



Implementation of the Merdeka Curriculum in Biology Learning: Comparative Study with International and National Curricula

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Abstract

This article examines the implementation of the Merdeka Curriculum in Biology learning at a senior high school in Jakarta and relates it to principles commonly found in international curricula such as the International Baccalaureate (IB) and Cambridge. Based on in-depth interviews with a Biology teacher and a student, this article finds that implementing the Merdeka Curriculum has encouraged deeper learning, student-centered learning, and holistic, ongoing assessment through methods such as group discussion, presentation, peer assessment, and laboratory practicum. Teachers are given flexibility to adapt teaching strategies to the characteristics of each class, in line with the principle of differentiated instruction also emphasized in the IB and Cambridge curricula. The assessment system in the Biology classroom combines process and final-result assessment, comparable to the Internal Assessment component in international curricula. Biology material is also linked to students' real lives and global issues, although not all material has been optimally contextualized. This article concludes that national and international curricula, despite differing frameworks, both move toward meaningful, contextual, student-centered Biology learning, and recommends strengthening teacher training, mapping contextual material, and exchanging good practices between schools.

1. INTRODUCTION

Education in Indonesia is entering a new chapter with the government's introduction of the Merdeka Curriculum. This curriculum emerged as a response to the need for more flexible, contextual, and student-oriented learning, after years in which the national education system was criticized for being too oriented toward broad but shallow content mastery (Harahap, 2023). At a senior high school in Jakarta, this spirit is clearly reflected in the Biology subject, where both teachers and students are adapting to a new approach that emphasizes deep understanding rather than mere memorization. This paradigm shift did not happen overnight. Teachers are required to let go of old habits centered on lectures and textbooks, while students also need to adapt to a learning pattern that demands initiative and active involvement. As will be elaborated further in this article, this adaptation process has unfolded gradually and not always smoothly, yet shows a fairly promising direction of development.

Interestingly, this spirit does not stand alone. Amid global developments in education, international schools also continue to promote curricula oriented toward conceptual understanding, inquiry-based learning, and the application of science in real-life contexts principles that turn out to share much in common with the spirit of the Merdeka Curriculum. This similarity is worth examining, given that the two education systems developed from very

different social, historical, and policy contexts, yet converge on a similar goal: shaping students who can think critically and remain relevant to the challenges of the times.

This article was prepared based on in-depth interviews with a Biology teacher and a student at a senior high school in Jakarta. Through these conversations, a real picture emerged of how the Merdeka Curriculum is translated into everyday learning practice, from material planning, teaching methods, and assessment systems, to the use of learning resources and efforts to connect Biology concepts with students' real lives. The interview results were then related to the frameworks of international curricula such as the International Baccalaureate (IB) and Cambridge, in order to see how classroom learning practices can be understood from both national and global education perspectives. With this comparative approach, this article does not intend to position one system as superior to the other, but rather to show that the major ideas in education deep learning, student-centered learning, holistic assessment, and relevance to real life can grow and be realized through different pathways, according to the context and needs of each education system.

2. METHOD

This article was prepared using a qualitative descriptive approach, with data collected through in-depth interviews with one Biology teacher and one student at a senior high school in Jakarta. The interviews focused on the implementation of the Merdeka Curriculum in Biology learning, covering material planning, teaching methods, assessment systems, the use of learning resources, and efforts to connect Biology concepts with students' real lives. The interview results were then analyzed thematically and related to the frameworks of international curricula, namely the International Baccalaureate (IB) and the Cambridge International Curriculum, in order to identify points of convergence and divergence between Biology learning practices at the national school level and the principles commonly applied in international schools. This comparative approach is not intended to judge the superiority of one system over the other, but to understand how the ideas of deep learning, student-centered learning, holistic assessment, and relevance to real life can be realized through different pathways.

