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Implementation of Biology Curriculum in Secondary Schools: Analysis based on The Oliva Model

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ABSTRACT

Private secondary schools in Indonesia have considerable autonomy in adapting the national curriculum, creating opportunities for curriculum innovation and contextualized learning practices. However, empirical studies that systematically analyze curriculum implementation using comprehensive curriculum models remain limited. This study aims to examine the implementation of the biology curriculum in a private senior high school in Bandung using the Oliva Curriculum Model, which consists of twelve interrelated components. This study employed a qualitative instrumental case study design. Data were collected through classroom observations, semi-structured interviews with two biology teachers, and document analysis of teaching modules and student worksheets. Learning observations involved 35 eleventh-grade students during instruction on the human digestive system. Data were analyzed through thematic coding based on the twelve components of the Oliva Model and validated using triangulation across data sources. The findings indicate a strong alignment between curriculum implementation and all components of the Oliva Model. Key results include the integration of the school's vision and mission into curriculum objectives, systematic analysis of student and community needs, student-centered learning grounded in scientific inquiry, continuous teacher professional development, and the use of digital technologies to support learning and assessment. Curriculum evaluation was conducted in a structured and continuous manner at both instructional and institutional levels. These findings suggest that the Oliva Model provides a robust analytical framework for understanding biology curriculum implementation holistically

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and may serve as a reference for curriculum development in other secondary school contexts.

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1. INTRODUCTION

Biology education at the secondary school level plays a strategic role in developing students' scientific concept mastery, science process skills, and character formation. The complexity of biology learning lies not only in understanding facts and theoretical concepts, but also in students' ability to connect biological knowledge with contemporary issues such as health, environmental sustainability, and global challenges (Sera et al., 2025). These challenges are further intensified by the demands of 21st-century education, which require students to develop higher-order thinking skills, including critical thinking, creativity, and problem-solving abilities (Safitri et al., 2025).

In the Indonesian context, the implementation of the biology curriculum in secondary schools continues to face various challenges. Previous studies have reported gaps between curriculum expectations and classroom practices, limitations in learning resources, and variations in teachers' readiness to implement student-centered learning approaches (Tarigan et al., 2025). Recent studies confirm that the main obstacles in Merdeka Curriculum-based biology learning include suboptimal teacher readiness, limited implementation references, and the lack of biology textbooks as learning resources (Azharuddin, 2024).These findings indicate that curriculum effectiveness is determined not only by policy design, but also by the quality of implementation at the school and classroom levels. The Merdeka Curriculum emphasizes student-centered learning, basic literacy development, and 21st century skills, as well as providing flexibility to teachers and principals in designing learning experiences that match students' potential (Fuadi et al., 2023). The implementation of the Merdeka Curriculum has shown a positive impact on improving students' learning abilities, where teachers and students can design the learning process according to their learning and teaching styles, making learning more enjoyable (Rahmayumita et al., 2023).

Private secondary schools in Indonesia generally have greater autonomy than public schools in adapting the national curriculum, while still complying with national education policies. This autonomy allows schools to integrate institutional vision and mission, student needs, and local contexts into curriculum implementation. Since the introduction of the Merdeka Curriculum, schools have been granted increased flexibility to design contextualized, student-centered learning experiences that emphasize literacy, character development, and 21st-century skills (Hidayat et al., 2025; Saa, 2024).

Despite these opportunities, school autonomy also presents significant challenges. Several studies highlight that curriculum implementation under decentralized systems may result in disparities in educational quality, uneven teacher preparedness, and a strong dependence on institutional support and instructional leadership (Gaol, 2023; Widiastuti, 2025). Teachers' perceptions of the Merdeka Curriculum show that although this curriculum is considered more flexible than the 2013 Curriculum, its implementation still requires time to gain a deeper understanding, so further training is needed to improve its effectiveness(Tendrita et al., 2024). Furthermore, pedagogical innovation and successful curriculum implementation are closely associated with collaborative school culture and continuous teacher professional development (Budirahayu & Saud, 2023).

