Feasibility of Class XII Enzyme and Cell Metabolism Material Booklet Media Based on Acute Toxicity Test of Zuriat Fruit Seed Extract

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ABSTRACT Learning media is a tool that makes it easier for educators to convey material to students effectively and efficiently to improve the quality of learning. Biology subjects in the essential enzymes and cell metabolism competencies require precision and accuracy, so appropriate learning media are needed. Booklets are a medium that can make it easier for students to learn. They are small, attractive, practical, simple, and easy to carry anywhere. This research aims to determine the suitability of booklet media for enzyme material and cell metabolism based on the acute toxicity test of Zuriat seed extract. This research's stages are determining potential problems, collecting information, designing booklets, validating booklets, revising booklets, and making booklets. The initial stage of making the booklet is to carry out an acute toxicity test of Zuriat seed extract and design the contents of the booklet. The suitability of the booklet is seen from the assessment carried out by five validators. The research instrument uses a validation sheet. The aspects assessed include format, content, and language. The research results show that the booklet can be declared suitable as a learning medium. The value for the format, content, and language aspects is 1. The results of the validation show the CVI value is 1. It can be concluded that the class XII booklet on enzymes and cell metabolism is based on the acute toxicity test Zuriat seed extract as a learning medium, which can be declared feasible.

Keywords Aspects, Booklet, Indicators, Learning media, Validation

1. INTRODUCTION

Learning is a process of teaching and learning activities between students and their teachers (Syarah, Rahmi & Darussyamsu, 2021). The learning process is an interaction between teachers and students in transferring and interpreting the experience and knowledge they have (Pane & Dasopang, 2017; Octiana, Darussyamsu, Yogica & Syamsurizal, 2020). Learning in education covers many branches of science. There are sciences such as biology. Biology is the science of life, symptoms, and life processes that interact with and within society (Rustaman & Lufri, 2016). Biology is considered one of the subjects that is difficult to understand because it uses many scientific terms that are not commonly used in everyday life, complex learning concepts, and process material that is difficult to explain, which is related to the natural life around us. (Syarah, Rahmi & Darussyamsu, 2021). Biology learning provides direct and meaningful learning experiences to develop students' competencies to better understand the natural environment. Biology learning includes concepts, symptoms, and life processes around us, meaning it is closely related to everyday life, whether related to humans, animals, plants, microorganisms, and their environment (Banila, Lestari & Siskandar, 2021).

Based on the results of interviews with SMA Negeri 2 Mempawah, SMA Negeri 1 Sepauk, and SMA Karya Sekadau, these three schools still need effective and innovative learning media on class XII enzymes and cell metabolism because students do not understand and have difficulty remembering terms of science and cycles, and difficulty understanding the material. Nazarni (2020) thinks that biology subjects, especially enzymes and cell metabolism, are challenging to understand. Working on biology questions takes a long time because students have to read, understand, and take notes carefully. Muspikawijaya, Iswari & Marianti (2017) stated that students' low mastery of enzymes and cell metabolism is thought to be because students experience learning

difficulties. Learning difficulties experienced by students have an impact on their ability to understand the material or concepts being taught.

Biology subjects on basic competency in enzymes and cell metabolism require precision and accuracy (Nazarni, 2020). The biology learning transfer process runs optimally if it is supported by appropriate learning media and learning approaches (Octiana, Darussyamsu, Yogica & Syamsurizal, 2020). An educator must master methods and choose appropriate learning media to support a quality learning process (Istiqlal, 2018; Shidiq & Faikhamta, 2020).

Learning media are tools that can help the teaching and learning process and function to clarify the message's meaning so that learning goals can be achieved better and more perfectly (Kustandi & Sutjipto, 2013; Babincakova & Bernard, 2020). Learning media makes it easier for educators to convey material to students effectively and efficiently to improve the quality of learning (Hanum, Ismayani & Rahmi, 2017; Panjaitan, Titin & Wahyuni, 2021). To achieve quality learning, learning media must be carefully planned and determined, and learning media can even be designed according to needs to solve learning problems (Panjaitan, Titin & Wahyuni, 2021; Ramadhani, Asri & Purnama, 2021).

