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The Problems of IPAS Learning in the Merdeka Curriculum

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ABSTRACT
This study aims to analyse teacher readiness and competency in implementing the Independent Curriculum in Natural and Social Sciences (IPAS) learning at SMA Negeri 2 Tondano. This study used a descriptive qualitative approach. Data collection was conducted through in-depth interviews with seven informants: the principal, the vice principal for curriculum, two IPAS teachers, and three 10th-grade students. Data analysis techniques used included data reduction, data presentation, and conclusion drawing to identify patterns, themes, and meanings emerging from the field data. The research focused on teachers' understanding of the Independent Curriculum concept, their ability to design project-based learning and assessment, and the use of technology in the learning process. The results indicated that the readiness and competency of IPAS teachers were still in the early adaptation stage. Teachers had attempted to implement the principles of the Independent Curriculum, but still face challenges in analysing Learning Outcomes (CP), formulating Learning Objectives (TP), developing Learning Objective Flows (ATP), and developing contextual teaching modules. Other obstacles included limited digital literacy, inadequate supporting facilities, and low ability to implement project-based learning. Institutional support from schools existed, but it was not optimal due to limited time, resources, and technical assistance from external parties. Therefore, continuous teacher competency strengthening through practice-based training, increased educational technology literacy, and collaboration between teachers are needed to realise integrative science and science learning in accordance with the spirit of Freedom to Learn.

INTRODUCTION

The implementation of the Merdeka Curriculum by the Ministry of Education, Culture, Research, and Technology since 2022 has brought a paradigm shift in school learning, including the integration of Natural Science (*Ilmu Pengetahuan Alam*) and Social Science (*Ilmu Pengetahuan Sosial*) subjects into a unified form known as IPAS (*Ilmu Pengetahuan Alam dan Sosial*). The Merdeka Curriculum emphasises flexible learning that focuses on competence and character development in alignment with

the *Profil Pelajar Pancasila* (Pancasila Student Profile) and provides opportunities for students to learn according to their interests, abilities, and needs (Kemendikbudristek, 2022b; Dharma & Sihombing, 2020). The primary goal of this integration is to build a holistic understanding of life phenomena through an interdisciplinary approach. IPAS learning is expected to train students to think critically, creatively, collaboratively, and communicatively in accordance with the Pancasila Student Profile. However, in practice, this curriculum reform presents major challenges, especially for teachers and students who were previously accustomed to teaching patterns that separated natural and social sciences. In many schools, including SMA Negeri 2 Tondano, adaptation to these changes has not been fully optimal due to limited resources, teachers' incomplete understanding of the essence of the Merdeka Curriculum, and the unpreparedness of integrated learning materials.

Theoretically, IPAS learning within the Merdeka Curriculum is rooted in constructivist theory developed by Jean Piaget and Lev Vygotsky. This theory emphasises that learners construct knowledge through active interaction with their environment and meaningful learning experiences (Ardiati, 2021). In the context of IPAS, teachers act as facilitators who help students construct scientific and social concepts through project activities and contextual inquiry. However, in practice, many teachers are still unable to design truly integrative project-based IPAS learning due to limited theoretical understanding and pedagogical skills. The discrepancy between theory and practice thus becomes one of the root causes of the problems in implementing IPAS at the secondary school level.

Several studies reinforce this depiction of the challenges. Denada Viqri et al. (2024) found that in implementing IPAS learning under the Merdeka Curriculum, students still struggle to integrate theoretical understanding with real-world contexts, reflect on their work outcomes, and communicate concepts clearly and coherently. According to Syamsudin & Siti (2024), a common issue faced by teachers is the lack of a deep understanding of curriculum change concepts, particularly in implementing the Merdeka Curriculum. In addition, teachers are required to be creative and innovative educators who can design learning processes effectively, utilise technology, and select suitable models, approaches, strategies, media, and assessments according to students' characteristics and needs.

