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High School Students' Perceptions about Implementation of the Merdeka Curriculum in Biology Lessons in Samarinda

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Abstract: The Fourth Industrial Revolution has had Indonesia to be determined to foster students' critical thinking, creativity, collaboration, communication, and technological proficiency, leading to the creation of the Merdeka Curriculum to enhance the curriculum in Indonesia. The implementation of this curriculum began in Indonesia in 2020, starting with pioneer schools including in Samarinda. Consequently, a study was conducted at pioneer high schools in Samarinda focusing on students' perceptions of Biology learning using the Merdeka Curriculum. This qualitative research involved students and educators engaged in the implementation of the curriculum. The study utilized interviews and data triangulation. The informants were gathered using the snowball sampling technique. The findings indicate the implementation of the Merdeka Curriculum in pioneer high schools in Samarinda encompasses the planning, execution, and evaluation of components: diagnostic assessment, formative and summative assessments, differentiated teaching modules, Pancasila Student Profiles reinforcement projects, and supportive learning environment. These components align with curriculum planning and learning principles, fostering positive impact on students' skills including critical thinking, analytical abilities, literacy, public speaking, and creative thinking. Additionally, the curriculum promotes character development such as diligence in religion and spirituality, self-confidence, self-independence, creativity, empathy, responsibility, courage to innovate, negotiation skills, leadership skills, and collaboration with peers.

Keywords: Biology; Implementation; Merdeka curriculum; Students' perceptions

Introduction

The industrial revolution 4.0 has taken place in several developed countries and has had broad implications for other nations. Indonesia is also determined not to lag behind in embracing this new era, where critical thinking, creativity, collaboration, communication skills, and the ability to use technology have become essential for today's industries (Whorton, 2017). Education plays a key role, leading to the emergence of the Merdeka Curriculum as a result of curriculum improvement studies in Indonesia.

The Merdeka Curriculum is designed to equip students with the 4C skills (critical thinking, communication, collaboration, and creativity) in response to the demands of the 21st century (Indarta et al., 2022). The Merdeka Curriculum has been implemented in Indonesia since 2020 (Suryaman, 2020), spearheaded by pioneer schools, including in the city of Samarinda.

Curriculum development encompasses planning, the learning process, assessment, and learning evaluation (Baharuddin, 2021). After two years of implementing the Merdeka Curriculum in these pioneer schools, questions arose regarding its implementation including the planning, the execution and the evaluation as well as the curriculum impact on students. Based on these concerns, a study was conducted at three senior high schools which are also the pioneer high schools for implementation of the Merdeka Curriculum in Samarinda. The study focused on students' perceptions of Biology learning that involved students, subject

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teachers, and other teachers on the implementation of the Merdeka Curriculum in their schools.

Previous studies have been done in different city in Indonesia. Hutabarat et al. (2022) found that in Padangsidimpuan, North Sumatra, schools implementing the Merdeka Curriculum make their students feel relieved about the examination system, as the exams become more comprehensive, allowing students more opportunities and diverse ways to demonstrate their competencies. Students also feel more comfortable learning at school and are more motivated to participate in every learning activity. The implications of the Merdeka Curriculum for students and teachers in Indonesia pertain to its distinctive characteristics. In this curriculum, students and teachers collaborate to implement Project-Based Learning, aiming to cultivate soft skills and character traits aligned with the Pancasila Student Profile. Emphasis is placed on essential content, allowing for comprehensive exploration of fundamental competencies, such as literacy and numeracy. Furthermore, teachers are granted flexibility to deliver differentiated instruction tailored to the individual abilities of their students (Kurniati, 2022).

There is more to investigate on students' perceptions. According to Burge (2022), perception is defined as the sensory capacity controlled by current stimulation. The capacity to differentiate experienced conditions includes representation with a level of accuracy that is an inherent characteristic. The process of objectification marks the capacity in the formation of perception. In the research, students' perceptions become important to provide a picture of how the Merdeka Curriculum has been implemented and the changes happen to them.