According to Arsyad (2015), learning media can be grouped into four groups: media resulting from print technology, media resulting from audio-visual technology, media resulting from computer-based technology, and media resulting from a combination of print and computer media. Print media is one of the commonly found learning media. Print media is visual media produced through a printing or offset process. According to Putri & Lasari (2023), the use of print media in the learning process can increase students' understanding and interest aimed at teachers and students to (1) teachers have strategies and can also make the learning process enjoyable; (2) can motivate students; (3) students receive varied material; (4) using media can also increase students' understanding; and (5) media as an alternative in learning activities.

Booklets are learning media in the form of prints or small books measuring 14.8 x 21 cm (A5), which contain specific information and are equipped with text, images, photos, and color elements (Susilawati & Marlina, 2015). The advantage of booklet media is that it makes it easier for students to learn because students do not need to take notes on the material the teacher has presented. Its appearance is small and attractive, making booklets a practical, simple, and easy medium to carry anywhere so they can be studied well at home or school (Octiana, Darussyamsu, Yogica & Syamsurizal, 2020). Several studies show that learning through the use of booklets can increase knowledge (Fitriani & Krisnawati, 2019; Yuliana, Muldayanti & Kahar, 2019), improve learning outcomes (Mahendrani & Sudarmin, 2015; Yuliana, Muldayanti & Kahar, 2019), foster student activity (Mahendrani &

Sudarmin, 2015; Pralisaputri, Soegiyanto, & Muryani, 2016), and increase communication effectiveness (Hapsari, 2013; Rehusisma, Indriwati & Suarsini, 2017).

Through validity from experts and validators, booklets can help students understand the material and are suitable for use in teaching and learning activities, especially material on enzymes and cell metabolism. As in research conducted by Rosalia & Isnawati (2018) regarding the validity, practicality, and effectiveness of science booklets on the scientific literacy abilities of junior high school students, Balqis & Hidayati (2018) regarding the validity of ethnoscience-based booklet media, physical and chemical properties and their changes for the classroom. VII SMP, and Harahap, Helendra, Farma & Syamsurizal (2020) regarding the validity of the human respiratory system booklet as a supplement to science teaching materials for class VIII SMP.

Based on the description above, the research aimed to determine the feasibility of a booklet on enzymes and cell metabolism based on the acute toxicity test of Zuriat fruit seed extract to increase the understanding of concepts for class XII students.

2. METHOD

Research into the feasibility of booklet media uses the Research and Development research and development method (Sugiyono, 2017) with the stages, namely potential and problems, information gathering, product design, design validation, design revision, and product creation (Figure 1). The information gathering stage carried out an acute toxicity test of Zuriat fruit seed extract. From the information obtained, product design was done by determining the booklet's title, analyzing competency standards (basic competencies, achievement indicators, and learning objectives), preparing booklet components, editing process, and preparing evaluation questions. Next, the design validation stage was carried out to determine the suitability of the booklet media. Five validators assessed the validation of the booklet media using a validation sheet based on their expertise in biology and learning. The booklet media validation sheet consists of three aspects: format, content, and language.

Media validation data will be analyzed using the Content Validity Ratio (CVR) (Lawshe, 1975) with the following formula:

$$CVR = \frac{Ne - \frac{N}{2}}{\frac{N}{2}}$$

Information:
Ne: Number of validators who agree on the validity of the media (considered agreeing if the score for each aspect is 3 – 4. If < 3, then they are considered disagreeing)
N: The total number of validators or the expert team