In the context of urban schools, the implementation of biology learning has been carried out effectively and systematically with the availability of a curriculum, teaching methods, teaching materials, teaching media, adequate facilities, and learning resources that are in line with the characteristics of students(Ikhtiara et al., 2022). Comprehensive studies on curriculum implementation in biology learning in private schools using *a*

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systematic analysis framework are still limited. Most studies tend to focus on aspects of learning methods and learning outcomes without analyzing the holistic linkages between the various components of the curriculum. This gap is an opportunity for researchers to bridge how schools manage the curriculum systematically and comprehensively. A systematic and comprehensive analysis of curriculum content is essential to understand the extent to which the curriculum can develop competencies essential for future life and work (Lin et al., 2023). The development of the biology curriculum from the 1984 Curriculum to the Merdeka Curriculum shows significant changes in the learning approach, from an emphasis on process skills and science-based competencies to independent thinking with a learning load that focuses more on essential material (Ervia et al., 2024).

The Oliva Curriculum Model offers a comprehensive and systematic framework for curriculum development and analysis, consisting of twelve interrelated components ranging from philosophical foundations and needs analysis to curriculum evaluation and continuous revision (Oliva, 2009). This model has been applied in various educational contexts and has demonstrated its usefulness in guiding structured curriculum analysis and development (Daud et al., 2012). Nevertheless, the application of the Oliva Model as an analytical framework for examining biology curriculum implementation at the secondary school level in Indonesia remains underexplored.

However, its application in the context of curriculum implementation in biology learning in high schools in Indonesia is still rarely explored. This research fills the gap by using the Oliva Model as an analytical framework to understand the implementation of the Biology curriculum holistically. Using this systematic framework, this study not only identifies how each component of the curriculum is implemented, but also analyzes how the components interact with each other and support each other in creating an effective learning ecosystem. This approach is in line with global trends in biology education that emphasize the importance of a comprehensive conceptual framework to guide curriculum reform (Brownell et al., 2014; Cary & Branchaw, 2017).

Addressing this research gap, the present study aims to analyze the implementation of the biology curriculum in a private senior high school in Bandung using the Oliva Curriculum Model. This study seeks to provide a comprehensive understanding of curriculum implementation practices and to identify innovative learning characteristics that may inform curriculum development in other secondary school contexts.

This study seeks to answer the following research questions:

(i) How is the implementation of the 12 components of the Oliva Model in the Biology curriculum in private high schools in the city of Bandung?
(ii) How are learning strategies and evaluation techniques applied in biology learning?
(iii) What are the characteristics of the innovative learning practices implemented?
(iv) What are the challenges and *best practices* that can be identified from the implementation of the curriculum?

2. METHODS

Research Design

This study employed a qualitative research approach using an instrumental case study design. The instrumental case study was selected because the case was examined not for its uniqueness, but as a means to gain a deeper understanding of a broader issue, namely the implementation of the biology curriculum in secondary education (Stake, 1995; Yin, 2018). This design allowed for an in-depth exploration of curriculum implementation within its real-life context.

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Research Site and Participants

The study was conducted at a private senior high school in Bandung, Indonesia. The school was purposively selected based on the following criteria: (1) strong academic reputation, (2) implementation of innovative curriculum practices, (3) adequate learning facilities, and (4) willingness to participate in the study.

Participants consisted of two biology teachers and 35 eleventh-grade students. The students were involved in classroom observations during biology instruction on the topic of the human digestive system. Teachers participated in semi-structured interviews to provide insights into curriculum planning, implementation, and evaluation.

Research Instruments

The research instruments were developed based on the twelve components of the Oliva Curriculum Model to obtain comprehensive data on biology curriculum implementation at the secondary school level. Data were collected using classroom observation sheets, student activity observation sheets, semi-structured interview guides, and document analysis sheets.

Classroom observations focused on the implementation of curriculum components during biology instruction and covered all twelve elements of the Oliva Model, including philosophical foundations, needs analysis, curriculum objectives, curriculum organization, instructional strategies, assessment techniques, learning evaluation, and curriculum evaluation. This instrument was used to examine the alignment between curriculum planning and classroom practices.

Student activity observations were structured according to three learning phases and focused on students' readiness, active participation, collaboration, problem-solving abilities, communication skills, and the application of 21st-century skills.

Semi-structured interviews with biology teachers were conducted using an interview guide aligned with the Oliva Model to explore teachers' understanding of curriculum objectives, instructional planning, learning strategies, assessment practices, and reflections on curriculum implementation. Document analysis was conducted using a structured analysis sheet to examine teaching modules, instructional materials, and assessment documents, with particular attention to their alignment with curriculum objectives, learning activities, assessment strategies, and the components of the Oliva Curriculum Model.

