



How is The Implementation of Diagnostic Tests in Biology Learning in South Sumatra?

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Abstract: Diagnostic tests have a very important role to provide information about the strengths and weaknesses of students related to a concept to be studied. This study aims to obtain an overview of the implementation of diagnostic tests carried out by Biology teachers in South Sumatra Province using the survey method. This study involved 86 Biology teachers in South Sumatra Province. Samples were taken using the convenience sampling method. Data collection by using e-questionnaire distributed through Google Form. The e-questionnaire consists of 25 questions developed from standard indicators of assessment, including planning, method selection, test instrument development, test implementation, test result management, test results reporting and the implications of these test results in the biology learning process in schools. The results of this study indicate that Biology teachers in South Sumatra have carried out routine diagnostic tests. The development of this diagnostic test instrument has also referred to the learning objectives and the results of the diagnostic test have been used to determine the methods, strategies, and approaches used in the learning process. Although in general the implementation of diagnostic tests in Biology learning is good, but the implementation and management of diagnostic tests that are very close to the learning process is feared will not have a significant effect on the implementation of the learning process in schools.

Keywords: Diagnostic Test; Biology Teacher; Evaluation Standart; South Sumatera

Introduction

Biology learning is a compulsory subject for high school students, especially for students with specialization in science. Biology concepts studied at the high school level are dominated by abstract concepts and broad studies. The character of this concept makes it difficult for students to understand the concept correctly. The results of previous studies reveal that many Biology concepts are very difficult to understand due to the limited time allocation (Fauzi et al., 2021; Lissa et al., 2021; Hadiprayitno et al., 2019). Learning difficulties experienced by students lead to misconceptions (Wahyono & Susetyarini, 2021; Duda et al., 2020; Prayitno, 2022).

Misconceptions often occur in the learning process, including in the biology learning process. In almost all the biology concepts taught in class, students have

misconceptions (Rahmi & Zulyusri, 2021). Misconceptions occur when the concept understood by students is different from the actual concept. This misconception can come from teachers, books and even students themselves (Gusmalini, et al., 2020; Fuchs & Arsenault, 2018; Coley & Tanner, 2012). Teachers who experience misconceptions can pass them on to students (Reydon, 2021; Ebenes & Caballes, 2020; Susanti, 2018). This misconception can continue until students understand the correct concept. Correction of wrong concepts in students can be done through the learning process in the classroom. Prior to the improvement of the concept of students who experience misconceptions, identification needs to be carried out to find out which concepts tend to make students experience misconceptions. Identification of misconceptions in students can be done using a diagnostic test instrument

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before the learning process is carried out (Hasyim et al., 2018; Nugraha & Fitrihidajati, 2021; Saat et al., 2016).

Diagnostic tests have a very crucial role in the learning process. Diagnostic tests can not only identify students' misconceptions but can also identify concepts that students have understood well or lack of knowledge (Kirbulut & Geban, 2014; Andariana et al., 2020). In addition, diagnostic tests can provide an overview of the strengths or weaknesses possessed by students in relation to the concept being studied (Wola et al., 2020; Gurel et al., 2015; Fakhriyah & Masfuah, 2021; Agustina & Supahar, 2021). This important information becomes a very valuable resource to assist teachers in determining the methods, approaches, strategies, learning resources, and media that will be used in the biology learning process in schools (Syamsiar & Raharjo, 2021). The selection of the right methods, strategies, approaches, media can not only make it easier for students to understand concepts but also influence student learning outcomes.

Diagnostic tests can be carried out in various forms of tests, including multiple choice, descriptions, brief descriptions, reasoned descriptions or using multiple tier test instruments such as two-tier tests, three-tier tests, and four-tier tests (Rukayah et al., 2020; Andariana et al., 2020; Wola et al., 2020). Each form of this instrument has its strengths and weaknesses for diagnosing students' initial abilities. This instrument also has a different sensitivity to identify students' misconceptions, for example the four-tier instrument has a very good ability to identify students' misconceptions when compared to the three-tier test instrument. However, if viewed from the effectiveness and efficiency of the time needed to carry out diagnostic tests and the data analysis process, the three-tier test is a better choice (Gurel et al., 2015).