The problems in science learning at the elementary level are generally related to students' low understanding of scientific concepts, caused by teacher-centred and memorisation-oriented instruction. Many teachers have not fully applied contextual and inquiry-based learning approaches as emphasised in the Merdeka Curriculum, resulting in students being given limited opportunities to experiment, observe, and draw conclusions from natural phenomena around them. Furthermore, the lack of facilities and infrastructure, such as teaching aids, simple laboratories, and digital learning media, also hampers the development of meaningful learning experiences. Another contributing factor is the lack of teacher training in integrating technology and active learning strategies, leading to monotonous learning processes that fail to spark students' interest in science. As a result, science learning in elementary schools has not yet fully achieved its main goals of fostering curiosity, critical thinking, and problem-solving abilities (Zulaiha et al., 2022; Winangun, 2022).

Based on preliminary observations and teacher reports at SMA Negeri 2 Tondano, several key problems were identified in the implementation of IPAS learning. First, some teachers do not yet fully understand the integration of science and social studies as required by the Merdeka Curriculum, resulting in learning that still focuses on rote memorisation of concepts. Second, the limited availability of contextual learning media and laboratory facilities hinders the implementation of project-based learning, which should be a hallmark of IPAS. Third, students' learning outcomes show an imbalance between cognitive and affective aspects—students tend to grasp theory more easily but are less actively engaged in practical activities. Fourth, authentic assessment, which evaluates both process and outcome, has not been consistently implemented due to insufficient mentoring for teachers. These issues underscore the need for an in-depth analysis of the factors underlying the challenges in IPAS learning at this school to develop contextual solutions that meet the needs of both teachers and students.

The novelty of this research lies in its specific focus on analysing the problems of IPAS learning at the senior high school level, with a contextual focus on SMA Negeri 2 Tondano. This study not only identifies learning challenges but also links them directly to constructivist and contextual learning theories as its conceptual foundation. By combining theoretical analysis, previous empirical findings, and actual school conditions, this research is expected to produce strategic recommendations to improve the effectiveness of IPAS implementation within the Merdeka Curriculum. Furthermore, the results of this study are expected to enrich the literature on integrated curriculum implementation at the secondary education level and serve as a reference for other schools in North Sulawesi to optimise meaningful and contextual IPAS learning. This study aims to analyse the level of teacher readiness and competence in implementing the Independent Curriculum in Natural and Social Sciences (IPAS) learning at SMA Negeri 2 Tondano. Teacher readiness includes an understanding of the concepts and characteristics of the Independent Curriculum, the ability to design learning tools, and readiness to adapt learning strategies and methods to student needs. Meanwhile, teacher competence is reviewed in terms of mastery of IPAS material, pedagogical skills, utilisation of learning media and technology, and skills in conducting assessments oriented towards developing student competencies and character. Thus, this study is expected to provide a comprehensive picture of the actual conditions of teachers in supporting the successful implementation of the Merdeka Curriculum in schools.

RESEARCH METHOD

This study employed a descriptive qualitative approach to provide an in-depth description of the various problems faced by teachers and students in the IPAS learning process under the implementation of the Merdeka Curriculum. This approach was chosen because it allows the researcher to uncover naturally occurring phenomena within the school environment without manipulating variables, while also providing a contextual understanding of the experiences and perspectives of the research subjects (Anggito & Setiawan, 2018). The research subjects were teachers and students at SMA Negeri 2 Tondano who were directly involved in IPAS learning. The main informants in this study included two IPAS subject teachers, the school principal, the vice principal for curriculum affairs, and three students, all selected using a purposive sampling technique—namely, the selection of informants based on specific considerations aligned with the research objectives and needs. Data collection techniques used in this study included observation, interviews, and documentation to obtain comprehensive information about the research object (Afrizal, 2019). Through these three techniques, the researcher was able to directly observe the ongoing processes, explore respondents' opinions and experiences, and collect written evidence or relevant archives to support the findings. The data analysis process employed the Miles and Huberman model, which consists of several components carried out through stages of data reduction, data display, and conclusion drawing (Thalib, 2022; Wijaya, 2019; Sumarmi, 2023).

RESULTS AND DISCUSSION

Teachers' Readiness and Competence in Implementing the Merdeka Curriculum

To gain an in-depth understanding of the various issues arising in the implementation of IPAS learning within the Merdeka Curriculum, the researcher conducted interviews with several informants who possess direct experience and understanding of the teaching process. The interviews involved two IPAS subject teachers, the principal, the vice principal for curriculum affairs, and three tenth-grade students who actively participated in IPAS learning at SMA Negeri 2 Tondano.