Instrument Validity

The validity of the research instruments was established through expert judgment. All instruments were reviewed by two experts in biology education and curriculum studies who evaluated content relevance, clarity of indicators, alignment with the research objectives, and consistency with the Oliva Curriculum Model. Revisions were made based on the experts' suggestions to improve wording clarity, indicator relevance, and overall instrument quality.

Data Collection Procedure

Data collection was conducted through a single classroom observation during one biology lesson on the topic of the human digestive system in an eleventh-grade class. Following the observation, semi-structured interviews were conducted with the biology teacher to obtain reflective explanations of the observed instructional practices. Document analysis of teaching modules, learning materials, and assessment documents was carried out concurrently to corroborate and strengthen the findings obtained from observations and interviews.

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Data Analysis

Data analysis followed a thematic analysis procedure. Interview transcripts, observation notes, and documents were read repeatedly to obtain a holistic understanding of the data. Initial coding was conducted by mapping data segments to the twelve components of the Oliva Curriculum Model. Subsequently, thematic coding was applied to identify patterns and relationships among components. Data triangulation across observations, interviews, and document analysis was employed to enhance credibility and trustworthiness.

3. RESULTS AND DISCUSSION

Component 1: Philosophical Foundations and Vision-Mission Alignment

The analysis of the school's vision and mission shows a strong commitment to education that balances spiritual, intellectual, and social dimensions. The school's vision is "To become an educational institution in faith, science, and service", while its mission is "To develop the potential of students optimally through quality education and learning based on institutional values". The vision and mission are clearly displayed in the classroom as a reminder for students. Teachers translate this vision and mission in the context of biology learning by emphasizing the growth of students who are physically, mentally, and spiritually healthy. As expressed in the interview:

"We hope that students will grow up healthy physically, mentally, and spiritually and be ready to face future challenges, including becoming a productive and competitive golden generation. Family values, tolerance, positive change, and freedom to grow as they can be are emphasized."

The implementation of institutional values can be seen concretely in routine activities such as morning prayers together, teachers and students discuss verses relevant to daily life. Based on observations in biology learning, the alignment of vision and mission can be seen from the emphasis on the spiritual dimension such as being invited to be grateful for creation and the responsibility of maintaining one's health, the intellectual dimension can be seen from the process of developing conceptual understanding and science process skills, and the social dimension such as concern for public health through free health screening programs.

The findings in this component are in line with the literature on the importance of coherence between institutional philosophy and learning practice. Recent research shows that the alignment between school visions and missions and curriculum implementation has a significant effect on the effectiveness of learning and character formation of students (Fullan & Quinn, 2020). School with a clear vision and mission that is concretely translated in daily activities tends to have a strong organizational culture and has a positive impact on student development holistically (Hattie & Zierer, 2019). The integration of spiritual values in science learning can be an effective strategy to develop scientific attitudes as well as character.

Component 2-3: Student and Community Needs Analysis

The school provides a variety of programs to respond to students' needs to channel students' interests, potential, and career aspirations. The programs include a biology olympiad preparation program, biology study club in collaboration with universities, one form of the program is a scoby cultivation microbiology practicum and students directly

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learn to university laboratories. In addition, students are also facilitated with extracurricular activities to develop students' interests and talents.

The analysis of the needs of the special community is realized through programs relevant to the surrounding environment where schools are close to traditional markets. These programs include free health checks and services, waste management programs, students learn about environmental issues and contribute to overcoming environmental problems. These findings show that schools have conducted a systematic needs analysis and responded to them through concrete programs. This is in accordance with the principles of the Oliva Model which emphasizes the importance of curriculum relevance (Oliva & Gordon, 2019). Collaboration with universities is an innovative practice that provides students with exposure to authentic learning and the university environment in real life. Research shows that school university partnerships can improve students' learning motivation, conceptual understanding, and academic aspirations (Darling-Hammond et al., 2020). School-university patnership results in post-school changes in the school climate, both from the perspective of students and teachers (Burrell-Craft et al., 2022).

Programs that link learning to community issues, in this case environmental health, reflect the *Community-Based Education* that can improve *civic engagement* and *Social Responsibility* students. This is in line with the concept of transformative education to develop individual competencies and social awareness. Research by Billig & Waterman (2021) shows that service-learning integrated into science curriculum can improve students' conceptual understanding, problem-solving skills, and social awareness. Studies within the Education for Sustainable Development framework emphasize the importance of linking learning to local and global issues to prepare students to become responsible agents of change (UNESCO, 2020).