Students' perceptions that are studied in this paper includes the six components of the Merdeka Curriculum in the learning process. The components are diagnostic assessment, differentiated learning module, formative and summative assessment, Pancasila Student Profile projects, and supportive learning environment (Hasanah, 2022). The specific parts that differ the Merdeka Curriulum from the previous curriculum which is 2013 Curriculum lay on the project-based learning approach (Sagita et al., 2023) and differentiated learning approach (Marliana et al., 2022). The academic performance of students in project-based learning is influenced by factors such as the subject area, school location, hours of instruction, and support from information technology, rather than being impacted by the educational stage or group size (Chen, 2018). Differentiated learning necessitates educators dedicating their focus and taking measures to cater to the individual needs of learners. By embracing differentiated learning, teachers are able to gain a comprehensive understanding of learning by considering various perspectives (Marliana et al., 2022).

The implementation of the Merdeka Curriculum became crucial for students because it is them who will receive the effect and will be the subject of outcomes. It is then important to have ideas about their perceptions toward the Merdeka Curriculum, especially in this paper, in Biology field.

Method

The research is qualitative and descriptive in nature, conducted using interviews with informants (Zellatifanny & Mudjiyanto, 2018), that consist of seventeen students of Biology classes, three Biology teachers, three school counselors and a school coordinator project. Data source triangulation and method triangulation for cross-validation of data were also done following the interview results (Carter et al., 2014; Craig et al., 2021). In data source triangulation, the researcher conducted interviews with students, Biology teachers, and other teachers involved in the implementation of the Merdeka Curriculum. In method triangulation, the researcher used interview method, class observations, and documentations that show the same phenomenon to collect data (Farmer et al., 2006; Campbell et al., 2020). The data sources were informants obtained through snowball sampling technique. The collected qualitative data then underwent a process of reduction and were presented in coded form using the NVivo12 Plus software.

Result and Discussion

The implementation of the Merdeka Curriculum in Biology learning consists of planning, execution, and evaluation processes. The components planned, implemented, and evaluated in the Merdeka Curriculum are diagnostic assessment, differentiated learning module, formative and summative assessment, Pancasila Student Profile projects, and supportive learning environment. Senior High Schools in Indonesia cater the students from grade 10 to grade 12. Based on interviews conducted with seventeen student informants from three pioneer senior high schools in Samarinda, data were obtained indicating that, according to the students, diagnostic assessment was conducted in the form of cognitive diagnostic assessment by the Biology teacher, while non-cognitive assessment was carried out by the school counselor. The cognitive diagnostic assessment as confirmed by the interviewed Biology teachers often comes as a pre-test questions or review questions about previous topics. The non-cognitive diagnostic assessment was done by

the school counselor during counseling sessions and discussions at the end of semester as the preparation to choose subjects to learn in grade 11. Students' perception about the implementation of diagnostic assessment can be seen as indicated in the Nvivo 12 Plus coding results in Figure 1.

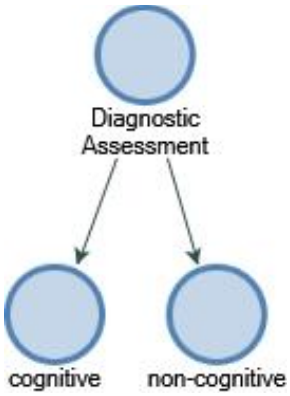

Figure 1. Students perception on diagnostic assessment implementation

The benefits of diagnostic assessment according to students can be seen in Figure 2.

