

Validity and Practicality Test of STEAM-Based E-Booklet on Food Microbiology Course

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Abstract

The learning process in food microbiology courses generally uses learning media in the form of powerpoint slides which are still general in nature and have not been able to mobilize students' critical thinking skills. As a result, the student's ability score obtained is in the low category. This study aims to determine the level of validity and practicality of STEAM-based E-booklet media. This type of research is research and development using the ADDIE development model which consists of five stages, but in this case it is carried out until the development stage. The validity test was carried out by giving validation sheets to six experts while the practicality test was carried out by giving questionnaire sheets to lecturers and students. The results of the validity test by material expert validators, media experts and learning design experts obtained an average percentage of 88% with a very valid category. Practicallity test by course lecturers obtained an average percentage of 88,5% and student assessment of 97%. The E-booklet can be used as a learning media for students

Keywords: E-booklet; Practicality; STEAM; Validity



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INTRODUCTION

Food microbiology is a science that studies the effect of processing on microorganism cells, including the mechanism of microorganism resistance to processing (Harahap et al., 2016). Based on the results of the initial analysis conducted by researchers related to the types of learning resources and media used in lecture activities, it was found that the media used in the form of powerpoints and learning resources in the form of books that did not meet the learning demands contained in the lecture implementation plan. This affects students' ability to understand the subject matter. Consequently, the results of analyzing the problem through

the distribution of questionnaires that researchers conducted found that 50% of students did not understand the material well.

The study of microbiology has a close relationship in everyday life, as a result, not only knowledge is expected but skills are needed (Kristiana et al., 2016). For this reason, teaching media is needed that is actualized to students (Slameto et al., 2016). Learning media is a tool for educators to convey material so that learning activities can run effectively and motivate students to learn so that learning objectives are achieved (Sary & Isnawati, 2023). Furthermore, learning media serves to facilitate student understanding of the subject matter (Sunarno, 2018).

Based on the description of the paragraph above, it is necessary for educators to develop learning media (Panjaitan et al., 2019). This is in line with the statement Nevrita et al., (2020) that the development of the media used can support the learning process to be more optimal and quality. With regard to the development of the media, it is necessary to prepare the material carefully in order to obtain media that is in accordance with the needs of the students (Mustaqim, 2017; Wulandari et al., 2020). Furthermore, the media must be validated to determine the feasibility of the product and obtain suggestions to improve the content of the learning media (Apriani et al., 2021; Gonibala et al., 2019; Hamka & Effendi, 2019). One of the media that can be developed is electronic booklet media.

Electronic booklets are printed booklet products that are developed into electronic or digital-based booklets with the help of a number of software. E-Booklets can be used by students independently so as to create active learning (Wahidah & Ruhmawati, 2022). E-booklets are very effective and practical for improving understanding of material concepts (Hoiroh & Isnawati, 2020). However, the use of E-booklets alone is not enough, it is necessary to integrate learning approaches, one of which is the *Science, Technology, Engineering, Art and Mathematics* (STEAM) approach.

STEAM is an integration of five disciplines, namely *science, technology, engineering, art* and *mathematics*, the STEAM approach was chosen because the components contained in STEAM are in accordance with the challenges of the 4.0 revolution era (Sam & Rahayu, 2022). In addition, the STEAM approach can provide opportunities for students to apply the theory that has been given by developing ideas and creativity (Degeng et al., 2021). Furthermore, Hasruddin & Lestari (2020) mentioned that the implementation of STEAM in learning is needed as an effort to develop higher-order thinking skills and develop creativity. Based on the description of the problems above, the solution that can be proposed is to develop a STEAM-based E-booklet on food microbiology course for students. The purpose of this research and development is to determine the validity and practicality of e-booklets so that they are feasible to be applied in learning activities.

METHOD

This type of research is research and development using the ADDIE model, but in this study it was only carried out until the development stage to obtain an assessment from validators, lecturers and students. The research was conducted in April to July 2024 at Medan State University.

Sample or Participant

The research subjects consisted of six experts who aimed to provide an assessment of the validity of the product, two lecturers teaching food microbiology courses and fifteen students which is the number of students who choose food microbiology courses. Given that the course is an elective course so that there are only a few students in the class. The fifteen students consisted of 5 low, 5 medium and 5 high cognitive ability levels, cognitive students which were selected based on the results of the initial study with the aim of knowing the comparison of student assessments of the products developed based on these cognitive differences.

