

The Development of Student Worksheets on Inquiry-Based Plant Growth and Development Sub-Concept

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Article Information

Keyword:

Student Worksheet
Validity
Practicality
Plant Growth
Inquiry

Kata Kunci:

LKPD
Validitas
Kepraktisan
Pertumbuhan Tumbuhan
Inkuiri

History:

Received : 29/03/2021
Accepted : 23/06/2021
Published : 28/06/2021

Abstract

The concept of plant growth and development is important to learn, through a conceptual, contextual and scientific approach. The results of the analysis of the needs of Biology teachers and grade XII students of SMAN 2 Kintap show that there are still problems in making student worksheet on certain materials. As many as 91% of students are interested in student worksheet which is accompanied by lots of illustrations, concrete pictures, and easy to understand subject matter. Then, as many as 83% who like worksheet which looks colorful and attractive. This development research uses a 4D model which is limited to the Develop stage. This study aims to describe the validity and practicality of the student worksheet subconcept of Inquiry-Based Plant Growth and Development. The research was carried out in grade XII MIA SMAN 2 Kintap and Biology Education Study Program FKIP ULM. The results showed that the student worksheet of the Plant Growth and Development subconcept obtained an average validity score of 97% from 4 aspects of the assessment that were assessed by 3 (three) validators and included very valid criteria (can be used without revision), while practicality obtained a value of 3.8 from the assessment. by 12 (twelve) students, included in the very good criteria, so it is practical to use.

Abstrak

Konsep pertumbuhan dan perkembangan tumbuhan penting untuk dipelajari, melalui pendekatan konseptual, kontekstual dan ilmiah. Hasil analisis kebutuhan guru Biologi dan peserta didik kelas XII SMAN 2 Kintap menunjukkan bahwa pembuatan LKPD pada materi tertentu masih terkendala. Sebanyak 91% peserta didik tertarik dengan LKPD yang disertai banyak ilustrasi, gambar-gambar yang konkrit, dan mudah memahami materi pelajaran. Lalu, sebanyak 83% yang menyukai LKPD yang tampilannya warna-warni dan menarik. Penelitian pengembangan ini menggunakan model 4D yang dibatasi pada tahap *Develop*. Penelitian ini bertujuan untuk mendeskripsikan validitas dan kepraktisan LKPD subkonsep Pertumbuhan dan perkembangan Tumbuhan Berbasis Inkuiri. Penelitian dilaksanakan di kelas XII MIA SMAN 2 Kintap dan Program Studi Pendidikan Biologi FKIP ULM. Hasil penelitian menunjukkan LKPD subkonsep Pertumbuhan dan Perkembangan Tumbuhan memperoleh skor validitas rata-rata 97% dari 4 aspek penilaian yang dinilai oleh 3 (tiga) validator dan termasuk kriteria sangat valid (dapat digunakan tanpa revisi), sedangkan kepraktisan diperoleh nilai 3,8 dari penilaian oleh 12 (dua belas) peserta didik, termasuk dalam kriteria sangat baik, sehingga praktis untuk digunakan.

A. Introduction

Learning is a method that can integrate the situation of students with factors that can influence it, so that it can bring students to be active in learning. In addition, the stages that can provide support and guide in every teaching-learning process can also be said to be a process of active "learning". Aspects of attitudes, knowledge and skills that are assessed in the current implementation of the 2013 Curriculum, are not just the acquisition of student learning outcomes in the form of assignments that are assessed, but how to do practicum, discussion and other assignments are also included in the evaluation of students in the learning process.

The Student Worksheets development is adjusted to the learning model in the 2013 curriculum, with the application of recommended learning models such as *Discovery Learning (DL)*, *Problem Based Learning (PBL)*, *Problem Solving (PS)* and *(Project Based Learning (PjBL) and Inquiry (I)*. Inquiry learning that is applied can be in the form of: free inquiry model, modified free inquiry, and guided inquiry.

The method taught by the teacher to students is by applying an inquiry model, where students can be active in finding and studying their own problems, giving birth to temporary guesses, gathering information, and analyzing information, and making conclusions (Misbah *et al.*, 2019) and (Listiani *et al.*, 2016).

