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## STUDENT'S WORKSHEETS WITH GUIDED INQUIRY APPROACH ON SUB MATERIALS OF ENDOCRINE SYSTEM ENRICHED WITH REDUCING PROCESS OF DIABETIC BLOOD SUGAR LEVELS

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ARTICLE INFO	ABSTRACT
Article history Submission May 25 <sup>th</sup> , 2022 Revision July 15 <sup>th</sup> , 2022 Accepted October 5 <sup>th</sup> , 2022	<i>The use of student's worksheets as teaching materials and supporting learning activities is still not evenly distributed. The components are sometimes incomplete. This study aims to describe the development and determine the feasibility of guided inquiry-based worksheets as teaching materials for the endocrine system sub material for second-grade of high schools. This study used a 4D development model limited to three defining, designing, and developing stages. The student's worksheets were designed based on the problems obtained from interviews with biology teachers in three different schools. At the development stage, the worksheets were validated by five validators consisting of two lecturers and three biology teachers in Pontianak. The validation assessment contained four aspects: the feasibility of the content/material, language, presentation, and graphics with 19 criteria. The student's worksheet was successfully developed with enrichment in the form of discourse analysis activities related to diabetes and the process of lowering blood sugar levels by plant extracts with guided inquiry stages. The feasibility analysis results of the guided inquiry-based student's worksheet obtained CVR and CVI values of 1 each so that product can be declared ready for the limited and extensive trial phase. However, the significance of the enrichment topics in this student's worksheet still needs to be re-examined directly in the teaching and learning process in the Endocrine System Sub material for second grade of high school in both small and large scales groups.</i>
<b>Keywords:</b> <i>Endocrine system Guided inquiry approach Student's worksheet</i>	

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### INTRODUCTION

The implementation of learning activities in the classroom certainly requires preparation that must be done by the teacher, including those related to planning teacher and student activities, using appropriate learning methods, clear learning objectives, and

preparing media, sources, and learning materials to be used (Ananda, 2019). A student's worksheet is a type of teaching material that is commonly used and can be applied at various levels of education for several kinds of lessons. Teaching materials can function as tools, facilities, subjects, and places to improve the quality of education. In addition, teaching materials are everything that provides information, knowledge, and skills in learning (Kosasih, 2021). However, the interview results on January 5<sup>th</sup>, 2019, showed that only two out of three teachers at SMAN 5, SMA Muhammadiyah 1 and SMA Mujahidin Pontianak, had implemented student's worksheets as their teaching materials.

Moreover, teaching materials are tools or materials that contain information about learning materials that are systematically arranged, both printed and non-printed (Prastowo, 2015). The interviews in the three schools also found that although two of three teachers had used the student's worksheets, there were still components lacking when referring to the Daryanto & Dwicahyono (2014), which did not include learning instructions indicators of competency achievement work steps, and assessments. On the other hand, student's worksheets can be packaged more completely by enrichment, increasing student activity and knowledge.

The observation results also found that the three schools had not used students' worksheets in the endocrine system sub material. Meanwhile, when learning is linked to basic competencies (BC), students are expected to be able to analyze the relationship between the structure of the tissue of the organ in the endocrine system and functional disorders that may occur in the human endocrine system through literature studies, observations, experiments, and simulations. Thus, it is necessary to use teaching materials that can provide appropriate forms of activity during endocrine system learning, such as student's worksheets. LKPD, or student's worksheet assist and facilitate teaching and learning activities to form effective interactions between students and educators and increase student learning activities and achievements (Umbariyati, 2016). Examples of enrichment regarding disorders in the endocrine system can be included in the LKPD to train students in analyzing.

With prioritizing the organizing of student's worksheets, which pays attention to efforts to train student's skills such as scientific processes, scientific thinking, and creativity, the approach used in the student's worksheets working stage on the endocrine system sub material can be used a guided inquiry approach (Zahro *et al.*, 2019; Zahrotin

*et al.*, 2021). Various studies report that guided inquiry-based worksheets are also able to influence concept mastery (Marleni, 2020) and improve communication skills (Fara *et al.*, 2019), in addition to improve learning outcomes (Firdaus & Wilujeng, 2018; Putra & Iryani, 2019) in addition, learning activities with guided inquiry can improve students' cognitive learning outcomes (Lestari & Irawati, 2020). The guided inquiry has phases in implementing learning: formulating problems, formulating hypotheses, collecting data, analyzing data, and drawing conclusions (Irwandi, 2020). When viewed from the research conducted by Aditya *et al.* (2020), using the same research method, it turned out that the development of guided inquiry-based student worksheets (LKS) for class XI human coordination system materials at SMAN 5 Taruna Brawijaya East Java, the worksheets that were made covering all coordination system materials were also declared "eligible" for use in learning. So that a guided inquiry-based LKPD was made for the endocrine system sub-material, which contains information and pictures that support and train students to understand the material.