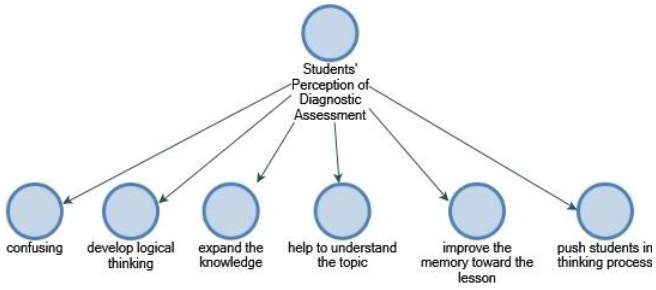

Figure 2. Students perception on diagnostic assessment

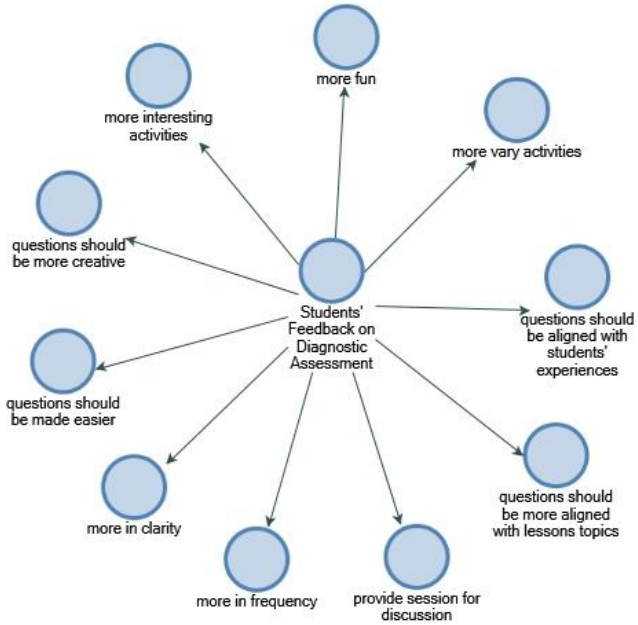

Figure 3. Students' feedback on diagnostic assessment

The researchers delved deeper into students who stated that diagnostic assessment was confusing. They subsequently found results indicating that sometimes, during its implementation, students had difficulty understanding the questions provided by the teacher. Additionally, they perceived that the teacher asked about things they were not previously aware of. The students then provided suggestions for the implementation of diagnostic assessment in the classroom, as indicated in the following coding results in Figure 3.

The interview results with the students provided data on the forms and impact of formative and summative assessment on their skill development, as indicated in the following coding results in Figure 4 and 5.

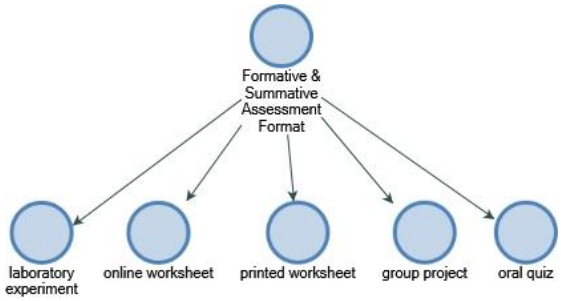

Figure 4. Students' perception on assessment format

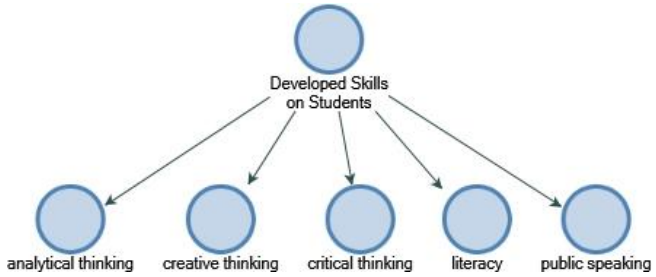

Figure 5. Students' perception on their skills development

During the interview, students provided information about the instructional modules they received at school. The forms of instructional modules they received from teachers varied, as indicated in the following coding results in Figure 6.

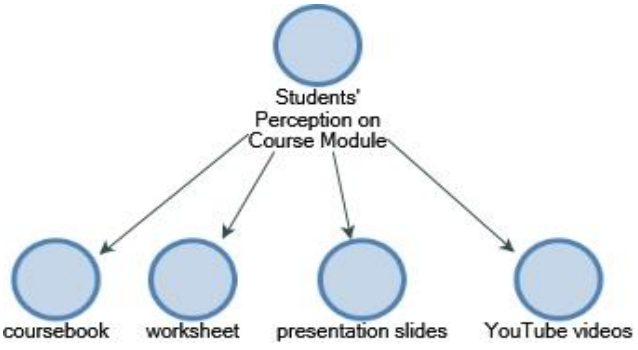

Figure 6. Students' perception on course module

This is consistent with the interview results from Biology teachers in the researched schools, where the forms of course modules varied and were created based on students' abilities. The Merdeka Curriculum also emphasizes project-based learning, such as the Pancasila Student Profile projects or known as P5 project, as part of character education and the application of knowledge in a more holistic manner (Suryaman, 2020). The interview results with students provided information to the researcher about the character development they experienced during project activities which can be seen in Figure 7. Some students mentioned that they grow empathy when working together as a group to do the projects. Projects are similar with voluntary work where the students can choose the topics from the given themes that they eventually grow a teamwork mindset, triggered to have effective communication and voluntarily work to complete them (Sumarmi et al., 2022).

