



Analysis of the Planning Stage of the Natural and Social Sciences (IPAS) Instructional Design Based on Project-Based Learning

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Abstract

One of the learning models that involves three domains of learning outcomes (cognitive, affective, and psychomotor) is project-based learning in science subjects. In practice, the application of this model should also not contradict the prevailing curriculum (Merdeka Curriculum). This study aimed to analyse the planning of natural and social sciences (IPAS) instructional design based on the project-based learning (PjBL) model. This research is descriptive qualitative with a case study method. The research participants comprise a teacher, a school principal, and 18 students of the 5th grade. The data were collected through interviews, observations, and documentation. The data analysis technique used was Milles & Huberman's interactive analysis. The researchers applied data validity test with triangulation of sources, techniques, and theories. The results of the study suggested that the planning of teaching modules based on the project-based learning model created by the teacher considered students' learning achievements in line with the demands of the Merdeka Curriculum in terms of syntaxes of the project-based learning. The results imply that teachers need to design systematic project stages, provide adequate resources, and provide space for collaboration and student creativity, and a rubric for assessing students' processes and outcomes in the planning stage of the IPAS instructional design based on project-based learning consistently in the future.

Keywords:

IPAS Instructional Design, Project-Based Learning, Teaching Module Planning

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Info Artikel	Abstrak
<i>Riwayat Artikel</i> Diterima: 01 April 2025 Direvisi: 15 April 2025 Diterbitkan: 30 April 2025	Salah satu model pembelajaran yang melibatkan tiga ranah hasil belajar (kognitif, afektif, dan psikomotorik) adalah pembelajaran berbasis proyek pada mata pelajaran sains. Dalam pelaksanaannya, penerapan model ini juga tidak boleh bertentangan dengan kurikulum yang berlaku (kurikulum merdeka). Penelitian ini bertujuan untuk menganalisis perencanaan desain pembelajaran Ilmu Pengetahuan Alam dan Sosial (IPA) berdasarkan model pembelajaran berbasis proyek (PjBL). Penelitian ini bersifat deskriptif kualitatif dengan metode studi kasus. Partisipan penelitian terdiri dari seorang guru, seorang kepala sekolah, dan 18 siswa kelas 5 SD. Data dikumpulkan melalui wawancara, observasi, dan dokumentasi. Teknik analisis data menggunakan analisis interaktif Milles & Huberman. Peneliti menggunakan uji keabsahan data dengan triangulasi sumber, teknik, dan teori. Hasil penelitian menunjukkan bahwa perencanaan modul ajar berdasarkan model pembelajaran berbasis proyek yang dibuat oleh guru telah mempertimbangkan capaian pembelajaran siswa sesuai dengan tuntutan Kurikulum Merdeka dalam hal sintaks pembelajaran berbasis proyek. Hasil penelitian ini mengimplikasikan bahwa guru perlu merancang tahapan proyek yang sistematis, menyediakan sumber daya yang memadai, dan memberikan ruang untuk kolaborasi dan kreativitas siswa, serta rubrik untuk menilai proses dan hasil siswa dalam tahap perencanaan desain instruksional IPAS berdasarkan pembelajaran berbasis proyek secara konsisten di masa depan.
Kata Kunci:	Desain Pembelajaran IPAS, Pembelajaran Berbasis Proyek, Perencanaan Modul Ajar
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INTRODUCTION

Meaningful learning not only motivates students to memorise or understand a concept but also encourages active student involvement, such as developing critical thinking, creativity, communication, and teamwork skills. These competencies appear in three learning outcome domains: cognitive, affective, and psychomotor. One of the learning models involving these three domains is project-based learning in the subject of IPAS in elementary schools, a combination of natural sciences and social sciences for elementary school students. The combination of the two disciplines aims to trigger students to be able to manage the natural and social environment in one unit (Andreani & Gunansyah, 2023). Social sciences also help students to foster curiosity about the occurring phenomena in their surroundings. This curiosity is expected to trigger students to understand how the universe works and interacts with human life. The social sciences are divided into three phases, starting from Phase A, B, to C (Anisah et al., 2023). Phase A takes place in grades 1-2 of elementary school, which focuses on a concrete and simple introduction to the surrounding environment. Phase B is found in grades 3-4 of elementary school, in which students begin to be invited to understand the cause-and-effect relationship and patterns in natural and social phenomena. Phase C is the last phase of the subject, which introduces project-based learning (PjBL). Student understanding of the material obtained in phase C helps students solve problems related to everyday life. PjBL for elementary school students is a learning model that highlights students by learning through challenging projects relevant to real life (Putri et al., 2024). This model is extremely apt for learning IPAS, especially on the ecosystem topic in the 5th grade of elementary school. The model also aims to help students be able to understand the concept of ecosystems more deeply and to understand how the theories they learn are directly connected to their surroundings.