The focus of the interviews in this section was directed toward indicators of teacher readiness and competence in implementing the Merdeka Curriculum, which include teachers' understanding of the curriculum concept, their ability to design teaching materials and assessments, mastery of project-based learning methods, and the use of technology in the learning process. Through these interviews, it was expected to provide a clear picture of IPAS teachers' readiness in applying the Merdeka Curriculum at school, the obstacles they encountered in teaching practices, and students' perceptions

of how teachers managed integrative learning that combines natural and social sciences. The following are the results of the interviews with the informants regarding these indicators.

Informant: Principal

> "From our observation, IPAS teachers have tried to follow the Merdeka Curriculum guidelines, but they still need more time to adapt. They have prepared teaching modules and projects, but not all of them fully reflect the integrative principles between science and social studies. We are also trying to provide internal training and invite external speakers. Another challenge is fostering collaboration among teachers, as IPAS learning requires teamwork and cross-disciplinary understanding."

Informant: Vice Principal for Curriculum Affairs

> "In terms of curriculum, we have prepared teaching devices, but in practice, teachers are still often confused. IPAS demands a high level of creativity, while some teachers are still used to textbook-based approaches. Support from the education office is still limited, so the school has initiated internal sharing sessions among teachers. However, these sessions are not yet conducted regularly due to time constraints and administrative workloads. I think this is one of the root problems in IPAS learning at our school."

Informant: IPAS Teacher 1

> "We have received socialisation and training about the Merdeka Curriculum, but implementing it in the classroom is not easy. IPAS combines two disciplines, science and social studies, which we used to teach separately. Sometimes, I am still unsure how to connect social and natural concepts within a single learning activity. For example, when teaching environmental topics, students can understand the scientific aspects, but they struggle to analyse the social impacts. We need more concrete examples of project plans that suit our students' conditions."

Informant: IPAS Teacher 2

> "In terms of readiness, we still need further guidance. The training we had was only once, and it wasn't enough. Sometimes, we are unsure about determining appropriate learning outcomes, especially when developing project-based assessments. Moreover, teaching aids and internet access are limited, so IPAS learning is not yet fully aligned with the Merdeka Curriculum's expectations. Often, we end up reverting to traditional teaching methods like lectures and simple discussions."

Informant: Student 1 (Grade X-1)

> "Learning IPAS can be confusing because it mixes science and social materials. Our teacher explains well, but sometimes we don't understand how the two subjects relate. During projects, we enjoy working in groups, but the grading criteria are unclear."

Informant: Student 2 (Grade X-1)

> "I like learning through projects, but sometimes the teacher also seems unsure when giving directions. We're sometimes only told to look up information online without being explained how it relates to the topic. So, we just do it as best as we can. I think if the teacher explained the project goals more clearly, we would be more enthusiastic."

Informant: Student 3 (Grade X-1)

> "The teacher tries to make IPAS lessons interesting, for example, by using videos or discussions, but not all teachers can use technology well. Sometimes, the videos don't play, or the internet is slow, so learning is disrupted. But I like it when we have outdoor activities because it's easier to understand."

After the data reduction process, which involved selecting, focusing, and simplifying the interview results from various informants, the next step was data presentation. Data reduction on the indicator of Teachers' Readiness and Competence in Implementing the Merdeka Curriculum produced several key themes that reflect the real conditions of teachers in implementing IPAS learning at SMA Negeri 2 Tondano. The results were then presented in a table to facilitate analysis, comparison, and interpretation of each informant's perspective. This data presentation aims to provide a comprehensive overview of teacher readiness, school support, and students' perceptions regarding the implementation of the Merdeka Curriculum, especially in IPAS subjects. Through this process, the researcher identified emerging patterns such as pedagogical challenges, adaptation to curriculum

changes, and teachers' understanding of integrating science and social studies concepts in IPAS learning. The results of the data presentation regarding teacher readiness and competence in implementing the Independent Curriculum in science learning at SMA Negeri 2 Tondano can be seen in Table 1.

