Implementation and Constraints of Diagnostic Assessment in the Independent Curriculum Towards Deep Learning-Based Biology Learning in High Schools

Nukhbatul Bidayati Haka✉, Hardiyansyah Masya✉, Ismi Rakhmawati✉, Laila Puspita✉, Didi Nur Jamaludin✉ and Raicha Oktafiani✉

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Abstract

The implementation of diagnostic assessments in the Independent Curriculum is a crucial step in mapping students' initial abilities and designing appropriate learning strategies. This study aims to identify obstacles to the implementation of diagnostic assessments in deep learning-based biology learning in public senior high schools in Bandar Lampung City, encompassing the planning, implementation, and follow-up stages. The study used a descriptive qualitative approach with a purposive sampling technique. The sample consisted of three public senior high schools, four biology teachers, and 69 tenth-grade students studying Biodiversity. Data were obtained through interviews, observations, questionnaires, and documentation. Data were analyzed through data reduction, data presentation, and conclusion drawing. The results showed that the implementation of diagnostic assessments was not optimal. Only two schools had implemented cognitive and non-cognitive diagnostic assessments, while one school had not implemented them at all. The main obstacles lay in limited school facilities and the low level of socialization regarding the Independent Curriculum, particularly the implementation of diagnostic assessments in innovative, deep learning-oriented biology learning. However, limited understanding and institutional support remained a significant obstacle. This study recommends improving teacher training, providing supporting facilities, and implementing more systematic assessment follow-up policies.

Keywords: Biology Education; Diagnostic Assessment; Deep Learning; Independent Curriculum.

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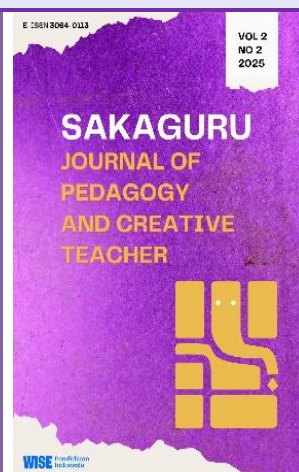
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INTRODUCTION

The quality of educational outcomes is largely determined by the evaluation system used to measure, assess and evaluate the learning that has been done. Therefore, changes in the education paradigm are often followed by changes in the assessment system. The provisions of the assessment carried out by the school, especially those related to the assessment of the process and learning outcomes of students, will provide an overview of the learning achievements of students [1]. Diagnostic assessment, which is a new innovation in the independent curriculum, functions as an evaluation tool that can be used to identify students' obstacles and weaknesses at the beginning and end of learning. Students' difficulties in understanding the material can be seen and determined through diagnostic assessment [2]. Diagnostic assessment is also used to identify students' competencies, strengths, and weaknesses, and is carried out at the beginning and end of the learning process [3]. Learning can be designed according to the competencies and conditions of the learners. Teachers use the results of diagnostic assessments as a reference in planning learning activities based on student learning needs. Under certain conditions, information related to family background, learning readiness, learning motivation, student interest, etc., can be used to organize learning.[4], [5], [6], [7].

The independent curriculum is currently the policy of the Ministry of Education, Culture, Research and Technology to recover from the learning crisis after the COVID-19 pandemic during 2022-2024. There are several developments and changes in the independent curriculum, one of which is the assessment that will be carried out. Assessment in the independent curriculum includes the development and addition of Diagnostic Assessments from previously only Formative and Summative Assessments. All three assessments must be listed in the Independent Curriculum teaching module[8]. Research by Diki Fimanzah found that diagnostic assessments have been carried out by science teachers in the Menganti Gresik area before learning and the implementation of diagnostic assessments does not depend on the quality of school accreditation [9]. Teachers in the field experience various obstacles in integrated science learning both from the implementation of learning, implementing classroom assessments, transferring material into something that is easy to understand, but solutions that can be done to overcome this by conducting training related to science learning, implementing assessments, and discussing with teachers who have a science education background [10], [11]. Therefore, the management of learning and assessment with diagnostic assessments is needed for learning improvement [12].