One of the determining factors for the success of implementing the PjBL method for IPAS in elementary school is the planning of comprehensive teaching modules. Well-

designed teaching modules will accommodate teachers to manage learning systematically, ensure that the projects given follow the learning objectives, and facilitate students' development of their skills in the field of science. Teachers should understand how to compile teaching modules that are befitting curriculum demands and can encourage students' exploration of ecosystem concepts to be completed creatively and collaboratively (Reinita, 2020). Teachers can guide students in completing meaningful and applicable learning projects conveniently with structured teaching modules. The role of teaching modules in PjBL method is as a guideline for teachers in compiling and implementing PjBL (Irawan et al., 2023). Teaching modules proffer clear instructions regarding the tasks to be completed, the resources used, and the criteria for project success. With structured teaching modules, teachers can establish project stages, learning objectives, and appropriate strategies to support active student involvement.

Planned teaching modules for science learning in the Merdeka Curriculum play a significant role in ensuring that the learning activities are effective and meaningful for students (Ardianti & Amalia, 2022). Teachers should address various aspects, such as learning objectives, selection of appropriate learning materials, innovative learning methods, appropriate assessments, and efficient learning management. Planning teaching modules is a tactical step to successfully implement the PjBL method in IPAS for elementary school students. The created teaching modules act as the main guide for students to carry out meaningful learning and produce projects that can be academically accounted for (Ilmawan, 2024). Teachers can refer to the learning outcomes set out in the Merdeka Curriculum to ensure that the projects designed in the teaching modules are according to the competencies students ought to master. Planning teaching modules can also yield empirical experience to elementary school students about various cases based on real problems around them, so that they can actively participate in solving the problems with academic projects related to the science discipline. These issues comprise local

ecosystem problems, waste management, and maintaining water sources wisely.

According to Suhartini et al. (2024), instructional design is a step in logically determining certain learning targets and objectives, namely behavioural changes and a series of activities that need to be performed to achieve these targets by utilising all available learning potentials and resources. Anggraeni and Nurazizah (2024) argue that it is a crucial step to ensure that the learning process takes place successfully and efficiently. This includes ascertaining student needs, setting specific goals, choosing teaching methods and materials, and designing teaching plans. Rosmana et al. (2024) opt for another opinion. They state that in elementary schools, learning planning within the framework of the Merdeka Curriculum is the process of describing and organising learning activities based on the principles of the Merdeka Curriculum. This planning consists of several activities in which the teacher makes learning plans that are tailor-made for the principles of the curriculum guidelines. This requires adaptability when choosing teaching strategies, materials, and evaluation formats to meet the needs of each student. Thus, it can be synthesised that learning planning is a teacher's step in determining learning targets and objectives that are logically and systematically arranged so that the learning process occurs successfully and efficiently.

On the other hand, instructional design or learning planning has several aspects. According to Putri (2024), important aspects of learning planning consist of: (1) characteristics of students; (2) formulation of learning objectives; (3) selection of subject matter; (4) learning strategies; (5) design of learning activities; (6) preparation of authentic assessment measurements; and (7) learning reflection and evaluation activities. According to Lase (2019), the aspects of learning planning are: (1) what material will be taught; (2) how to do it; and (3) what form of evaluation will be used. Meanwhile, according to Serdianus and Saputra (2023), the features that teachers need to understand in learning planning are (1) understanding the curriculum, (2) mastering teaching materials, (3) implementing teaching programs, and (4) evaluating teaching and the results of the

learning process. This study adopts aspects in planning according to Putri (2024), namely (1) characteristics of students; (2) formulation of learning objectives; (3) selection of subject matter; (4) learning strategies; (5) learning activity design; (6) preparation of authentic assessment measurements; and (7) learning reflection and evaluation activities.