Images and tables can be included in this section in the format shown in Figure 1. Every object inserted into the article is always referenced in the text, for example, by capitalizing the name of the object as in referring to Figure 1. Images are avoided being placed directly after tables for aesthetic reasons, and vice versa; a brief description is provided to separate the two.

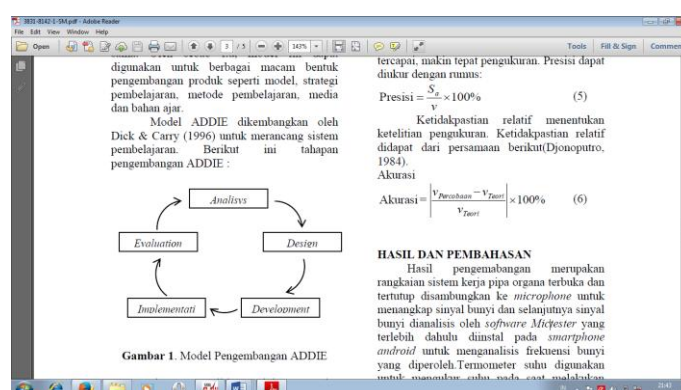


Figure 1. Research Design

The image quality is kept clear, and where color is used, it remains legible when converted to grayscale. A caption is provided for the image. As for table formatting, it follows the example in Table 1. Horizontal lines are hidden except for the header row. Units are enclosed in parentheses and italicized.

Table 1. Table Name

Parameter	Value (t)
Maximum Iteration	10, 50, 100
Learning Ratio	0.1, 0.5, 1
Minimum Error	0.1, 0.01, 0.001

3. RESULT AND DISCUSSION

3.1 Getting to Know the Characteristics of International Schools

Before comparing further, it is necessary to first understand what is meant by an international school. In general, an international school is an educational institution that adopts curricula, standards, and learning philosophies that apply globally, rather than fully following a single country's national curriculum. The most commonly used curricula include the International Baccalaureate (IB), the Cambridge International Curriculum, and Advanced Placement (AP) from the United States. All three have different philosophies and assessment structures, but are all designed to be recognized across countries.

The first distinguishing characteristic of international schools is the use of a foreign language of instruction, generally English, as the main language across all subjects, including Biology. This aims to prepare students to continue their education or pursue careers in a global environment that demands strong foreign-language skills. The early use of scientific terms in English also makes it easier for students to access international academic literature at higher levels of education.

The second characteristic is a learning approach that places strong emphasis on conceptual understanding and critical-thinking skills, rather than mere memorization of facts. Students are encouraged to question, analyze, and connect knowledge across subjects (interdisciplinary learning), so that learning feels more holistic and relevant to the global real-world context. In Biology, for instance, students are not only asked to memorize cell structures but are also invited to analyze how those structures relate to physiological function and their implications for human health.

The third characteristic is an assessment system that is holistic and ongoing, combining formative (process) and summative (final result) assessment, including components such as Internal Assessment, presentations, independent research projects, and portfolios. Such assessment is designed to measure student understanding comprehensively, not solely based on a single written exam, so that students who excel in oral presentation or project work still receive recognition equal to those who excel in written tests.

The fourth characteristic is the diversity of students and teaching staff. International schools generally have student and teacher populations from various countries and cultural backgrounds, creating a multicultural learning environment. This also shapes how students view global issues, including issues related to science and the environment, such as climate change, the biodiversity crisis, and biotechnology ethics. The fifth characteristic is a globally oriented and internationally recognized curriculum, enabling students to continue their

education at universities around the world without barriers to diploma recognition. The IB curriculum, for example, is specifically designed to be accepted by prominent universities across various parts of the world, including Europe, North America, and Asia. This cross-country recognition is one of the main attractions for parents considering an international education for their children. With these five characteristics in mind, the following discussion relates the interview findings on Biology learning at the Jakarta senior high school to principles commonly found in international schools, in order to examine in more detail the similarities and differences in approach between national and international schools.