Component 4: Specification of the Discipline of Biological Sciences

The biology curriculum at this school reflects a strong understanding of the nature of biology as a science and an emphasis on the scientific process is seen in four aspects. First, based on the analysis of teaching module documents and strengthened by observations of the implementation of learning in the classroom, there is an adjustment of the material to current issues and implementation in the classroom is more emphasized on the scientific process in science. On the topic of digestion, students do not study the structure and function of organs theoretically and do a practicum of anthropometric measurements (weight and height) as well as calculating nutritional needs (BMI, BMR, total calorie needs).

Second, teachers take part in Subject Teacher Deliberation (MGMP) and lesson studies to upgrade the material with colleagues across cities. MGMP involves biology teachers throughout the city under a nationally organized institution that is scheduled periodically to discuss pedagogical developments, content, and assessments. The results of the discussion were then applied and adjusted to the context of each school. Third, the school held a Teacher Development Day (HPG) for three days, students were on holiday and all teacher staff participated in various trainings including public speaking, emotional management, and emotional quotient development. As conveyed by the teacher through an interview.

"At our school, there is an HPG (Teacher Development Day) program, all staff are given the opportunity to participate in various trainings. The program lasted for three days, students were on holiday, and the teachers focused on face-to-face self-development. Large training funds are spent as a long-term investment to improve the quality of education."

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"Finally, schools use the Schola app to facilitate students' self-paced learning as well as integrate technology in biology learning such as virtual reality (VR) to visualize abstract concepts in biology."

These findings show a strong institutional commitment to teacher professional development as the key to successful curriculum implementation. Investment in the HPG program reflects the understanding that the quality of learning is highly dependent on the competence and welfare of teachers. The concept of lesson study is in line with the model of professional development based on collegiality and reflection of practice (Takahashi & Mcdougal, 2018) Studies by Huang & Shimizu (2016) shows that lesson study improves teachers' pedagogical content knowledge and learning quality. Participation in cross-city MGMP also opens up opportunities for teachers to learn from the best practices of other schools and develop a wider professional learning community. Studies by (Admiraal et al., 2021) found that teachers who are active in professional learning networks have higher self-efficacy and learning innovation.

Components 5-6: Curriculum Objectives (General and Specific)

The general objectives of the curriculum in this school reflect a holistic vision of education that focuses not only on the cognitive aspect but also on the development of character and values. The teacher stated:

"The curriculum is geared towards forming students who are characterful, independent, and globally competitive through a balance between academic mastery, character, and spirituality."

The specific objectives of the curriculum based on the analysis of teaching codes are concretely described in Learning Outcomes (CP) and Learning Objectives (TP) which are operational, measurable, and include cognitive, affective, and psychomotor aspects. On the topic of the digestive system, learning objectives were formulated using the ABCD category: A (Audience): High School XI grade students; B (Behavior): Identifying food content, calculating nutritional needs, explaining the function of the digestive organs, and applying the principle of balanced nutrition; C (Condition): Through practicum activities, group discussions, and data analysis on LKPD; and D (Degree): Students achieve completeness based on the performance rubric and success indicators set out in the teaching module. Objectives include: Cognitive domain (Understanding of the concept of the digestive system, analysis of food nutritional content); affective domain (Caring and responsible attitude towards a healthy diet); and Psychomotor Domain (Practicum of Food Analysis and BMI/Bbi/KKT Calculation).

The ABCD method is a systematic approach to writing learning objectives that consists of four key elements, namely Audience (who will achieve the objectives), Behavior (behavior that can be observed using action verbs), Condition (the conditions under which learning will take place), and Degree (the expected level of mastery) (Gogus, 2012). The formulation of learning objectives using the ABCD criteria demonstrates the teacher's understanding of the principles of effective instructional design. Goals that are specific, measurable, and include conditions and success criteria make it easier for teachers to design learning and assessment activities that are aligned.

Component 7: Curriculum Organization and Implementation

Based on the results of interviews with biology teachers, the implementation of the curriculum shows the process of translating Learning Outcomes (CP) into structured and meaningful learning activities. The teacher explained, "*Each meeting is designed with a focus on certain scientific skills and always integrates the character values of PKBN2K*

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(Honesty, Perseverance, Self-Mastery, and Care). We not only teach the concepts of biology, but also build the character of the students."

