Development of Print Modules into Electronic Modules in Food Microbiology Courses

Ruhul Fitri Rosel1, Anni Faridah2, Kasmita3, Ambiyar4
Ulierosel09@gmail.com, faridah.anni@fpp.unp.ac.id, kasmita70@fpp.unp.ac.id, ambiyar@ft.unp.ac.id
Universitas Negeri Padang

Abstract
Food microbiology is one of the compulsory and important subjects as a basis for advanced courses such as Food Control, Food Preservation and Food Technology. Students experience difficulties in understanding learning material because there is no valid and practical media to use. To overcome this problem, media development was carried out in the form of E-modules for Food Microbiology Courses. The aim of this research is to develop E-module on Food Microbiology course in terms of material, format and presentation. This research uses the method Research and Development. E-module development using 4D models. Number of test validators validity 6 lecturers, consisting of 3 media test validator lecturers and 3 material test validator lecturers as well as 27 students majoring in Culinary Management. The average result of the assessment of material validation is 0.84 with the Valid category. Data were analyzed using the Aiken’s V formula. The average result of the E-module validation assessment was 0.85 in the Valid category. The overall average result of the E-module validation on Food Microbiology Course is 0.84 with the Valid category. The average percentage of practicality by lecturers is 86.3% in the very practical category while the average practicality by students is 83.29% in the very practical category. Based on the results of all analyzes can concluded E-module Food Microbiology Course is suitable for use in learning.
A. Introduction

Advances in science and technology demand continuous adaptation of technical advances in an effort to improve the quality of education, especially in updating the use of information and communication technology in the process of learning activities. Learning is a component consisting of various systems that are connected to one another. In essence, learning activities are interactive activities between educators and students that occur either directly or indirectly.[1]

This technological development encourages the creation of new creative and innovative innovations, one of which is in the form of electronic learning. E-learning is a new learning process combined with very fast information and communication technology, one of which is learning media such as e-modules. E-modules are electronic learning resources that combine material, procedures, limitations, and evaluation methods that are arranged methodically and aesthetically to achieve skills according to the curriculum[2]. In line with that (Irawati & Setyadi, 2021) superior learning modules will be able to create motivation and improve students' fundamental abilities[3].

With the current e-module, it is hoped that it can help students capture information more simply and to inspire students in the learning process. This e-module is offered in various formats including videos and pictures when delivering learning information, and is equipped with assessment questions. E-modules are designed to make it easier for students to access the material they need in learning without any time limits whenever and wherever they want, and to make it easier for students to remember and understand the material because they don't just rely on one sense. (Sari et al, 2022) in his research explained that e-modules can be used in the teaching and learning process to improve student learning outcomes[4]. In line with research (Rusmanto & Rukun, 2020) says that e-modules are an excellent and effective form of learning media to use at this time[5].

Based on observations that have been made on students who have taken and passed the Food Microbiology course at the Faculty of Tourism and Hospitality, Padang State University, it was found that many students had difficulty understanding the material due to a lack of motivation in learning. This is caused by the large amount of content that must be mastered by students and the lack of reading material in these courses. Even now, the media used tend to be printed books, handouts, and power points. Food microbiology is one of the compulsory and important subjects as a basis for advanced courses, such as food control, food technology, and food and nutrition research. Food microbiology is a subject that is classified as difficult to understand for the Family Welfare Education Study Program, especially the Culinary Department. Because the material in this lesson is very broad and complex, a comprehensive learning media package is needed that contains material, videos, and images that are easily available and according to student preferences. The use of e-modules in this course is ideal because it can be used anywhere and anytime.

Seeing this phenomenon, it is known that the learning approach applied previously was not able to help students understand the material and obtain solutions to the problems given, this e-module for food microbiology courses had never existed before. As a result, students are less interested in independent learning, and rely more on explanations from lecturers, books and online services.
[6]. Therefore there is a need for innovation in food microbiology courses so that students feel happy and can understand the material during learning[6].