Based on the background, it is necessary to conduct research that aims to develop teaching materials in guided inquiry-based student worksheets on the endocrine system sub material for class XI SMA and test their feasibility according to expert judgment. This development is designed to meet the needs of activities following the demands of Basic Competency while improving concepts, communication skills, and student learning outcomes. In this study, enrichment was carried out by presenting the research results on reducing blood sugar levels in diabetic rats from Maulina (2022). Thus, students must understand the material more broadly by applying a guided inquiry approach.

## **MATERIALS AND METHODS**

### ***Research design***

This research is a development research that uses the 4D method (define, design, develop and disseminate) but only uses three stages of the four stages of the process.

### ***Research instrument***

The research instrument of validation of guided Inquiry-based LKPD teaching materials shows the feasibility of the teaching materials, namely guided inquiry-based worksheets on the endocrine system sub-material for second-grade high school students.

### ***Research subject***

The subjects of this research were five teaching materials experts with two lecturers of Biology Education FKIP UNTAN and three teachers from three different schools, namely SMA Muhammadiyah 1, SMA Mujahidin, and SMAN 5 Pontianak.

### ***Tools and materials***

The instrument used was a validation sheet of student's worksheet of teaching material. In this study, the instrument validation experts were two FKIP lecturers. Instrument validation was carried out before validating teaching materials with five validators. Instrument validation refers to the Depdiknas (2008) guidelines for teaching material validation.

### ***Research procedure***

This research was conducted from July 2021 to March 2022 at the Laboratory of Biology Education, Faculty of Teacher Training and Education, Universitas Tanjungpura, Pontianak. In this research, the technique only used 3 of 4 steps.

#### **1. Define**

This stage was for determining and analyzing product development needs by paying attention to the defined set, namely conducting an initial diagnosis, student characteristics, diagnosing main student tasks and material concepts, and determining learning objectives (Thiagarajan *et al.* (1974) as followed by Panggabean and Danis (2020). At this stage, a field survey was conducted by interviewing three biology teachers at SMAN 5 Pontianak, SMA Muhammadiyah 1, and SMA Mujahidin about the endocrine system sub material for class XI SMA/MA, and the teaching materials used.

#### **2. Design**

At this stage, it began with designing the student's worksheets by making activities following the steps of guided inquiry. The structure of student's worksheets was modified while still following the basic structure rules from the Depdiknas (2008), including titles, study instructions, competencies to be achieved, supporting information, tasks and work steps, and assessments. Then, the student's worksheets were printed using 75 gsm A4 paper with a 210 x 197 mm paper size.

### 3. Develop

Teaching materials that had been designed were made and improved according to the needs of learning tools (Rachmawati *et al.*, 2019). Furthermore, experts will conduct a validation process. Validation aims to determine the feasibility of the product that has been made. Validation was carried out by two lecturers of FKIP Tanjungpura University who were considered experts and three biology teachers from the three schools who were previously interviewed to see if they matched the learning needs in schools according to the teacher's experience. The validation of students' worksheets teaching materials was measured using a Likert scale with a score of 4 if very agree, three agree, two disagree, and one very disagree. Validated aspects include content, language, presentation, and graphics, referring to the Depdiknas (2008), modified according to needs.

#### *Analysis and Data Interpretation*

The total criteria used to assess the guided inquiry-based students' worksheets were 19 statements. The analysis of the validation results was carried out by calculating the Content Validity Ratio (CVR) and Content Validity Index (CVI) values according to Lawshe (1975) as reviewed by Gilbert and Prion (2016) with the following formulas:

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

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

Description:

CVR : *Content Validity Ratio*

CVI : *Content Validity Index*

Ne : The number of validators who agree on the validity of teaching materials (considered agreeing if the value of each aspect and an average range of each aspect is 3.00 - 4.00, if < 3.00, then it is considered not to agree with the validity of teaching materials).

N : Total validator

$\Sigma CVR$  : Content Validity Ratio

$\Sigma n$  : Criteria

Suppose the final calculation, the CVR and CVI scores are by Lawshe's (1975) and Gilbert & Prion's (2016) minimum limit value of 0.99. In that case, the students' worksheets teaching materials are declared valid and feasible to use.

