



Construction of biology magazine based on the antidiabetic test of pasak bumi roots



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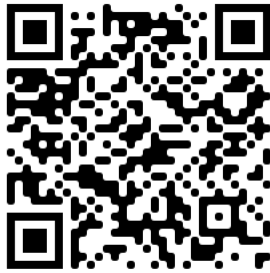
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ABSTRACT

The enrichment program is an additional effort or activity given to students who have achieved complete learning with the aim of increasing students' understanding and insight into the material being or has been studied. In carrying out the enrichment program, teachers can use enrichment materials as learning resources, one of which is a biology magazine. This study aims to develop a biology magazine as an enrichment material to increase students' understanding and insight into the hormone system sub-material. This type of research is an R&D research that uses an adaptation of the 4D Thiagarajan model, namely define, design, and development. The data sources for this research consisted of 36 students from Christian High School Immanuel Pontianak and SMA Santo Fransiskus Asisi Pontianak, 3 biology teachers from these schools, and 3 lecturers of Biology Education FKIP UNTAN. The results of the analysis of student needs indicate that it is necessary to develop a biology magazine in order to motivate students to increase their understanding and insight. The results of the feasibility test can be seen that biological magazines are suitable for use as material for enrichment of the hormone system sub-material, this is indicated by the Aiken's V value obtained 0.79.

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INTRODUCTION

The enrichment program is an effort to change and add to the regular curriculum in order to meet the needs of students' talents and abilities in the cognitive, affective, creative, and psychomotor fields (Dewantara, 2018). The enrichment program aims to increase students' understanding and insight into the material being or have been studied, provide new learning opportunities for students in order to maximize the development of their interests, talents, and abilities, as well as foster a sense of social responsibility and a sense of responsibility in students

(Nugroho & Susilowibow, 2019; Sugihartono, 2012; Wijaya, Muttaqin, & Taufiq, 2020). In carrying out enrichment activities, teachers can facilitate students by providing various learning resources, one of which is enrichment materials (Liany, Desnita, & Raihanati, 2018; Sahri & Listiadi, 2015).

Materials in the form of enrichment books that can be used in enrichment programs for students (Khoiriah, Raihanati, & Budi, 2018; Kurniawan & Subyantoro, 2016; Liany et al., 2018). According to Widyaningrum, Aprilya, & Iqbal (2015), enrichment books have a role in increasing knowledge and increasing students' insight into science, technology, and art. In addition, according to Pusat Kurikulum & Perbukuan (2018), enrichment books play a role in improving students' thinking skills and broadening students' insight into the environment based on current knowledge. According to (Alfarisi & Suseno, 2019), enrichment books consist of knowledge enrichment books, skill enrichment books, and personality enrichment books. According to Pusat Kurikulum dan Perbukuan (2018), one of the knowledge enrichment books that can be used in enrichment programs is a magazine. Magazine is a means of communication that has a role in supporting the development of science. Not only that, the magazine is a popular scientific work designed in a simpler language so that it is easily understood by students (Nurasih, Leksono, & Wahyuni, 2020). In addition, the magazine consists of various writing topics that are in accordance with the topic of the magazine in question, and there are several illustrations that make the magazine look more attractive (Nuraida & Astuti, 2019). Based on several research results that have been reported, magazines have various advantages, namely having an attractive appearance so that it does not make students feel bored, magazines can help students to see the relationship between the material being taught and the environmental conditions of students, and can achieve several competencies independently. at the same time so that it can be time efficient (Fiidami, Ashari, & Ngazizah, 2021; Kartika, 2018).

The hormone system is one of the sub-materials of the coordination system studied in class XI and is classified into basic competence 3.I0, which is to analyze the relationship between the structure of the organ-making network in the coordination system (nerves, hormones, and sense organs) in relation to the mechanism of the coordination and regulation system. and functional disturbances that can occur in the human coordination system. According to Irnaningtyas (2014), the hormone system has material coverage in the form of characteristics of endocrine glands, endocrine glands in humans, and hormone secretion. The hormone system sub material has abstract and complex material characteristics that require students to use reasoning in understanding the hormone system sub material (Sopian, 2019). Not only that, the hormone system sub-material consists of many foreign terms in mentioning the types of hormones so that students only use the memorization method to study the hormone system sub-material (Badruzzaman & Raharjo, 2019; Irnaningtyas, 2014).

Pasak Bumi (*Eurycoma longifolia* Jack.) is a type of plant that is used by various ethnicities in Indonesia, especially the Batak ethnic community in Sumatra and the Dayak ethnic community in Kalimantan. Batak and Dayak ethnic communities often use these plants as medicine, namely as a medicine for fever, malaria, stomach pain, stamina enhancers, and strong drugs (Silalahi & Nisyawati, 2015). According to Khanijou & Jiraungkoorskul (2016), Pasak Bumi has benefits that are quite popular in society, such as increasing stamina, fertility, and sexual arousal in men, increasing muscle mass, relieving stress, acting as an antioxidant, and various other types of diseases. The part of the pasak bumi that is often used in medicine is the root part (Rehman, Choe, & Yoo, 2016). Pasak Bumi's root has been reported to have acted as a hepatoprotective with its mechanism as an antioxidant, as well as having an antidiabetic activity (Fransisca, Kalangi, Candrasari, & Hendra, 2018; Panjaitan, Handharyani, Chairul, & Manalu, 2013). According to Panjaitan et al. (2013), preparations of the methanol-water fraction of the pasak bumi root can improve the