The implementation of diagnostic tests in the classroom must pay attention to six important elements. First, the components tested must be guided by the applicable curriculum. Second, diagnostic tests can identify student needs and achievement targets in accordance with the applicable curriculum. Third, the diagnostic test must be able to describe the strengths and weaknesses of the students so that the results of this test can help the learning process. Fourth, synchronization between content, design, and selection of test implementation methods. Fifth, the diagnostic test must be able to coordinate all the information needed by the teacher. Sixth, diagnostic tests must be able to have an influence on the development of students' conceptual understanding (Fan, et al., 2021).

The importance of carrying out diagnostic tests before the start of the learning process makes the development of a three-tier test diagnostic test instrument to be carried out so that the instrument developed is confirmed to be valid and reliable before

being used. Before developing a diagnostic test instrument, it is necessary to conduct a survey to see how the implementation of the diagnostic test that has been carried out by Biology teachers in schools. This research is expected to provide a comprehensive picture of the process of implementing diagnostic tests that refer to assessment standards starting from planning, selecting methods, developing test instruments, implementing tests, managing test results, reporting test results and the implications of these test results in the biology learning process in schools.

Method

This study uses a survey method to obtain an overview of the implementation of diagnostic tests in Biology learning at South Sumatra Senior High School. This research was carried out through three stages, instrument making, data collection process, and data analysis. The process of developing the instrument is carried out referring to the indicators for the implementation of the Standard Assessment Process in PP No. 55 of 2021. The data collection process is carried out using an e-questionnaire distributed via Google Form. The data obtained were then analyzed.

The population in this study were Biology teachers in South Sumatra Province. Samples were taken using convenience sampling method. The number of samples involved in this study were 86 Biology teachers. All samples are provided with an e-questionnaire link via Google Form. The e-questionnaire used is a closed questionnaire with answer choices provided. This questionnaire consists of 25 questions. The distribution of questions on the e-questionnaire is presented in Table 1.

The data that has been collected is then analyzed using descriptive analysis techniques in the form of percentages for each question item given. The data obtained is then calculated using a tally sheet. The percentage calculation is done by dividing the number of samples that choose an answer by the total number of samples then multiplied by 100 percent. The result of calculating the percentage of each question is then described.

Table 1. Distribution of questions on the e-questionnaire

Indicator	Question Number
Formulation of the problem	7, 8, 9
Selection of assessment instrument	5, 6
Assessment instrument development	10, 11, 12
Implementation of the assessment	1, 2, 3, 4
Management of assessment results	13, 14
Assessment result reporting	15, 16
Implications of the assessment results	17, 18, 19, 20, 21, 22, 23, 24, 25

Result and Discussion

A diagnostic test is a test conducted by the teacher before the learning process begins. The diagnostic test aims to determine the students' strengths and weaknesses towards a particular concept. Diagnostic tests identify students who have misconceptions, do not understand, or have understood the concept well. The results of the analysis of this diagnostic test are used as information to determine the methods, strategies and learning approaches that will be used by the teacher. The diagnostic test carried out is used as an objective view and standard data about the learning points of students who are weak in understanding a concept or a skill being trained (Esomonu & Eleje, 2020). Weaknesses that have been detected indicate that the teacher must emphasize the concept so that it can be understood by students well.

A survey on the implementation of diagnostic tests conducted by biology teachers in schools has been conducted involving 86 teachers. The topics studied in this study were developed from the National Education Standards, namely Assessment Standards, including problem formulation, selection of assessment instruments, development of assessment instruments, implementation of assessments, management of assessment results and reporting of assessment results. This research also examines the implications of the implementation of diagnostic tests carried out by teachers in relation to the biology learning process in the classroom. The results of the study are shown in Table 2.