Instructional design for teachers is an essential aspect for learning, so that its implementation does not conflict with the achievements of the prevailing curriculum. Unfortunately, Umamah et al. (2021) found that the majority of teachers create learning designs only to complement administrative requirements. In fact, an extensive understanding of learning planning is principal to improve the quality and effectiveness of learning (Sabrina & Sya, 2024). Moreover, in project-based learning, Allen and Gardner (2021) explain that instructional design in project learning requires teachers' competence in project management that will be applied in the classroom.

Various studies have proven that project-based learning has an impact on improving student learning outcomes: cognitive, affective, and psychomotor (Guo et al., 2020; Sumarni & Kadarwati, 2020; Yustina et al., 2020; Zhang & Ma, 2023; Safitri et al., 2024). However, there has been no research that specifically examines project-based teaching design planning as we currently do, let alone one that examines science subjects. Therefore, project-based instructional design planning in IPAS materials has an urgency to maximise the development of student competencies in solving problems through academic projects under teachers' guidance. Teachers can also identify students' abilities and provide learning differentiation based on their abilities (Vhalery et al., 2022). Another urgency is that teachers are able to plan teaching modules that prioritise project activities, focusing on the main concepts in IPAS, hence, the final results of the project will reflect a deep understanding of the concept. A well-designed teaching module helps students be more actively involved in the learning process, as students feel they have control over the projects they work on. Planning teaching modules can also cater to more meaningful learning because it is

linked to real-world situations. Therefore, they are encouraged to explore and investigate new things that foster curiosity. Planning teaching modules can also facilitate teachers to manage classes since it is based on guidelines and learning flows that are apt for the rules of the Merdeka Curriculum. Thus, the process of planning a PjBL-based IPAS teaching module is indispensable to support the learning in the Merdeka Curriculum implementation.

Elementary school homeroom teachers are instrumental in making learning based on the demands of the Merdeka Curriculum a success. Teachers should have comprehensive readiness, from planning to evaluating learning. Besides, teachers have a moral responsibility to improve their pedagogical skills, which will have a direct impact on the success of the curriculum. Mounting studies describing the implementation of the Merdeka Curriculum have been carried out. The studies range from their general implementation to specific ones, such as the implementation of the PjBL model in science learning in elementary schools (Irawan et al., 2023; Kurniastuti et al., 2023; Puspitasari & Wahyuni, 2023; Rizkianida et al., 2023).

However, thus far, no researcher has analysed the planning of teaching modules used by homeroom teachers, especially the material regarding harmony in the ecosystem in grade V of elementary school. This study aims to probe the teaching design planning of elementary school 5th-grade teachers in science subjects. Given the previous seven aspects of learning planning, this study examines those seven aspects to understand how a classroom teacher can design project-based learning steps systematically. Therefore, the results of the planning analysis in this study are expected to be a complete picture of how teachers design learning tools and are expected to be a reference for educators, especially elementary school teachers, in developing effective project-based teaching designs.

METHODS

This research is qualitative descriptive research using a case study method. According to Robbani (2022) qualitative research is rooted in the philosophy of postpositivism used to study natural objects with researchers as the key instrument. Meanwhile, the case

study method is used by researchers to understand a condition in depth by connecting various types of evidence, including documents, interviews, observations, or other data collection tools (Alpi & Evans, 2019).

The participants in this study were 18 students of the 5th grade and their homeroom teacher, as well as the principal of SDN Wonobojo, Wonogiri Regency, Central Java. Additionally, the researchers used a coding system to describe the research data. The class teacher employed the code G, and the principal used the code K.

