



Development of students worksheet based on mastery learning in crossing-over field concept of genetic subject

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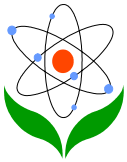
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Abstract

Students have difficulties understanding the crossing-over field concept in genetic courses because within the concept of crossing-over there are facts and problems that are difficult to solve as well as the absence of valid, practical, and effective student worksheets. So that the learning process is complete, activities and student learning outcomes become low. The purpose of this research is to develop a student worksheet based on mastery learning that is valid, practical, and effective on crossing-over field concept. The type of research is developed using 4-D model. The data analysis technique is a descriptive analysis that describes the results of validity, practicality, and effectiveness of the student worksheet. The result of the validity test



and the practicality of student worksheet based on mastery learning on crossing-over field concept is a validity value of 88% and practical value of 80,24%. This student worksheet is used because it can increase student activity and learning outcomes.

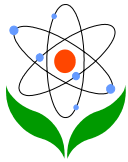
Keywords: development, student worksheet, mastery learning, crossing-over

Introduction

Genetics is one of the compulsory subjects of every student of Biology education at STKIP PGRI Sumatera Barat in semester five. Genetics is one of the subjects of sciences and skills in the field of Biology. The genetics subject has a code BIO 10024 with a weight of 3 credits. Genetics is part of the science of Biology that requires the ability to think creatively in solving various problems in society (Susantini et al., 2016). The purpose of this subject is that students of the biology education department in STKIP PGRI Sumatera Barat have knowledge in the basics of Mendel genetics, introduction to modern genetics and are able to apply the science of genetics in everyday life. But in reality, there are still many students who do not master the concepts in the subject of genetics, especially the crossing-over field concept.

Many students regard the crossing-over field concept as difficult as the crossing-over field concepts are facts and problems that are difficult to solve, and there is an absence of valid, practical, and effective student worksheets. The concern is the learning process is complete, activities and student learning outcomes become low. Besides, this student only expect information and notes from the lecturer whereas the subject matter is less than adequate. Therefore, it is necessary to develop a student worksheet based on mastery learning in the crossing-over field concept. Student worksheets can enhance students' understanding of the learning process and the quality of learning outcomes (Toman et al., 2013). Student worksheets based on mastery learning can improve the process of complete learning and the occurrence of educational interaction between lecturer and students (Megahati et al., 2016).

Student worksheets based on mastery learning contains the identity of the course, the unit of curriculum that will be achieved by the students, the learning activities that will be conducted in mastery learning, the systematic compilation of material, examples of questions and answers that are easy to understand, and formative and summative questions. The identity of the courses is listed on the student worksheets based on mastery learning, such as the name of the course, study



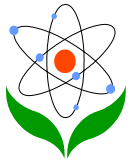
program/department, the name of the material, and the length of the meeting. The curriculum units include competency standards, basic competencies, and learning indicators to be achieved by the students. The subject matter is divided into units of lessons sorted according to the set of learning indicators in the syllabus. Examples of questions and answers are easy to understand, and formative and summative tests relating to the material are contained in the student worksheets. In the crossing-over field concept, the exercise questions are generally in the form of questions in the form of calculations that require accuracy in answering these questions.

This study aims to develop a students worksheet based on mastery learning on crossing- over field concept that is valid, practical and effective. Students worksheet based on mastery learning that contains the tasks that must be completed by the students until the learning outcomes can be achieved.

Methods

This research was conducted in the odd semester 2016/2017 on the Biology education department in STKIP PGRI Sumatera Barat. The type of research is developed using 4-D model and the data analysis technique is a descriptive analysis that describes the results of validity, practicality, and effectiveness of the student worksheet.

The stages development of 4-D models are defined, design, and development. In this research is limited until the development stage of student worksheet based on mastery learning in crossing- over field concept. The validity test is performed by two validators are includes three validation aspects. The data is then processed to obtain the average score of validity. Practicality test can be seen in several aspects, such as ease of use, the time required in the implementation, the attractiveness of the device to the interests of students, ease in interpreting, and have the same equivalent. In the effectiveness test carried out, a limited effectiveness test was conducted in a class of 29 students. Effectiveness testing is done to know the effectiveness of student worksheet in increasing student activity and a result of learning. Aspects of activity are observed by the observer, ie doing the exercises, working in groups and presenting group results. Learning outcomes are obtained from the final exam score after attending the lecture. Processing the value of learning outcomes is tailored to the standard assessment used by STKIP PGRI Sumatera Barat to determine the graduation of students.