structure of the liver organs in mice induced by CCL4, so it can be proved that the roots of the earth peg have activity as a hepatoprotective with its mechanism as an antioxidant. Not only that, according to the research of Fransisca et al. (2018), methanol extract of pasak bumi root has an antidiabetic activity which is characterized by a decrease in blood glucose levels in mice that are burdened with glucose. In connection with the results of research showing the characteristics of the hormone system sub-materials which are abstract, complex, and difficult to understand by students, while biology magazines have a role to support students' understanding of biological material, as well as long jack's root has activity as a hepatoprotective and antidiabetic. It is necessary to develop a biology magazine as an enrichment material for sub-materials. hormone system based on the results of the antidiabetic mellitus test results from the ethanol-water fraction of the roots of the pasak bumi root (*Eurycoma longifolia* Jack.).

RESEARCH METHODS

Research Design

This research is a type of Research & Development research. The development model used in this study is the Four-D Model which was developed by Thiagarajan, Semmel, and Semmel in 1974. This development model consists of four stages, namely define, design, development, and dissemination. In this study, it was only carried out until the development stage, this is because this research was carried out only at the validation stage of the development product which was followed by product revision.

Population and Samples

The research subjects used in this study consisted of 6 validators which included 3 lecturers of Biology Education, Faculty of Teacher Training and Education, Tanjungpura University, and 3 biology teachers from Immanuel Christian High School Pontianak, Immanuel Christian High School Pontianak (Bilingual Class), and Santo Fransiskus Asisi High School Pontianak. as well as 47 students from Immanuel Christian High School Pontianak and Santo Fransiskus Asisi High School Pontianak.

Instruments

The research instrument used in this study consisted of a Biology teacher interview guide, a questionnaire sheet for the literacy culture index of class XI MIPA students, and a biology magazine validation sheet as material for enrichment of the hormone system sub-material. Biology teacher interview guidelines are used to obtain the basic problems faced by teachers in implementing the enrichment program. The interview results that have been obtained are used as the basis for the development of a biology magazine as an enrichment material for the hormone system sub-material. The preparation of the biology teacher interview guide was developed based on the main issues that have been determined, namely the implementation of the enrichment program, the use of enrichment materials in the enrichment program, the obstacles faced in the implementation of the enrichment program, the coverage of diabetes mellitus material, and the potential of biology magazines as enrichment materials. The student literacy culture index questionnaire sheet is used to obtain the habits, attitudes, and behavior of students in implementing the literacy culture. The preparation of the student literacy culture index questionnaire sheet refers to the grid that has been determined using a Likert scale. Each statement consists of 4 alternative answers, namely strongly agree, agree, disagree, and disagree. The questionnaire sheet compiled consisted of 8 positive statements and 8 negative statements. The following is a grid of student literacy index questionnaire sheets which can be seen in Table I.

Biology magazine validation sheets were used to obtain data on expert assessments of biology magazines developed as enrichment materials. The results of the validation of the biology magazine

are used as the basis for improving the product. Biology magazine validation sheets will be filled out by expert lecturers/practitioners. The preparation of the biology magazine validation sheet refers to the Ministry of Education and Culture Research and Development Materials Pusat Kurikulum dan Perbukuan (2014) cit. Fuadah (2017). The feasibility aspects used in the feasibility test for biological magazines as enrichment materials are aspects of content feasibility, presentation feasibility, graphic feasibility, and linguistic feasibility

Table I. Grid of the Student Literacy Culture Index Questionnaire Sheet

Research Variable	Sub Variable	Indicator	Statement Item	
			Positive	Negative
Literacy Culture Index	<i>Habit</i>	Habits of students in taking time to read	1	2
		The habit of students in choosing reading sources.	3	4
		Habits of students in understanding reading sources.	5	6
	<i>Attitude</i>	The attitude of students in taking the time to read.	8	7
		The attitude of students in choosing reading sources.	9	10
		Attitude of students in reading.	11	12
	<i>Behavior</i>	The behavior of students in taking the time to read.	13	14
		The behavior of students while reading.	15	16

Procedures

This research consists of three stages, namely the stages of define, design, and development. At the definition stage, a front-end analysis was carried out to obtain the basic problems that became the basis for developing a biology magazine, which was carried out through interviews with biology teachers at Christian High School Immanuel Pontianak and SMA Santo Fransiskus Asisi Pontianak. The next stage is a learner analysis which is carried out to obtain an index of student literacy culture which is carried out using the questionnaire method. In the task analysis, an analysis of core competencies and basic competencies related to the material to be developed through biology magazines is carried out to identify the main tasks that must be mastered by students in order to achieve the specified competencies. In the concept analysis, the content of the biology magazine was compiled by analyzing learning sources and testing the ethanol-water fraction of pasak bumi roots as antidiabetic mellitus whose research results were used as learning resources. At the stage of specifying instructional objectives, the determination of learning indicators and learning objectives is carried out.