Instrument

The instruments used in this study are: (1) material expert validation sheet; (2) learning design expert validation sheet; (3) layout expert validation sheet; and (4) lecturer and student response questionnaire.

Data collection

Data collection techniques in STEAM-based E-booklet development research on Food Microbiology course use 2 techniques, namely (1) questionnaires and (2) documentation. The targets of this questionnaire are Biology students as respondents for problem analysis, validators material expert, media expert and design learning expert, lecturer teaching the course and students of Stambuk 2021 to determine the feasibility, readability and practicality of STEAM-based Food Microbiology E-booklets. In this study, documentation was obtained when analyzing learning resources, namely in the form of books used by lecturers and the semester plan.

Procedure

Research and development starts from the stage: (1) Analysis, at the analysis stage the teaching materials were analyzed by observation, then problem analysis needs analysis were carried out by distributing questionnaires to students. So that in the analysis, the problem was found that the lack of media and learning resources used and students stated that it was difficult to understand food microbiology courses; (2) Design, at this stage the determination of material, learning objectives, questions and initial planning of e-booklet preparation is carried out. The preparation of e-booklets is adjusted to STEAM indicators, namely the connection of material with components of Science, Technology, Engineering, Art and Mathematics; (3) Development, at this stage the validity and practicality tests are carried out using a questionnaire. The validity test consists of the validity of the suitability of the material, media and learning design with STEAM indicators. While the practicality

test consists of an assessment related to the ease of presentation of e-booklet content, language, presentation and appearance of the e-booklet.

Data analysis

Validity data was analyzed using the following formula from [Riduwan \(2013\)](#),

$$K = \frac{F}{N \times I \times R} \times 100 \dots\dots\dots (1)$$

Description:

- V : Validity Value
- F : All Respondents' Answers
- N : Maximum Score of Questionnaire
- I : Number of Questions on the Questionnaire
- R : Number of Respondents

Practicality data was analyzed using the following formula from [Riduwan \(2013\)](#),

$$\text{Validity (\%)} = \frac{\text{Total Score of Collection Results}}{\text{Sum of Criteria Scores}} \times 100 \dots\dots\dots (2)$$

Furthermore, the results of the calculation of the validity and practicality of the E-booklet test were interpreted with the criteria in Table 1.

Table 1. Criteria for Validity and Practicality of E-booklets, Source: [\(Riduwan, 2013\)](#)

Percentage	Validity Criteria	Practicality Criteria
81% - 100%	Very Valid	Very Practical
61% - 80%	Valid	Practical
41% - 60%	Less Valid	Less Practical
≤ 40%	Invalid	Not Practical

RESULT AND DISCUSSION

The resulting product is a STEAM-based E-booklet on Food Microbiology material made with Canva and Heyzine applications. The e-booklet can be accessed via a link using a *smartphone* or laptop. The material contained in the e-booklet is microbiology of food damage, foodborne diseases, food preservation and fermentation which are all integrated with STEAM components. There are several criteria that need to be met when preparing e-booklets based on National Education Standards Body (BSNP), namely: validity of content, presentation, language and graphics ([Fajarini, 2018](#)). E-booklets are arranged systematically starting from the cover, table of contents, introduction, content and cover ([Amalia et al., 2020](#)). In addition, the e-booklet also contains an evaluation in the form of questions ([Prananda et al., 2022](#)).

The results of previous research show that to become a feasible learning media, it must go through a validation process ([Muslina et al., 2018](#);

Panjaitan et al., 2019; Wulandari et al., 2020). The results of the analysis of the validity test of the e-booklet based on the assessment of all validators obtained an average percentage of 88% which is included in the very valid category. The tabulation of the assessment results by the validator can be seen in Table 2. The summary of the validity test results by material experts, learning design experts and media experts can be seen in Table 3.

Table 2. E-booklet Validity Test Results by All Validators

Validity	Percentage
Material	79%
Learning Design	93%
Layout	92%
Average Percentage	88%
Criteria	Very Valid

Table 3. Summary of Validity Test Results by E-booklet

Validity	Aspects	Validator		Value (%)
		V1	V2	
Material	Material Suitability	10	9	79
	Material accuracy	20	16	75
	Material Sequence	14	12	81
	STEAM component of the E-booklet	15	17	80
Average Value (%)				79
Criteria				Valid

Validity	Aspects	Validator		Value (%)
		V1	V2	
Learning Design	Presentation Technique	8	8	100
	Presentation of Learning	11	12	96
	STEAM Learning in E-booklets	18	13	78
	Completeness of Presentation	20	20	100
Average Value (%)				93
Criteria				Very Valid