Results and discussion

Validity test

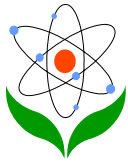
Validation results carried out by two validators against student worksheets in crossing-over field concept include three aspects of validation. The data is then processed so as to obtain the average score of prevalence and student worksheets based on mastery learning (Table 1).

Table 1. Results of validation in crossing-over field concept

Assessment Standards	The value of validity (%)	Criteria
Material Aspects	83	Valid
Aspect of Presentation	87	Valid
Aspects of Readability and Language	93	Very Valid
Average	88	Valid

Based on the results of the validator assessment shown in Table 1, student worksheets based on mastery learning in crossing-over field concept have been referring to valid categories with an average of 88%. Validity results assessed by two validators against student worksheets based on mastery learning in crossing-over field concept are valid categories. Some of the aspects observed in the student worksheets based on the mastery learning validity test in the crossing-over field concept material, presentation form, legibility, and language.

Based on the validity test conducted, the material aspect has valid criteria with 83% validation value. Although the criteria are valid in terms of material, there are some that should be revised according to the suggestion of the validator. Revisions made to the material should be accompanied by images and descriptions that are related to conceptual understanding. But in general, student worksheets based on mastery learning in the crossing-over field concept produced in terms of material has been referring to the existing curriculum because it has been in accordance with the learning objectives contained in the syllabus. Based on the curriculum analysis conducted, the translation of the crossing-over field concept has been in accordance with the standard of competence and basic competence. The teaching program that



will be submitted through this media to the students must be in accordance with the applicable curriculum in terms of content, structure, and depth.

The presentation aspect of student worksheets based on mastery learning in crossing-over field concept has valid criteria with an 87% validation score but is not independent of revisions suggested by validators. The revision made is that the part of the drawing used should be more interesting to the students. Benefits of learning media in the learning process is the lesson will attract more students so that it can grow the motivation to learn, learning materials will be more clear meaning that the topic can be better understood by the students and allows students to master the goal of learning better.

Language aspect has very valid criteria for 93% validation value. But not apart from the revisions suggested by the validator. The revision is to correct a little error in writing and improve the writing of scientific names used for students ease of understanding. An instrument is said to be valid if it can be used to measure what should be measured. Validation results conducted by two validators who are people who served in the field of crossing-over and education stated that student worksheets based mastery learning in crossing-over field concept is valid with a mean of 88%, which means the results of this validity can be justified.

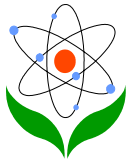
Based on the above, the criteria of student worksheets described above have been meet by student worksheets mastery learning in crossing-over field concept, developed by researchers, based on the assessment provided by the validator. Broadly speaking, student worksheet based on mastery learning in this crossing-over field concept can be used by lecturers and students in lecturing process.

Practicality test

The result of the practical test of the student worksheet based on mastery learning by lecturer and students shows that student worksheet based on mastery learning in genetics subject is in practical criteria (Tables 2 and 3).

Table 2. Practical test results of student worksheets by lecturer

Aspects	Item	Assessment of lecturer	The value of practicality (%)	Criteria
Ease of use	1-5	16	80	Practical



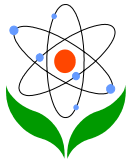
Time required for execution	6-7	6	75	Quite practical
The appeal of worksheet on student interest	8-12	16	80	Practical
Ease in interpreting	13-15	11	91,67	Very Practical
Has the same equivalent	16	3	75	Quite practical
Average			80,33	Practical

Table 3. Practical test results of student worksheets by students

Aspects	Item	The value of practicality (%)	Criteria
Ease of use	1-7	81,27	Practical
Time required for execution	8-9	79,93	Practical
The appeal of worksheet on student interest	10-12	75,50	Quite practical
Ease in interpreting	13-14	79,93	Practical
Has the same equivalent	15-16	84,09	Practical
Average		80,14	Practical

Based on the results of practical tests conducted by lecturer and students, the ease of use aspect shows practical criteria with 80% and 81.27%. This means that the student's worksheet can be used repeatedly and can be used even if there is no lecturer. This can happen because the instructions for using the student's worksheet are easy to understand. The time aspect required in the execution shows practical and practical criteria with 75% and 79.93% judgments. This indicates the student's worksheet can save the lecturer time in explaining genetic material because it does not require a long time to explain the material without using the student worksheet. An aspect of device appeal to student interest has practical and quite practical criteria with 80% and 75.50%.