Table 1. Research Data Presentation

No	Informant	Main Interview Statement	Data Meaning/Interpretation	Main Theme /Category
1	IPAS Teacher 1	Teachers have attended Merdeka Curriculum training, but are still confused about integrating science and social studies topics.	Teachers have a basic understanding but cannot yet link both disciplines thematically.	Limited conceptual understanding
2	IPAS Teacher 2	The training received was insufficient; difficulties remain in planning projects and assessments aligned with IPAS learning outcomes.	Teachers are not yet competent in planning and assessing project-based learning.	Limited planning and assessment ability
3	Principal	Teachers have tried implementing the Merdeka Curriculum, but need continued mentoring to make IPAS projects truly integrative.	Teachers are still in the adaptation phase and need ongoing support.	Low implementation readiness
4	Vice Principal	Teachers are still used to traditional teaching patterns; internal mentoring is inconsistent due to time constraints.	Lack of collaborative and reflective culture among teachers in developing IPAS learning.	Suboptimal institutional support
5	Student 1	IPAS learning is confusing as it combines science and social subjects; the links between materials are unclear.	Students cannot yet understand concept integration due to unclear explanations.	Difficulty understanding integrative concepts
6	Student 2	Students enjoy project learning, but teachers seem uncertain and unclear about project goals.	Teachers have not yet mastered project-based learning steps.	Ineffective project-based learning
7	Student 3	Teachers use digital media but face internet issues and limited tech skills.	Teachers' digital literacy is still limited, making learning less interactive.	Low digital literacy

Based on the reduction and presentation of data, it can be concluded that the readiness and competence of teachers in implementing the Merdeka Curriculum for IPAS learning at SMA Negeri 2 Tondano are still at the adjustment stage. IPAS teachers show a positive attitude toward adapting to the new curriculum, yet they still face various challenges in pedagogical, professional, and technological aspects. Limited understanding of the Merdeka Curriculum's essence and the integration of natural and social sciences causes learning implementation to fall short of policy expectations.

Interviews with the principal and vice principal indicate that the school has made efforts to support teachers through training and mentoring, but this has not yet evenly improved teachers' competence. Differences in teachers' educational backgrounds, some from science and others from social studies, make interdisciplinary integration challenging. The school recognises the need to strengthen teachers' capacity through workshops and inter-school collaboration to ensure more effective and sustainable curriculum implementation.

From the students' perspective, most believe that teachers have tried to apply varied teaching methods consistent with the Merdeka Curriculum principles, such as project-based and group learning. However, they also feel that some teachers still rely on conventional approaches, making lessons monotonous and less engaging. This reveals a gap between the ideals of the Merdeka Curriculum and actual classroom practices.

Therefore, it can be concluded that the main issue in IPAS learning lies in teacher readiness and competence. The lack of optimal readiness and limited competence has affected the extent to which learning can truly reflect independent and contextual learning. Continuous teacher capacity development through practice-based training, strengthened learning communities, and consistent school policy support are essential so that teachers can fully understand and apply the principles of the Merdeka Curriculum.

Availability of Facilities, Infrastructure, and Learning Resources Supporting IPAS Learning

Before entering the data analysis on the indicator Availability of Facilities, Infrastructure, and Learning Resources Supporting IPAS Learning, it is important to understand that the presence of adequate learning facilities is a crucial component in supporting the successful implementation of the Merdeka Curriculum. Comprehensive facilities and infrastructure, along with relevant learning resources, play a vital role in creating an active, contextual, and meaningful learning process for students. Therefore, this section will present an in-depth analysis of the availability and utilisation of facilities, infrastructure, and learning resources in schools, based on interviews with the principal, vice principal for curriculum affairs, IPAS teachers, and students as research informants.

Principal:

> "At our school, we have made efforts to provide facilities and infrastructure to support IPAS learning, such as a science laboratory, several projectors, and internet access. However, in reality, these facilities are not yet fully adequate to support the implementation of the Merdeka Curriculum. IPAS learning requires exploration and project-based activities, while teaching aids and practical materials are still limited. The school's budget also does not allow for regular procurement, so we rely heavily on support from the government or the education office."

Vice Principal for Curriculum Affairs:

> "In implementing the Merdeka Curriculum, IPAS poses a challenge because not all facilities are available. IPAS modules and teaching materials that align with the curriculum are still lacking, so teachers have to create their own materials. We try to assist by conducting small-scale training and encouraging collaboration among teachers, but facilities such as LCD projectors or computers are not yet evenly distributed across all classrooms. This situation affects the quality of project-based learning."