In the context of biology learning, diagnostic assessments have strong relevance to efforts to develop deep learning-based instruction. The concept of deep learning emphasizes in-depth understanding, interconnectedness between concepts, and students' critical and analytical thinking skills[13][14]. In order for deep learning to be achieved, teachers need to understand the initial conditions of students through diagnostic assessments, so that teaching strategies can be designed to address misconceptions, strengthen basic concepts, and develop scientific skills[15], [16]. In other words, diagnostic assessment functions as a gateway to learning that is not merely memorization, but encourages students to explore, construct, and apply Biology knowledge in various life contexts[17], [18].

Based on the results of pre-research, it is known that 85% of teachers who have used diagnostic assessments in three public high schools in Bandar Lampung City, implementing

cognitive and non-cognitive diagnostic assessments, starting from the preparation stage, the implementation stage and the follow-up stage have not really been effectively carried out by several schools in Bandar Lampung city. The author is interested in conducting this research because of the implementation of new diagnostic assessments, various advantages of diagnostic assessments in relevant research. Therefore, this study aims to analyze the design, implementation, follow-up, and constraints of diagnostic assessment in biology learning under the Independent Curriculum in public senior high schools in Bandar Lampung City. The results are expected to provide empirical evidence and practical recommendations for improving the quality of diagnostic assessment implementation to promote deep learning-oriented biology education in Indonesia.

METHODS

Research Design

This study employed a descriptive qualitative case study design aimed at obtaining an in-depth understanding of teachers' practices and experiences in implementing diagnostic assessment. [19], [20], [21]. Data were analyzed using the Miles and Huberman framework, which involves data reduction, data display, and verification to ensure systematic and credible interpretation of findings.

Population and Sample

The population of this study was 17 public high schools in Bandar Lampung City, Biology Subject Teachers in Nageri High Schools, and all phase E class X students in public high schools in Bandar Lampung City. The research sample has been selected using various sampling techniques including SMAN X with 2 people number of biology Teacher, 23 People Number of Learners. SMAN Y with 1 people number of biology Teacher, 23 People Number of Learners. SMAN Z with 1 people number of biology Teacher, 23 People Number of Learners. Total Sample is 4 people number of biology Teacher, and 69 People number of learners.

Location and Timing

This research was conducted in three public high schools, namely schools X, Y, and Z. The selection of these schools with purposive sample technique [20], through the consideration that the three schools have implemented the Merdeka Curriculum and are A accredited schools. While the sample of four teachers was selected using total sampling [22]. And 69 samples of students were selected using random sampling technique with a selection percentage of 20% [23].

Research Procedure and Instruments

Data collection methods in this study used teacher observation sheets, teacher questionnaires, teacher interviews, and documentation at three public high schools in Bandar Lampung with the aim of analyzing the implementation of diagnostic assessments and their obstacles. The research instrument grids are attached below:

Table 1. Teacher Observation Sheet Instrument

Form of Assessment	Aspects Observed

Cognitive Diagnostic Assessment	**Preparation Stage**
	• Teachers make a schedule for conducting assessments
	• Teachers identify assessment materials
	• Develop simple questions to measure initial competence
	
	Implementation Stage
	• The teacher composes simple questions
	  - two questions according to class, on the topic of new learning outcomes
	  - six questions with topics one grade below
	  - two questions with topics two grades below
	
	Follow-up of Diagnostic Assessment Results
	• The teacher processes the results of the assessments that have been given
	• Before starting a new learning topic, teachers conduct a learning assessment of the previously taught topic to adjust the learning to the average skills of the students.
	• Teachers repeat this diagnosis process by conducting formative assessments (with different forms and tactics) until students reach the required level of competence