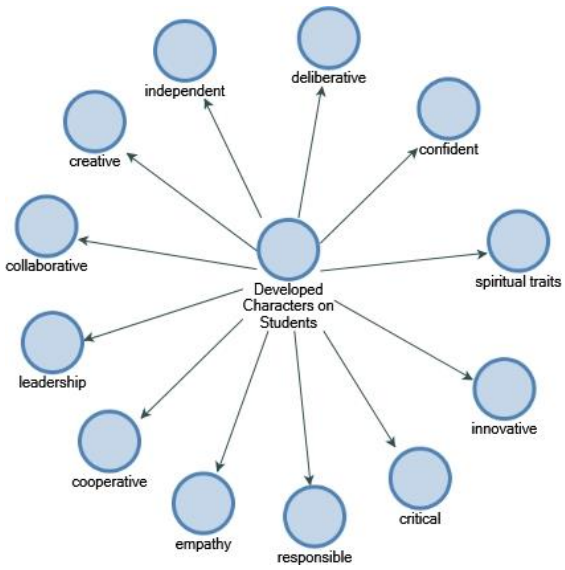

Figure 7. Students' perception on developed characters

Based on interviews with project coordinators, the Pancasila Student Profile project activities are conducted every semester with different project themes. For senior high school standards within one academic year, students are required to complete a minimum of three projects. The results of the project activities are evaluated each semester through the issuance of project reports by the school, separate from the end-of-semester report. The school project coordinator explained that during the implementation of the activities, the emphasis is not only on assessing the final product but also on assessing the process. The process assessment includes the initial planning process by students, the project execution process, and the final outcomes. Each project theme has its own assessment criteria and a consistent assessment rubric for all students, enabling the measurement of character development within each project theme. The project report documents include an assessment rubric, which does not utilize numerical grades but rather descriptive categories such as "Not Developed", "Beginning to Develop", "Developing as Expected" and "Highly Developed". These rubrics were then studied and they are aligned with the requirements for assessing social-emotional development in youth (Pancorbo et al., 2020).

Students also provided their evaluations when asked about the implementation of the Pancasila Student Profile projects in their school. They gave their opinions that projects activities can sometimes challenging for them and that they need more time to complete the project with quality, also with the grouping issues. However, the learning approach using this project-based learning approach has made them grow self-confidence that they become more independent and deliberative as also shown in Bilgin et al. (2015) with project-based learning approach. Students also described some suggestions regarding the implementation process of those project activities, as indicated in the following coding results in Figure 8.

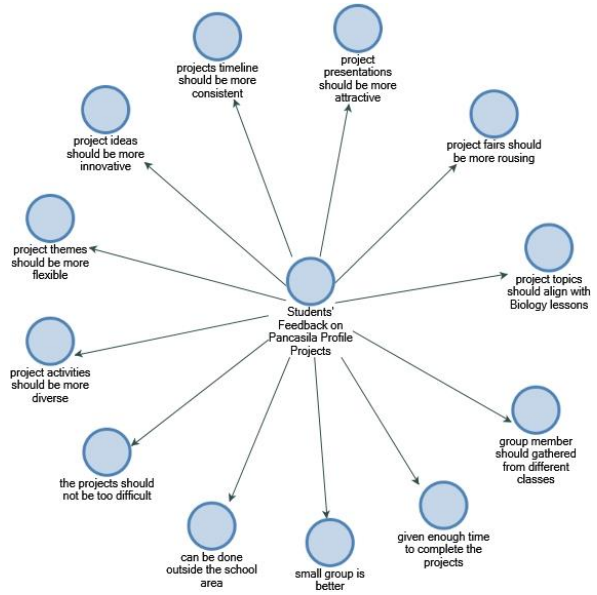

Figure 8. Students' feedback on pancasila profile projects

The last component of the Merdeka Curriculum is a supportive learning environment. Supportive learning environment is defines as a learning place where students can comfortably learn with peers, there is open communication between students and teachers, as well as coaching, sharing and reflection activities (Lancaster & Di Milia, 2015). The pioneer senior high schools examined in Samarinda pay attention to those qualities, seen during the observation of learning activities in the classrooms and the overall school environment including when students were having counseling with

