in developing a lathe-machining module for Grade XI students of Machining Engineering study program at SMK N 2 Klaten, and examining the appropriateness level of the developed module.

2. METHOD
2.1 Research Design
This was a Research and Development (R & D) study. R & D is a research method employed to create a certain product and test its effectiveness. The development model adopted in this study was the 4D model of Thiagarajan.

2.2 Research Setting
This study was carried out in SMK N 2 Klaten in February to March, 2018.

2.3 Research Subjects
The subjects of this study were two material experts (one Mechanical Engineering lecturer from Yogyakarta State University with an expertise in lathe machining and one Machining Engineering teacher from SMK N 2 Klaten) and one media expert (a Mechanical Engineering lecturer from Yogyakarta State University with an expertise in learning media). In the user response test, 66 Grade XI students majoring Machining Engineering at SMK N 2 Klaten were employed as the respondents. Meanwhile, the research object was the lathe-machining module.
2.4 Procedure
The researchers adopted the 4D development model proposed by Thiagarajan as cited by Mulyatiningsih (2013: 195 – 199). This model consisted of four main stages, namely defining, designing, developing, and disseminating, which were modified into twelve detailed stages as depicted in Figure 1.

![Figure 1. The Procedures for Developing the Module](image)

2.5 Data Collection Technique
The data of this study were collected using a 4-Likert scale questionnaire ranging from 4 “very good” to 1 “poor”. The instrument for the appropriateness test was developed based on the five characteristics of a module, namely self-instruction, self-contained, stand alone, adaptive, and user-friendly. The instrument to be used by the media expert included the aspects of format, organization,
attractiveness, font type and size, space, consistency, and the presentation of images, whereas the one used by the students in the user response test covered such aspects as usability and ease of understanding.

2.6 Data Analysis Technique
Both qualitative and quantitative data were analyzed using descriptive statistics to investigate the appropriateness of the lathe-machining module. The assessment used the Likert scale with four alternative answers as shown in Table 1.

| Assessment Aspects | Scores |
|--------------------|--------|
| Very Good          | 4      |
| Good               | 3      |
| Fair               | 2      |
| Poor               | 1      |

The appropriateness of the module could be identified through the mean score of each instrument that was distributed to the material experts, the media expert, and the students as the respondents and was calculated using Equation 1 as follows:

\[
\text{Mean Score} = \frac{\text{Total Score}}{\text{The number of respondents} \times \text{The number of instrument items}} \quad \ldots (1)
\]

The obtained mean scores were then classified into intervals that showed their appropriateness levels. The interval ranges from the “inappropriate” to the “highly appropriate” category were determined by using Equation 2 (Widoyoko, 2015: 110).

\[
\text{Interval Range} (i) = \frac{\text{Maximum score} - \text{Minimum score}}{\text{The number of interval classes}} \quad \ldots (2)
\]

Based on the yielded interval ranges, the researchers could set the appropriateness classification of the module as seen in Table 2.

| Intervals     | Product Categories         |
|---------------|---------------------------|
| 1 – 1.75      | Inappropriate              |
| >1.75 – 2.5   | Fairly Appropriate         |
| >2.5 – 3.25   | Appropriate                |
| >3.25 – 4     | Highly Appropriate         |

The above classification was used as a reference in deciding whether the module was appropriate or not. The developed module had to have a minimum mean score of > 2.50 to be appropriate as a learning medium.
3. RESULTS AND DISCUSSION

This study began with the first stage in the 4D model, namely the defining stage. This stage included the analyses of curriculum, students’ characters, as well as materials, and formulation of objectives. In the designing stage, the researchers developed the grand design as well as the framework of the module (Draft I). In the development stage, Draft I was validated through expert judgment and was revised into Draft II. Draft II was then validated through a user response test, and the results were used for revision. The disseminating stage was modified into two sub-stages: module enhancement and limited distribution to the students at school.

The module was made up of three main sections: front matter, body matter, and end matter. Each of these sections consisted of smaller sub-sections. The front matter included the cover of the module, acknowledgment, table of contents, list of figures, and the manual and requirements for using the module. The body matter covered four basic competences. The materials were always presented in order from introduction, learning indicators, learning objectives, materials, and evaluation tasks. At last, the end matter was made up of reference, glossary, and answer key. The module was developed in such a way that it met the aforementioned characteristics and elements of module quality.

To determine the appropriateness level of the module, the data obtained from both the expert judgment and user response test were analyzed. The results were then converted using the following classification guidelines:

| Intervals       | Product Categories |
|-----------------|--------------------|
| 1 – 1.75        | Inappropriate      |
| > 1.75 – 2.5    | Less Appropriate   |
| > 2.5 – 3.25    | Appropriate        |
| > 3.25 – 4      | Highly Appropriate |

3.1 The Validation from Material Expert I

The material expert I was a Mechanical Engineering lecturer from Yogyakarta State University with an expertise in machining field. He evaluated the module in five aspects: self-instructional, self-contained, stand alone, adaptive, and user-friendly. The expert judgment results from the material expert I are presented in Table 4.

| Scoring Aspects   | Scores | Categories       |
|-------------------|--------|------------------|
| Self- Instructional | 3.53   | Highly Appropriate |
| Self-Contained     | 3.67   | Highly Appropriate |
| Stand Alone        | 3.5    | Highly Appropriate |
| Adaptive           | 3      | appropriate      |
| User-Friendly      | 3.67   | Highly Appropriate |
| Mean               | 3.53   | Highly Appropriate |

As presented in Table 4, the material expert I gave a mean score of 3.53, 3.67, 3.5, 3, and 3.67 for the self-instructional, self-contained, stand alone, adaptive, and user-friendly aspects respectively, resulting in a total mean score of 3.53. It indicated that the module was highly appropriate.

