



Initial Analysis of the Implementation of Biology Learning in the Merdeka Curriculum

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Abstract: The Merdeka Curriculum is a curriculum policy that provides schools the freedom to develop a curriculum according to the needs and learning environment of the students. This curriculum, which has been in place for the past three years, must be evaluated on a micro level. This study aims to reveal the implementation of biology learning in the Merdeka Curriculum at State High Schools in Padang City. A survey method using a questionnaire instrument consisting of 70 statements regarding lesson planning, learning implementation, learning assessment, the Pancasila student profile, and learning obstacles was used to collect data. The research sample consisted of 34 biology teachers and 100 students at State High Schools in Padang City. The results showed that the aspect of lesson planning scored 78.78% in the good category, the aspect of learning implementation scored 80.82% in the good category, the element of learning assessment scored 79.26% in the good category, the aspect of the Pancasila student profile scored 78.04% in the good category, and learning obstacles scored 43.06% in the small category. Overall, the implementation of biology learning in the Merdeka Curriculum at State High Schools in Padang is in a good category with minor obstacles.

Keywords: Learning obstacles, Merdeka Curriculum, Biology learning, Learning process

Introduction

The development of technology and information in the Industrial Era 4.0 towards Society 5.0 demands changes in various sectors, including education. Evaluations conducted on education indicate that the learning crisis (learning loss) in Indonesia has been ongoing for a long time and became particularly evident during the COVID-19 pandemic. The problem identified is the low learning outcomes of students in literacy and numeracy both before and after the pandemic. This is suspected to be due to the heavy burden on teachers and students, resulting in a lack of focus on developing the skills and learning experiences needed for 21st-century life. Additionally, the learning gap has widened. The classroom learning gap shows that students with access

to digital devices, adaptive teachers, actively involved parents, and higher socioeconomic status will see increased academic achievement (Ardianti & Amalia, 2022; Pratyca et al., 2023; Suryaman, 2020).

The Merdeka Curriculum was introduced as an effort to recover learning and improve education quality by creating a more enjoyable, in-depth, meaningful learning climate that actively explores current issues based on the developmental characteristics of students and their learning environment, thus achieving the Pancasila student profile competencies. The Merdeka Curriculum grants freedom to students and teachers to think and express themselves within the learning space (Darlis et al., 2022). The concept of the Merdeka Curriculum is based on the educational principles initiated by Ki Hajar Dewantara, which state that ideal

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learning facilitates students to be free according to their natural and temporal conditions through the "among system." Learning needs to be strengthened through a learning environment based on the tri-center education principle: family, school, and community (Ainia, 2020; Cholilah et al., 2023).

The implementation of the Merdeka Curriculum encourages teachers to play a role in curriculum development within the learning process. Teachers' role in curriculum development is crucial to align the curriculum content with students' needs in the community (Alfath et al., 2022). Curriculum and learning, as part of an educational program plan, need evaluation. Teachers need to know the evaluation results to gauge the progress made in developing students' potential. Moreover, evaluation helps identify weaknesses and find solutions to obstacles faced (Sales et al., 2022).

Field facts based on interviews with several biology teachers at SMAN 3, 7, and 9 Padang revealed that these schools were selected as the first phase pilot project for Sekolah Penggerak in West Sumatra, implementing the Merdeka Curriculum in the 2021/2022 academic year. Despite being selected as a pilot project, the schools still face implementation challenges. Teachers reported a lack of confidence in applying the Merdeka Curriculum principles due to insufficient socialization of the curriculum's implementation. The available Merdeka teaching platform is considered incomplete in facilitating teachers' needs. Additionally, the availability of textbooks not aligned with the learning outcomes set by the ministry causes confusion among teachers due to overlapping learning materials in phases E and F. Furthermore, the content is deemed too concise.