3.2 Curriculum as the Foundation of Flexible Learning

The Jakarta senior high school officially uses the government-provided Merdeka Curriculum as its main reference in the teaching and learning process. Notably, its implementation does not stop at the administrative level but is directed toward strengthening deep learning (Cahyono, 2024; Feriyanto & Anjariyah, 2024). This approach requires students to genuinely understand concepts, rather than merely memorize theoretical biological facts. This spirit aligns with the national philosophy of the Merdeka Curriculum, which gives teachers the flexibility to design learning according to the needs and characteristics of the students in each of their classes. Teachers are therefore no longer rigidly bound to a single teaching method, but are encouraged to innovate and improvise according to the context of the class they face (Ferdaus & Novita, 2023). This flexibility, on the one hand, opens up wide creative space for teachers, but on the other hand also demands more thorough lesson planning compared to when teachers simply follow a textbook linearly.

One of the biggest challenges in implementing this new curriculum is aligning teaching material with established learning outcomes. The Biology teacher at the Jakarta senior high school explained that the main consideration in this adaptation process is students' condition and ability. Each class has different characteristics, so teaching strategies need to be adjusted so that learning outcomes can be achieved optimally (Musfidah et al., 2023). "One method is not necessarily suitable for every class," said the teacher. This statement confirms that flexibility of method is key to successful learning. Teachers are required to be sensitive to classroom dynamics, read students' needs, and adaptively adjust their teaching approach from one class to another, even when the material taught is essentially the same. In practice, this means teachers need to prepare more than one learning scenario for the same material, depending on students' initial level of understanding and learning styles in each class.

This principle of flexibility aligns with international curriculum frameworks such as IB and Cambridge, which likewise emphasize the importance of differentiated instruction and deep conceptual understanding, rather than mere mechanical memorization (Dulfer, 2019; Dulfer et al., 2025). In the IB curriculum, for example, teachers are encouraged to use the Approaches to Teaching and Learning (ATL) framework, which positions thinking, research, communication, social, and self-management skills as an inseparable part of content mastery. In other words, although they originate from different education systems, the spirit of flexibility and personalization of learning is a common thread uniting the national and international approaches. The most striking difference may lie in the level of structural support: international curricula are generally equipped with very detailed implementation guidelines and globally standardized teacher training, while the Merdeka Curriculum is still in the process of strengthening its supporting ecosystem at the school level, including teacher training and the provision of contextual teaching materials.

3.3 Student-Centered Learning: Discussion, Presentation, and Inquiry

In practice, Biology learning at the Jakarta senior high school has progressed considerably toward a student-centered learning (SCL) approach. Group discussion is the primary method teachers use to encourage independent student learning, with the teacher acting as a guide who directs students' thinking process rather than as the sole source of information in the classroom. In discussion sessions, students are typically divided into small groups to dissect a biological problem before presenting their discussion results to the class. Even so, the teacher acknowledged that the lecture method is still occasionally used, particularly for certain Biology material that requires direct and structured explanation of basic concepts. This shows that the implementation of student-centered learning is not applied rigidly or extremely, but is adjusted to the needs of the material, leaving room for conventional methods when considered most effective.

From the student's perspective, the implementation of this approach feels quite real and memorable. One of the most memorable methods is being asked to explain material to classmates, with the explanation then jointly assessed by peers. This method not only trains students' understanding of the material but also hones their communication skills and confidence in front of the class. This practice of presentation and peer assessment closely resembles the Internal Assessment component commonly found in the IB assessment system, in which students are required to account for their understanding both orally and in writing (Stenberg et al., 2021). This similarity shows that the idea of student learning accountability to peers, not only to teachers, is becoming common practice in both national and international schools.

In addition to discussion and presentation, laboratory practicum and collaborative discussion are the learning experiences students find most dominant. Students routinely present their findings to classmates, who then provide feedback, which helps build communication skills alongside a deeper understanding of the material. Such practicum provides direct experience that cannot be fully replaced by theoretical explanation in class, particularly for topics such as microbiology, physiology, and biotechnology.