The general problem experienced in the world of education is the less than optimal process in learning a material that is taught to students, as a result students find it difficult to describe their ability to remember without having to understand the explanations obtained, especially to apply them in life and their environment. In addition, students have not obtained learning outcomes in the form of perfect grades at school. This will be causal in the learning process which is still very monotonous in cognitive, affective and psychomotor which is accommodated to be able to increase the personality of students (Sanjaya, 2018).

Weaknesses in the learning system and teaching and learning processes that must be carried out by students and educators are also the issuance issues in Indonesia carried out in terms of teaching, learning and learning processes, education financing, facilities and infrastructure that are not evenly distributed. The process of teaching and learning activities is a complex form, in this case the students who will later create a learning activity. Individual learning is a form of learning that requires students to be mastered learning (Agustin, 2020).

Character education that still has not achieved its target will also affect the education

system in Indonesia. Many of Indonesia's students who still have low moral quality, so they caused morality backwardness. With the existence of the education system which can later change the learning system to be better.

Judging from these problems, the implementation of a successful learning stage is supported by the teacher's ability to develop a method that is applied to students in order to increase their abilities to be more active, and to think critically. The model applied in this research is the inquiry model. This is because the inquiry model is a model which in its implications can optimally involve the ability of students to make a summary of the problem in their own logical, systematic and critical way.

There are objects of SMA/MA biology learning material that can be observed directly during learning, for example plant structure and morphology. However, there are also materials that require learning media as a substitute for the original object. The concept of plant growth and development is a biological material in which it discusses the stresses of internal and external factors that affect plants, in the discussion of hormones which explains natural and artificial organic compounds contained in plant organs. Hormones in plants in the process of growth and development, how they work is abstract, but the consequences can have a concrete effect. The concept in question is generally difficult for some students to understand. Therefore, it is necessary to carry out practical activities in the learning process, discussions and assignments in learning material for plant growth and development.

The results of the questionnaire analysis of the needs of Biology teachers at SMA Negeri 2 Kintap grade XII MIA, show that so far the learning methods have been quite good. However, the use of worksheets is still sometimes used by teachers, because there are still obstacles in its manufacture, such as lack of time to conduct experiments on materials that require practical activities, even though the reactions of students are more interested in using worksheets when learning. At the time of learning the teacher observes the activities, motivation and attention of students is still low to learn. Efforts and steps that have been taken are to find out the cause of students being less motivated, then try to reflect and improve the learning process by involving more student activities in learning.

The concept of plant growth and development in SMA/MA is quite difficult to teach when learning in class without any practicum activities, discussions and assignments. Therefore, it needs to be taught by conducting experiments,

discussions and assignments, for that it is necessary to have worksheets. The use of it needs to be taught by conducting experiments, discussions and assignments, for that it is necessary to have worksheets.

The results of the questionnaire analysis of student needs obtained, on the development of the Biology worksheets at grade XII MIA SMA Negeri 2 Kintap which was filled out by students, showed that as many as 91% of students were interested in the worksheets which was accompanied by many illustrations and pictures. Concrete, which can make students easy to understand the subject matter. The results of the questionnaire also showed that 83.3% of students liked the worksheets which was attractive and had a colorful appearance. Thus, the development of the worksheets sub-concept of plant growth and development will be very helpful in providing understanding, learning experiences, and recordings of students, especially the concept of growth and development,

Research and development of worksheets for high school biology material has been reported by several researchers including Aulia (2020) in their research "The Validity of Guided Discovery-Based Growth and Development worksheets to Train Critical Thinking Skills for Grade XII High School Students" obtained a validity value of 3.8. Lorena *et al.* (2020) in their research on "Inquiry Model Student Worksheet Expansion for Improving Students' Science Process Skills" concluded, the product that had been tested had a validity percentage value of 87.55% and was in the category "very valid" from material experts, and that had a validity percentage value of 91.01% and includes the "very valid" criteria by media experts. The practicality test results have a value of 92% with the criteria "very good", it will be very helpful in teaching students.

Based on the results of the questionnaire on the needs of teachers and students of grade XII MIA SMA Negeri 2 Kintap on the need for worksheets development, the researchers are interested in carrying out Research and Development in the form of Student Worksheets with the title "The Development of High School Biology Student Worksheets on Inquiry Based of The Plant Growth and Development Sub Concept".