Based on these phenomena, it is clear that several teachers and students experience obstacles in implementing the Merdeka Curriculum in the biology learning process. This can affect the quality of learning conducted. Therefore, it is crucial to evaluate the extent to which the Merdeka Curriculum can be implemented. However, there is currently no scientific data revealing the implementation of biology learning in the Merdeka Curriculum at State High Schools in Padang City. This prompted the authors to conduct this research.

Method

The type of research is descriptive quantitative with survey methods. This research design has been used by (Dhanil & Mufit, 2023; Tosuncuoglu & Küçükler, 2019). The following research flow diagram is presented in Figure 1.



Figure 1. Research flow diagram

The first stage of this research is to collect data on the implementation of biology learning in the Merdeka curriculum using validated and reliable instruments in the form of questionnaires and interview sheets (Syamsurizal, 2020). The questionnaire was filled out by 34 biology teachers and 100 students from State High Schools in Padang City, selected randomly from 17 state schools. Interviews were conducted with 3 biology teachers who had implemented the Merdeka curriculum in its first year of implementation.

The second stage involves testing the data results, including data tabulation and analysis. In quantitative data analysis, data collected includes the Respondent Achievement Level (TCR). These responses were recorded in MS Excel. The data collected from respondents were analyzed using Descriptive Statistics in SPSS 20.0 (Statistical Package for Social Sciences version 20.0) by describing and summarizing the measurements of the implementation of biology learning in the Merdeka curriculum at State High Schools in Padang City. Subsequently, the criteria for the learning process are presented in Table 1, and the criteria for learning obstacles are presented in Table 2.

Table 1. Decision Values for the Learning Process and Pancasila Student Profile

Score Interval	Category
$85 < P \leq 100$	Very good
$66 < P \leq 84$	Good
$51 < P \leq 65$	Good Enough
$36 < P \leq 50$	Not Well
$0 < P \leq 35$	Not good

Table 2. Decision Values of Learning Barriers

Score Interval	Category
$85 < P \leq 100$	Very large
$66 < P \leq 84$	Big
$51 < P \leq 65$	Large enough
$36 < P \leq 50$	Small
$0 < P \leq 35$	Very small

Results and Discussion

The results of the study are presented in the form of descriptive statistics from seventy questionnaire items distributed to 34 respondents. These responses were recorded in MS Excel and analyzed using SPSS.

Table 3. Learning Process and Obstacle Values

Variable	Mean ± SD	P-value	Category
Learning process	3.96 ± 0.480	0.148	Good
Learning Barriers	2.15 ± 0.394	0.593	Small

Table 3 shows that the descriptive statistical value of the average score of biology learning processes and barriers in Padang City Public High School in 2023 is shown by the average score value ($2.15 \leq P \leq 3.96$) with standard deviation ($0.394 \leq P \leq 0.480$). Based on the Kolmogorov-Smirnov results, the learning process and

barriers scores were normally distributed (P-value 0.148 and 0.593). This shows that biology teachers at Padang City Public High School in 2023 have implemented a learning process that is in accordance with the principles of independent curriculum learning and the implementation of this learning has also encountered obstacles that teachers can still overcome. The length of time the curriculum is implemented in schools also does not affect the results of the learning process carried out. This can be seen in Figure 2.