Table 2. Implementation of diagnostic tests in Biology Learning

Item Question	Respons	Percentage
Routinely carry out diagnostic tests	Yes	73.3
	No	26.7
Question processing time	One minute/Question	27.9
	Two minutes/Question	20.9
	Three minutes/Question	27.9
	Five minutes/Question	23.3
	More than five minutes/question	0
Execution of diagnostic tests	Same day	86
	Three days before	1.2
	One week before	7
	One month before	2.3
	The beginning of semester	3.5
Number of questions	Three questions	43
	Five questions	43
	Ten questions	14
	More than 10 question	0
Question form	Multiple choice question	26.7
	Short answer	55.8
	Essay	17.4
Question distribution method	Offline	81.4
	Online	18.6

Item Question	Respons	Percentage
Announce to students before the test	Yes	66.3
	No	33.7
The questions are adjusted to the learning objectives	Yes	100
	No	0
Make a question grid	Yes	54.7
	No	45.3
Analyzing learning objectives	Yes	80.2
	No	19.8
Create an answer key	Yes	90.7
	No	9.3
Create a scoring rubric	Yes	93
	No	7
Checking test results	Yes	98.8
	No	1.2
Test result check	As soon as	57
	Before learning	10.5
	After learning	32.6
Reporting results to students	Yes	86
	No	14
Reporting results to parents	Yes	9.3
	No	90.7

Table 3. Implications of implementing diagnostic tests on Biology learning in the classroom

Item Question	Respons	Percentage
Implications of test results on learning methods	Agree	82.6
	Dissagree	17.4
Implications of test results on learning strategies	Agree	87.2
	Dissagree	12.8
Implications of test results on learning media	Agree	79.1
	Dissagree	20.9
Implications of test results on the learning model	Agree	84.9
	Dissagree	15.1
Implications of test results on the learning approach	Agree	88.4
	Dissagree	11.6
Describing students' prior knowledge	Agree	98.8
	Dissagree	1.2
Describing students' misconceptions	Agree	95.3
	Dissagree	4.7
Describe the student's weaknesses or strengths	Agree	95.3
	Dissagree	4.7
Using valid and reliable instruments	Agree	97.7
	Dissagree	2.3

In general, the implementation of diagnostic tests has been carried out well, starting from the planning, development, implementation, and reporting of test results. Planning and development of questions used by teachers to diagnose students' prior knowledge was carried out well. Before the teacher develops a diagnostic test instrument, the teacher conducts a study of the learning objectives and makes a grid of questions. Learning objectives are developed from basic competencies and learning indicators as the main target for implementing the learning process in the classroom. The purpose of this assessment and creation of a grid of questions is to ensure that the implementation of the

diagnostic tests carried out still refers to the focus of the expected learning outcomes together. This is done so that the diagnostic prior knowledge of students really helps students understand the concepts being taught and can improve student learning outcomes (Fan et al., 2021; Esomonu & Eleje, 2020; Halim et al., 2018; Juhanda, 2017). The results of previous research revealed that students who were given a diagnostic test before the implementation of learning had better learning outcomes than students who were not (Ofem et al., 2017). The implementation of diagnostic tests before learning is very important for diagnostic analysis and providing feedback on the design of the learning process and student test results (Tang & Zhan, 2021). It is intended that the learning process carried out as feedback from the results of the diagnostic analysis can facilitate the achievement of learning objectives (Esomonu & Eleje, 2020).