IPAS Teacher 1:

> "The facilities for IPAS learning are still limited. Teaching aids and practical materials are scarce, so I often replace experiments with educational videos or demonstrations using simple objects around the school. However, of course, the results are different from hands-on practice in the laboratory. IPAS textbooks for the Merdeka Curriculum are also incomplete, so I have to look for additional references from the internet or other sources."

IPAS Teacher 2:

> "Our main obstacle is the lack of supporting facilities for project activities. For instance, when students are assigned to conduct environmental observations, measuring tools and documentation media are unavailable. We have tried to use digital platforms like *Merdeka*

Mengajar, but the school's internet connection is sometimes unstable. Therefore, learning cannot yet be optimised as expected in the Merdeka Curriculum."

Student 1:

"IPAS lessons are interesting because they combine science and social studies, but we rarely have hands-on practice. Usually, we just have discussions in class or watch videos. We want to do our own experiments, but we're told the tools are not available yet. So, it feels less exciting when it's only theory."

Student 2:

"The teacher tries to make the lessons interesting, but the facilities are lacking. For example, when learning about the environment, we couldn't go outside to observe because there were no tools we could use. The IPAS books are also limited, so we often look for additional materials on the internet."

Student 3:

"Not all classrooms have projectors, so when teachers want to show videos or images, sometimes we have to move to another room. The school's internet is also often slow, making it difficult to use digital media. We hope the school can add more teaching aids and facilities so that IPAS learning becomes more engaging."

After conducting the data reduction process, which involved selecting, simplifying, and grouping important information from interviews with the principal, vice principal for curriculum affairs, two IPAS subject teachers, and three tenth-grade students at SMA Negeri 2 Tondano, the next step was data presentation. At this stage, the reduced data were organised systematically to provide a clear depiction of the real conditions in the field related to the indicator Availability of Facilities, Infrastructure, and Learning Resources Supporting IPAS Learning. This data presentation aims to display the interview results concisely yet meaningfully, making it easier for the researcher to identify the relationship between facility readiness and the challenges of IPAS learning in the context of the Merdeka Curriculum. Through data presentation in tabular form, it is expected that the perspectives of each informant regarding the availability and utilisation of facilities, infrastructure, and learning resources in the school can be clearly seen. These data form an important foundation for understanding the extent to which existing facilities are able to support the implementation of project-based and contextual learning, which are the main characteristics of the Merdeka Curriculum.

Table 2. Availability of Learning Facilities to Support the Independent Curriculum

No	Informant	Main Statements from Interview Results	Meaning / Key Findings	Relation to the Problems of IPAS Learning in the Merdeka Curriculum
1	Principal	Basic facilities such as laboratories and projectors are available, but teaching aids and practical materials are still very limited. The school budget is insufficient for regular procurement.	The school is committed to supporting the Merdeka Curriculum but faces constraints in resources and funding.	The lack of facilities directly affects the implementation of project-based learning, which requires exploratory practice.
2	Vice Principal for Curriculum Affairs	IPAS modules are incomplete, teachers still create their own teaching materials, and technological facilities are not evenly distributed across all classrooms.	The unpreparedness of facilities and learning resources causes inequality between classes in curriculum implementation.	IPAS learning has not been fully optimised due to limited media and supporting digital tools.

3	IPAS Teacher 1	Lack of teaching aids and practical materials; experiments replaced with videos or simple demonstrations; IPAS books are still limited.	Teachers adapt creatively, but students' learning outcomes are less optimal without hands-on practice.	Limited facilities make IPAS learning more theoretical than practical, which contradicts the spirit of the Merdeka Curriculum.
4	IPAS Teacher 2	Project activities are difficult to carry out due to a lack of tools; unstable internet connection; *Merdeka Mengajar* platform cannot be fully utilised.	Digital learning is not optimal due to technical and infrastructural constraints.	The Merdeka Curriculum demands interactive learning, but limited networks and tools make implementation difficult for teachers.
5	Student 1	IPAS learning is interesting but lacks practice; usually limited to class discussions; experimental tools are unavailable.	Students want hands-on learning experiences to better understand and stay motivated.	The lack of facilities hinders contextual learning experiences, which are key elements of the Merdeka Curriculum.
6	Student 2	Facilities are inadequate; learning is still dominated by theory; IPAS books are limited.	The lack of learning resources makes students less active in exploring materials.	The IPAS learning process does not yet reflect independent learning or project-based activities.
7	Student 3	Not all classes have projectors, slow internet, and teachers have difficulty using digital media.	Students struggle to access visual and digital learning.	Technological infrastructure does not yet support modern learning as required by the Merdeka Curriculum.