In this study, data collection techniques were interviews, documentation, and observations of the IPAS teaching module. Moreover, researchers distributed questionnaires for students to delve into their perspective data on teacher-made learning planning. The interview guideline sheet was prepared by adjusting the planning aspects adopted from Putri (2024), explaining that aspects in learning planning encompass; (1) characteristics of student; (2) formulation of learning objectives; (3) selection of subject matter; (4) learning strategies; (5) learning activity design; (6) preparation of authentic assessment measurements; and (7) learning reflection and evaluation activities. Meanwhile, the observation guideline sheet was created by referring to Koesnadi and Astuti (2024) to describe three components of the teaching module: general information components, core components, and appendices.

This qualitative case study has several steps. First, the researchers determined the topic or case. The researchers raised the issue of the Merdeka curriculum. Second, the researcher established the focus and research problems. The focus of this research was the Merdeka Curriculum, which combines science & social studies into IPAS. This provides various responses among homeroom teachers. Moreover, the integration of these subjects determines the learning strategy that should be implemented by teachers in the classroom, the PjBL model. Therefore, the researchers should examine how class teachers plan to implement science and education learning based on project-based learning. The third step is to determine the research design and instruments. The researchers used a qualitative case study

research design. The instruments used were interview sheets, observation sheets, and document analysis sheets. The researcher tested the validity of the data with triangulation techniques and sources. The triangulation technique was conducted by combining the results of observations, interviews, and documentation to obtain a more comprehensive understanding of the current variables. Meanwhile, source triangulation is carried out by comparing research data from different sources, i.e. between teachers, principals, and 5th-grade students.

The fourth step is data collection. The researcher interviewed the principal to collect data. Then, the researchers search for information from the homeroom teacher. The fifth step is determining the data analysis technique. The researcher applied Milles & Huberman's interactive analysis technique to analyse research data, including data collection, data reduction, data presentation, and conclusion (Muthmainna et al., 2025). Further, the researchers calculated the data validity with triangulation techniques of sources, techniques, and theories. The sixth step is that the researchers analysed research data based on what was obtained in the field. The seventh step is to interpret the research results. Lastly, it is to prepare a report.

RESULTS AND DISCUSSION

Planning the IPAS instructional design based on PjBL-based learning is the initial stage for the homeroom teacher in implementing the Merdeka curriculum in the classroom. Planning not only refers to physical learning documents but also logical actions of the homeroom teacher as class managers, as well as policymakers in schools. Regarding the planning of teaching modules, aspects of planning consist of (1) characteristics of students; (2) formulation of learning objectives; (3) selection of subject matter; (4) learning strategies; (5) design of learning activities; (6) preparation of authentic assessment measurements; and (7) reflection and evaluation activities for learning. Interviews with the principal were included in the aspects of the formulation of learning objectives and reflection and evaluation activities for learning. Meanwhile, interviews

with the homeroom teacher were included in the seven aspects of planning.

Regarding the planning of the teaching module, the researchers observed and analysed three main components in the teaching module, namely general information components, core components, and appendices. Only the teaching module components in the appendix section were incomplete. The components of the teaching module in the appendix section that were missing included the glossary and bibliography. Other teaching module component points already existed. The results of the observations are displayed in Table 1.

Table 1. Teaching Module Components Analysis

Teaching Module Components	Indicators	Availability
General Information Component	Identity of the module author, institution of origin, and year of the teaching module, school level, class, and time allocation	Available
	Initial Competence	Available
	Pancasila Student Profile	Available
	Facilities and Infrastructure	Available
	Target Students	Available
	Learning Model	Available
Core Components	Learning Objectives	Available
	Meaningful Understanding	Available
	Eliciting Questions	Available
	Learning Activities	Available
	Assessment	Available
	Remedial and Enrichment	Available
Appendices	Student Worksheets	Available
	Enrichment and Remedial	Available
	Teacher and Student Reading Materials	Available
	Glossary	Unavailable
	Bibliography	Available

Table 1 illustrates that the teaching module created by the teacher for PjBL-based science learning is all set because there is only one missing component, the glossary. The main and supporting components of learning have been prepared by the teacher. In addition to observing the teaching module that was used by the teacher, the researchers interviewed the principal and homeroom teacher regarding the planning. Table 2 presents the results of interviews with the principal and homeroom teacher in terms of the formulation of learning objectives and reflection and evaluation activities of learning.