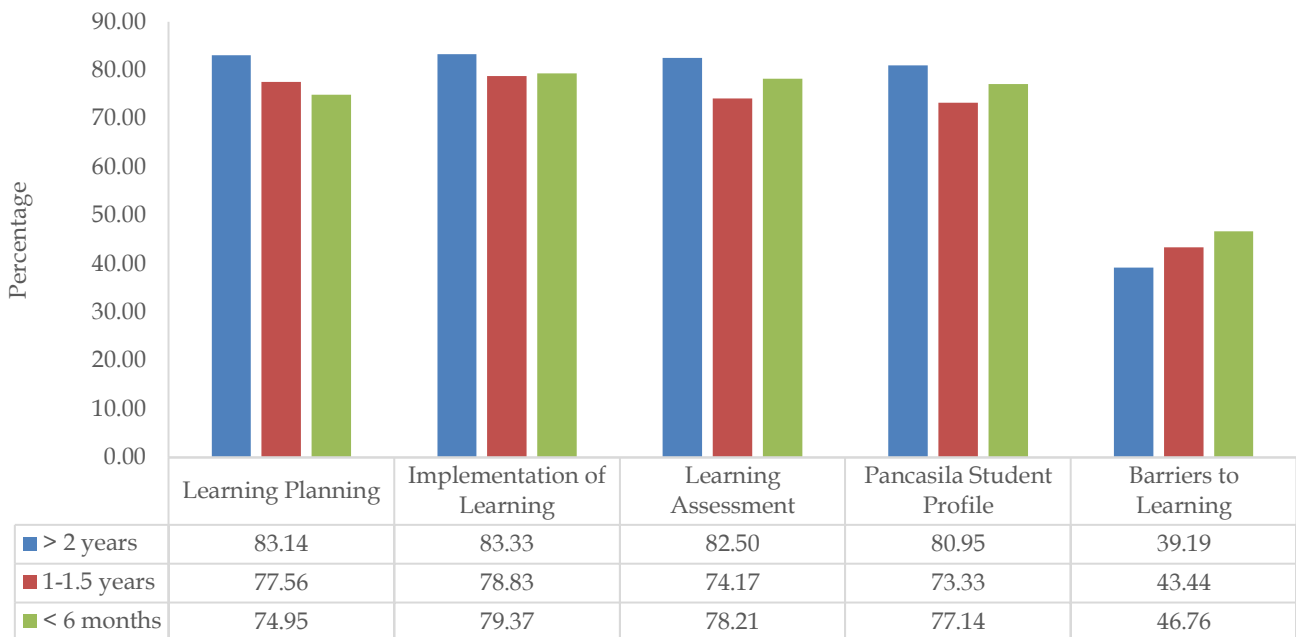


Figure 2. Biology learning implementation diagram based on length of implementation of the independent curriculum in Padang City State High Schools in 2023

Figure 2 shows the values of the implementation of biology learning in the Merdeka curriculum at State High Schools in Padang City in 2023, based on the duration of curriculum implementation, which does not differ significantly. This indicates that the length of service and age range of teachers remain adaptable to curriculum challenges (Anggraini et al., 2022; Ningrum & Suryani, 2022). Schools that implemented the curriculum in the second year during the data collection period had values not much different from those implementing the curriculum in the first year and the inaugural year.

Lesson Planning

Lesson planning in the Merdeka curriculum gives teachers the freedom to modify teaching modules according to the context, characteristics, and needs of the students. The self-designed learning plan allows

students to be actively involved in learning activities (Helendra et al., 2018; Zetriuslita et al., 2023).

Table 4 shows that the descriptive statistical value of biology lesson planning in State High Schools in Padang City in 2023 obtained an average score of 78.78%, indicating that respondents have implemented lesson planning based on the principles of the Merdeka curriculum well. However, this planning score still needs improvement, particularly in some indicators such as choosing meaningful learning strategies, contextual learning, and meticulous selection of continuous learning assessments. Further investigation revealed that teachers still use the same learning strategies for each meeting, the designed lessons include little local wisdom, and the learning media do not accommodate various student learning styles. This shows that lesson planning prepared by teachers is still administrative and not yet tactical.

Table 4. Learning Planning Score Results

Percentage (%)	Indicator
90.88	Formulation of learning objectives with learning outcomes
87.94	Preparation of essential teaching materials/materials
73.92	Selection of meaningful learning strategies
71.57	Contextual learning plans
79.71	Selection of learning media
76.08	Selection of continuous learning assessments
78.78	Average

Findings in this study are similar to those conducted by Ndiokubwayo et al. (2020) in Rwanda, where lesson plans made by teachers were still administrative and not tactical. Teachers have not used effective active learning techniques that facilitate students with low cognitive levels. Teachers need to develop lesson plans that not only meet curriculum needs but also create engaging and highly relevant learning experiences for students by integrating innovative learning strategies. Innovations that can be implemented in the Merdeka curriculum include the application of HOTS-oriented learning and problem-solving, the four pillars of education, self-regulated learning (SRL), blended learning, and formative assessment (Nurhayati, 2020).