This approach is highly comparable to the inquiry-based learning model widely used in international curricula (Palaguyan & Abusama, 2025). Even so, the lecture or direct-instruction method is still occasionally used, particularly for basic Biology concepts that require clear and structured explanation a practice also commonly found in IB and Cambridge classrooms when introducing new topics. This reflects the presentation and peer-review components commonly found in international assessment models, in which students are assessed not only on academic ability but also on their capacity to collaborate, communicate, and think critically during group learning.

3.4 Assessment System: A Balance between Process and Final Outcome

The assessment system applied in the Biology classroom at the Jakarta senior high school also reflects the spirit of the Merdeka Curriculum, which emphasizes the importance of the learning process. The teacher affirmed that assessment does not come solely from the teacher's perspective but also involves students in assessing their own learning process. This approach creates space for reflection, allowing students to understand how far they have developed during the learning process. This kind of self-reflection also trains students to more honestly assess their own strengths and weaknesses a metacognitive skill that is often overlooked in conventional assessment systems that focus only on the final score. Final scores are still counted as an additional or bonus value for students, but the main emphasis remains on the process. In other words, a balance is maintained between process evaluation and outcome evaluation, so that students are not only required to achieve high final scores but are also appreciated for the effort and progress they show during the learning process.

This holistic approach is a hallmark of the assessment systems in the IB and Cambridge curricula, which combine formative and summative assessment and value students' learning journey as much as the final results achieved. Summative scores remain part of the overall assessment but are positioned as a complement rather than the sole indicator of student learning success. From the students' point of view in both the national and international context—this kind of assessment is considered reasonably fair. Students feel that the assessment they receive genuinely reflects how they have developed and understood the material, as well as how they are able to apply Biology concepts in daily life, rather than being based solely on exam or written-test results.

3.5 Use of Learning Resources and Technology

Beyond methods and assessment, the use of diverse learning resources is also an important part of implementing the Merdeka Curriculum in the Biology classroom. Teachers no longer rely entirely on a single textbook but make use of various additional resources, from instructional videos and popular science articles to current data and case studies, to enrich students' understanding of a concept. This pattern also aligns with practices commonly found in international schools, where teachers are encouraged to use varied and up-to-date learning resources so that students become accustomed to connecting theory with current scientific developments. In Biology, for example, issues such as genetic engineering, vaccines, and the biodiversity crisis are often raised as case studies to enliven classroom discussion. Even so, the use of technology and digital learning resources in both national and international schools faces its own challenges, such as gaps in device access and digital literacy among students, which need continued attention in future learning development.

3.6 Connecting Biology to Daily Life and the Global Context

One of the strengths of Biology learning is its closeness to students' real lives. The teacher explained that most Biology material can naturally be linked to students' everyday experiences. However, the teacher also honestly acknowledged that not all material has been optimally connected, so students sometimes still feel unsure in understanding the relevance of a concept to their real lives. From the student's perspective, the connection between Biology material and daily life feels very real and meaningful. One example the student remembers most is the material on puberty, particularly menstruation in girls, including how to handle and understand the process scientifically. This material felt highly relevant because it relates directly to a biological experience the student personally goes through. Another example mentioned by the student is the biotechnology material studied in grade 10, particularly regarding the use of bacteria in everyday life. Such material helps students understand that Biology is not merely theory in a textbook, but a science that is genuinely applied and whose benefits are felt in everyday human life.

The relevance of material to real life is a shared priority in both national and international curricula. This connection aligns with the real-world application and global-contexts strands emphasized in international Biology syllabi. By linking scientific concepts to the real issues students face, Biology learning becomes not only academically relevant but also personally meaningful to students' daily lives. Global issues such as climate change, food security, and public health also serve as a bridge connecting classroom Biology material to students' experience as part of the global community, while strengthening their awareness of social and environmental responsibility in the future.