Non-cognitive Diagnostic Assessment	**Preparation Stage** • The teacher prepares tools such as pictures that represent emotions • The teacher lists key questions about the learners' activities **Stages of Implementation** Teacher asks learners to express their feelings while learning at home and explain their activities. **Follow-up of Non-Cognitive Assessment Results** • The teacher identifies learners who show negative emotional responses and asks them to have a one-on-one talk. • The teacher determines follow-up steps and communicates with learners and parents as needed. • The teacher repeats the implementation of non-cognitive assessment at the beginning of the lesson • The teacher repeats the implementation of non-cognitive assessment at the beginning of the lesson

The observation technique used in the study was non-participant observation, including observation of the stages of preparation, implementation, and follow-up of assessment results. To deepen the data, the researcher included a teacher questionnaire with 30 items of favorable and unfavorable statements, using a linkert scale with four answer choices. The research instrument used next was teacher and student interviews.

Data Analysis Techniques

The data analysis technique uses the Miles and Huberman Model [24], [25] these are data reduction, data display, and verification. Data analysis in this study occurs during data collection. This allows for data reduction. Data reduction is the process of collcting data and classifying it into specific categories [26], This study examines the implementation of diagnostic assessments conducted by biology teachers in the city of Bandar Lampung. The data

reduction results were processed to provide clearer insights, specifically through the implementation of diagnostic assessments conducted by biology teachers in the two public high schools. The validity of qualitative research data according to Lincoln and Guba [27], [28], [29], [30], achieved with four criteria principles, namely: credibility, dependability, confirmability, and transferability. To validate the data, source triangulation and technique triangulation techniques were used.

RESULT AND DISCUSSIONS

Result

The results of the study include interview data results, observation sheet data results and questionnaire data results.

1. Data From the Interview Instrument

The following data is obtained from closed interviews intended for class X biology teachers to collect information related to general knowledge of diagnostic assessments to the implementation of cognitive and non-cognitive diagnostic assessments, then interview instruments in this study are also intended for students with questions related to validating the implementation of diagnostic assessments in these schools.

a) Teachers' Understanding of Diagnostic Assessment in the Merdeka Curriculum

The importance of diagnostic assessment is used by teachers to find the strengths and weaknesses of students in learning, after the teacher knows the location of difficulties for students, the teacher can design instruments that will be used in the next lesson [31], [32], [33]. That four biology teachers from State Senior High Schools X, Y and Z know the purpose and importance of the implementation of diagnostic assessment, some answered that diagnostic assessment is an initial assessment used to map the initial knowledge, condition, background of students. However, of the four teacher samples, it is known that only two teachers at SMAN X, namely teacher XL1 and teacher XP1, know the implementation of diagnostic assessments comprehensively starting from designing assessment implementation plans and implementing them in class. While biology teachers at schools Y and Z do not understand the importance of designing the implementation of diagnostic assessments. The main focus of assessment is to determine the achievement and progress of students in learning and improve the learning process and activities of students in learning and improve the learning process and activities of students in learning (assessment of learning and assessment for learning) with a good assessment model, the teacher / educator knows where his weaknesses are in teaching, so that he can improve [34].

b) Implementation of Cognitive and Non-Cognitive Diagnostic Assessments

Diagnostic assessment is one of the assessments emphasized in the independent curriculum. The Ministry of Education and Culture provides the learning outcomes in this curriculum, which will then be developed independently to meet the needs of each school. The education unit operational curriculum is an independent curriculum that is modified to meet the needs of

schools. The development of this program uses the concepts of goal- oriented curriculum development, continuity, flexibility and integration[35].

Diagnostic assessments are divided into two, namely cognitive and non-cognitive assessments [2]. The objectives of cognitive diagnostic assessment are: (1). Identifying student competency achievements (2). Adjusting classroom teaching to the average competence of students (3). Provide remedial or additional teaching to students with below average skills. This explanation shows that cognitive diagnostic assessment is an effort to obtain a comprehensive picture of students' cognitive learning readiness. So that educators can carry out learning activities in accordance with the competencies and characteristics of students, as well as implement various necessary changes[36].