Meaningful learning design needs to be created by involving constructivist activities that involve students' life environments and utilize nature as a learning source. Integrating local wisdom into learning can enhance student learning outcomes, critical thinking skills, creativity, and science process skills. Additionally, it can increase learning motivation, make learning meaningful, foster positive attitudes, and strengthen national character (Mellawen et al., 2024; Putri & Darussyamsu, 2021). The selection of approaches, methods, and learning models can be adjusted in three ways: integrated content, supporting integrated content, or integrated context (Arsih et al., 2019; Fajrina et al., 2020). Using digital learning media prepared with videos, audio, images, and interactive animations can also develop interest and facilitate students' understanding of the material (Irdawati et al., 2023). This way, students can understand learning materials by connecting new concepts and expanding and reconstructing existing cognitive structures (Vargas-Hernández & Vargas-González, 2022).

One of the learning designs that can be used to align objectives, activities, and assessments is the Understanding by Design (UbD) approach. The UbD framework aims for students to elaborate on their understanding in different contexts. The UbD framework employs a backward design by establishing appropriate assessments so that teachers can

systematically and purposefully design learning (Lumbreras & Rupley, 2020; Pramesti & Dewi, 2023; Tshering, 2022). It is important for teachers to have an understanding of the UbD framework and to review the learning designs they create to improve the quality of education. As technology in learning evolves, students tend to become less dependent on teachers because the role of teachers in knowledge transfer diminishes. However, the essence of the teacher's role never disappears. Instead, the teacher's role will increasingly focus on curriculum planning, providing guidance, and assessing students' learning progress. Teachers become facilitators and mentors for students in achieving their learning goals (Lufri et al., 2020; Safirda et al., 2024).

Implementation of Learning

Effective learning implementation shows that the curriculum is not only well planned but also well integrated into the learning process. A teacher's teaching ability is one indicator of learning achievement. Basic teaching skills are crucial for teachers because they show how learning can be received by students (Susanto, 2022).

Table 5. Learning Planning Score Results

Percentage (%)	Indicator
89.71	Skills unlock learning
88.04	Class management skills
90.59	Skills in mastering learning material
69.71	Accuracy of implementing learning strategies
75.10	Skills in using learning media
87.06	Skills close learning
68.04	Implementation of differentiated learning
80.82	Average

Table 5 shows that the descriptive statistical value of biology learning implementation in State High Schools in Padang City in 2023 obtained an average score of 80.82%, indicating that respondents have implemented learning well. However, this learning implementation score still needs improvement, particularly in several indicators, such as the skill in applying learning strategies, the skill in using learning media, and the implementation of differentiated learning. Low cognitive learning outcomes of students are partly due to the incorrect choice of learning strategies (Alberida et al., 2022). The learning methods used still tend to be teacher-oriented, resulting in limited learning experiences for students (Asih, 2018). Meanwhile, biology learning is not just about memorization but also about enhancing sensitivity, responsiveness, and problem-solving abilities in students concerning current environmental issues. Teachers can implement problem-based and project-

based learning in biology to engage students actively in learning activities (Lufri et al., 2018).

Learning strategies can be adapted to the learning needs and characteristics of students through differentiated learning (Paraniti et al., 2024; Prihandini et al., 2023) and scaffolding (Haka & Sari, 2021; Haryati et al., 2024). This is because each student has a unique way of learning that reflects their tendencies in receiving, processing, and presenting information. Teachers need to understand the characteristics of students based on different cognitive levels, interests, learning styles, and learning speeds. Differentiated learning is an approach aimed at meeting the diverse learning needs of each student, thereby creating a diverse classroom that provides learning opportunities for all students. Differentiated learning can be divided into cognitive and non-cognitive differentiation (Herwina, 2021). The differentiated learning approach in the Merdeka curriculum includes content differentiation, process differentiation, and product differentiation. Approaches that can be used include Teaching at the Right Level (Amalia et al., 2024a; Binaoui et al., 2023), Culturally Responsive Teaching (Abubakar et al., 2024), and Digital Integrated Learning (Amalia et al., 2024b; Gisbert & Bullen, 2015) to support a more meaningful and measurable learning process in the Merdeka curriculum for students.