Teachers also apply learning differentiation to accommodate the diversity of students. Based on the interview, *"We adjust the depth of the material and the type of activity to the student's ability. There are students who are already very interested in medicine, so we provide deeper enrichment. There are also students who need more intensive assistance, we provide appropriate scaffolding."*

The teaching modules also demonstrate a strong fit with the Learning Objectives Flow (ATP). Learning objectives reflect a direct link to the CP set out in the national curriculum. Learning activities are designed to develop science process skills, scientific attitudes, and simultaneous integration of character values. The allocation of time between theory and practicum is proportional, with one showing a balance between conceptual and applicative learning. This finding is in line with Lin et al., (2023) explaining that an effective curriculum must reflect a clear link between national curriculum standards and implementation at the grade level. The application of learning differentiation carried out by teachers is also in line with the principles of the Independent Curriculum which provides space for teachers to adjust learning to the characteristics and needs of students (Fuadi et al., 2023).

Component 8: Learning Strategies

Based on the results of the interviews, Biology teachers at the school used varied and contextual learning strategies, adjusted to the characteristics of the material and student profiles. Based on the analysis of the teaching module on the topic of the digestive system, it was shown that teachers applied *the Discovery Learning model* with discussion methods, simple practicums, and reflection. From the results of learning observations in the classroom, it can be seen that teachers provide a wide space for students to discuss and explore. The teacher acts as a facilitator who provides *scaffolding* when students are having difficulties, not as the main source of knowledge.

The selection of strategies is also supported by the use of digital learning media and technology. Based on the results of the teacher's interviews using a 3D application to visualize the digestive organs that cannot be seen directly, as well as independent learning, students use the Schola application which contains videos, interactive quizzes, and supporting materials. This is in line with Adipat (2021) the opinion that the integration of digital technology reflects an understanding of *Technological Pedagogical Content Knowledge* (TPACK) which emphasizes the importance of integrating technology in a way that is appropriate to content and pedagogy.

In addition, teachers are also involved in the process of developing learning strategies with collaboration between teachers of subjects between Foundations to discuss the best learning strategies, share experiences, and learn from each school's best practices. This indicates that *lesson study* and collaboration between teachers can improve teachers' *pedagogical content knowledge* (PCK) and learning quality (Coenders & Verhoef, 2019).

Component 9: Evaluation Techniques

The evaluation system applied in schools includes three complementary assessments, namely diagnostic, formative, and summative. Diagnostic assessments consist of non-cognitive diagnostics and cognitive diagnostics that are carried out before learning begins in each chapter. Based on the results of observation, the teacher starts the learning by asking about the social-emotional condition of the students. For cognitive diagnostics, teachers ask triggering questions such as *"What do you think healthy food is like?"* to identify the student's initial knowledge of the topic to be studied. This is in line with a

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holistic approach in education that recognizes the importance of students' emotional well-being to learning outcomes (Brackett et al., 2011). Research shows that paying attention to students' social-emotional states can increase *engagement* and reduce anxiety in science learning (Pekrun et al., 2017).

In the formative assessment, based on the results of the interview, the teacher explained, *"Formative assessment is very important to monitor student development in real-time. From their questions, from the way they worked on the LKPD, I could tell if they really understood or if there were still misconceptions. So I can immediately give feedback or adjust strategies."* This is in line with Salas-bustos et al., 2025) that the formative assessment applied is in line with the principle *of assessment for learning* which emphasizes the importance of *continuous feedback* to improve learning. Meanwhile, the summative assessment is carried out at the end of the learning material. Based on the interview, the teacher explained that, *"After the daily test, we give back the student's answer sheet with written* feedback*. There is communication between teachers and students regarding the true-false scores of their answers. This is important as constructive feedback, not just value."*

Component 10: Implementation of Learning Strategies

Based on the observation results, learning shows the implementation of Discovery Learning that is coherent with the design of the teaching module. Learning begins with checking the student's social-emotional condition and perception that relates the material of the circulatory system to the digestive system. This is reinforced by the opinion (Akuoko et al., 2025) that explains that triggering questions that are relevant to the context of students' lives are in line with the principles *of contextual learning* that can increase student motivation and *engagement* .

In the core activity, students conduct height and weight measurement practicum in groups. The teacher acts as a facilitator who does not interrupt the student's exploration process, only gives directions when asked. In the closing activity, the teacher gave the main content during the reflection stage, explaining the importance of maintaining an ideal weight and a healthy diet, and related it to spiritual values about the responsibility of maintaining a healthy body. Providing content at the reflection stage after students do practicum is in line with constructivist theory, where students are better prepared to receive and understand information when they have had direct experience and questions arising from that experience (Sugrah, 2019).