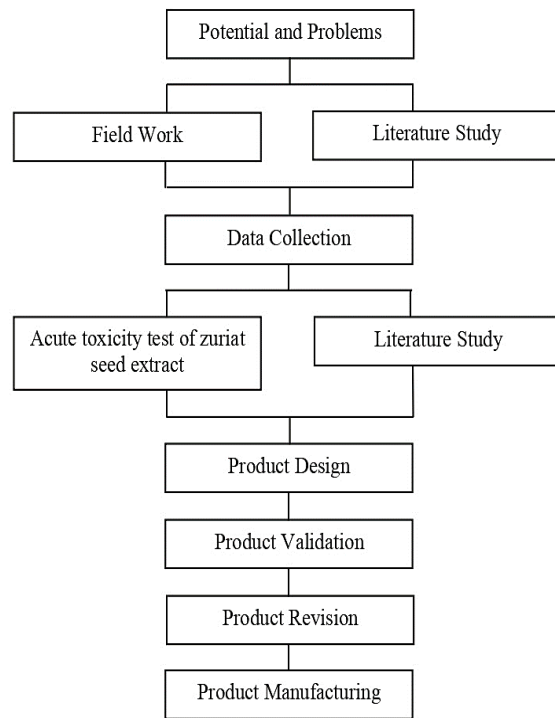Provisions regarding the CVR index, according to Lawshe (1975), are as follows:

Figure 1 Research method scheme

1. When the number of respondents who agree or strongly agree is less than ½ of the total respondents, the CVR value = -
2. When the number of respondents who agree or strongly agree is ½ of the total respondents, the CVR value = 0
3. When all respondents agree or strongly agree, the CVR value = 1

4. When the number of respondents who agree or strongly agree is more than $\frac{1}{2}$ of the total respondents, the CVR value = 1

After calculating the CVR value for each criterion, the CVI (Content Validity Index) value or the overall average CVR value is calculated. The CVI formula includes the following:

$$CVI = \frac{\sum CVR}{\sum n}$$

Information:

ΣCVR : total CVR value

Σn : number of items in all aspects

The criteria used in CVI are:

1. If the CVI value is ≥ 0.99, the booklet media can be said to be valid
2. If the CVI value is ≤ 0.99, the booklet media can be said to be invalid

If the media is said to be "valid," then the media is suitable for use, and if the media is said to be "invalid," then the media is not suitable for use.

3. RESULT AND DISCUSSION

Five validators carried out booklet media validation. The assessment of booklet media consists of four aspects: format, content, and language. Media validation data will be analyzed using the Content Validity Ratio (CVR) (Lawshe, 1975). The calculation results from data analysis using CVR are:

1. First indicator: $CVR = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

2. Second indicator; $CVR = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

Table 1 Results of booklet media validity analysis

Aspect	Indicators	Validator					CVR	Information
		1	**2**	**3**	**4**	**5**		
Format	1. The attractiveness of the booklet cover design	4	4	4	4	4	1	Valid
	2. Completeness of the booklet presentation	4	4	4	4	4	1	Valid
	3. Clarity of images in booklet media	3	4	3	3	4	1	Valid
	4. Suitability of booklet size	4	4	4	3	4	1	Valid
	5. Clarity of letters in booklet media	4	4	4	4	4	1	Valid
Content	1. Suitability of material with basic competencies, achievement indicators and learning objectives	3	4	4	4	4	1	Valid
	2. Information on research results presented is in the form of toxicity of Zuriat fruit seed extract	3	4	4	4	4	1	Valid
	3. The presentation of material does not violate applicable laws	4	4	4	4	4	1	Valid
	4. The information in the material is self-contained	3	3	3	4	3	1	Valid
Language	1. The language used in the booklet is correct	3	3	4	4	3	1	Valid
The value of CVI							1	Valid

Information:

a. If the CVI value is ≥ 0.99, the booklet media is said to be valid

b. If the CVI value is ≤ 0.99, the booklet media is said to be invalid

(Lawshe,1975)

(a) Front cover   (b) Back cover

Figure 2 Presentation of (a) front cover and (b) back cover on booklet media in Bahasa

3. Third indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

4. Fourth indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

5. Fifth indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

6. Sixth indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

7. Seventh indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

8. Eighth indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

9. Ninth indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

10. Tenth indicator: $\text{CVR} = \frac{5-\frac{5}{2}}{\frac{5}{2}} = \frac{2.5}{2.5} = 1$ (Valid)

The calculation of the CVI value or average CVR value is:

$\text{CVI} = \frac{10}{10} = 1$ (Valid)

Data from the validity analysis are presented in Table 1.