Learning Assessment

Assessment can be understood as a process of collecting information about students' learning progress through various procedures. Assessment involves activities such as observing students' learning, describing, collecting, recording, scoring, and interpreting information regarding students' learning. The purpose of assessment is no longer just to determine the learning outcomes but also to reflect on the learning process conducted by both teachers and students and to see individual students' progress (Maemonah, 2018). Assessment implementation in the Merdeka curriculum is divided into three types: diagnostic assessment, formative assessment, and summative assessment.

Table 6. Learning Planning Score Results

Percentage (%)	Aspect
83.53	Implementation of diagnostic assessments according to student needs
75.29	Application of formative assessment for learning feedback
83.53	Implementation of summative assessment
75.29	Determination of criteria for completeness of learning objectives
79.26	Average

Table 6 shows that the descriptive statistical value of biology learning assessment in State High Schools in Padang City in 2023 obtained an average score of 79.26%, indicating that respondents have implemented learning assessments well. Diagnostic and summative assessments have been conducted very well. According to Maut (2022), a diagnostic assessment is conducted to identify students' learning characteristics, competencies, strengths, and weaknesses so that learning can be designed according to the student's needs. At the end of the learning process, teachers can see students' learning reports through summative assessments. Summative assessment is done to ensure the achievement of overall learning objectives through evaluation activities that produce scores used to make decisions about students' learning progress (Warsah & Habibullah, 2022). However, the assessment scores still need improvement, particularly in using formative assessment as feedback and determining the criteria for achieving learning objectives in the planning process.

In line with Festiyed et al. (2022), the assessments that teachers often conducted before the curriculum change were summative assessments. Teachers tended to only conduct summative assessments by looking at the final results of students' written tests. This assessment is used to measure what students have learned at the end of the learning process. Meanwhile, Mahendra (2019) explains that formative assessment functions as feedback for teachers regarding the learning process they have conducted. Formative assessment not only serves to measure students' learning progress but also to evaluate the quality of the learning process conducted.

Pancasila Student Profile

The goal of Indonesian education according to Law No. 20 of 2003 is to develop capabilities and form the character and civilization of a dignified nation to educate the nation's life. This proves that the primary goal of education is to develop skills and form character in accordance with the nation's identity. The new concept introduced by the Merdeka curriculum in character building according to the nation's identity through the internalization of Pancasila values is reflected in the Pancasila student profile. The research results are presented in Table 7.

Table 7. Score Results for Applying the Pancasila Student Profile in Biology Learning

Percentage (%)	Aspect
86.47	Inclusion of Pancasila student profiles in teaching modules
72.35	Determining elements of the Pancasila student profile according to student needs
75.29	Application of elements of the Pancasila student profile in classroom learning
78.04	Average

Table 8. Pancasila Student Profile Values in Learning

Percentage (%)	Dimensions of the Pancasila Student Profile
71	Have faith, be devoted to God Almighty, and have a noble character
51	Independent
67	Critical reasoning
27	Global Diversity
40	Worked together
63	Creative

The Pancasila Student Profile can be implemented through intramural learning, co-curricular activities (projects to strengthen the Pancasila Student Profile or P5), extracurricular activities, and school culture, focusing on the development of students' character and abilities in line with the six dimensions of the Pancasila Student Profile: faith and piety to God Almighty, global diversity, independence, teamwork, critical thinking, and creativity. This study focuses on the application of the Pancasila Student Profile values in intramural learning activities.