Component 11: Learning Evaluation

The learning evaluation system is designed to provide continuous feedback. Remedial programs are provided for students who have not yet achieved completion, while enrichment is given to students who exceed targets with higher challenges. The evaluation system applied reflects the principle of assessment as learning, where assessment not only measures learning but also becomes an integral part of the learning process itself (Mccarthy et al., 2025). The practice of providing written *feedback* on the answer sheet and opening communication about assessment results is in line with research showing that specific, timely, and actionable feedback can significantly improve student learning (Trujillo et al., 2024).

Component 12: Evaluation of the Continuing Curriculum

Curriculum evaluation involves a systematic mechanism. First, *lesson study* and *team teaching* are carried out routinely where one teacher teaches while the other observes with a specific focus, followed by reflective *debriefing*. Second, MGMP engages biology teachers from 18 cities under the Foundation's institutional framework to discuss

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pedagogical developments, current science content, and assessment strategies. The results of the discussion were adapted according to the context of each school. Third, the three-day Teacher Development Day (HPG) program includes *public speaking training*, emotion management, *emotional quotient*, and educational technology development. The teacher explained, *"HPG is a big investment from the school. The training funds spent are not small, but the school sees this as a long-term investment in the quality of education."*

Fourth, the Foundation's national coordination monitors and harmonizes programs in 15 cities, including the preparation of textbooks and the collaborative development of question banks. Fifth, a transparent teacher career system with *rewards*, structured promotions, and supportive supervision. The teacher added, *"Our career system is very clear. There are regular performance evaluations, but not for dropping, but for development. If we have achievements, there is appreciation and rewards."*

The continuous curriculum evaluation system implemented reflects a systematic *continuous improvement* model . The practice of *lesson study* is in line with a model that has been proven to be effective in improving *teachers' pedagogical content knowledge* (PCK) and learning quality (Coenders & Verhoef, 2019).

4. CONCLUSION

This study analyzed the implementation of the biology curriculum in a private senior high school using the Oliva Curriculum Model. The findings show that curriculum implementation was generally aligned with the twelve interconnected components of the model, particularly in the formulation of curriculum objectives, the application of student-centered and inquiry-based learning strategies, and the integration of continuous evaluation at instructional and institutional levels.

The Oliva Curriculum Model proved to be an effective analytical framework for examining curriculum implementation holistically by linking curriculum planning, instructional practices, assessment, and evaluation. This finding highlights the model's potential use as a reference for analyzing and developing biology curricula in secondary school contexts with curricular autonomy.

This study is limited by its focus on a single school and a single classroom observation, which may restrict the transferability of the findings. Future studies are encouraged to involve multiple schools, conduct longitudinal observations, and apply mixed-method approaches to strengthen empirical evidence and examine the impact of curriculum implementation on student learning outcomes.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

6. REFERENCES

Adipat, S. (2021). Developing Technological Pedagogical Content Knowledge (TPACK) through Technology-Enhanced Content and Language-Integrated Learning (T-CLIL) Instruction. *Education and Information Technologies*, *26*, 6461–6477. https://doi.org/10.1007/s10639-021-10648-3

Admiraal, W., Schenke, W., De Jong, L., Emmelot, Y., & Sligte, H. (2021). Schools as professional learning communities: what can schools do to support professional development of their teachers? *Professional Development in Education*, *47*(4), 684–698. https://doi.org/10.1080/19415257.2019.1665573

Akuoko, E. A., Fulmer, G. W., Hand, B., Suh, J., & Gardner, G. (2025). Characterizing inquiry-based science classroom learning environments—generative or replicative—using teachers ' epistemic orientations : a qualitative study. *Frontiers in Education*, *10*, 1508207. https://doi.org/10.3389/feduc.2025.1508207

Azharuddin. (2024). Kendala dan Solusi dalam Pembelajaran Biologi Berbasis Kurikulum Merdeka di Sekolah Menengah Atas. *Jurnal Ilmiah IPA dan Matematika (JIIM)*. https://jurnalcendekia.id/index.php/jiim/

Billig, S. H., & Waterman, A. S. (Eds.). (2021). *Studying service-learning: Innovations in education research methodology (2nd ed.)*. Routledge.

Brackett, M. A., Rivers, S. E., & Salovey, P. (2011). Emotional Intelligence : Implications for Personal, Social, Academic, and Workplace Success. *Social and Personality Psychology Compass*, *5*(1), 88–103.