Validity	Aspects	Validator		Value (%)
		V1	V2	
Layout	Cover Design	15	15	94
	Cover Typography	15	13	88
	Content Design	40	37	88
	Illustration of Contents	20	20	100
Average Value (%)				92
Criteria				Very Valid

The results of validation from material experts obtained a percentage of 79 % which was included in the quite valid category. This shows that the material contained in the e-booklet is in accordance with the Semester Learning Plan and Course Learning Outcomes Food Microbiology, presented accurately, coherently and has been adapted to the STEAM component. The e-booklet media is organized systematically so that when students read the media, the information contained in it is easily understood by the reader because one of the functions of the media is to convey information (Sary & Isnawati, 2023). In addition, the language contained in the e-booklet must use concise and concise sentences (Arsyad, 2016). Furthermore,

Hidayati et al., (2019) stated that students will be more assisted in learning activities if learning is presented based on indicators and learning objectives.

The results of the validity of e-booklets obtained from learning design experts obtained an average percentage of 93 % which was included in the very valid category. This value shows that the presentation technique, learning presentation, STEAM learning and presentation completeness have been arranged very well. Well-organized learning components are useful to facilitate the learning process of students and increase their interest in the learning process (Novita et al., 2018). The results of this validity also show that the structure of the book is organized, clear, easy to understand and appropriate for the level of students (Harahap et al., 2020).

The results of the validity of the e-booklet layout obtained an average percentage of 92% which indicates that the cover design, cover typography, content design and content illustrations have been arranged very well. In line with Harahap's research on 2020 which states that booklets have an attractive design that includes a cover, the use of balanced colors and proportional structures and the selection of attractive fonts that make it easier for students to read. Content illustrations in e-booklets have a significant influence on teaching materials (Fitriani & Krisnawati, 2019). Graphic aspects can also be determined from the use of elements, determination of appropriate images, visual appeal and utilization of free space in e-booklets (Putri & Saino, 2020). After the product was assessed by the validator and obtained very valid results, the next thing to do was to conduct a practicality test to two lecturers teaching the course. The results of the practicality test based on the lecturer's assessment can be seen in Table 4.

Table 4. Practicality Test Results Based on the Assessment of Lecturers

Aspects	Lecturer		Maximum Score	Value (%)
	D1	D2		
<i>E-Booklet</i> Contents	16	14	20	75
Language	7	8	8	94
Presentation	17	19	20	90
View	26	27	28	95
Average Value (%)				88.5
Criteria				Very Practical

Products that have been assessed by the lecturer, then reassessed by students. In this study, there were fifteen students who chose the food microbiology course, in this case including a limited scale product trial. The results of the practicality test based on student assessment can be seen in Table 5.

Table 5. Practicality Test Results Based on Student Assessment

Aspects	Score Obtained	Maximum Score	Value (%)
E-booklet Contents	288	300	96
Language	116	120	97
Presentation	291	300	97
View	355	360	99
Average Value (%)			97
Criteria			Very Practical

The practicality test was conducted on course lecturers and students. The results of the practicality test based on the assessment of the lecturer obtained an average percentage of 88.5 % while the results of the practicality test based on student assessment obtained a value of 97 % which means that in terms of content, language, presentation and appearance the e-booklet has been well prepared. In line with the statement [Muliawan et al., \(2022\)](#) which states that the practicality value shows the quality/content of the material is in accordance with the STEAM basis, the presentation and use of language have met the criteria. Online booklet presentation also makes it easier for students to learn anywhere. In line with the opinion of [Sary & Isnawati \(2023\)](#), stating that the presentation of online booklets through links is considered more practical because learning can be done anywhere, especially students always carry smartphones. [Hendriyani et al., \(2020\)](#), stating that the use of vocabulary and language that is easy to understand determines the success of the practicality test.

CONCLUSION

Based on the results of research and development carried out, it can be concluded that the final product obtained from this research is a STEAM-based E-booklet on Food Microbiology material which the product has been declared feasible and practical for use by Semester V Students of the Biology Study Program FMIPA UNIMED. Based on the above conclusions, there are several suggestions that can be given, namely: (a) This STEAM-based E-booklet can be used for other Food Microbiology materials and adapted to student problems; (b) STEAM-based E-Booklets developed in the form of links and require the internet, readers should be able to develop E-booklets that can be accessed offline; (c) This STEAM-based E-Booklet can be used by lecturers to train students' critical thinking skills.

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