Based on the results of data reduction and presentation, it can be concluded that the availability of facilities, infrastructure, and learning resources at SMA Negeri 2 Tondano is not yet fully adequate to support IPAS learning in accordance with the demands of the Merdeka Curriculum. The school has made efforts to provide facilities such as science laboratories, projectors, and internet access; however, their quantity and quality remain limited. This condition directly affects teachers' ability to conduct project-based, observational, and experimental learning, which should be the main characteristics of the Merdeka Curriculum. The lack of facilities has led teachers to rely more on lectures or classroom discussions rather than contextual learning that involves students' direct experiences in the field.

Interviews with the principal and the vice principal for curriculum affairs revealed that the school shows a strong commitment to supporting the implementation of the Merdeka Curriculum, but is constrained by limited funds and resources. The school's limited budget makes it difficult to regularly procure teaching aids and practical materials. Although the school has tried to overcome these challenges through teacher training, collaboration among educators, and the utilisation of local resources, such efforts have not been sufficient to meet the facility's needs for IPAS learning. This indicates that implementing the Merdeka Curriculum requires systemic support, not only teacher readiness but also adequate investment in educational infrastructure.

From the perspective of IPAS teachers, the lack of facilities such as teaching aids, laboratory materials, and internet access is a major obstacle to applying project-based learning. Teachers have to innovate by using simple media or digital videos as substitutes for hands-on practice, but these alternatives fail to provide students with meaningful learning experiences. The lack of learning resources, such as incomplete IPAS textbooks aligned with the Merdeka Curriculum, also makes it difficult for teachers to design appropriate learning plans. This situation highlights a gap between the idealism of the curriculum, which emphasises exploratory and experiential learning and the actual conditions in the field that remain limited by infrastructure.

Students' perspectives further reinforce these findings. They expressed that IPAS lessons are interesting because they integrate natural and social sciences; however, practical or experimental activities are rarely conducted. Facilities such as observation tools, experimental materials, and digital devices are still inadequate. As a result, learning feels monotonous and remains theory-oriented. These limitations hinder students from gaining contextual, creative, and challenging learning experiences. Therefore, it can be concluded that the limited availability of facilities, infrastructure, and learning resources is a major problem in implementing IPAS learning under the Merdeka Curriculum. Strategic measures are needed from both schools and the government, such as providing relevant teaching aids, improving internet access, and developing contextual teaching materials, so that IPAS learning can truly embody the spirit of *Merdeka Belajar* (Freedom to Learn).

From a professional competence perspective, limitations are still found in preparing teaching modules and project-based assessments aligned with IPAS learning outcomes. Some teachers reported difficulties in determining indicators of learning success due to a lack of concrete examples and practical references from the training they attended. This indicates that teachers' professional competence needs to be strengthened, particularly in planning project-based learning (Project-Based Learning) and formative assessments suitable for differentiated approaches (Palangda et al., 2023b; Aslan & Nashran, 2025). Rahmawati (2023) emphasised that competent teachers not only understand the curriculum content but also facilitate learning processes that are flexible, adaptive, and encourage student independence. In the context of SMA Negeri 2 Tondano, IPAS teachers still require intensive guidance to apply these principles effectively and consistently in the classroom.

In addition, students' perspectives provide additional insight into teacher readiness. Although they recognise that teachers strive to make IPAS learning engaging through projects and digital media, most students still feel that the learning is not entirely clear and well-directed. They mentioned confusion in understanding the relationship between natural and social science concepts, as well as the suboptimal use of technology due to teachers' limited digital skills and school facilities. These findings are consistent with Daga (2021), who stated that the transition to the Merdeka Curriculum demands high digital literacy for both teachers and students. Therefore, low digital readiness and unclear project instructions constitute major challenges in IPAS learning. Addressing this issue requires enhancing teachers' educational technology competence and pedagogical understanding so they can design integrative, contextual learning that aligns with the spirit of *Merdeka Belajar*.