Brownell, S. E., Freeman, S., Wenderoth, M. P., & Crowe, A. J. (2014). BioCore Guide : A Tool for Interpreting the Core Concepts of Vision and Change for Biology Majors. *CBE—Life Sciences Education*, *13*, 200–211. https://doi.org/10.1187/cbe.13-12-0233

Budirahayu, T., & Saud, M. (2023). Pedagogical innovation and teacher collaborations in supporting student learning success in Indonesia Pedagogical innovation and teacher collaborations in supporting student learning success in Indonesia. *Cogent Education*, *10*(2), 1–16. https://doi.org/10.1080/2331186X.2023.2271713

Burrell-Craft, K., Beck, J. S., & Wiens, P. D. (2022). *Leading Through Partnership: An Examination of Longitudinal Trends in a School-University Partnership*.

Cary, T., & Branchaw, J. (2017). Conceptual Elements : A Detailed Framework to Support and Assess Student Learning of Biology Core Concepts. *CBE—Life Sciences Education*, *16*(10), 1–10. https://doi.org/10.1187/cbe.16-10-0300

Coenders, F., & Verhoef, N. (2019). Professional Development in Education Lesson Study : professional development (PD) for beginning and experienced teachers. *Professional Development in Education*, *5257*, 1–14. https://doi.org/10.1080/19415257.2018.1430050

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Daud, D., Ahmad, H., & Johari, H. (2012). Oliva Model in Malaysian Logistics Curriculum : A Conceptual Framework Paper. *International Journal of Learning & Development*, *2*(3), 217–228. https://doi.org/10.5296/ijld.v2i3.1884

Ervia, E., Delima Harahap, R., Chastanti, I., Biologi, P., Labuhanbatu, U., & Utara, S. (2024). Analisis Perkembangan Kurikulum Biologi dari kurikulum 1984 Sampai dengan Kurikulum Merdeka. In *Jurnal Kependidikan* (Vol. 13, Issue 1). https://jurnaldidaktika.org

Fuadi, M., Zulfikar, T., & Shadiqin, S. I. (2023). Analysis of the Implementation of the Independent Curriculum in Elementary Schools in Indonesia. *Jurnal Sustainable*, *6*(2), 617–623. https://doi.org/https://doi.org/ 10.32923/kjmp.v6i2.4071 Analysis

Fullan, M., & Quinn, J. (2020). *Coherence - The Right Drivers in Action for Schools, Districts and Systems*. Corwin Press.

Gaol, N. T. L. (2023). School leadership in Indonesia : A systematic literature review. *Educational Management Administration & Leadership*, *51*(4), 831–848. https://doi.org/10.1177/17411432211010811

Gogus, A. (2012). Learning Objectives. In N. M. Seel (Ed.), *Encyclopedia of the Sciences of Learning* (pp. 1950–1954). Springer US. https://doi.org/10.1007/978-1-4419-1428-6_144

Hattie, J., & Zierer, K. (2019). *Visible Learning Insights (1st ed.)*. Routledge.

Hidayat, M. T., Suryadi, S., Latifannisa, N., & Sari, S. N. (2025). Evolution of The Education Curriculum in Indonesia. *Journal of Innovation in Educational and Cultural Research*, *6*(2), 381–395. https://doi.org/10.46843/jiecr.v6i2.1312

Huang, R., & Shimizu, Y. (2016). Improving teaching, developing teachers and teacher educators, and linking theory and practice through lesson study in mathematics: an international perspective. *ZDM*, *48*. https://doi.org/10.1007/s11858-016-0795-7

Ikhtiara, T., Jaya, A., Raiha Zahratina, H., Kristia Madalena, D., & Putri, N. (2022). Analisis Implementasi Kurikulum Merdeka pada PembelajaranBIOLOGI di Sekolah Urban. *Jurnal Penelitian, Pendidikan Dan Pengajaran*, *3*, 2022. http://dx.doi.org/10.30596%2Fjppp.v3i3.12940

Lin, S., Wang, J., Li, X., Tang, X., Sun, C., Tan, M., & Luo, T. (2023). Curriculum content mapping of the Chinese National Biology Curriculum Standards for middle school: an analysis from the OECD Education 2030 perspective. *Disciplinary and Interdisciplinary Science Education Research*, *5*(16), 1–16. https://doi.org/10.1186/s43031-023-00082-5

Mccarthy, N., Neville, K., & Pope, A. (2025). Feedback and formative assessment — looking backwards to move forward. *Discover Education*, *41*(1), 25. https://doi.org/10.1007/s44217-025-00414-9

Oliva, P. F. (2009). *Developing the curriculum (7th ed.)*. Pearson.