B. Materials and Method

This research is using the 4D model, which includes the following steps: *Define, Design, Develop, and Disseminate (Deployment)* (Thiagarajan *et al.*, 1974). The research was conducted for 6 (six) months, starting from August 2020 to January 2021, taking place in Grade XII MIA SMA Negeri 2

Kintap which is located at Jl. Ahmad Yani Km.151, RT.09/RW.03, Sungai Cuka Kec. Kintap, Kab. Tanah Laut and at the Biology Education Study Program of PMIPA FKIP ULM, Jl. H. Hasan Basry Kodya Banjarmasin, South Kalimantan Province.

Descriptive research development instruments include a questionnaire to analyze the needs of teachers and students. According to Katriani and Danureja (2014) the worksheets development instruments include a validation instrument using an assessment, format adapted from Akbar (2013) and an individual test using an assessment format adapted from Mardapi (2008).

In developing the student worksheets validation data collection techniques were carried out using the combined theoretical method of Akbar and Sriwiyana (2010), including the following:

- 1) Setting a rating scale of 1, 2, 3, and 4 on the aspects of the worksheets validation assessment, namely:
 - 1 = Very Less
 - 2 = Less
 - 3 = Good
 - 4 = Very Good
- 2) If there is a rating scale that states 3, then improvements will be made to the worksheets validation assessment aspect sheet.
- 3) If the results of the validation assessment aspect are not valid (cannot be used), then the product will be improved gradually and repeatedly so that the results of the worksheets product have "very valid" criteria and can be used without improvement.

The calculation formula used to analyze the data that has been obtained is:

$$V = \text{TSe} / \text{TSh} \times 100\%$$

Information:

V = Validity

Tse = Total Empirical Score

TSh = Total maximum score

The data is matched with the validity criteria referring to Akbar (2013) below:

Table 1 The Validity Criteria

Score	Validity	Description
75,01%-100%	Very Valid	Can be used without revision
50,01% - 75%	Valid	Can be used with minor revisions
25,01% - 50%	Quite Valid	Can be used with mayor revisions
00,005 - 25%	Not Valid	Can't be used

(Adapted by Akbar, 2013)

Practical data collection techniques are as follows:

- 1) Establish a rating scale from 1, 2, 3, and 4 to the assessment aspects of worksheets development, namely:

1 = Very Less

2 = Less

3 = Good

4 = Very Good

Then students provide suggestions and input on the worksheets.

- 2) If there is a rating scale that states 3, the researcher will make improvements to the aspect of assessing the practicality of the worksheets.
- 3) If the results of the development of the worksheets are not yet practical, the product will be re-improved until it is declared practical with the criteria of "very good" and can be used without revision in the learning process.

Table 2 The Content Practicality Criteria

Score	Level Practicality
$X \geq 3$	Very Good
$3 > X \geq 2,5$	Good
$2,5 > X \geq 2$	Quite
$X < 2$	Less

(Adapted by Mardapi, 2008)

Practicality was analyzed descriptively based on the average score, then the data was matched with the content practicality criteria referring to Mardapi (2008) on Table 2 above.

C. Results and Discussion

1. The Worksheets Validity of The Plant Growth and Development Sub-Concept

Student Worksheets sub-concepts of plant growth and development were developed, based on the results of preliminary studies with needs analysis on worksheets, and by combining several concepts contained in student teaching materials. The results of the worksheets validation were obtained by validation tests by 3 (three) expert validators, namely supervisor I (V1), supervisor II (V2) and 1 biology teacher for Grade XII MIA SMA Negeri 2 Kintap (V3).

The validation stages include requiring several media experts to assess the feasibility of the product to be developed to get a validation score and suggestions and improvements from the validator (Septiani *et al.*, 2020). The recapitulation of the validation results of each aspect by 3 (three) expert validators can be seen in Table 3 below.