school counselors. Those three schools also pay attention to the comfort of the students' learning climate. From interviews with teachers, it was found that Biology teachers collaborate with school counselor to provide guidance in choosing subjects. Additionally, the researched schools also prioritize the comfort of the school environment, cleanliness, and the lushness of every area within the school. Some even initiated the Green School movement and intensified greening efforts within the school premises. Some focuses on school cleanliness and maintaining tidiness in every corner of the school.

In addition to school facilities, the researchers also conducted interviews with students about the factors that make them comfortable in learning at school, both in the classroom environment and extracurricular activities. The students' responses were then coded to capture their perceptions of the supportive learning environment, as shown in the code in Figure 9.

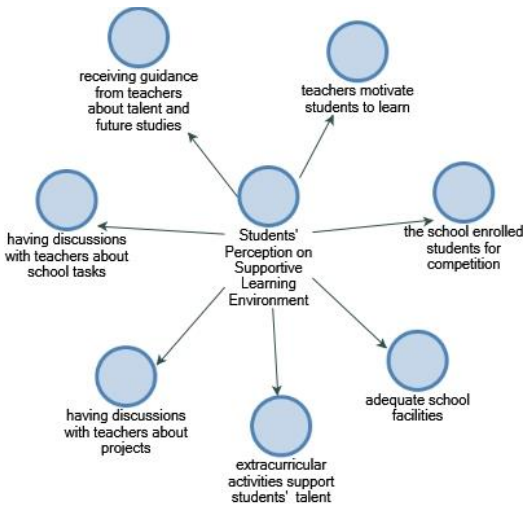

Figure 9. Students' Perception on Supportive Learning Environment

The implementation of the Merdeka Curriculum and its components in Biology learning at the pioneer senior high schools in Samarinda encompasses the processes of planning, execution, and evaluation. According to Grant (2018), there are six steps in curriculum planning are shown in Figure 10.

In the Merdeka Curriculum, the government has determined the characteristics of the Biology field of study and specified learning outcomes for each phase of students. This aligns with step 1 of the planning process. Based on interview results and research on each component of the Merdeka Curriculum implemented in Biology learning at the pioneer schools, a pattern emerges where Biology teachers design learning objectives in the classroom according to the specified learning outcomes for each phase and created their own learning objective approach as stated in the document number 56 of 2022 from Ministry of Education (Hasanah, 2022). This corresponds to step 2. The documents created by teachers such as lesson plans, modules, worksheets, and assessment rubrics that were observed demonstrate the competencies to be achieved, aligning with step 3. There is integration between the Biology subject and other subjects in the form of the Pancasila Student Profile Project activities based on the themes for each phase of students' development, which is coordinated by the school project coordinator. This corresponds to step 4.