Biology teachers in South Sumatra routinely carry out diagnostic tests before the learning process begins (73.3%). The number of questions used in the diagnostic test is very diverse but is still dominated by 3 or 5 questions and it is very rare to find teachers who give more than 10 diagnostic test questions to their students. The time allocation given by the teacher to solve the questions ranges from one to 5 minutes for each question. Determining the duration of time to work on the questions given is influenced by several factors, including the method of distribution of questions and the form of questions used by the teacher (Bayazit & Askar, 2012). In this study, the distribution of diagnostic test questions is still done face-to-face compared to the distribution of questions online with the help of applications, for example Google Form, Quizziz, and others. The results of previous studies also show that the implementation of tests conducted online requires more time than online processing (Bayazit & Askar, 2012). The duration of working on questions becomes longer in computer-based implementation because students do not understand the system or application used by the teacher. This is a challenge for teachers so that students are familiar with the applications used to carry out tests (Alruwais et al., 2018). The longer duration of question processing on questions distributed online is also caused by the loading time required by the system to display questions or save answers that have been given by students. In addition, the information that can be displayed in a single screenshot is sometimes only partially compared to carrying out a pencil and paper-based test (Bayazit & Askar, 2012). Although in theory, the implementation of online tests can reach further, can be carried out anywhere, anytime, and students feel more relaxed when working on the questions given (McClelland & Cuevas, 2020; Alruwais et al., 2018) but students have difficulty reading questions and causes eye fatigue; difficulty writing long answers using the

keyboard; disturbed by the sound generated from the device; even to the point of losing motivation (Bayazit & Askar, 2012).

The results of this study revealed that most of the implementation of diagnostic tests by Biology teachers in South Sumatra Province on the same day before the concept learning was carried out (86%). The implementation of diagnostic tests at such a time is not effective. Diagnostic tests have a specific purpose, namely, to obtain information related to students' prior knowledge. This important information is obtained from the process of analyzing student answers to the diagnostic tests carried out. The data obtained will be more effective and useful if the analysis process carried out by the teacher is really carried out as well as possible, thus the results of the diagnostic test can be used as valuable feedback for improving the quality of learning (Esomonu & Eleje, 2020). Although the results of diagnostic tests conducted by teachers may not be used optimally in the biology learning process in the classroom, Biology teachers in South Sumatra Province agree that the results of diagnostic tests can be used to assist teachers in choosing learning media (79.1%), learning (82.6%), learning models (84.9%), learning strategies (87.2) and learning approaches (88.4%). The selection of appropriate media, methods, models, approaches and learning strategies is expected to be able to assist students in understanding the concepts taught in accordance with the expected competencies and improve student learning outcomes at school (Sutarto et al., 2020; Rodiyah et al., 2020; Susanto et al., 2022; Ariyanto et al., 2021).

Short answer are the dominant form of questions used by Biology teachers for diagnostic tests (55.8). Making questions in the form of short answer is easier to do when compared to multiple choice questions (McDermott et al., 2014). The development of short-form questions does not require the creation of distracting answers as in multiple-choice questions (Lions et al., 2021). In addition, the short form questions also make it easier for teachers to correct student test results. The results of previous studies also show that the short form of the questions allows more topics to be tested on each test that uses this form of questions. Short field questions can also dig deeper into the knowledge possessed by students because they are almost free from the possibility of guessing for some students which is very often found in the use of multiple-choice questions. The student's perspective on the use of short essays shows that the use of short answer is more effective in the assessment process, allows students to write down what they know, and the long duration of working on the questions in this form is the same as the true-false form (Puthiaparampil & Rahman, 2020). However, both short-form questions and multiple-choice questions

have been shown to delay the retention of learning that occurs in students (Haynie, 1994).

The use of short answer questions for diagnostic tests may be sufficient to reveal the students' initial understanding. However, the use of short descriptions has not been able to describe clearer information about misconceptions or the depth of understanding that students have about a certain concept (Puthiamparmpil & Rahman, 2020) when compared to questions in the form of multiple tier question tests. Although the form of questions used by the teacher has not been able to express students' misconceptions well, the teacher agrees that the diagnostic test is expected to be able to dig deeper into students' misconceptions (95.3%) and provide information related to students' prior knowledge (98.8%). When compared with essay questions, essay questions have a good ability to identify many abilities or skills possessed by students, for example critical thinking skills, creative, and higher order thinking skills. The use of essay questions becomes more complicated when the process of assessing test results is carried out. Essay questions require a more complex assessment rubric when compared to multiple-choice questions and short entry questions (Zubaidah et al., 2020).