The booklet media displays material on enzymes and cell metabolism concisely and interestingly, consisting of enzyme sub-material, understanding of acute toxicity tests, acute toxicity test methods, research results of acute toxicity tests, pictures of Zuriat plants, taxonomic classification of Zuriat plants, and descriptions of Zuriat plants. Furthermore, the booklet also has competency standards, evaluation questions, answer keys, and a glossary. Booklets are learning teaching materials that are included in printed media, also called small books, and contain information on a certain topic (Mahendrani & Sudarmin, 2015). The small shape makes the booklet easy to carry anywhere, and the illustrations make it easy for students to use during the learning process (Pralisaputri, Soegiyanto & Muryani, 2016). Apart from that, users can view the contents at their leisure, information can be shared with family and friends, it is easy to create, reproduce, and repair and easy to adjust, reduces the need to take notes, can be made simply at relatively low cost, is durable, has a wider capacity, and can be directed at certain segments (Hapsari, 2013).

Making this booklet learning media aims to make it easier for teachers to convey the material's content and make it easier for students to receive the material presented by the teacher, especially regarding enzymes and cell metabolism. This booklet learning media has a simple, clear, and easy-to-understand concept, and pictures support

Media suitability testing is the initial stage to determine its suitability for learning and the expected competencies. To determine the suitability of the booklet media, it is first validated by five validators. Booklet media consists of 10 indicators with three aspects, namely, format, content, and language, including the following:

3.1 Format Aspect

Assessment of the first indicator, namely the attractiveness of the cover design of the booklet, obtained a CVR value of 1 in the valid category. This is in line with Muktaf's statement (2016). It is believed that a book cover design must have distinctive characteristics that other cover designs do not have by highlighting a certain theme and displaying images that match the content. Booklet media has three criteria: the booklet cover design uses more than three colors. Hence, it is varied, contains information, and
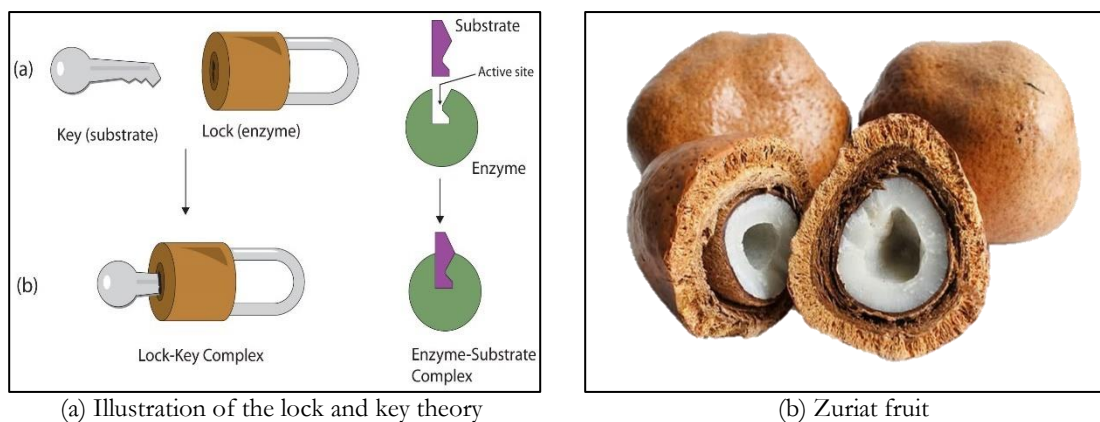
<div align="center">(a) Illustration of the lock and key theory   (b) Zuriat fruit</div>

Figure 3 Presentation of images (a) illustration of lock theory with key and (b) image of Zuriat fruit on booklet media

mentions the title of the booklet, the name of the institution, the name of the booklet author, the class, and the semester. There are supporting images (Figure 2). As stated by Muswita, Yelianti, Intan & Kusuma (2020), the harmony of the combination of colors, letters, and cover images can provide an overview of the content so that it can attract readers' interest.