Cognitive diagnostic assessment is a set of cognitive-based diagnostic methods that aim to identify learners' strengths and weaknesses in relation to learners' knowledge structures and processing skills. This is in contrast to non-cognitive tests, which try to identify learners' emotional and psychological readiness to receive learning [33][37]. Data from interviews about the implementation of diagnostic assessment in three schools, it is known that biology teachers XL1 and XP1 at SMAN X have implemented non-cognitive diagnostic assessment at the beginning of the new school year during the introduction of the school environment. While biology teacher YP2 and biology teacher ZL10 at SMAN Y and Z have also implemented non-cognitive assessment through question and answer at the beginning of the face-to-face meeting. In contrast to the implementation of cognitive diagnostic assessment, four teachers have and routinely carry out, such as biology teachers at SMAN X and Z do it with questions and answers, while SMAN Y does it with a pretest in the lesson.

Furthermore, the interviews of X grade students were conducted openly at SMAN X, Y, and Z to find out how the students' perspectives on the implementation of cognitive and non-cognitive diagnostic assessments in schools X, Y and Z. That the implementation of cognitive diagnostic assessment in school X has been carried out by class X biology teachers, but the implementation still rarely uses the pre-test method. While the implementation of non-cognitive assessment of students stated that the teacher had done, by asking about the background of students, as well as a variety of learning styles. bBased on the data form research, it is known that SMAN Y, all C grade biology teachers carry out cognitive diagnostic assessments through pretests containing biological material tests. The implementation of noncognitive diagnostic assessment has not been done by biology teachers. The results of the next research findings at SMAN Z are known through the interview process to 23 respondents, validates that the implementation of diagnostic assessments (cognitive and non- cognitive) at SMAN Z has not been carried out by biology teachers, teachers rarely provide material through direct explanation, but students are more often given practice questions from the student worksheet book.

c) Constraints and Opinions on the Implementation of Diagnostic Assessments

In carrying out diagnostic assessments, teachers must at least have an adequate understanding of matters related to the assessment [38]. Teachers must have sufficient competence to design diagnostic assessments so that they can be carried out effectively and systematically so that the data obtained truly describes the existing conditions [39].

Obstacles in implementing diagnostic assessments are common, because the implementation of relatively new assessments has made teachers still adapt to new policies in the Merdeka curriculum. Conditions that still have many obstacles are expected to be improved so that teachers' understanding of the importance of diagnostic assessments in biology learning is getting stronger and very well trained. The results of teacher interviews about the obstacles to the implementation process of diagnostic assessments, some of the common obstacles felt by teachers in implementing diagnostic assessments in biology subjects, including the lack of socialization of the implementation of the independent curriculum (IKM), misconceptions about understanding differentiated learning, learning facilities and infrastructure in schools that have not supported which makes teacher creativity limited, and limited learning time allocations, the use of variations in models, approaches, strategies, learning methods that have not been maximized .

2. Teacher Observation Sheet Instrument Result Data

Observations were carried out at SMAN X, Y and Z, during the learning process in the biodiversity material class in two meetings, in 90 minutes per meeting to see how teachers implement diagnostic assessments both cognitive and non-cognitive. The description of the process of implementing diagnostic assessments in the classroom can be seen in Table 2.

Tabel 2. Observation Results of Diagnostic Assessment Implementation On Biology Learning

No.	Diagnostic assessment	Teacher respondents	School	Documentation	Description
1.	Cognitive diagnostic assessment	XL1 teacher	School X	**Figure 1.** Initial Q&A Process of Biodiversity Material School X	Figure 1 is the implementation stage of cognitive diagnostic assessment using question and answer.
2.	Cognitive diagnostic assessment	XP2 Teacher	School X	**Figure 2.** Awwal Q&A Process of the Material Starting School X	Figure 2 shows the implementation of a cognitive diagnostic assessment using question and answer.