The development of diagnostic tests carried out by teachers should be designed to reveal as many errors or weaknesses as students (Ofem et al., 2017). The development of diagnostic test instruments needs to be done carefully so that the information obtained is useful for improving the quality of learning (Tang & Zhan, 2021). Therefore, the diagnostic test item instrument used must go through the development stages in accordance with the question development procedure and have tested the validity and reliability of the test. However, the development process until a valid and reliable instrument is produced is not an easy step for teachers to do (Rahmi et al., 2021) and it would be better if the teacher uses diagnostic test questions that have been tested for validity and reliability. The results of this study also reveal that teachers will use diagnostic test instruments that are valid and reliable (97.7%). A valid and reliable diagnostic test instrument indicates that the questions are valid and have the same results even though they are tested repeatedly in different populations (Nugraha & Fitrihidajati, 2021).

A study on the development of diagnostic tests in Biology learning in South Sumatra Province shows that the process of managing the assessment results has been carried out well. The survey results show that 93% of teachers have provided an assessment rubric and 90.7% of teachers have provided an answer key before the diagnostic test was conducted. The availability of assessment rubrics can help teachers to make it easier to carry out the process of assessing the results of diagnostic tests and the assessments carried out are

more reliable (Ebuoh, 2018) and the assessments carried out are more accurate and balanced (Wolf & Stevens, 2007). The development of an assessment rubric can be done by identifying the performance criteria to be assessed, setting the performance level, and making a performance description (Wolf & Stevens, 2007). The assessment rubric is described in two types of assessment rubrics depending on the purpose of the assessment itself. The holistic assessment rubric is used by teachers to measure overall student performance, while the analytic rubric can be used by teachers to carry out diagnostics (Mishra, et al., 2022).

Reporting is carried out after the implementation and processing of test results is carried out by the teacher. The results of this study indicate that the test results are only reported to students as the subject of the assessment (86%). The data revealed that only 9.3% of teachers reported the results of this diagnostic test to parents. Students must know the results of the tests that have been carried out so that students better understand their abilities and provide opportunities for students to improve test results through the learning process that will take place. Reporting the results of diagnostic tests is deemed unnecessary to be reported to the parents of students. Students at the high school level are independent enough and able to understand the purpose of carrying out the diagnostic tests carried out. However, reporting the results of the assessment can be done to parents so that parents also know prior knowledge and can facilitate students to support the learning process. The role of parents in the learning process becomes even more crucial when distance learning is implemented during the COVID-19 pandemic (Rahmadani et al., 2021; Meslie et al., 2020; Novianti & Garzia, 2020; Sutarto et al., 2020). Assessments carried out before or after the learning process are important to measure the depth of understanding of concepts in students, detect various student learning difficulties, or misconceptions that occur in students (Wulandari et al., 2020).

Conclusion

Diagnostic tests have an important role in improving the quality of learning in schools and the achievement of student learning outcomes. The implementation of diagnostic tests on Biology learning in South Sumatra Province in general has been going well in accordance with the rules of implementing the assessment that refers to the National Education Standards. Teachers carry out structured planning, selection of assessment instruments, instrument development, implementation, management and reporting well. The process of developing a diagnostic test instrument needs to be carried out by paying attention to the validity and reliability of the test so that

the information obtained from this test can be used by the teacher. The use of test instruments that have been carried out previously and have been tested for validity and test reliability is better for teachers. In this study it was also found that the implementation of the diagnostic test was carried out shortly before the learning process was carried out. This results in the analysis process of diagnostic test results not being optimal and important information obtained from this test cannot be utilized optimally. However, teachers agree that the results of diagnostic tests can help teachers to determine media, models, methods, strategies, and learning approaches and can identify misconceptions and weaknesses that students have regarding the concepts to be studied.

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