Table 2. The Results of Interviews with the Principal and 5th Grade Teacher

Aspects	Questions	Person	Answers
Formulation of learning objectives	As the principal, what actions did you take in responding to the Merdeka Curriculum?	K	A little confused about school readiness because there are so many things that the school should prepare, especially the provision of learning resources and facilities.
	How did you respond to the merger of natural and social studies?	K	I still don't have a description of it.
	Did you hold a special meeting before the homeroom teacher used the new curriculum?	K	The principal held a meeting with all class teachers to provide possible facilities.
	How did you respond after seeing the teacher's guidebook in the Merdeka curriculum?	G	I was surprised because all the materials are project-based. More preparation is required.
Learning reflection and evaluation activities	Is there a joint evaluation for the implementation of the project-based learning model? If yes, what form does it take?	K	The evaluation from the school is only in the form of providing learning resources and facilities.

	What do you plan to do if there are students who have not achieved the indicators or learning objectives?	G	As an anticipatory step, each stage of the project-based model directly tests students' understanding of questions and answers.
Triangulation Source	In planning, the principal and class teachers hold a joint meeting as a step to prepare learning resources and facilities that students might need in making learning projects.		

In addition to interviews on the two aforementioned aspects, the researchers conducted interviews with the homeroom teacher on five other aspects, namely 1) characteristics of students; (2) formulation of learning objectives; (3) selection of subject matter; (4) learning strategies; (5) design of learning activities; (6) preparation of authentic assessment measurements; and (7) reflection and evaluation activities for learning.

The first aspect is student characteristics. Student characteristics are the first feature that teachers should understand because, in any case, this affects the learning strategy teachers choose. The results of the interviews with the teacher indicate that the characteristics of 5th-grade students at SDN Wonobojo are alike those of elementary school students in general. The difference lies in the number of students, namely 18, consisting of 10 female students and 8 male students. The teacher asserted that the percentage of gender in this class, which is almost equal, makes the teacher have to use more flexible teaching techniques to avoid a negative impact on the learning project.

The second aspect is described in Table 2, showing that the teacher prepared tools, materials, learning resources, and facilities that support the project. Apart from that, the teacher also anticipated student learning achievement by directly testing student understanding at each step of PjBL so that at the end of the learning project, students had been able to master all aspects of learning outcomes, especially cognitive learning outcomes. The third aspect is the selection of learning materials. The researchers focused on ecosystem material. The teacher said

"If you look at a glimpse of the ecosystem material, you still wonder what form the project is. However, after studying the teacher's manual, it turns out that after students have mastered the cognitive aspect, they should also be able to apply it to everyday life. For example, in this ecosystem material, there is a composting project. This composting project is one way to maintain the balance of the ecosystem. Therefore, I prepared a series of student activities while following this material by ensuring that the students' reading materials in the book are relevant to making compost. In addition, I have prepared student study groups at the initial stage of this material to make it easier for them to work together in groups."

The fourth aspect is the learning strategy. The results of teacher interviews showed that teachers prepared other reading sources besides those available in student books. This is done to implement learning strategies stating that the more reference sources a teacher has, the more they can enrich students' knowledge. On top of that, teacher also prepared learning procedures based on the teacher's guidebook to implement the PjBL model, the learning procedures that students follow are (1) understanding the problems and objectives of the project; (2) searching for information; (3) designing and making products; and (4) presenting their work. However, before carrying out the learning project, students followed learning steps such as (1) let's try, (2) do it together, (3) let's reflect, (4) learn more, and (5) choose a challenge.

The fifth aspect is the design of learning activities. The results of interviews with teachers revealed that in the ecosystem material, the principal's form of support was only to provide a printer and paper, because it would be useful for printing other reading sources that might be prepared by the homeroom teacher. The composting project did not require special tools, materials, or facilities, so that teachers could strengthen students' learning resources through reading materials. Furthermore, considering that PjBL is interrelated to psychomotor learning outcomes, the teacher ensured the achievement of cognitive learning outcomes first before starting to do the project with students. Thus,

students would know what to do when making projects with their peers.