At the design stage, a standard test was prepared, which was carried out by preparing test questions based on the results of the formulation of learning objectives. Furthermore, at the enrichment material selection stage, the selection of enrichment materials is carried out based on the results of front end analysis, student analysis, task analysis, concept analysis, and formulation of learning objectives. After that, at the format selection stage, the biology magazine format was selected, and at the initial design stage the initial design was made using adobe photoshop CS6 and coreldraw X7 tools. At the development stage, the biology magazine was validated by experts/practitioners, followed by revisions. The purpose of this stage is to produce a final product from a biology magazine based on suggestions/input from experts/practitioners.

Data Analysis

Biology magazine's assessment is in the form of a Likert scale with categories of very good (score 5), good (score 4), moderately good (score 3), less good (score 4), and very poor (score 1).

The results of the validation were analyzed using Aiken's V analysis. According to Hendryani (2017), the Aiken's V formula aims to calculate the content-validity coefficient based on the results of an assessment from an expert panel of n people on a system from the extent to which the item represents the construct being measured. . Aiken's V formula can be seen at Formula I:

$$V = \frac{\sum(r-lo)}{[n(c-1)]} \dots\dots\dots \text{Formula I}$$

Description:

- r : the score given by the rater/validator
- lo : lowest rating score
- c : highest rating score
- n : number of raters/validators

In determining the minimum value for the feasibility of a biology magazine, Aiken's V table is used. In Aiken's V table, it can be seen that the validator who assessed as many as 6 people and each item used 5 scale choices, namely very poor (1), not good (2), quite good (3), good (4), and very good (5), and using an error probability of p > 0.05. Based on this, when viewed from Aiken's V table, it can be determined the feasibility value of a biology magazine, which is 0.79 for each item (V > 0.79).

After analyzing the validation of the biology magazine as an enrichment material, the assessment data by the validator will then be analyzed for reliability. In this study, the Intraclass Correlation Coefficients (ICC) reliability analysis developed by Pearson (1901) was used to analyze interrater reliability. The steps of interrater reliability analysis, namely analyzing data from the validator, and determining the model, type, and definition of interrater reliability using ICC (Koo & Li, 2016). The model used in this study is two-way mixed effects, the type used is multiple raters, and the definition used is consistency definition. Based on the specified model, type, and definition, the formula used for interrater reliability uses ICC, namely:

$$ICC = \frac{MS_R - MS_E}{MS_R + \frac{MS_C - MS_E}{n}} \dots\dots\dots \text{Formula 2}$$

Description:

- MS_R : Mean square for rows
- MS_E : Mean square for error
- MS_C : Mean square for columns
- n : Number of subjects

In determining the category of interrater reliability assessment using the ICC, therefore the interrater reliability assessment using the ICC with a 95% confidence interval has the following categories Tabel 2.

Table 2. Category value of interater correlation coefficients

ICC	Criteria
ICC < 0,5	Low reliability
0,5 ≤ ICC ≤ 0,75	Moderate reliability
0,75 < ICC ≤ 0,9	High reliability
ICC ≥ 0,9	Perfect reliability

(Koo & Li, 2016)

RESULT

a. Results of Needs Analysis (Defining Stage)

Based on the results of interviews with biology teachers at 'Immanuel Christian High School Pontianak' and 'Santo Fransiskus Asisi High School Pontianak', it is known that the enrichment program is implemented on students who have achieved the minimum completeness criteria. The enrichment program provided aims to increase the insight of students. In implementing the enrichment program, the teacher uses enrichment materials such as making clippings based on the results of analysis of learning resources from various literatures related to the learning topics being studied, working on discussion materials obtained from articles/other reading sources, and working on analytical questions from a case study. The enrichment material has advantages, namely it can motivate students to increase their insight in the field of knowledge and skills, but the enrichment material used is partial due to the characteristics of the biological material that is difficult for students to understand and has a broad scope of material, thus causing students' interest in learning. participating in the enrichment program becomes less and feels bored with the enrichment materials used. Student analysis aims to determine the characteristics of students in accordance with the design of learning device development. Characteristics of students observed in this study, namely the index of student literacy culture which includes the habits, attitudes, and behavior of students in following the literacy culture. The following are the results of the analysis of the student literacy culture index shown in Table 3.

Table 3. Results of the Analysis of the Literacy Culture Index for Class XI MIPA Students

School Name	Literacy Culture Index			Average (%)	Category
	Habit	Attitude	Behavior		
SMA Kristen Immanuel Pontianak	70.22	65.43	71.99	69.21	Good
SMA Santo Fransiskus Asisi Pontianak	73.75	69.79	74.69	74.24	Good
Overall average (%)	71.99	67.61	73.34	71.73	Good

Task analysis carried out in this study consisted of basic competency analysis and core competency analysis. Based on the results of the analysis carried out, it can be seen that the sub-material of the hormone system is classified into KD. 3.10, namely analyzing the relationship between the structure of the network making up organs in the coordination system (nerves, hormones, and sense organs) in relation to the mechanism of the coordination and regulation system as well as functional disturbances that can occur in the human coordination system. Based on the results of the analysis, it can be seen that the material coverage of the hormone system sub-material is the characteristics of the hormone system, glands and hormone secretion, and abnormalities of hormone secretion. At the task analysis stage, the identification of tasks given by the teacher related to enrichment materials, such as making clippings based on the results of analysis of learning resources from various literatures related to the learning topics being studied, working on discussion materials obtained from articles/other reading sources, and working on analytical problems from a case study.