## RESULTS AND DISCUSSION

The development of learning tools in the form of guided inquiry-based students' worksheets as teaching materials was carried out well using three of the four stages of the 4D model from Thiagarajan *et al.* (1974) as followed by Panggabean & Danis (2020). The descriptions of the three stages that have been carried out are as follows:

### **Define**

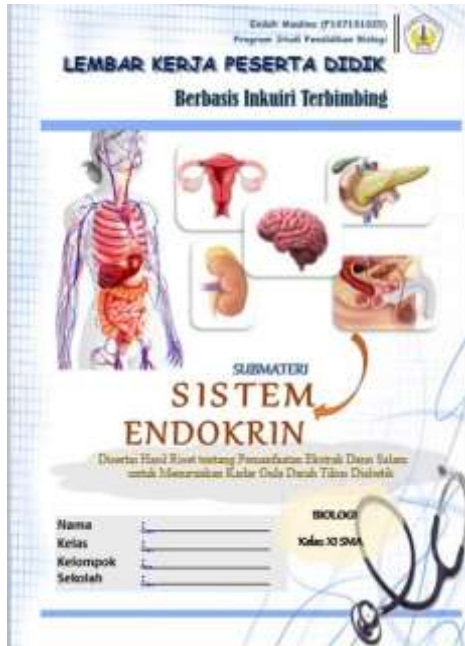
Thiagarajan *et al.* (1974) in Panggabean and Danis (2020) stated that this stage was carried out to analyze development needs and obtain information by paying attention to the steps that must be carried out at this stage, such as initial diagnosis to determine learning efficiency and effectiveness, student characteristics, main tasks that students must master to achieve the specified competencies, the concept of the materials presented and arrange the steps for learning activities and focus on learning objectives that expect students to experience changes in behavior after studying the teaching materials made. At this stage, interviews were conducted with three high school biology teachers in Pontianak City. Information was obtained that in delivering the Endocrine System Sub material, some teachers used textbooks, and some used textbooks along with students' worksheets. However, incomplete components were found in the students' worksheets compared to elements according to Depdiknas (2008) or Daryanto & Dwicahyono (2014). The complete student's worksheets must include titles, study instructions, competencies to be achieved, supporting information, indicators, tasks and work steps, and assessments.

### **Design**

The student's worksheets were designed to be printed on A4 75 gsm paper with 36 pages. Overall, the contents of the students' worksheets were divided into two parts: an explanation of glands and hormones and then disorders in the endocrine system. In this students' worksheets, the research results on reducing diabetic blood sugar levels were also added, which were taken from Maulina (2022).

The composition of the guided inquiry-based student's worksheets on the endocrine system sub material is the front cover, introduction, table of contents, learning and assessment instructions, KI-KD, indicators, objectives, the scope of material about glands and hormones, which is then followed by a sequence of guided inquiry activities starting

from formulate problems, formulate hypotheses, collect data, analyze data, and draw conclusions. Furthermore, the contents of the material about endocrine system disorders are followed by five steps of guided inquiry. At the end of student's worksheets, the material deepening, answer key, references, and back cover are presented (Figure 1).