3.2 The Validation from Material Expert II
The material expert II was the Grade XI lathe-machining teacher of SMK N 2 Klaten. He assessed the validity of the module on five aspects like those used by the material expert I. Table 5 summarizes the validation results from material expert II.

**Table 5. Data Analysis Results from the Material Expert II**

| Scoring Aspects     | Scores | Categories          |
|---------------------|--------|---------------------|
| Self-Instructional  | 3.58   | Highly Appropriate  |
| Self-Contained      | 3.67   | Highly Appropriate  |
| Stand Alone         | 3      | Appropriate         |
| Adaptive            | 3.5    | Highly Appropriate  |
| User-Friendly       | 3.67   | Highly Appropriate  |
| **Mean**            | 3.56   | Highly Appropriate  |

As indicated in Table 5, the material expert II gave a mean score of 3.58, 3.67, 3, 3.5, and 3.67 for the self-instructional, self-contained, stand alone, adaptive, and user-friendly aspects respectively, resulting in a total mean score of 3.56. It indicated that the module was highly appropriate.

### 3.3 Cohen’s Kappa Agreement Test

For there were two material experts assessing the validity of the module, the Cohen’s Kappa agreement test was carried out to measure the degree of agreement between the two raters.

The data obtained from both material experts were analyzed quantitatively using Cohen’s Kappa coefficient in SPSS version 23.0. The results of the agreement test are presented in Table 6.

**Table 6. The Results of the Cohen’s Kappa Agreement Test**

| Measure of Agreement | Kappa | Asymptotic Error | Approximate T-value | Significance |
|----------------------|-------|------------------|---------------------|--------------|
|                      | .798  | .110             | 4.382               | .000         |
| N of Valid Cases     | 30    |                  |                     |              |

The data from the Cohen’s Kappa agreement test were then classified based on the strength of agreement scales as presented in Table 7.

**Table 7. Strength of Agreement based on the Kappa’s Value**

| Value of Kappa | Strength of Agreement |
|----------------|-----------------------|
| < 0.20         | Poor                  |
| 0.21 – 0.40    | Fair                  |
| 0.41 – 0.60    | Moderate              |
| 0.61 – 0.80    | Good                  |
| 0.81 – 1.00    | Very Good             |

As suggested in Table 6, the yielded Kappa value was 0.798, indicating good agreement. In other words, the degree of consistency between the two material experts in evaluating the lathe-machining module was good.
3.4 The Validation from Media Expert

The media expert was a lecturer of Mechanical Engineering study program, Yogyakarta State University. He evaluated the module in seven aspects: format, organization, attractiveness, font type and size, space, consistency, and the presentation of images. The expert judgment results from the media expert are presented in Table 8.

| Scoring Aspects | Scores | Categories       |
|-----------------|--------|------------------|
| Format          | 3.5    | Highly Appropriate |
| Organization    | 3.9    | Highly Appropriate |
| Attractiveness  | 3.83   | Highly Appropriate |
| Font            | 3.57   | Highly Appropriate |
| Space           | 3.25   | Highly Appropriate |
| Consistency     | 3.67   | Highly Appropriate |
| Image           | 4      | Highly Appropriate |
| **Mean**        | **3.74** | **Highly Appropriate** |

As indicated in Table 8, the media expert gave a mean score of 3.5, 3.9, 3.83, 3.57, 3.25, 3.67, and 4 for the format, organization, attractiveness, font type and size, space, consistency, and the image aspects respectively, resulting in a total mean score of 3.74. It indicated that the module was highly appropriate.

3.5 The Results of the User Response Test

The user response test was carried out to investigate the students’ response to the developed module in terms of its usability and ease of understanding. The detailed test results are presented in Table 9.

| Scoring Aspects | Scores | Categories       |
|-----------------|--------|------------------|
| Ease of Understanding | 3.42 | Highly Appropriate |
| Usability       | 3.4    | Highly Appropriate |
| **Mean**        | **3.41** | **Highly Appropriate** |

In terms of the ease of understanding and usability, the module scored 3.42 and 3.4 respectively. With a total mean score of 3.41, the module was categorized as “highly appropriate.”

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This study aimed to develop a lathe-machining module using the modified version of the 4D method (defining, designing, developing, and disseminating) proposed by Thiagarajan. The results of the validation from both material expert I and II, 3.53 and 3.56 respectively, indicated that the module was highly appropriate. Similarly, the validation result from the media expert (3.74) suggested that the module was highly appropriate. In addition, the students also considered the module highly appropriate as the results of the user response test yielded a mean score of 3.41.
To sum up, the late-machining module developed for the Grade XI students majoring Machining Engineering at SMK N 2 Klaten was appropriate to be used in the teaching and learning process.

4.2 Recommendations

For further study on module development, it is suggested that the researchers broaden the scope of the materials, present the materials in a clear, concise, and interesting way, add more exercises, vary the question types not only to those related to the subject matters but also to the things or phenomena related to the lathe-machining. In addition, it is expected that there will be other studies investigating the effectiveness of the module when used in the learning process or when compared to other media.

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