No.		Indicator		
3.	Cognitive diagnostic assessment	YP3 Teacher	School Y	**Figure 3.** Formative Test Process at the Beginning of School Y Materials	Figure 3 shows the implementation stage of cognitive dysgnostic assessment using formative tests.
4.	Cognitive diagnostic assessment	Teacher ZL10	School Z	**Figure 4.** Teaching and Learning Process at School Z	Figure 4 shows that in its implementation, the Xth grade biology teacher at school Z did not conduct a Cognitive diagnostic assessment but immediately gave the initial material.

Table 2 shows that SMAN X, Y have conducted cognitive diagnostic assessment during the learning process, but SMAN z has not done so.

3. Teacher Questionnaire Instrument Result Data

Based on the questionnaire on the implementation of diagnostic assessments in biology learning in the Merdeka curriculum in public high schools in Bandar Lampung City, which consists of 30 statement items for teacher respondents at SMAN X, Y, and Z, it is presented below:

Tabel 3. Biology Teacher Questionnaire Results Phase E Schools X, Y, and Z

Variables	Indicator	Aspects	Teacher Respondents				Avarage per-indicator
			Sekolah X		Sekolah Y	Sekolah Z	
			XL1 teacher	XP1 teacher	YP3 teacher	ZL10 teacher	
Cognitive	**Prepations stage**	Teachers make a schedule for conducting assessments	83 %	79,1%	91,6%	91,6%	86,4% (Very Good)
		Teacher Identifies assessment materials	83 %	79,1%	91,6%	91,6%	86,4% (Very Good)
		Develop simple questions to measure initial competence	83 %	79,1%	91,6%	91,6%	86,4% (Very Good)
	Implementation stage	Teacher Develops a simple question Two grade-appropriate questions, on the topic of new learning outcomes: - Six questions with topics one grade below	100%	87,5%	100%	87,5%	93,8% (Very Good)

		- Two questions with topics two grades below					
	Follow-up stage	Teacher processes the results of the assesmentss that have been given	81,3%	81,3%	65,5%	68,8%	69,8% (Good)
		Before starting a new learning topic, teachers conduct a learning assessment of the previously taught topic to adjust the learning to the average skills of the learners.	81,3%	81,3%	65,5%	68,8%	69,8% (Good)
		Teachers repeat this diagnosis process by conducting formative assessments (with different forms and tactics) until students reach the required level of competence	81,3%	81,3%	65,5%	68,8%	69,8% (Good)
Non-cognitive	**Preperations stage**	The teacher prepares tools such as pictures That represent emotions	75%	93,8%	62,5%	62,5%	73,5% (Good)
		The teacher lists key questions about the learners' activities	75%	93,8%	62,5%	62,5%	73,5% (Good)
		Provide tools to represent learners	75%	93,8%	62,5%	62,5%	73,5% (Good)
	Implementation stage	Teacher asks learners to express their feelings while learning at home and explain their activities.	75%	62,5%	87,5%	50%	68,8% (Good)
		The teachers identifies learners with negative emotional expressions and invites one-on-one discussions	79,1%	75%	29,1%	90%	68,3% (Good)
	Follow-up stage	Teachers determines follow-up and communications with learners and parents if needed	79,1%	75%	29,1%	90%	68,3% (Good)
		The teachers repeats the implementation of non-cognitive assessment at the beginning of the lesson	79,1%	75%	29,1%	90%	68,3% (Good)

	The teachers repeats the implementation of non-cognitive assessment at the beginning of the lesson	79,1%	75%	29,1%	90%	68,3% (Good)
Per-Indicator avarage	**80,2% (Good)**	**78,7% (Good)**	**64,1% (Good)**	**77,4%S (Good)**	**70,3% (Good)**