Front cover



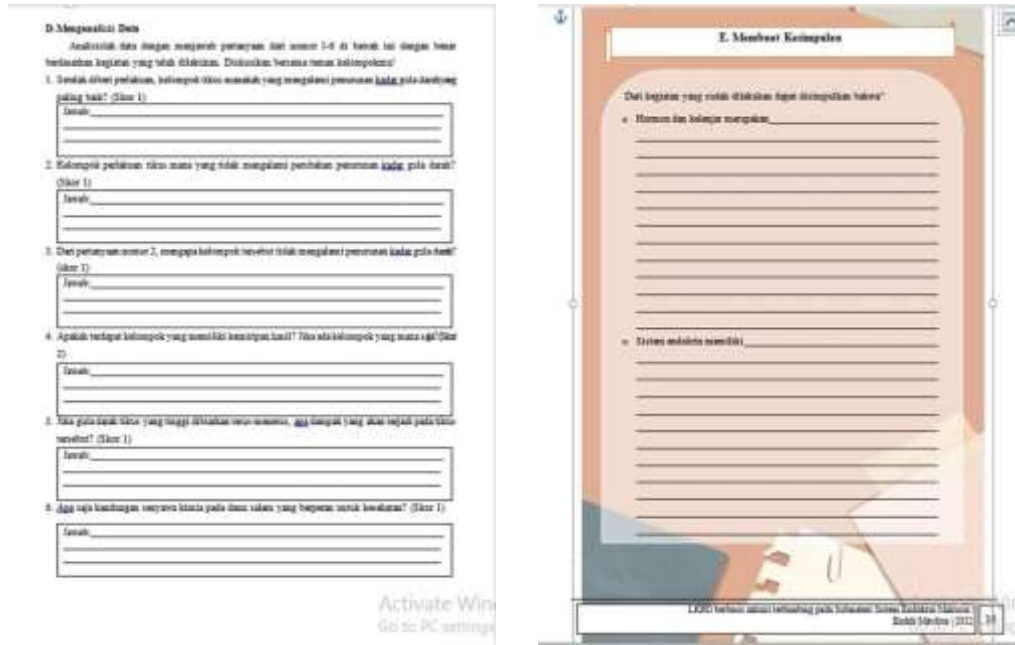
Basic Competencies



Information



Collecting Data



Data Analysis

Conclusion

**Figure 1.** Content snippet of guided inquiry-based students' worksheet on the endocrine system sub material with enrichment of research results on the process of reducing diabetes blood sugar levels according to Maulina (2022)

The cover display is given a soft color, and pictures of organs related to the material to strengthen that what will be conveyed in these guided inquiry-based students' worksheets is the endocrine system sub-material. Then, an additional title regarding the results of research on the process of lowering blood sugar levels in diabetes is intended to clarify the concept of abnormalities/disorders in the endocrine system. This is because the process of lowering blood sugar levels has a close relationship with the glands and hormones in the endocrine system. In the BC display, indicators and learning objectives focus on students' learning material. In formulating indicators, it is necessary to pay attention to the characteristics of Core Competency (CC) and Basic Competency (BC) through a study of the active verbs used. In addition, the criteria that must be considered in selecting and using teaching materials are accuracies with learning objectives. With the right learning objectives, we can pay attention to the main content in teaching materials so that the opportunity for students to succeed in learning is getting bigger (Arsyad, 2014).

Adding supporting information as part of the critical content in preparing teaching materials. Enriched information presented to students can train students to find,



understand, and evaluate something to improve the quality of learning (Latifah & Husna, 2016). The information presented in the students' worksheets can also help students formulate problems and create hypotheses to fulfill activities in the students' worksheets. The information in this guided inquiry-based worksheet is presented by including appropriate and supportive images for understanding the material on glands and disorders/disorders in the endocrine system. According to Ananda (2019), the addition of pictures used for learning should be determined based on the need and suitability for understanding.

In data collection, students try and work together to collect evidence and look for other information to answer the hypothesis proposed in the students' worksheets. Sanjaya (2015) stated, in the guided inquiry learning strategy, data collection activities are an essential process in learning activities which are then carried out in the data analysis stage. The collected data is analyzed through questions by the activities carried out previously. This activity encourage students to think and predict answers to the problems created at this guided inquiry-based student's worksheets. Based on the results, students are asked to make a conclusions based on the activities that answer whether or not the proposed hypothesis was accepted.

### **Define**

The student's worksheets were made according to the design at the development stage, followed by a feasibility test through a validation process. The results of the CVR calculation for all criteria in each aspect (feasibility of content, language, presentation, and graphics) are declared valid/feasible because they have met the minimum CVR value (**Table 1**) according to Lawshe (1975) for five validators is 0.99.

The assessment of the student's worksheets in content/material, language, presentation, and graphics are declared valid/feasible. The suitability of all components in the students' worksheets with the results of the needs analysis and previously designed design shows the development success of the method used. The content feasibility assessment is one of the four assessment criteria in addition to language, presentation, and graphics that must be considered and adjusted to existing regulations (Kinanti & Sudirman, 2017),. Setyowati (2018) stated that assessing the feasibility aspect of the content needs to pay attention to the suitability of the basic competencies of the syllabus.

**Table 1.** Results of student's worksheet validation based on guided inquiry on the endocrine system sub material for second grade class of highschool