Assessment of the second indicator, namely the completeness of the booklet presentation, obtained a CVR value of 1 in the valid category. This is in line with Daryanto's (2014) statement that the complete content of a teaching medium must be fully discussed through presentations so that students feel they understand a particular field of study, which can increase students' motivation and enthusiasm in developing abilities and interacting directly with the environment. The booklet media has eleven criteria, namely a front cover, foreword, table of contents, competency standards, a description of the contents consisting of material on enzymes and cell metabolism, brief information about the Zuriat plant, and the stages and results of the acute toxicity test of Zuriat fruit seed extract, evaluation questions. , answer key, bibliography, glossary, index, and back cover.

Assessing the third indicator, namely the clarity of the images in the booklet media, a CVR value of 1 was obtained in the valid category. This aligns with Habibati's (2017) statement that clarity in image displays aims to ensure that learning material is conveyed effectively and efficiently. Students like exciting reading with a little description and lots of pictures or colors, so it can help them absorb and understand the material's content. Booklet media has three criteria, namely clear and colorful image display, the image displayed is appropriate to the material presented, and there is information explaining the image (Figure 3). According to Asyhar (2011), learning media must be good, clear, and neat when presenting writing and images to maximize their function in learning.

Assessment of the fourth indicator, namely the suitability of the booklet size, obtained a CVR value of 1 in the valid category. This is in line with the statement by

Susilana & Riyana (2018) that the booklet is in the form of a small book with dimensions of 14.8 x 21 cm (A5) and Dewi, Hamidah & Sukmono (2020) that the number of booklet pages consists of 32 to 96 pages and the maximum is 100 pages. Booklet media has three criteria: booklets using A5 size paper (14.8 x 21 cm), portrait orientation and bound in book form, and booklet pages numbering less than 100.

Assessing the fifth indicator, namely the clarity of the booklet letters, obtained a CVR value of 1 in the valid category. This is in line with the statement of Panjaitan & Tenriawaru (2022), Rahma (2019), and Valentino (2019) that the suitability of the use of letters affects the readability of the media so that the media is easy for readers to read. The booklet has five criteria, namely selecting letters that are attractive and easy to read, the title uses the Book Antiqua font with a font size of 20, the subtitle uses the Book Antiqua font with a font size of 14, and the contents use the Book Antiqua font with a font size of 12.

3.2 Content Aspect

Assessment of the first indicator, namely the suitability of the material with essential competencies, achievement indicators, and learning objectives, obtained a CVR value of 1 in the valid category. This is in line with the statement by Babincakova & Bernard (2020) and Susilana & Riyana (2018) that competency achievement indicators are formulated based on basic competencies, and learning objectives are formulated based on competency achievement indicators. Booklet media has three criteria. Namely, the material in the booklet is based on basic competencies, achievement indicators, and learning objectives. The booklet is arranged according to achievement indicators and learning objectives so that students, after completing the booklet, can understand the material on enzymes and cell metabolism according to basic competency 3.2. Achievement indicators and learning objectives are then described in a description of the material equipped with examples and pictures to clarify the concept of enzymes and cell metabolism (Figure 4).