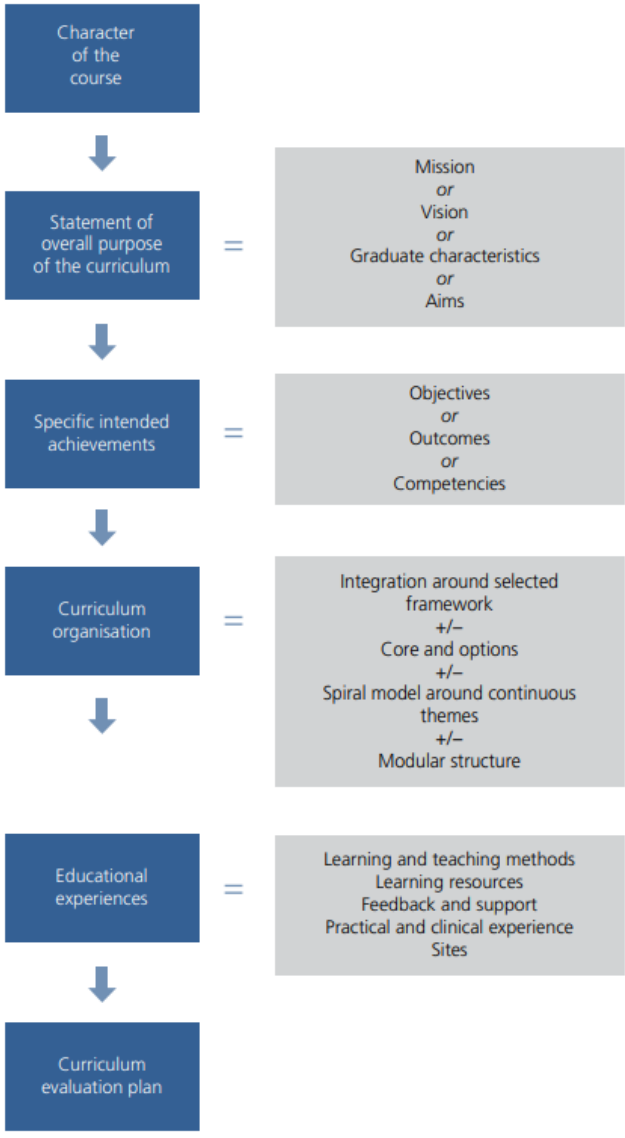

Figure 10. Curriculum design by Grant (2018)

Teachers have the freedom to design course modules. The course modules in Biology learning are developed by Biology teachers based on the document of learning outcomes and aligned with the learning objective approach. The format of instructional course

modules varies among teachers, some are in the form of PowerPoint presentations, providing relevant video links from YouTube, worksheets, or handouts given to students. In the learning activities, students use digital media such as smartphones and laptops. Reynolds (2016) stated that in a learning environment where it is computer-supported, students will have more sense of abstract concepts that it will help them draw a visible knowledge. Additionally, differentiated instructional modules are implemented in the classroom. While providing the same modules to all students, there are different implementations according to the individual needs of the students. Teachers prepare enrichment materials to accommodate students who grasp the material quickly and group students in the classroom.

For students who still have difficulties, teachers provide guidance to those groups, while for those who understand, teachers allow them to explore the enrichment materials prepared by the teacher. It is also apparent that teachers use more than one course book as learning resources. Teachers also have time to hold meetings with other teachers and school management to determine the schedule for psychological tests on grade 10 to assess students' interests and talents before planning the selection of elective subjects on grade 11. In the three researched schools, teachers also allocate time for students to consult about their interests and talents in choosing elective subjects before they enter grade 11. These aspects align with step 5. The report received by students includes academic performance and character development through the project activities, which teachers use to evaluate the implementation of the Merdeka Curriculum, corresponding to step 6. Based on the above description, it can be seen that the researched schools have followed the steps of curriculum planning as well as guided by the government. It is evident that in these pioneer schools, teachers are given the freedom to be creative in delivering lessons to students.

The Merdeka Curriculum planning, as described above, is then implemented with students, considering the principles of learning. Oliver et al. (2008) outlines the principles of learning as follows: Learning is a brain activity that functions most effectively during self-directed learning; Relevant and adequate prior knowledge is a prerequisite for learning; finding the appropriate level to enter new knowledge is crucial; Students learn more when the material has meaning and relevance to them and when they perceive their role in it, i.e., learning in context (the implication is that learning outside of context is more challenging; for example, teaching and learning medical subjects when taught by doctors or surgeons may be difficult for students to understand); Students need practice to learn and master knowledge and skills; Good and supportive learning conditions contribute to learning outcomes; Material presented in a logical sequence is easier to learn. These principles guide the implementation of the Merdeka Curriculum and emphasize the importance of students' active engagement, meaningful learning experiences, prior knowledge, practice, supportive learning conditions, and logical sequencing of material.

The curriculum planning results are experienced by students during its implementation. This is evident in students' perceptions of each component of the Merdeka Curriculum. It begins with students receiving cognitive diagnostic assessment from the Biology teacher in the classroom and non-cognitive diagnostic assessment from the school counselor. According to document number 719/P/2020 from Ministry of Education, learning activities should start with diagnostic assessment. Students benefit from the implementation of diagnostic assessment in learning, as it trains their logic, stimulates thinking, enhances topic understanding, broadens their knowledge, and improves memory. Students also suggest increasing the frequency of diagnostic assessments, providing clearer instructions, simplifying the process, making it more creative, engaging, enjoyable, and varied. They also request discussion sessions. However, some students feel confused about the diagnostic assessment activities in learning and ask for questions that are more relevant to their experiences. These student perceptions reflect the implementation of the Merdeka Curriculum, aligning with principle number 2, where students are prepared to learn new material.