Concept analysis carried out in this study consisted of compiling the content of biology magazine material by analyzing learning resources. In the analysis of learning resources, research was carried out on the antidiabetic power of the ethanol-water fraction of the roots of the pasak bumi root (*Eurycoma longifolia* Jack.) on white rats induced with streptozotocin whose research results were used as a learning resource. Based on the test results obtained, it can be seen that the administration of ethanol-water fraction preparations of pasak bumi root at a dose of 500 mg/kg body weight can reduce blood glucose levels, malondialdehyde levels, and improve the structure of

the pancreas organs of wistar strain white rats that have been damaged after being induced with streptozotocin.

In addition to research on the power of antidiabetic mellitus, at the concept analysis stage, literature analysis related to information from learning resources will also be carried out which will be compiled in biology magazines. At the stage of formulation of learning objectives, indicators of learning achievement are determined and the formulation of learning objectives through the results of concept analysis and task analysis with the aim of knowing the study of material displayed in biology magazines and determining the grid of test questions that will be given to students.

b. Biology Magazine Design Results (Design Stage)

The design stage consists of the preparation of test standards, the selection of enrichment materials, the selection of formats, and the making of the initial design of the biology magazine. At the stage of preparing test standards, the preparation of test questions is carried out based on the results of the formulation of learning objectives. The preparation of the test questions carried out in this study consisted of the preparation of the grid and the preparation of the test questions in the magazine. The test questions that are prepared are multiple choice questions, totaling 20 questions. The test questions referred to in this study are evaluation tests of student learning outcomes in the hormone system sub-material and are not tested on students. At the stage of selecting enrichment materials, the selection of enrichment materials to be developed is carried out based on the results of the needs analysis that has been obtained. Based on the results of the needs analysis, it can be seen that the literacy culture index is classified into a good category so it is necessary to develop interesting enrichment materials that can increase the interest and motivation of students in adding insight into their knowledge.

The enrichment material developed in this study was a biology magazine based on the results of the antidiabetic mellitus test of the ethanol-water fraction of the pasak bumi root. At the format selection stage, the biology magazine format used consists of a front cover page containing the magazine title, illustrations that support the overall aspect of the magazine's content, and the Tanjungpura University logo, an editorial page consisting of an introduction and thanks, and a content page consisting of main reports, special reports, research, bibliography, and glossary. The main report contains information about the general description of the hormone system and diabetes mellitus. The special report contains information on the potential of the pasak bumi plant and the selling price of the pasak bumi root in Indonesia. The research section contains information on the results of the research on the antidiabetic power of the ethanol-water fraction of pasak bumi roots. The following are the results of the initial design of the biology magazine which can be seen in Figure 1. The results of the design of the biology magazine can be seen at the following link:

<https://drive.google.com/file/d/IXCSYerbSI366ztmZuAdeBEQr6AI8gwTI/view?usp=sharing>

c. Biology Magazine Validation Results (Development Stage)

The development stage in the 4D stage of Thiagarajan has the aim of producing a development product based on the results of an expert/practitioner assessment. At this stage of the research, 6 validators were assessed for the biology magazine, namely 3 lecturers of Biology Education FKIP Tanjungpura University, biology teacher at Christian High School Immanuel Pontianak, biology teacher at Christian High School Immanuel Pontianak (Bilingual Program), and SMA Santo Fransiskus Asisi Pontianak. The assessment component of a biology magazine consists of aspects of content feasibility, presentation feasibility, linguistic feasibility, and graphic feasibility. The following are the results of the validation of biology magazines which are shown in Table 5.



Figure I. Biology magazine view in Bahasa

Table 5. Biology Magazine Validation Results as Enrichment Material for Hormone System Sub-Material

Assessment Aspect	Statement	Rating result (Aiken's V)	Category
Feasibility of Content	The suitability of the presentation of the material to the educational level of students and can support the achievement of learning objectives.	0.88	Valid
	Presentation of the material contains concepts, procedures, and is clarified by examples, facts, and illustrations that are appropriate and clear.	0.96	Valid
	The material presented is in the form of concepts, case examples, and practice questions that apply in the biological sciences	0.88	Valid
	The material presented in the magazine is original work (not the result of plagiarism), does not cause SARA and gender discrimination.	0.83	Valid
	The material has scientific truth in accordance with the latest scientific developments, is valid, and	0.88	Valid