Assessment of the second indicator, namely information on research results presented in the form of toxicity of Zuriat seed extract, obtained a CVR value of 1 in the valid category. This is in line with the statement of Djannah, Sulistyawati, Sukesi, Mulasari & Tentama (2020) and Wulandari, Ruhiat & Nulhakim (2020) that the completeness of the information that has been presented can support the explanation of concepts so that they become clearer, so that the material can be conveyed well. Booklet media has three criteria: the information presented is useful, in the form of new knowledge, and presented in sentences that are easy to understand. Information on the results of toxicity tests on Zuriat seed extract should be added to introduce natural potential to students so they can find out the potential around them. Laboratory research can support learning activities and achieve three domains of educational goals, namely affective, cognitive, and psychomotor, of which the three domains mentioned are indicators of learning outcomes. Learning by applying theory in laboratory activities can improve process skills and problem-solving abilities and increase students' interest and attitudes toward learning (Yanuarta, Indriayu & Sudarno, 2018). Oral administration of zuriat seed extract also causes the active substances in the extract to be absorbed into the digestive tract. The active substance then undergoes a distribution and metabolism process. Toxic metabolic products work as enzyme inhibitors for the next metabolic stage. The reaction between the active substance and receptors in the effector organ causes poisoning symptoms. Each test animal used will respond differently to a certain dose. These differences in response are caused by differences in each animal's sensitivity level (Tuti, Yuliastri & Dewi, 2022).

Figure 4 Presentation of competency standards in booklet media

Assessing the third indicator, namely that the material presented does not violate applicable legislation, a CVR value of 1 is obtained in the valid category. This aligns with Kallang's (2017) statement that education must be based on certain foundations or principles because education is the main pillar in developing humans or national society. Booklet media has three criteria: the material or content in the booklet does not give rise to ethnic, religious, racial, and inter-group (SARA) problems, and the material or content does not contain pornography. The material or content in the booklet does not present anything that discriminates, biases or discredits other types of media, male or female (gender), region or region, profession, etc. (Figure 5). All aspects of education in the booklet media are by the legal

(a) Learning materials   (b) Research results

Figure 5 Presentation of learning materials and (b) research results in booklet media

basis and applicable legislation so that it does not cause SARA problems, pornography, and discrimination, by Law No. 20 of 2003 concerning the National Education System Article 4 paragraph 2, which reads "Education is carried out democratically and fairly and is not discriminatory by upholding human rights, religious values, cultural values, and national pluralism".

Assessment of the fourth indicator, namely that the information in the material is self-contained, obtained a CVR value of 1 in the valid category. This aligns with Djono's (2023) statement that teaching materials must be self-contained (complete and coherent) because they present complete learning material to provide students with learning opportunities. Booklet media has three criteria: presenting information in the form of enzymes and cell metabolism, achievement indicators and learning objectives, and the material presented. Self-contained aims to present complete enzyme and cell metabolism material so that students can study the complete description of enzyme and cell metabolism material.

3.3 Language Aspects

The assessment of the first indicator, namely the language used in the booklet, was correct, a CVR value of 1 was obtained in the valid category. This is in line with the statement of Panjaitan, Titin & Wahyuni (2021), Panjaitan, Titin & Wahyuni (2022), and Harahap, Helendra, Farma & Syamsurizal (2020) that a good booklet must meet the rules of Enhanced Spelling, have letters that are easy to read, not create duplicate information, and overall be easy for students to understand. Booklet media has five criteria, namely by the KBBI (Big Indonesian Dictionary), using effective sentences, the spelling used refers to the provisions of Enhanced Spelling (EYD), the language used is clear and easy to understand, and does not give rise to multiple interpretations (Figure 5).

The average total validation (CVI) results of the enzyme booklet media and cell metabolism were obtained with a value of 1 in the valid category. Based on the validation results, with the criteria used referring to Lawshe (1975), the total validation average was declared valid so that by presenting information on research results on the toxicity test of Zuriat seed extract, it was suitable to be used as a learning medium for class XII enzymes and cell metabolism material.

4. CONCLUSION

The class XII enzyme and cell metabolism material booklet based on the acute toxicity test of Zuriat seed extract received a score for the format aspect, namely 1, the value for the content aspect is 1, the value for the language aspect is 1,, and the CVI value is 1, so that the booklet can be declared suitable as a learning medium.

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