Before being used in learning, the e-module must be valid. The validity used in this research is material validation, format validation, and e-module presentation validation in microbiology courses. Validity is the method used to determine whether the measured data is valid or not. In line with the opinion (M et al., 2019) validity is a metric used to determine the level of validity of an instrument so that the instrument can be used if it produces high validity[7].

Based on these problems, the researcher wants to create an e-module learning media for food microbiology courses in order to improve learning outcomes and students' cognitive and psychomotor values. The researchers conducted a study entitled "Development of E-Modules in Food Microbiology Courses". The purpose of this research is to develop an e-module learning media in the Food Microbiology Course. The reason for conducting this research was motivated by the absence of valid and practical learning e-modules in the Food Microbiology Course.

**Literature Review**

The module is a learning design that is based on the curriculum as a potential source of support in learning activities. Modules are interpreted in the form of independent teaching, so modules are characterized as a single unit of educational material that can be used for individual learning and displayed in electronic format, with the aim of increasing student interest and motivation in learning [8][9]. The module aims to help students understand the subject matter being taught. Each module provides a background for understanding and applying certain subjects[10][11]. The module that will be designed and developed has two objectives, namely that it can be used by students as an independent learning tool at home and by teachers as an aid or complement to teaching in class. The development of electronic modules can be a solution to support the learning process[12]. E-module is a learning resource that is considered innovative. To arouse students' interest in learning the e-module, it includes various components such as graphics, video links, practice questions, and formative exams[8]) Food microbiology is a branch of science that studies the influence of microorganism cells on food processing, especially mechanism of resistance of microorganisms to processing[13].

**B. Research Method**

The type of research used is the method of research and development (Research and Development). Development research is the study strategy used to manufacture goods and verify their validity and applicability. The 4D model is used in the research method. The 4D model consists of 4 steps: Define, Design, Develop and Disseminate (Thiagarajan, 1974). The validity test of the E-module was carried out by competent validators, namely 3 media expert validators and 2 material expert validators, for the effectiveness of 30 students taking microbiology courses. This research was conducted in semester 3 at the Culinary Department, Faculty of Tourism and Hospitality, Padang State University from July to December 2022. The data collection approach was used to calculate information that would be used by
The data collection technique in this study was in the form of a questionnaire. Descriptive analysis approach was used in this study to calculate the percentage of validation and practicality results. Figure 1 illustrates the research method.

![Diagram of research method]

**Figure 1.** Microbiology E-module Development Stage Using 4D Models

C. **Result and Discussion**

The results of this development research are in the form of a product, namely E-module in the Food Microbiology course. This learning media product is a source of independent learning which students can use at any time. Because the purpose of this research is only to develop and produce learning media that are valid and practical to apply based on the validator's assessment, the making of learning media in this research is limited to the manufacturing stage. There are four stages in the development of this 4D model including the define, design, develop, and disseminate stages. The stages of development research are described as follows:

1. **Define,** at the stage of defining and evaluating the process of making learning support media at the stage of needs analysis. At this level operations such as needs analysis, curriculum, students, assignments, and concepts are carried out. This research leads to setting learning objectives which require the use of media as a tool for lecturers to convey information and for students to use as a chosen independent learning tool[14]. The learning media chosen is the food mycobiology course, because this course has subjects that are not easy to understand and many terms that are not commonly known by students. By using the E-module, it can provide a concrete explanation of the subject matter.

2. **Design,** according to (Tegeh et al., 2019) there are several concepts designed, namely a) Design Concept, b) Media Concept, c) Script Concept. In this study, several design stages were carried out, including: 1) Paying attention to the material according to the indicators and learning objectives. Main tasks at this level include writing, reviewing and editing modules that are created taking into account language, phrases, objective forms, assessments and images; 2) Materials and pictures that are appropriate and appropriate to the material; 3) material design using the Canva application; 4) Designing validation sheets for
media experts and material experts, 5) Practicality questionnaires for lecturers and students.