	accurate.		
	The material presented in the magazine maximizes the use of sources that are in accordance with Indonesian conditions and are closely related to the Indonesian context.	0.92	Valid
Feasibility of Presentation	The material presented is coherent, systematic, straightforward, and easily understood by students.	0.79	Valid
	Presentation of the material can develop the knowledge, skills, and motivation of students to be creative and innovate.	0.88	Valid
	The material presented is complemented by several illustrations/pictures/figures, references/sources, and practice questions that are presented consistently.	1.00	Valid
Appropriateness of Language	The material presented uses simple sentences and does not cause ambiguity for students.	0.79	Valid
	The language used is ethical, aesthetic, communicative, and functional with the target audience.	0.79	Valid
	The use of spelling punctuation, vocabulary, sentences, and paragraphs is in accordance with the rules and terms used by the magazine.	0.83	Valid
	The content of the material between topics reflects a logical relationship.	0.96	Valid
	The suitability of the use of language in explaining concepts in biology magazines with the level of development of students.	0.83	Valid
	The use of terms is in accordance with the Big Indonesian Dictionary or technical terms that have been standardized in biology.	0.88	Valid
Graphic Eligibility	The harmony of color, illustration, and typography elements displayed makes the magazine cover attractive.	0.88	Valid
	Titles, subtitles, text, illustrations, and image captions are placed proportionally.	1.00	Valid
	The use of fonts in magazines is clear and easy to read by students.	1.00	Valid
	The developed biology magazine uses a variety of letters to distinguish the level/hierarchy of titles and subtitles, and puts emphasis on the arrangement of text in bold/italics.	1.00	Valid
	The pictures contained in biology magazines are interesting and in accordance with the material.	0.88	Valid
Average		0.89	Valid

Based on the results of the validation of biology magazines, which are shown in Table 5, it can be seen that all aspects of the assessment of biology magazines are declared valid. This is indicated by the value of Aiken's V obtained 0.79. Based on the validation results obtained, then the validation results are tested for reliability to determine the level of agreement between validators

(raters). Reliability analysis used in this research is reliability analysis using ICC. The following are the results of the reliability analysis of biology magazines which are shown in Table 6.

Table 6. Biology Magazine Reliability Analysis Results

	Intraclass Correlation Coefficients						
	Intraclass Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	DF1	DF2	sig
Single Measures	0.147 ^a	0.033	0.401	2.261	19	95	0.005
Average Measures	0.558 ^a	0.170	0.801	2.261	19	95	0.005

Based on the results of the interrater reliability analysis obtained, it can be seen that the average agreement between validators (average measure) on intraclass correlation is 0.558 and is categorized as moderate reliability.

DISCUSSION

This research is a type of Research & Development research that uses a 3D development model which is an adaptation of Thiagarajan's 4D model. This research consists of three stages, namely the stages of definition, design, and development.

The definition stage is an activity that consists of determining the product to be developed along with its specifications and needs analysis carried out through research and literature study (Sugiyono, 2019). According to Thiagarajan, Dorothy, & Melvyn (1974), the definition stage consists of front-end analysis, learner analysis, task analysis, concept analysis, and the formulation of learning objectives (specifying learning objectives). At the front end of the analysis stage, it aims to find out the basic problems faced by biology teachers in implementing the enrichment program. Based on the results of the interviews obtained, it can be seen that the implementation of the enrichment program is carried out on groups of students who have reached the minimum completeness criteria in order to increase the insight of students. According to Wijaya et al. (2020), the enrichment program aims to increase students' understanding and insight into the material being/has been studied, and students can learn optimally both in terms of utilizing their abilities and obtaining learning outcomes. In implementing the enrichment program, the teacher uses enrichment materials such as making clippings based on the results of analysis of learning resources from various literatures related to the learning topics being studied, working on discussion materials obtained from articles/other reading sources, and working on analytical questions from a case study. The enrichment material has advantages, namely it can motivate students to increase their insight in the field of knowledge and skills. This is in accordance with the Pusat Kurikulum & Perbukuan (2018), namely enrichment materials can improve students' thinking skills and can broaden students' insight into the environment based on current knowledge. Based on the results of the interview, it can also be seen that the enrichment material used is very good, which can increase students' motivation and insight, but the enrichment material is partial due to the characteristics of biological material that is difficult for students to understand and has a broad scope of material, thus causing the interest of students in participating in the enrichment program becomes less and feels bored with the enrichment materials used.

Stages of student analysis aims to determine the characteristics of students. Characteristics of students observed in this study is the index of student literacy culture which includes habits, attitudes, and behavior of students in implementing literacy culture. Based on the results of the analysis of the student literacy culture index, it can be seen that the student literacy culture index is

categorized as good, therefore it is necessary to develop enrichment materials that can support students to increase their knowledge insight. The task analysis stage aims to determine to determine the tasks given by the biology teacher related to the enrichment material provided. At the task analysis stage, basic competency analysis and competency analysis are carried out. Based on the results of the interviews that have been obtained, the tasks given by the teacher are related to enrichment materials, namely making clippings based on the results of analysis of learning resources from various literatures related to learning topics, working on discussion materials obtained from articles/other reading sources, and working on problem analysis of a case study. Based on these enrichment materials, it can be seen that the enrichment materials used by teachers are in accordance with the demands of the 2013 curriculum, this is because the enrichment materials provided aim to train the independence of students in increasing students' insight. According to Supriyadi (2017), in the 2013 curriculum, teachers are not the only source of learning, but rather one source of learning so that students are required to actively learn and seek their own learning resources.