Table 3 Recapitulation of Validity Results

No	Aspek yang divalidasi	Score (%)			Average (%)
		V1	V2	V3	
1	Serving worksheets	88	94	100	94
2	Conformity with good and correct use of Indonesian (EYD)	94	94	100	96
3	Eligibility contents	100	96	100	99
4	Suitability of presentation according to learning recommendations centered on students	100	100	100	100
Average		96	96	100	97
Total average (%)		97%			
Conclusion		Very Valid			

Validation of the developed student worksheets is very important to get a valid value from the expert validator. The validation stage was carried out by 3 experts, obtaining an average validation value of 97%, which is included in the "very valid" category and can be used without revision.

Fannie and Rohati (2014) stated that the results of the validation on product creations carried out by expert validators aimed to provide value to the worksheets that the products that have been designed can be seen for their accuracy, advantages, and disadvantages, as well as to obtain validation of product suitability with needs.

So that it is valid and suitable for use in learning for students. In addition, with the test from the expert validator so that the worksheets can be applied to students in learning by looking at the design on the worksheets, then the expert validators

provide an assessment, so that improvements and input can be used as the basic points of improvement in product design through. Giving a questionnaire to the expert validator in the form of a validation instrument to assess the product on the worksheets that has been developed.

Repairs carried out in accordance with the input of expert validators, namely the first aspect of the worksheet of students such as the designation of the worksheets and layout settings that are in accordance with the good and correct study sheet. Widodo (2017) states that the presentation is a standard reference in presenting the worksheets of students who can be divided into four, namely 1) The presentation technique, consists of (a) the systematics of the presentation that contains the title, the purpose of the instructions and questions, (b) the material presented Proceeds from easy pain, (c) about the needs of students with the difficulty

level of simple to difficult. 2) Supporting presentation, consisting of (a) includes instructions in working on the worksheets of the students, (b) there are cover sheets of students. 3) Presentation of learning activities, consists of (a) Learning activities invite students to active, (b) exercises and questions reflect problem solving skills. 4) The material is presented with the obedile and every part of the material in harmony.

The second aspect is the feasibility of the contents consisting of processed material with the 2013 curriculum revision, the truth of the content of the material, the contents of the worksheet of students is easy to understand, the activities of students who are clearly formulated and operationally, material presentation allows active students, and material suitability and task with time allocation. In assessing this aspect that needs to be reprocessed is that aspects of students' activities are clearly formulated and operational. The worksheet of the participants is well done must have the compatibility between the material and competence to be achieved, the worksheet of the diyang participants is designed systematically and has been in accordance with the stages of the concept. Worksheets of students can be used in helping students find concepts by sorting the concept of a simple complex console, so students can hold independent learning (Dinantia *et al.*, 2017).

Widodo (2017) in his research states that, the standard of filling is a minimum reference that must be used in choosing material. The contents adjust the curriculum and development of students. The contents section consists of 1) Adjusting the applicable curriculum contains core competencies and basic competencies. 2) material accuracy,

adjusted to (a) core competencies and basic competencies, (b) the context of the material, (c) images or illustrations there are clear sources, and (d) terms and material in accordance with the development of students. 3) Material presentation, adjusted to (a) conditions in Indonesia and actual problems, and (b) there is material that encourages the expansion of students' knowledge.

The third aspect is the suitability of language with good and correct Indonesian rules that improvements also carried out such as: 1) using a clear sentence structure or word. 2) Use language that matches EYD. 3) The language used is communicative. 4) Accuracy of the use of the term. Based on research conducted by Widodo (2017) it is known that linguity is a reference applied in choosing a good language. Language refers to the use of good and correct Indonesian, and in accordance with the level of language development of students consisting of, 1) material, questions, instructions, and easy to understand activities. 2) The sentence and language used can guide students in working on the worksheets of students. 3) terms and spelling adjust to Indonesian rules.