Table 7 shows that the descriptive statistical value of the Pancasila Student Profile integrated into intramural learning at State High Schools in Padang City in 2023 obtained an average score of 78.04%, indicating that respondents have integrated the Pancasila Student Profile values well in biology learning. There is a need for improvement in determining the Pancasila Student Profile elements according to students' needs and applying these elements in learning. This is evidenced by the results of student questionnaire responses shown in Table 8.

Table 8 indicates that the reinforcement of the Pancasila Student Profile among students is still relatively low, especially in aspects of global diversity, teamwork, and independence (Rahmi et al., 2024). According to Irawati et al. (2022), the Pancasila Student Profile is expected to be developed within educational institutions and continue throughout life. Strengthening the development of the Pancasila Student Profile can be pursued by expanding the curriculum structure, not only regulating intramural programs but also co-curricular and extracurricular programs. Specifying each element of the Pancasila Student Profile

dimensions in learning can help teachers optimize the development of each student's profile.

Learning Obstacles

During the implementation of a program, various obstacles are often encountered, including in the learning process. Teachers' ability to organize a good learning process can create a comfortable learning environment for students.

Table 9. Biology Learning Barrier Score Results

Percentage (%)	Indicator
37.84	Teachers' difficulties in planning lessons
40.42	Teachers' difficulties in implementing learning
48.63	Difficulty of students engaging in learning
45.10	Availability of facilities and infrastructure that support learning
43.88	Difficulties in implementing the Pancasila student profile
43.06	Average

Table 9 shows the descriptive statistical values of the obstacles found in the biology learning process at State High Schools in Padang City in 2023. The research findings indicate that the average score for obstacles in implementing the Merdeka curriculum is 43.06%. This suggests that the obstacles faced by teachers in the learning process can still be overcome. These learning obstacles were identified as difficulties in planning lessons, executing lessons, involving students in learning, availability of facilities and infrastructure supporting learning, and applying the Pancasila Student Profile.

Teachers' difficulties in planning lessons include formulating learning objectives, determining assessments, and selecting appropriate learning strategies and media. Difficulties in formulating criteria for achieving learning objectives can be addressed through the SMART principles (Specific, Measurable, Achievable, Relevant, and Time-bound). According to Rusyandi et al. (2017), having measurable planning goals is more effective than unclear targets. Although the SMART principles are often used in business for program planning, they can also be applied to learning planning aligned with assessments and the Understanding by Design (UbD) framework.

Technological development allows teachers to become digital architects who integrate digital technology and learning, resulting in positive teacher performance that positively impacts the classroom with values, ethics, and aspirations that transcend the curriculum (Julita & Zulyusri, 2023). A crucial component that teachers need to know and apply is the TPACK (Technological Pedagogical Content

Knowledge) framework. TPACK illustrates the connection between knowledge of teaching methods (pedagogical knowledge), subject matter (content knowledge), and the use of technology (technology knowledge) (Riandi et al., 2019).

Teachers face challenges in implementing formative assessment, which is often overlooked. Neglecting formative assessment affects the follow-up on students' learning progress and activities. Many student process skills, such as asking and answering questions, connecting learning material with everyday life contexts, communicating, and collaborating, do not improve optimally due to the lack of performance assessment and learning reflection. The solution is to plan measurable and continuous formative assessments. Another crucial component for supporting quality learning is the enhancement of school facilities and infrastructure, as well as equitable access to networks and technology in every region.

Conclusion

The conclusion drawn from this research on the implementation of biology learning within the Merdeka curriculum at State High Schools in Padang City is that it has been carried out well and by the principles of the Merdeka curriculum. However, the implementation of the biology learning process still needs improvement, especially in aspects such as differentiated learning planning, appropriate assessment implementation, learning based on local wisdom, and enhancing the values of the Pancasila Student Profile. Challenges in learning under the Merdeka curriculum can be overcome through teachers' understanding of the learning paradigm and practices aligned with the Merdeka curriculum, support from school management, readiness of facilities and infrastructure, and involvement of school partners in the students' learning environment.

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Conflict of Interest

The authors declare no conflict of interest.

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