Discussions

Assessment in the 2022 prototype curriculum prioritizes the diagnostic assessment process on cognitive and non-cognitive aspects [40]. Cognitive diagnostic assessment is a collection of cognitive-based assessment methods that seek to identify learners' strengths and weaknesses in terms of knowledge structure and processing skills. This is in contrast to non-cognitive tests, which attempt to identify learners' emotional and psychological preparation before starting learning [41][42]. Based on table 8, in understanding the importance of cognitive assessment, the three schools already know the importance of diagnostic assessment starting from the preparation, implementation, and follow-up stages in these three indicators which obtained the highest score at the implementation stage of 93.8% which was categorized as "very good" while the lowest score was 69.8% at the follow-up stage which was still in the good category. In non-cognitive assessments, the three schools still do not know the importance of diagnostic assessments starting from the preparation, implementation, and follow-up stages of the three indicators which obtained the highest score of 73.5% which was categorized as "good at the preparation stage." However, the follow-up indicator on diagnostic assessments is still in the good category. However, the follow-up indicator on non-cognitive assessment can be seen from the lowest acquisition of 68.3% but still in the "good" category. There is also a percentage of the total average per school, based on the results of questionnaire data on the implementation of cognitive and non-cognitive diagnostic assessments that have been carried out by four respondents of class X biology teachers in each school X, Y and Z, the highest result obtained is 80.2% which is included in the "very good" category. While school Y obtained the lowest result of 64.1% which is still included in the "good" category and school Z obtained a result of 77.4% in the "good" category.

CONCLUSION

The three schools sampled in the study have not followed the rules in accordance with the Ministry of Education and Culture's circular letter on the independent learning curriculum, causing its application to be non-uniform in the three schools. According to the results of interviews and observations, school X is in the good category, while in school Y teachers have conducted cognitive diagnostic assessments quite well but in non-cognitive assessments teachers need direction and more understanding of the importance of both assessments. On the other hand, in school Z, the diagnostic assessment has not been done based on the information from the interview and observation in school Z. The results of this study showed that there were significant obstacles in implementing diagnostic assessments in the three schools that were the focus of the study. These constraints include the lack of socialization and training on the importance of diagnostic assessment in the context of the independent curriculum. As a

result, some schools have not implemented diagnostic assessment optimally, as seen in school Z, which does not understand the benefits of diagnostic assessment.

LIMITATIONS

This study has several limitations that should be acknowledged to provide context for interpreting the findings. First, the research was conducted within a limited sample of three public high schools in Bandar Lampung City, which may not fully represent the diversity of schools implementing the Independent Curriculum across different regions. Future studies are encouraged to involve a broader range of schools with varied accreditation levels and geographical contexts to obtain a more comprehensive understanding of diagnostic assessment implementation. Second, the data were collected primarily through qualitative methods interviews, observations, questionnaires, and documentation which depend heavily on participant honesty and researcher interpretation. Although triangulation was applied to ensure data validity, potential subjectivity and contextual bias cannot be eliminated. Third, the study focused only on the implementation of diagnostic assessments in biology learning, without exploring comparative applications across other subjects. Future research could expand to interdisciplinary contexts or integrate quantitative analyses to examine correlations between diagnostic assessment practices and student learning outcomes. Finally, the rapidly evolving educational policy landscape surrounding the Independent Curriculum poses a challenge for maintaining up-to-date interpretations. Ongoing revisions and differing levels of teacher training may influence implementation fidelity. Therefore, longitudinal and mixed-method approaches are recommended to capture dynamic changes and provide deeper pedagogical insights.

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CONFLICT OF INTEREST

"The authors declare no conflict of interest."

DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

The authors used **Grammarly** during the preparation of this work for editing and proofreading purposes, and **ChatGPT 5.0** solely for language refinement, grammar checking, and formatting adjustments. All processes, including conceptualization, research design, data collection, analysis, interpretation, and conclusion drawing, were conducted entirely by the authors. The use of AI did not influence the originality, academic integrity, or scientific substance of this research. All data, references, and interpretations presented in this article are the result of the authors' independent scholarly work.

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