At the concept analysis stage, the scope of the material presented in the biology magazine is determined, while the scope of the material included is an overview of the hormone system, characteristics of the hormone system, hormone glands and hormone secretion, abnormality of hormone secretion, general description, symptoms, causes, and types of disease. diabetes mellitus, principles and strategies for the treatment of diabetes mellitus, the potential of the pasak bumi plant (*Eurycoma longifolia* Jack.) as a new drug source, the selling price of the pasak bumi root in Indonesia, and the results of research on the antidiabetic power of the ethanol-water fraction of the pasak bumi root against induced mice. with streptozotocin. At the stage of formulating learning objectives, indicators of achievement of learning objectives are determined and the formulation of learning objectives based on the results of concept analysis and task analysis. The results of determining the indicators of learning achievement are used as specific learning objectives in compiling the study of material displayed in biology magazines. The indicators for achieving the competencies determined consist of analyzing the relationship between the structure of the network making up the hormone system, analyzing the types of hormones produced by the hormone glands, analyzing the relationship between hormonal system abnormalities and hormone secretion in humans, presenting the results of the analysis of the influence of lifestyle on hormonal system disorders in particular. in diabetes mellitus, and presents the results of the analysis of the relationship between diabetes mellitus treatment and insulin secretion.

The design stage consists of activities to make designs for predetermined products (Sugiyono, 2019). This stage consists of the stages of preparing the standard test preparation of the test standard (constructing-test construction), selection of enrichment material (enrichment material selection), selection of format (format selection), and preparation of initial design (initial design). At the stage of preparing test standards, the preparation of test questions carried out in this study consisted of the preparation of grids and preparation of test questions in magazines. At the stage of selecting enrichment materials, the selection of enrichment materials to be developed is carried out by adjusting the results of the needs analysis (Thiagarajan et al., 1974). Based on the results of the analysis of the ends of the needs that show a lack of interest and motivation of students in participating in the enrichment program, students feel bored with the enrichment materials used, the characteristics of biological material are abstract and difficult to understand by students, therefore it is necessary to develop interesting enrichment materials. and can increase students' insight and understanding. The enrichment material developed in this study was a biology magazine based on the results of testing the antidiabetic activity of the ethanol-water fraction of the roots of pasak bumi (*Eurycoma longifolia* Jack.).

According to Nurasih et al. (2020), the magazine is one of the popular scientific works designed using a younger language so that it can be understood by students easily. In addition, magazines have various advantages, namely having an attractive display of text and images so that they can give a relaxed impression and do not make students bored (Fiidami et al., 2021). Not only that, the development of biology magazines can also help students to see the relationship between the material being taught and real-world situations such as the environment, technology, and society, and students can also see a meaningful relationship between biological material (Kartika, 2018). Based on the results of the formulation of learning objectives that have been obtained, therefore the developed biology magazine contains material on the hormone system, diabetes mellitus, principles and strategies for the treatment of diabetes mellitus, the potential of the pasak bumi plant as a source of new drugs, the selling price of the pasak bumi root in Indonesia, and research on the antidiabetic activity of the ethanol-water fraction of pasak bumi roots.

In selecting the format, the biology magazine format is selected which is divided into the front cover page, editorial page, content page, bibliography, and glossary, and back cover page. The front cover page consists of the magazine title “BIOZEARTH: Biology Magazine”, pictures/illustrations that represent the entire contents of the magazine, magazine topics, and the Tanjungpura University logo. The editorial page contains the researcher's introduction and thanks to various parties who have participated in the development of the biology magazine. The content page of the biology magazine is divided into 4 sections, namely the main report, special report, research, and mini quiz. The main report contains information on the general description of the sub-material of the human hormone system, diabetes mellitus which includes the symptoms, causes, and differences between type 1 and type 2 diabetes mellitus. earth in Indonesia. The study contains information on the potential of the ethanol-water fraction of pasak bumi roots as antidiabetic mellitus against diabetic white rats induced by streptozorocin-nicotinamide. Mini Quiz contains practice questions for students after reading biology magazines. The bibliography page contains a list of references used during the making of the biology magazine, sub-material of the hormone system. Writing bibliography using the Harvard system (author-date style). The Harvard system uses the author's name and year of publication in alphabetical order by author's name. The glossary page contains important terms in the text with explanations of their meanings. The glossary can help students to find and understand terms that are foreign to students.

At the stage of preparing the initial design, the layout design of the biology magazine that will be used is carried out. Biology magazine layouting process was made using a combination of Corel Draw X7 and Adobe Photoshop CS6 software. Corel Draw X7 software is used to design biology magazine layouts which include cover pages, editorial pages, and content pages. While the Adobe Photoshop CS6 software is used for designing magazine logos, picture and photo editing, and making materials for magazines. The magazine developed in this study has A4 size or 21cm × 29.7cm and uses CMYK color format (Cyan, Magenta, Yellow, Black). The fonts used in biology magazines consist of Florena, Calibri, Futura Bold, and Gill Sans Ultra Bold. The purpose of using a combination of font types in biology magazines is to make the magazine look more attractive and not monotonous. In making the manuscript for a biology magazine, the font Calibri was used with a size of 12 and a space of 15.72. The use of these fonts can make it easier for students to read the contents of biology magazines.

The development stage is the stage for producing development products through two stages, namely expert appraisal and development testing. According to Sugiyono (2019), the development stage consists of activities to make product designs and test product validity repeatedly to produce products according to the specifications set. At the development stage in this study, a feasibility test of biology magazines was carried out as an enrichment material using the Aiken's V validity test and the ICC reliability test. Based on the results of the validation of the biology magazines that

have been obtained, it can be seen that all aspects of the biological magazines are declared valid. This is indicated by the Aiken's V value obtained from this study which has a range of 0.79 – 1. Based on the results of validation by the validator, it can be concluded that the development of a biology magazine based on the antidiabetic mellitus test of the ethanol-water fraction of the pasak bumi root is suitable to be used as an enrichment material for the hormone system sub-material. . This is indicated by the suitability of aspects of biology magazines which include content components, presentation components, linguistic components, and graphic components with the criteria for assessing enrichment materials that have been determined.