3.7 The Teacher's Role as Facilitator and Learning Designer

The major changes brought by both the Merdeka Curriculum and international curricula demand a shift in the teacher's role, from a mere deliverer of material to a facilitator and designer of learning experiences. Teachers are required to be sensitive to student needs, capable of designing varied activities, and skilled at managing diverse classroom dynamics. This shift in role is not always easy to navigate, particularly for teachers previously accustomed to more conventional teaching approaches. It requires a process of adaptation, continuous training, and a willingness to keep learning and trying new approaches—a demand also faced by teachers at international schools in consistently applying the philosophy of student-centered learning. On the other hand, the teacher's role as facilitator also opens space for a closer and more reflective relationship between teacher and student, in which the teacher is no longer positioned as the sole authority of knowledge in the classroom, but as a learning partner who helps students navigate their own thinking process.

3.8 Challenges and Notes for Improvement

Although the implementation of the Merdeka Curriculum in Biology learning at the Jakarta senior high school has shown much positive progress, a number of challenges still require attention. One important note is that not all material has been optimally linked to the real-life context of students, so some students still find it difficult to identify the practical relevance of certain concepts. In addition, the diversity of student characteristics in each class requires teachers to continually innovate in choosing appropriate teaching methods. The flexibility that characterizes the Merdeka Curriculum, on the one hand, gives teachers room for creativity, but on the other hand also demands higher readiness and competence from teachers in designing learning that truly matches student needs.

This challenge is not actually new in global education. Even schools with international curricula continue to face similar challenges in bridging scientific theory with the highly diverse life experiences of students, depending on each student's cultural, social, and geographical background. This gap is an important note for future curriculum development, both within national and international frameworks. Another relevant challenge is the administrative burden on teachers in designing and documenting differentiated learning for each class, which, if not balanced with adequate systemic support and time, risks reducing teachers' energy for sustained innovation.

3.9 Recommendations for Future Development

Based on the discussion above, there are several points worth considering for the future development of Biology learning, both at the Jakarta senior high school and other schools implementing the Merdeka Curriculum. First, there is a need to strengthen continuous teacher training in designing differentiated learning, so that curriculum flexibility does not remain merely a concept on paper but is genuinely realized in everyday classroom practice. Second, systematic efforts are needed to map material that is still difficult to connect to students' real-life context, so that teachers can design more targeted contextualization strategies, rather than relying solely on classroom improvisation. Third, the exchange of good practices between national schools and schools with international curricula can be one way to mutually enrich teaching methods, particularly in designing formative assessment and inquiry-based projects. Fourth, support for teacher well-being and workload needs serious attention, given that the demands of designing flexible and reflective learning require significant additional time and energy. Without adequate systemic support, teachers' spirit of innovation risks fading over time.

4. CONCLUSION

Overall, the implementation of the Merdeka Curriculum in Biology learning at the Jakarta senior high school shows a positive direction toward more meaningful, contextual, and student-centered learning. The combination of group discussion, process-based assessment, the use of diverse learning resources, and efforts to connect material with daily life are the main strengths in realizing the goals of this curriculum. Ultimately, both national and international curricula strive to realize meaningful, contextual, and student-centered Biology learning. The difference in terminology and frameworks used the Merdeka Curriculum on one side, IB and Cambridge on the other does not prevent a shared underlying goal: equipping students with deep scientific understanding along with the ability to apply it in facing real-world challenges. Going forward, further strengthening is needed so that all Biology material can be consistently connected to the real-life context of students, so that this curriculum can truly equip students with critical-thinking abilities and life skills relevant to facing future real-world challenges. Collaboration and the exchange of good practices between schools with national and international curricula can be an opportunity to mutually enrich teaching methods, assessment systems, and strategies for connecting Biology learning with students' real lives in an ever-developing global era.

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