Students also receive materials through various media and activities, not only in the form of worksheets or written assignments but also group projects. These materials are also included in formative and summative assessments in the form of Google Form, printed worksheet papers, oral question-and-answer sessions, group projects, and laboratory experiments. According to students, formative and summative assessments train their focus, responsibility, broaden their perspectives, foster collaboration, and make them consistent in learning. These are also traits defined as self-learning skills where students develop their skills and improve their practices (Densen, 2011; Hill et al., 2020). The research results indicate that teachers prepare formative and summative assessments during the learning process.

There is flexibility in the implementation of summative assessments during the mid-semester, as mentioned by the teacher at one pioneer school. It may or may not be conducted separately and can be directly incorporated into the final semester's summative assessment. The flexibility in the implementation of summative assessments is due to considerations

regarding the allocation of time for the Pancasila Student Profile Project activities. Students provided feedback on the skills developed through formative and summative assessments, such as critical thinking, analytical skills, literacy skills, public speaking abilities, and creative thinking. Similar finding also stated in Simarmata et al. (2022) where students show improvement in literacy skills especially writing through the process of doing Pancasila Students Profile projects. Based on these results, it can be said that principles number 1, 3, and 4, which are self-directed learning, learning in context, and mastery of knowledge, have occurred.

The coordinator of Pancasila Student Profile Project in the researched schools prepares project modules consisting of several parts, namely: the initial stage of goal determination, the implementation stage with diagram instructions, and the evaluation stage with dimensions assessed in the project. The project coordinator plays important role as the citizen science that bridging the common issues surrounding the learning environment area with the students who are going to do project about them (Turrini et al., 2018). A common finding is that the activities in the three pioneer schools are conducted on Fridays during the final period of learning. Students are grouped into different groups and then engage in project activities based on themes chosen by each group, resulting in different outcomes. These projects are later presented in the classroom. In one of the school, the project outcomes are presented in a large classroom in the school auditorium, allowing students from different class groups to see the work of other class groups.

The evaluation process of the project is done through a special report, namely the project report designed by the school and the project coordinator. Before conducting the project activities, subject materials are delivered first and integrated with other subjects, so the project activities, according to students' perceptions, although tiring, become good, cool, interesting, and enjoyable activities. This aligns with principle number 6, where the project activities make learning easier and more engaging for students. Students also provided feedback on the character development from the project activities, such as becoming more improved in religion and spiritual traits, more confident, independent, creative, empathetic, responsible, capable of critical thinking, innovation, consensus-building, as well as developing leadership and teamwork skills. All of these reflect principle number 4, which is the mastery of skills in the implementation of the Merdeka Curriculum. These student characters also indicate the formation of the Pancasila Student Profile.

The three pioneer schools also prioritize creating a conducive and supportive learning environment. In addition to providing adequate school facilities and a clean school environment, Biology teacher and school counselor in these schools dedicate time to have discussions with students about their subjects, interests, future aspirations, and any learning obstacles they may encounter. Another aspect of comfortable learning is when students have the freedom to choose elective subjects according to their interests. The counselors have guidelines for selecting elective subjects. The guidance process for students to choose their elective subjects begins in the first semester of grade 10, where a psychological test is conducted to map students' interests and talents. The school then distributes questionnaires to parents to assist their children in selecting elective subjects that align with their preferences. This process aligned with the principle that school and parents need to collaborate in providing supportive learning environment for each student (Marisa, 2021). Students can choose 4 to 5 elective subjects when they enter grade 11. The process of selecting elective subjects is planned by the counselor in collaboration with the homeroom teacher and parents.