Validation Aspects	Criteria	CVR	Description
<b>Content Eligibility</b>	1 The material follows CC, BC, indicators, and learning objectives	1	Valid
	2 The suitability of student's worksheets activities with the guided inquiry process	1	Valid
	3 Increase student's knowledge about the material selected based on student's worksheets activities	1	Valid
	4 The truth of the substance of the material presented in the guided inquiry-based student's worksheets	1	Valid
	5 Practicing values, morality, and social	1	Valid
	6 The suitability of research on the effect of bay leaf extract ( <i>Eugenia polyantha</i> Wight.) for diabetes mellitus on the selected material for the student's worksheets	1	Valid
	7 The suitability of the presentation of the bay leaf extract ( <i>Eugenia polyantha</i> Wight.) with the guided inquiry process in the student's worksheets	1	Valid
	8 The suitability of presenting research on the effect of bay leaf extract ( <i>Eugenia polyantha</i> Wight.) on the student's worksheets with KD, indicators, and objectives in learning activities	1	Valid
<b>Language</b>	9 The grammatical compatibility used with the General Indonesian Spelling Guidelines (PUEBI), which includes: a. Use of punctuation marks b. Writing foreign or scientific terms c. Capitalization	1	Valid
	1 The readability of the material contained in the students' worksheets is based on the use of language that is suitable for the student's level of comprehension	1	Valid
<b>Presentation</b>	1 The suitability of the use of standard words and does not cause double meaning	1	Valid
	1 Have clarity and suitability of indicators and learning objectives with basic competencies	1	Valid
	1 The students' worksheets have a complete structure (title, study instructions, competencies to be achieved, supporting information, tasks and work steps, and assessment).	1	Valid
	3		
	1 The work steps on the student's worksheets are clear and sequential	1	Valid
	4		
<b>Graphics</b>	1 Have information that helps students understand the selected material	1	Valid
	5		
	1 Attractive font size and clarity of writing and images so that they are easy to read and understand	1	Valid
	6		
	1 The student's worksheets are equipped with pictures that can help students understand the material	1	Valid
	7		
	1 The layout of the images on the student's worksheets is well organized	1	Valid
8			
1 The cover display is attractive and follows the learning material	1	Valid	
9			
<b>Content Validity Index (CVI)</b>		1	

Description: Score 4 (strongly agree), Score 3 (agree), Score 2 (disagree), and Score 1 (strongly disagree)

In this student's worksheets, there are enrichment activities regarding the reduction process of diabetic blood sugar levels, which is one of the characteristics of the students' worksheets that is assessed in the validation criteria. The inclusion of this enrichment is also adjusted to the BC to add information related to the endocrine system sub-material.

The assessment results on the language aspect. Guided inquiry-based worksheets are declared valid/feasible where language is an assessment factor that occupies the most critical position in conveying information to readers (Supriyadi & Zulaeha, 2017). Aspects of language that are still classified as lacking or still errors will affect the delivery of information to readers and students. Meanwhile, a proper assessment of the presentation aspect illustrates that the development of the student's worksheets has considered the content of the teaching materials according to learning needs and availability under the curriculum demands (Zukhaira & Hassyim, 2014). The presentation of the student's worksheets has been equipped with instructions for using and working steps on the activities presented to make it easier for students and teachers to use these guided inquiry-based student's worksheets.

Another important part when preparing teaching materials is the graphic element so that the teaching materials presented are exciting and fun so that students are interested and motivated to learn (Ramadhani & Mahardika, 2015). However, the presentation of visual elements should be determined based on the need and suitability for learning (Ananda, 2019). In these student's worksheets, graphic elements that can be seen are pictures of diseases in the endocrine system, which are neatly arranged and equipped with sources that can assist the process of delivering information to students. In addition, several variations of letters and other animations are also given to beautify its appearance.

The validation assessment of the guided inquiry-based student's worksheets, which enriches the process of reducing diabetes blood sugar levels, was declared valid/feasible as teaching material in the Endocrine System Sub material for second-grade high school students. The four aspects measured in this validation must be considered a condition for preparing good student's worksheets. According to the statement of Muqodas *et al.* (2015), making and designing teaching materials in the form of books should pay attention to four essential aspects following the Center for Curriculum and Books, namely characteristics of content or material, aspects of presentation, aspects of language and legibility, and aspects of graphics. Student's worksheets with a guided inquiry model are

expected to improve students' ability to interact, communicate and have good thinking and language skills that can be applied in everyday life. The addition of information in the form of research results is expected to bring students closer to applying knowledge about the relationship between the structure of tissues and organs in the endocrine system and the disorders/abnormalities that occur more clearly. Furthermore, to find out the meaning of the enrichment topic added in these students' worksheets, it is necessary to re-test directly in the teaching and learning activities in both small and large-scale study groups.

### **CONCLUSION**

The preparation of products in guided inquiry-based student's worksheet teaching materials by adjusting problems regarding the use of student's worksheet in the school environment was successfully carried out using research and development methods of 4D models. The content of the worksheet includes endocrine system sub-materials accompanied by enrichment of the results of research on diabetes blood sugar levels whose learning activities follow the steps of guided inquiry. The worksheets were declared eligible/valid based on the content, language, presentation, and graphics characteristics.

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