Overall, the challenges in IPAS learning at SMA Negeri 2 Tondano are largely influenced by uneven teacher readiness and competence, particularly in understanding and applying the principles of the Merdeka Curriculum. Limitations in pedagogical, professional, and digital aspects result in suboptimal implementation of project-based learning. Institutional support and continuous training systems are crucial for teachers to improve their skills comprehensively. Therefore, strengthening teacher competence becomes a key factor in bridging the gap between the ideals of the Merdeka Curriculum and the realities of IPAS learning implementation in the field.

The results of the study indicate that the readiness and competence of teachers in implementing the Merdeka Curriculum in IPAS subjects at SMA Negeri 2 Tondano are still at an initial adaptation stage. Teachers have shown a commitment to innovating in the learning process; however, they continue to face difficulties in thematically integrating the concepts of natural and social sciences. In

implementing the Merdeka Curriculum, teachers encounter various challenges at the planning, implementation, and assessment stages of learning. During the planning stage, some teachers experience difficulties in analysing Learning Outcomes (CP), formulating Learning Objectives (TP), and developing the Learning Objective Flow (ATP) and teaching modules appropriate to the characteristics of the students. This is due to changes in the curriculum structure that require teachers to be more independent and reflective in designing competency-based learning. Many teachers are still adjusting to the new format, which emphasises flexibility and cross-disciplinary integration, so the planning process is often not yet optimal and still refers to the previous curriculum model (Windayanti et al., 2023; Rahmadayanti & Hartoyo, 2022; Palangda et al., 2023a).

Furthermore, this study reveals that institutional support from the school has begun to focus on enhancing teacher competence through training and collaboration, but the implementation is not yet optimal. The principal and the vice principal for curriculum affairs acknowledged that guidance from the education office is still limited, prompting the school to initiate internal sharing sessions among teachers. This situation illustrates the importance of managerial support and school policies in fostering a learning culture among teachers. According to Ansumanti (2022), the success of curriculum reform heavily depends on the continuity of training and support systems that allow teachers to reflect on their teaching practices. However, at SMA Negeri 2 Tondano, such reflective and collaborative activities are not conducted routinely due to time constraints and administrative workload, which ultimately hinders teachers' adaptation to the Merdeka Curriculum.

The implementation of the Independent Curriculum, which emphasises active learning and technology integration, faces various challenges across educational institutions in Indonesia. These challenges need to be comprehensively mapped to ensure effective implementation and optimal impact on competency development (Indayanti et al., 2022). Nearly all aspects of the implementation of the Merdeka Curriculum are characterised by systemic challenges, such as limited facilities, insufficient time for instructional planning, and minimal professional collaboration. These challenges are not solely the result of low teacher readiness, but rather reflect the fact that the educational ecosystem supporting the implementation of the new curriculum has not yet been fully optimised (Rosmawati et al., 2024). Another issue is that teachers have not yet been able to step out of their comfort zone in teaching. This is evident in their tendency to rely on the same repetitive teaching methods and their limited ability to utilise learning media. In practice, teachers often primarily deliver the material verbally and then assign tasks to the students (Setiawan et al., 2025).

CONCLUSION

The research results indicated that teachers' readiness and competence in implementing the Independent Curriculum in science at SMA Negeri 2 Tondano were still in the early adaptation stage. Teachers had attempted to implement the principles of the Independent Curriculum, but still face challenges in analysing Learning Outcomes (CP), formulating Learning Objectives (TP), developing Learning Objective Flows (ATP), and developing contextual teaching modules. Other obstacles included limited digital literacy, inadequate supporting facilities, and low ability to implement project-based learning. Institutional support from schools existed, but it was not optimal due to limited time, resources, and technical assistance from external parties. Therefore, continuous teacher competency strengthening through practice-based training, increased educational technology literacy, and collaboration between teachers are needed to realise integrative science and science learning in accordance with the spirit of Freedom to Learn.

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