2. The Worksheets Practicality of Plant Growth and Development

The worksheets practicality assessment is taken from the assessment of student responses using practicality instruments. The student response test for Grade XII MIA SMA Negeri 2 Kintap was carried out on 12 (twelve) students, so that the results of practicality values were obtained by students. The summary of practical results is listed in Table 4 below:

Table 4 Recapitulation of Practicality Results

No	Assessment Aspects	Average
1	The questions and concepts presented in the worksheets can be understood	3,5
2	Questions on worksheets development can increase understanding of the concept of growth and development in Grade XII	3,8
3	Questions and concepts presented in simple terms so that they are easy to understand	3,8
4	The existence of pictures on the development of worksheets helps understand the concept of growth and development in Grade XII	3,8
5	There are terms in the concept of growth and development in worksheets development to increase memory	3,7
6	Use easy-to-understand language	4
7	Display of student worksheets is interesting	3,8
8	Layout on proportional worksheets	3,4
9	The appearance on the worksheets for each page is attractive and colorful	4
10	The presentation of images on the worksheets for each section is visually clear	3,8
11	Writing in the worksheets uses clear letters, colors, and pictures that match	4
Total		41,6
Practicality Average		3,8
Conclusion		Very Good

Based on the results of the instrument from students on the worksheets, the developed

worksheets can be used as a learning tool that has practicality criteria with a percentage value of 3.8

which is included in the "very good" category. With a worksheets validity value of 97% including the very valid criteria category and an average practicality of 3.8 with a very good category, it is stated that the worksheets is practical and can be used without revision. This is because the worksheets has a score of ≥ 3 . According to Nadhira *et al.* (2020), the practicality of the developed worksheets can be measured through responses to the worksheets assessment, if the developed worksheets has practicality in all aspects of the assessment meeting the very good criteria.

The practicality of student worksheets includes three aspects of assessment, namely the feasibility of presentation, feasibility of content, and language feasibility. The first aspect of the student worksheet developed based on the presentation aspect includes; 1) The questions and concepts presented on the worksheets of the students can be understood, 2) The image on the development of students worksheets helps understand the concept of growth and development in grade XII, 3) Display of interesting student worksheets, 4) Layouts on worksheets of Proportional Students, 5) Display on Student Worksheets each interesting and colored page, 6) Package of images on the worksheets of students, each part is clearly visually, and 7) the writing in the participant worksheet is encouraged by clear letters, colors, and images which is harmonious. The presentation aspect is one of the important factors for attracting student learning interest, it is supported by the worksheets of students developed to include clear identities, having attractive designs, coating layout, cover display in accordance with the subject matter, and the selection of images and the warranne Supports the appearance of student worksheets. This is due to the appearance of interesting student worksheets to be the first factor to attract students' learning interest (Marinta and Budiastuti, 2019).

The second aspect is the presentation of content, including; 1) The question of the development of the worksheet of the students can add an understanding of the concept of growth and development in grade XII, and 2) questions and concepts presented with a simple discussion so that it is easy to understand. According to Amri (2013) with the presentation of the contents in the use of the worksheet worksheets during the learning process, it can facilitate students in finding a concept, helping students apply and integrate various concepts that have been obtained, as one of the Student Learning Tools, as a strengthening topic Taught, and as one of the tools of practicum instructions.

The third aspect of the language presentation, covers; 1) there are terms in the concept of growth and development in the development of the worksheet work sheets to increase memory, and 2) the use of language is easy to understand, in this case the use of language, sentences and terms are good but still need to be repaired especially in use of sentences that are too long. The use of simple and clear sentences is more effective than the use of long sentences but does not cover clarity from the contents of the worksheet pession (Widjayanti, 2008).

The advantage of the worksheets is the sub-concept of plant growth and development which was developed by conducting experiments/practicums, so that students are helped in critical thinking, equipped with pictures and colorful combinations. The advantages of the worksheets include, the developed worksheets has sections that completely assist students in learning (Khalifah and Darma, 2015), the arrangement of activities is systematic and structured (Selpiya *et al.*, 2019). This is reinforced by the existence of the Depdiknas (2008) which states that worksheets has complete parts in each of its activities including, the title of the worksheets according to the material being taught, Basic Competencies (KD), Learning Objectives (TP), Competency Achievement Indicators (GPA), biological material according to the provisions of the 2013 curriculum, and the working mechanism of worksheets in learning activities.

D. Conclusion

The development results of the worksheets sub-concept of plant growth and development based on inquiry obtained a validity percentage value of 97%, including the "very valid" category or can be used without revision. The development results of the worksheets subconcept of plant growth and development based on inquiry obtained a practicality value of 3.8 which is included in the very good criteria, so it is practical to use in the learning process.

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