Aspects of ease in interpreting the material show very practical and practical criteria with an assessment of 91.67% and 79.93%. This is caused the student's worksheet can be a facilitator between lecturer and students. This is in line with the opinion of (Arsyad, 2011). which suggests that the function of learning media is to



explain the presence of messages and information so as to accelerate and improve the learning process, learning media can improve and direct the student's attention so as to generate student learning motivation.

The same equivalent aspect represents a fairly practical and practical criterion with an assessment of 75% and 84.09%. This means that the material used is in accordance with the standards of competence, basic competencies, indicators and learning objectives that have been formulated so that the material on this student worksheet can represent all the material that has been studied.

The results of the assessment state that the student worksheets that researchers develop are useful in the learning process, both for lecturers and for students. Benefits are gained for lecturers, and then can assist lecturers in providing a correct explanation of the concepts in the genetic material to students. The advantages of learning media one of them is to raise the perception of a similar concept (Trianto, 2010). The clarity of instruction in the learning media, the suitability of the content on the learning media, the preparation of the material on instructional media, the suitability of the material with the learning media, the harmony of the colors, the appearance of the drawing, the writing on the material, and the custom of the language used can help understand the material (Sukiman, 2012) .

In the effectiveness test of student worksheets, there are two aspects observed, namely activity and students learning outcomes. The observation of students activity is in the very good and good categories (Table 4). Table 4 shows activity data from 29 students who have followed the learning process by using mastery learning based student worksheet in crossing-over field concept. In the aspect of doing the exercises are very good criteria with a value of 98.5%.

Table 4. Student activity observation result

Aspects of student activity	Percentage (%)	Category
Doing the exercises	98,5	Very good
Cooperate in groups	83,5	Very good
Present group results	65,7	Good

The aspect of cooperation in the group meets the very good criteria with a value of 83.5%. While the aspect of presenting the learning outcomes the good criteria with



a value of 65.7%. So it can be concluded that student worksheets based on mastery learning in genetics subject can increase activities where students are more serious in doing the exercises, sharing knowledge with friends and confident in presenting the results of learning. Developing of student worksheet based on science process skill effective in improving student learning outcomes at the department of education, Giresun University, Turkey (Karsli and Sahin, 2009).

Activity is any activity carried out either physically or mentality. Student learning outcomes are in the form of a description test obtained from the final examination value of the semester. Of the 29 students who attended the lectures all students passed. Based on the percentage, then students who get an A there is 44.9 with very good value criteria. Students who get a B score of 17.2 with good value criteria. Students who get a C score of 20.7 with good enough value criteria. Students who get the value of D there are 17.2 with criteria of less good value. From the data, it is known that the average score of students 'learning outcomes is 74.6, which means that the students' scores are graduated in accordance with STKIP PGRI Sumatera Barat standard. According Samsudin et al., (2016) ALBICI teaching model enhanced pre-service physics students' conceptual understanding and reduced most of their misconceptions despite a few misconceptions still occurred.

The variation in student values is influenced by several factors, such as those presented by Arikunto, (2005), namely the instrumental input in the form of environmental influences on learning outcomes. Analysis of learning outcomes is used to see the success rate of students in using student worksheets. Learning outcomes obtained from the given problem in the form of a description test of 5 questions. The learning result test is a test item used to determine students' learning outcomes after following the learning activities (Trianto, 2010).

Development student worksheet based on mastery learning in crossing-over field concept can improve students understanding, students are able to solve the problems contained in the crossing-over field concept, students have been able to study independently with the student's worksheets, activities and student learning outcomes increased. Mastery learning method is more effective on the performance of weak students in higher levels of learning method than in common learning method. Mastery learning method caused to increase positive changes in attitude of the weak students to chemistry learning (Damavandi and Kashani, 2010).



Conclusions and Implications

Student worksheet based on mastery learning in crossing-over field concept declared valid, practical, and effective.

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