Oliva, P. F., & Gordon, W. R. (2019). *Developing the curriculum (9th ed.)*. Pearson.

Pekrun, R., Vogl, E., Muis, K. R., & Sinatra, G. M. (2017). Measuring emotions during epistemic activities : the Epistemically-Related Emotion Scales Related Emotion Scales. *Cognition and Emotion*, *31*(6), 1268–1276. https://doi.org/10.1080/02699931.2016.1204989

Rahmayumita, R., Hidayati, N., & Abstrak, I. A. (2023). Kurikulum Merdeka: Tantangan dan Implementasinya pada Pembelajaran Biologi. In *BIOLOGY AND EDUCATION JOURNAL* (Vol. 3, Issue 1).

Saa, S. (2024). Merdeka Curriculum: Adaptation of Indonesian Education Policy In The Digital Era and Global Challenges. *Revista De Gestao Social E Ambiental*, *18*(3), 1–24. https://doi.org/https://doi.org/10.24857/rgsa.v18n3-168

Safitri, T., Ardianto, D., Permana, I., Kurniasih, S., & Nuraeni, E. (2025). Advancing biology education through HOTS-based learning on digestive system concepts : A systematic literature review. *Bio-Edu: Jurnal Pendidikan Biologi*, *7*(2), 166–179. https://doi.org/10.20527/bino.v7i2.21669

Salas-bustos, D. A., Coral-padilla, S. J., Bustos-lozano, H. L., & Almeida-Reina, M. B. (2025). The Role of Formative Assessment in Higher Education : Strategies to Improve Learning and Knowledge Retention. *Pakistan Journal of Life and Social Sciences*, *23*(1), 5441–5455. https://doi.org/https://doi.org/10.57239/PJLSS-2025-23.1.00425

Sera, N., Pratama, A. T., & Saragih, D. M. (2025). Implementing Biology Learning with a Differentiated Approach to Support Students 21 st Century Skills Independent

Curriculum. *Jurnal Penelitian Pendidikan IPA*, *11*(3), 64–75. https://doi.org/10.29303/jppipa.v11i3.10422

Stake, R. E. (1995). *The Art of Case Study Research*. Sage Publications.

Sugrah, N. (2019). Implementasi Teori Belajar Konstruktivisme dalam Pembelajaran Sains. *Humanika, Kajian Ilmiah Mata Kuliah Umum*, *19*(2), 121–138.

Takahashi, A., & Mcdougal, T. (2018). *Collaborative Lesson Research (CLR)* (pp. 143–152). https://doi.org/10.1007/978-3-319-75696-7_8

Tarigan, MHd. R. M., Azis, S., Lase, N. K., & Tarwiyani. (2025). Exploring the implementation of the merdeka curriculum in biology education : A qualitative study at an Indonesian upper secondary school. *Jurnal Biolokus: Jurnal Penelitian Pendidikan Biologi Dan Biologi*, *8*(1), 1–16. https://doi.org/http://dx.doi.org/10.30821/biolokus.v8i1.4490

Tendrita, M., Kaliu, S., & Kolaka, S. N. (2024). *Persepsi Guru Biologi Kabupaten Kolaka Terhadap Implementasi Kurikulum Merdeka di Sekolah* (Vol. 10, Issue 1). http://ejournal.unsub.ac.id/index.php/FKIP

Trujillo, B. P. S., Velarde-Camaqui, D., Nu˜nez, C. A. G., Silva, E. V. C., & Oliva, M. del P. G. S. de la. (2024). The current landscape of formative assessment and feedback in graduate studies : a systematic literature review. *Frontiers in Education*, *10*, 1509983. https://doi.org/10.3389/feduc.2025.1509983

UNESCO. (2020). *Education for Sustainable Development: A Roadmap Education for Sustainable Development A roadmap*. https://doi.org/10.54675/YFRE1448

Widiastuti, I. (2025). Assessing the Impact of Education Policies in Indonesia : Challenges , Achievement , and Future Direction. *Al-Ishlah: Jurnal Pendidikan*, *17*(2), 1955–1964. https://doi.org/10.35445/alishlah.v17i2.6803

Yin, R. K. (2018). *Case study research and applications: Design and methods (6th ed.)*. Sage Publications.

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