After validating the biology magazine as an enrichment material for the hormone system sub-material, the validation results obtained were tested for reliability analysis. This study uses the Intraclass Correlation Coefficient (ICC) reliability test. According to Ismunarti, Zainuri, Sugianto, & Saputra (2020), ICC is a statistical test of reliability on the same variable with a continuous scale that is measured with two or more different measuring instruments. Based on the results of the reliability test that has been obtained, it can be seen that the ICC values obtained in single and average measures are 0.174 and 0.558. From the ICC value that has been obtained, it can be seen that the level of reliability in the research data is stated to be quite good or categorized as moderate reliability. Based on the research results obtained by Pertiwi et al. (2021), the ICC value which is categorized as moderate reliability indicates an agreement between validators in assessing a product development.

CONCLUSION

Based on the research results that have been obtained, the conclusion of this study is that the enrichment materials used by biology teachers are very good, which can train students' independence in increasing students' insight, but it is necessary to develop interesting enrichment materials in order to motivate and increase the interest of students in increasing their knowledge insight. Based on the results of the feasibility test for biological magazines that have been carried out, it can be seen that the validation results of biological magazines show the Aiken's V value 0.79, so that the biological magazine developed based on the results of testing the ethanol-water fraction of pasak bumi roots is suitable to be used as an enrichment material for the hormone system sub-material class XI MIPA.

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REFERENCES

- Alfarisi, R. S., & Suseno. (2019). Pengembangan Buku Pengayaan Menulis Teks Anekdote Bermuatan Cinta Tanah Air. *Jurnal Kredo*, 3(1), 102–115. Retrieved from <https://doi.org/10.24176/kredo.v3i1.3950>
- Badruzzaman, A., & Raharjo. (2019). Profil Miskonsepsi Siswa pada Materi Sistem Endokrin. *BioEdu*, 8(2), 225–231. Retrieved from <https://jurnal.umk.ac.id/index.php/kredo/article/view/3950>
- Dewantara, A. H. (2018). Soal Matematika Model PISA: Alternatif Materi Program Pengayaan. *Didaktika Jurnal Kependidikan*, 12(2), 197–213. Retrieved from <https://doi.org/10.30863/didaktika.v12i2.186>

- Fiidami, I. N., Ashari, & Ngazizah, N. (2021). Pengembangan Bahan Ajar Berbentuk Majalah Bedhug Berbasis Karakter Islami pada Kelas V Sekolah Dasar. *Jurnal Pendidikan Dasar*, 2(1), 85–94. Retrived from <https://doi.org/10.37729/jpd.v2i1.970>
- Fransisca, F., Kalangi, G. E., Candrasari, D. S., & Hendra, P. (2018). The Effect of Pasak Bumi Roots Towards Blood Glucose Level in Glucose-Loaded Mice. *Journal of Pharmaceutical Sciences and Community*, 15(1), 1–6. Retrived from <https://doi.org/10.24071/jpsc.151965>
- Fuadah, E. S. (2017). Pengembangan Bahan Pengayaan Mata Pelajaran Fisika untuk Meningkatkan Kemampuan Literasi Air Terjun Curug Tujuh Cibolang pada Peserta Didik SMAN 1 Cihaurbeuti Kabupaten Ciamis. *Skripsi*. Bandung: UIN Sunan Gunung Djati.
- Irnaningtyas. (2014). *Biologi Untuk SMA/MA Kelas XI Kelompok Peminatan Matematika dan Ilmu Alam*. Jakarta: Penerbit Erlangga.
- Ismunarti, D. W., Zainuri, M., Sugianto, D. N., & Saputra, S. W. (2020). Pengujian Reliabilitas Instrumen Terhadap Variabel Kontinu untuk Pengukuran Konsentrasi Klorofil-a Perairan. *Buletin Oseanografi Marina*, 9(1), 1–8. Retrived from <https://doi.org/10.14710/buloma.v9i1.23924>
- Kartika, N. A. (2018). Pengembangan Media Pembelajaran Biologi Sebagai Bahan Ajar pada Materi Sistem Regulasi. *Skripsi*. Lampung: UIN Raden Intan.
- Khanijou, T., & Jiraungkoorskul, W. (2016). Review ergogenic effect of long jack, *Eurycoma Longifolia*. *Pharmacognosy Reviews*, 10(20), 139–141. Retrived from <https://doi.org/10.4103/0973-7847.194041>
- Khoiriah, Y. N., Raihanati, & Budi, E. (2018). Pengembangan Buku Pengayaan Pengetahuan Hujan Untuk Siswa SMA. *Prosiding Seminar Nasional Fisika (E-JOURNAL) SNF 2018*, 7. Retrived from <https://doi.org/10.21009/03.SNF2018.01.PE.II>
- Koo, T. K., & Li, M. Y. (2016). A guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. *Journal of Chiropractic Medicine*, 15(2), 155–163. Retrived from <https://doi.org/10.1016/j.jcm.2016.02.012>
- Kurniawan, P. Y., & Subyantoro. (2016). Pengembangan Buku Pengayaan Menulis Teks Prosedur Kompleks yang Bermuatan Nilai-Nilai Kewirausahaan. *Jurnal Pendidikan Bahasa Dan Sastra Indonesia*, 5(1), 71–80. Retrived from <https://doi.org/10.15294/SELOKA.V5I1.12753>
- Liany, D. N., Desnita, & Raihanati. (2018). Pengembangan Buku Pengayaan Pengetahuan “Penerapan Konsep Fisika Pada Pesawat Terbang Komersial” Untuk Siswa. *Jurnal Wahana Pendidikan*, 3(1), 14–18. Retrived from <https://doi.org/10.17509/wapfi.v3i1.10932>
- Nugroho, A. S. A., & Susilowibow, J. (2019). Pengembangan Permainan Kartu BTS (Bid To Score) Sebagai Media Pengayaan Pada Materi Akuntansi Piutang Kelas XI Akuntansi di SMKN 10 Surabaya. *Jurnal Pendidikan Akuntansi*, 7(3), 282–287. Retrieved from <https://jurnalmahasiswa.unesa.ac.id/index.php/35/article/view/30268/27735>
- Nuraida, N., & Astuti, A. (2019). Pengembangan Majalah Sebagai Bahan Ajar Biologi Pada Materi Sistem Reproduksi untuk Siswa Sekolah Menengah Atas. *Journal of Education in Mathematics, Science, & Technology*, 2(1), 22–28. Retrived from <https://doi.org/10.30631/jemst.v2i1.16>
- Nurasih, Y. P., Leksono, S. N., & Wahyuni, I. (2020). Pengembangan Majalah Invertebrata Sebagai Sumber Belajar Siswa SMA Pada Sub Konsep Invertebrata. *Gagasan Pendidikan Indone*, 1(2), 87–97. Retrived from <http://dx.doi.org/10.30870/gpi.v1i2.9886>
- Panjaitan, R. G. P., Handharyani, E., Chairul, & Manalu, W. (2013). Hepatoprotective activity of *Eurycoma longifolia* Jack. Roots. *Indian Journal of Traditional Knowledge*, 12(2), 225–230.