The elective subjects offered by the school are based on the availability of teachers in the school, resulting in different elective subjects among those three researched schools. An interesting aspect of these elective subjects is the presence of an Entrepreneurship subject in all three schools, which has become a distinctive feature of the Merdeka Curriculum. Students also perceive the comfortable learning they experience in school, such as the freedom to discuss homework, consult on projects (Kokotsaki et al., 2016), the availability of adequate school facilities, teachers providing learning motivation and guidance on interests and future aspirations, and the school funding participation in competitions. One particular school regularly enrolled their students to participate in the National Science Olympiad, and the Biology teacher at that school organizes intensive training months before the competition. Additionally, extracurricular activities are facilitated by the school according to students' interests and talents. All of the aspects described above reflect principle number 5, which is a good and supportive learning environment contributing to learning outcomes. This highlights the implementation of the Merdeka Curriculum in the three pioneer schools, aligning with the learning principles reflected in the responses of the interviewed students.

There are three stages of pioneer schools: independent in study, independent in sharing and independent in change (Ayundasari, 2022). The pioneer high schools in Samarinda have different stages. Two of the schools are on the stage of independent in sharing, while one of them is on the stage independent in study. This difference in stages indicates the extent to which the

Merdeka Curriculum is implemented in these schools. The schools that are on the sharing stage have become study sites for teachers from other schools, thus they are considered schools that share freedom of learning. The school on independent stage implements the components of the Merdeka Curriculum in the learning process. According to the Biology teachers interviewed in these three schools, there are initial meetings at the beginning of the academic year to evaluate the learning process and students' achievements from the previous year. This demonstrates the evaluation of the Merdeka Curriculum taking place in these schools.

Although the implementation of planning, execution, and evaluation of the Merdeka Curriculum in the three researched schools has followed the suggested steps and principles, there are still challenges encountered by teachers and students as observed in the field. The constraints found in the implementation of the Merdeka Curriculum in Biology learning at those schools include difficulties in participating in national competitions or Olympiads, as identified in one school, where the question format tested differs from the literacy and numeracy format in the Merdeka Curriculum. Another challenge in two other schools is the difference in the sequence of topics covered compared to the 2013 Curriculum. This has led Biology teachers to develop learning modules to complement the content that needs to be delivered to students. Students also perceive challenges in the implementation of the Merdeka Curriculum in Biology learning, such as confusion caused by diagnostic assessments delivered by teachers, difficulties in understanding project themes, and insufficient project completion time. It is expected that these challenges can be addressed by relevant parties to find the best solutions. As evident in the interviews with Biology teachers, school counselors, and the coordinator of Pancasila Student Profile Project, they continuously update the implementation procedures for each component of the Merdeka Curriculum, working together with students, to achieve the overall goals of the Merdeka Curriculum, particularly in Biology learning, to the fullest extent possible for students.

Conclusion

The study conducted in three pioneer high schools in Samarinda concludes that the implementation of the Merdeka Curriculum in Biology lessons, including its planning, execution, and evaluation processes, followed the appropriate steps and principles. Students experienced positive effects of this implementation on their learning journey, leading to the enhancement of critical thinking, analytical abilities, literacy, public speaking, and creative thinking skills. The research also observed notable progress in character development, including increased traits in religion and spirituality, self-confidence, independence, creativity, empathy, responsibility, critical thinking, innovation, consensus-building, leadership skills, and teamwork skills. Based on the research findings, suggestions are provided for the pioneer high schools in Samarinda. Students recommend making the implementation of the Merdeka Curriculum components more engaging, diverse, frequent, and extensive, aiming to increase student involvement and further develop desired outcomes especially in learning Biology topics. The researcher also encourages future studies to delve into and expand upon this research, contributing to the fulfillment of the goals set as stated in the Merdeka Curriculum.

Author Contributions

In this writing, the authors have contributed to different sections as follows: conceptualization by Hariska Swandana; research methodology by Makrina Tindangen and Herliani; software by Hariska Swandana; supervision by Makrina Tindangen and Herliani; formal analysis by Hariska Swandana; data sources by Hariska Swandana; data curation by Hariska Swandana; original draft preparation by Hariska Swandana; writing editing by Makrina Tindangen and Herliani. All authors involved in this writing have read and agreed to publish the manuscript.

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Conflicts of Interest

In this article, the author affirms that there are no conflicts of interest during the journal writing process. The author does not possess the power to dictate the policies implemented by the schools being examined. There is no manipulation of data by the author, and the researched schools are solely utilized as sources of information, not actively participating in the writing of the research findings.

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