3. Development (Development), carried out to produce products that are made in accordance with the revision findings based on the validator's suggestions in order to achieve a valid module worthy of testing. The results of the development stage are: 1) This e-module consists of all materials needed in learning, pictures, and interactive evaluation questions; 2) Media validation score, 3) Obtain a score on the practicality of using the E-Module. Project Based Learning E-module learning media is shown in the following figure:

![Figure 2. Cover and Concept Map on Food Microbiology E-Module](image)

![Figure 3. Display of Formative Materials and Tests in the Food Microbiology E-Module](image)
Material Validation Results Data

The results of the evaluation of the E-module material validator in the Food Microbiology course consisted of 3 lecturers from the FPP-UNP Catering Department, which can be seen as follows:

<table>
<thead>
<tr>
<th>Table 1. Validity of E-module Material in Microbiology Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Validator</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Validator 1</td>
</tr>
<tr>
<td>Validator 2</td>
</tr>
<tr>
<td>Validator 3</td>
</tr>
<tr>
<td>Overall Average</td>
</tr>
</tbody>
</table>

Based on table 1, the assessment of the data validation of the E-module module material in the Food Microbiology Course above was filled in by the material validator, namely a lecturers at the Faculty of Tourism and Hospitality Department of Culinary Administration who teaches the Microbiology course, the three validators obtained the validity of the E-module material in the Microbiology Course is 0.84 with the "valid" category.

E-module Format Validation Result Data

The results of the evaluation of the E-module format validator in the Microbiology course consisted of 3 FT-UNP lecturers, can be seen in table 2 below:

<table>
<thead>
<tr>
<th>Table 2. Data Validity of E-module Format in Microbiology Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Validator</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Validator 1</td>
</tr>
<tr>
<td>Validator 2</td>
</tr>
<tr>
<td>Validator 3</td>
</tr>
<tr>
<td>Overall Average</td>
</tr>
</tbody>
</table>

It is explained in table 2 that the E-module validation data for the Microbiology Course were filled in by three validators and the result of the presentation validation was 0.85 in the "Valid" category.

Overall Results Validity of E-module

The results of all E-module validators for Microbiology courses are as follows:

<table>
<thead>
<tr>
<th>Table 3. Overall Results of the Microbiology E-module Course</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No</strong></td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
Based on table 3, the total validity value obtained from each validator is 0.84 in the "valid" category and 0.85 in the "valid" category. Then it can be taken that the average validation of the E-module for Microbiology Course is 0.845 so that it can be concluded that the E-module belongs to the group with the "Valid" category.

**Lecturer Practical Results Data**

Practicality data was obtained from a questionnaire filled out by supporting lecturers in the Food Microbiology course at Padang State University, which can be seen in the following table:

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Aspects of Ease</th>
<th>Aspects of Time</th>
<th>Aspects of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Value %</td>
<td>87,5</td>
<td>84,5</td>
<td>87</td>
</tr>
<tr>
<td>Overall Average</td>
<td>86,3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Very Practical</th>
</tr>
</thead>
</table>

Based on the results of the analysis, the average practicality test results for the E-module Microbiology course according to the lecturer in the subject concerned are very practical interpretations.

**Student Practicality Result Data**

The results of an assessment of the practicality of the learning E-module according to student responses, can be seen in table 5.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Aspects of Ease</th>
<th>Aspects of Time</th>
<th>Aspects of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Value %</td>
<td>80,82</td>
<td>83,71</td>
<td>85,33</td>
</tr>
<tr>
<td>Overall Average</td>
<td>83,29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Very Practical</th>
</tr>
</thead>
</table>

The results of student responses to the practicality of using E-modules in the Microbiology course obtained an average of 83% in the practical category.

Based on the results of the research, the development of E-modules in the Food Microbiology Course is a series of activities that have been carried out to obtain learning media with development theory. The purpose of developing E-module learning media is to produce a valid, practical, and effective learning media. Based on the explanation of the results of research on the research and development of E-modules in the Family Welfare Study Program with a focus on Culinary Management at the Faculty of Tourism and Hospitality, Padang State University, it can be concluded that the research discussion is in accordance with
predetermined research procedures, namely by using the 4D paradigm which includes defining (Define), design (Design), development (Develop), and dissemination (Disseminate). Define is the first step in the development procedure. According to previous research, it explains that there are several stages in carrying out the definition, namely; a) needs analysis, b) material analysis, and c) student analysis. The authors carry out these stages with the intention of obtaining and determining development needs[15].