- Pusat Kurikulum & Perbukuan. (2018). *Panduan Pemilihan Buku Nonteks Pelajaran*. Retrieved from <http://repositori.kemendikbud.go.id>
- Rehman, S., Choe, K., & Yoo, H. (2016). Review on a Traditional Herbal Medicine, *Eurycoma longifolia* Jack (Tongkat Ali): Its Traditional Uses, Chemistry, Evidence-Based Pharmacology and Toxicology. *Molecules*, 21(3), 331. Retrieved from <https://doi.org/10.3390/molecules21030331>
- Sahri, I. A., & Listiadi, A. (2015). Pengembangan Permainan Ular Tangga Akuntansi Sebagai Media Pengayaan Pada Materi Ayat Jurnal Penyesuaian Perusahaan Jasa. *Jurnal Pendidikan*, 3(1), 1–8. Retrieved from <https://ejournal.unesa.ac.id/index.php/jpak/article/view/32750>
- Silalahi, M., & Nisyawati. (2015). Etnobotani Pasak Bumi (*Eurycoma longifolia*) pada Etnis Batas Sumatera Utara. *Pros Sem Nas Masy Biodiv Indon*, 1(4), 734–746. Retrieved from <http://repository.uki.ac.id/617/>
- Sopian, H. (2019). Deskripsi Kemampuan Berpikir Logis dan Pemahaman Konsep Sistem Hormon pada Siswa Kelas XI SMA. *Jurnal Penelitian Ilmu Dan Pendidikan Biologi*, 7(2), 85–88. Retrieved from <https://doi.org/10.25134/edubiologica.v7i2.3023>
- Sugihartono. (2012). *Psikologi Pendidikan*. Yogyakarta: UNY Press.
- Sugiyono. (2019). *Metode Penelitian & Pengembangan Research and Development*. Bandung: Alfabeta.
- Supriyadi, S. (2017). Pemanfaatan Sumber Belajar dalam Proses Pembelajaran. *Lantanida Journal*, 3(2), 127. Retrieved from <https://doi.org/10.22373/lj.v3i2.1654>
- Thiagarajan, S., Dorothy, S., & Melvyn, I. (1974). *Instructional Development for Training Teachers of Exceptional Children a Sourcebook*. Washington DC: National Center for Improvement of Educational System.
- Widyaningrum, E., Aprilia, S., & Iqbal, M. (2015). Pengembangan Produk Penelitian Berupa Buku Nonteks sebagai Buku Pengayaan Pengetahuan. *Artikel Ilmiah Mahasiswa Universitas Jember*, 1(1), 1–5. Retrieved from <https://repository.unej.ac.id/handle/123456789/63558>
- Wijaya, H., Muttaqin, Z., & Taufiq, M. (2020). Peningkatan Nilai Ujian Nasional Melalui Pengayaan Materi Bahasa Indonesia di Sekolah SMA/MA Lombok Timur, Tahun Akademik 2018/2019. *Madaniya*, 1(1), 1–8. Retrieved from <https://madaniya.pustaka.my.id/journals/contents/article/view/1>