Based on the results of observations through the Google form distributed to students who have taken the Food Microbiology course, it is known that learning in this course still uses power point and there is no learning media that can support student understanding in understanding learning material. According to (Gupta et al., 2022; (Logan et al., 2021); (Sriyanti et al., 2020)) [16][15] said that students' knowledge of learning media in the form of E-modules is still low. Currently there is no E-module that is specifically used in learning Food Microbiology courses. Based on the needs analysis, it is necessary to develop learning media in the form of E-modules is still low. Currently there is no E-module that is specifically used in learning Food Microbiology courses. Based on the needs analysis, it is necessary to develop learning media in the form of E-modules [((Chen & Kurniawan, 2022); (Sitorus, n.d.); (M. Widya, 1940)[17][18][19]. At this stage the researcher has analyzed the lesson plan for the course, then explained what that will be achieved in this course. The description that must be mastered by students is being able to describe the concept of food preservation, the concept of food spoilage and being able to describe and carry out food preservation with Food Additives (BTP).

After conducting needs analysis, material analysis, and student analysis, it is continued by continuing to develop the initial product from the E-module learning media that has been made ([Arthur et al., 2021]; (Ilham & Huda, 2021); (Winatha, 2018))[20][21][22]. This research produced a product in the form of E-module learning media in the Food Microbiology Course. In the design stage, the media that will be developed by the researcher contains general instructions for using E-modules, quizzes, pictures, materials, bibliography and glossary which can make students more interested and can increase value in the learning[23][24][25]. The aim of the development stage is to create valid, practical, and successful E-module learning materials.

In the development stage, media validation was carried out by media experts, totaling three media validators which included aspects of appearance, aspects of utilization and aspects of language so that the results of media validation by the validator with a value of 0.85 were categorized as valid. The second validation is material validation. This validation is carried out by material experts, namely subject lecturers who understand the learning material. Material validation was carried out by three material experts. Material validation includes material aspects, learning quality aspects and linguistic aspects. The results of material validation by the validator obtained a value of 0.84 in the valid category. So that it can be seen based on the results of the validity of the E-module learning media declared feasible to be tested in class.

In line with research that has been carried out by (Rusmanto & Rukun, 2020) states that the E-module is very valid to use with a score of 91.50 based on the validator value, and the material is declared valid with a value of 91.50[5]. As well as the research results of Yuliawati Yunus and Firma Yenila (2018) also stated that E-modules are appropriate for use in learning to improve student learning...
outcomes. The validity of the e-module causes an increase in learning outcomes, so that learning can be said to be successful if there is an increase in student learning achievement.

The findings of this study will be used to innovate a new learning media, namely the E-module for food microbiology courses. The developed e-module is expected to help and make students feel happy and easier to understand the material during the learning process. It is hoped that this research can improve learning outcomes as well as students' cognitive and psychomotor scores in the Food Microbiology course. However, this research has a weakness which lies in the scope of the research which is still very limited. Therefore, it is hoped that future research will focus on the development and application of innovative E-modules. It is hoped that further research can further deepen and broaden the scope of research related to E-module innovations.

D. Conclusion

Based on the research that has been done, it can be concluded that the E-module in the Food Microbiology Course has been developed. The test results, this E-module is included in the very good category as a learning medium. Based on the data it is known that the validation value obtained by (validator), obtained an average value of 0.84 with a valid category. Whereas in the practicality category the percentage was 86.3% from lecturers and 83.29% from students, thus this E-module can be said to be a practical learning media for use in learning.

E. Acknowledgment

Thanks to all those who have helped in completing this research. Especially to the supervising lecturers, discussants and validators who have provided many suggestions and input in the preparation of this article. As well as to all teaching staff and students majoring in culinary at Padang State University who have facilitated and contributed to the implementation of this research so that this research can run smoothly.

F. References