The sixth aspect was the preparation of authentic assessment measurements. The results of teacher interviews revealed that, so far, the teacher has only used assessment guidelines in the manual. However, the researchers also suggested that assessment instruments be prepared and developed together so that learning projects can be measured validly in three domains of learning outcomes, namely cognitive, affective, and psychomotor. The assessment instruments for student learning outcomes in these three domains were declared valid by experts. Thus, the planning of the PjBL-based IPAS module learning had a valid document of learning outcome measurement instrument.

The seventh aspect, namely reflection activities and learning evaluation, is described in Table 2. The results of source triangulation showed that in planning, the principal and homeroom teacher held a meeting as a step to prepare learning resources and facilities that students might need in making learning projects.

In addition to extensively understanding data from the classroom teacher and principal, the researcher also searched data from students related to project-based teaching design planning carried out by the teacher. The data outline the students' perspectives on project-based learning planning they experience in the classroom, which is depicted in the following Table 3.

Table 3. Students' Perspectives on Project-Based Learning Planning

No.	Indicators	Percentage
1	Students understand the objectives of the project	100%
2	Students feel supported by the availability of adequate learning resources	100%
3	Students feel that learning is not confusing	83.3%

Table 3 displays that students understand the project plan to be implemented in class. However, the meaning of project learning that students understand only reaches 83.3%. Facts in the field show that some

children still cannot imagine the real form of the project that they will do in class and relate it to the core of the subject matter.

After the researchers described the results of the observations, interviews, documentation, and questionnaire, the following is a triangulation technique table to describe the conclusions of data acquisition obtained from the three data collection techniques.

Table 4. Technique Triangulation Results

Observation	Interview	Documentation
The PjBL-based IPAS teaching module has been carefully planned and used according to the teacher's guidebook and student needs. However, it is necessary to add a glossary.	The principal also plays a role in providing facilities for student learning projects.	Documents of teacher and student guidebooks for IPAS learning
Preparation of the IPAS lesson plan (RPP) for ecosystem harmony material	The teacher prepares the RPP by adjusting the characteristics of 5th-grade students at SDN Wonoboyo and the syntax of the project-based learning model.	RPP
Use of learning outcome assessments	The teacher uses learning outcome instruments in the cognitive, affective, and psychomotor domains that have been prepared by the researchers and have been declared valid by experts.	Assessment sheets for cognitive, affective, and psychomotor learning outcomes

Student Perspective	Students understand the project-based learning objectives they will follow	Student perspective questionnaire
Results of triangulation techniques	The planning of the PjBL-based science instructional design takes into account learning outcomes that are in line with the learning outcomes of the Merdeka Curriculum by addressing the syntax of PjBL.	

Table 4 presents that the planning of the IPAS teaching module based on PjBL in 5th-grade SDN Wonoboyo involved not only the homeroom teacher but also the principal and students. In addition, the learning tools were adjusted to the achievement of the Merdeka Curriculum standards. The homeroom teacher at this school realised his important role in making learning successful based on the demands of the Merdeka Curriculum.

Discussion

At the elementary school level, homeroom teachers have an important role in making learning successful based on the demands of the Merdeka Curriculum. Teachers must have comprehensive readiness, from planning to evaluating learning. Teachers have a moral responsibility to improve their pedagogical skills, which have a direct impact on the success of the Merdeka Curriculum. The results of observations showing the teaching modules available and ready to be used for learning were an indication that teachers had planned IPAS learning optimally. Although there were still shortcomings, i.e. no glossary, the core components of science learning could be an indication of teacher planning readiness. The teaching modules prepared by teachers had also been developed into a lesson plan for IPAS learning on the subject of ecosystem harmony. The lesson plan also contained an assessment instrument for student learning outcomes in the cognitive, affective, and psychomotor domains that had been prepared along with the researchers and had been declared valid by experts. In line with this result, Cevikbas et al. (2024) state that teachers need support in planning learning to increase their awareness of student thinking,

possible learning trajectories, and the use of effective curriculum and teaching resources. König et al. (2024) also reveals that teacher competence tends to be cognitive performance because it should be responsive to situations and demands in a particular setting. In addition, van den Berg and du Plessis (2023) state that the teaching plan also serves as a roadmap for teachers to follow, ensuring that they cover all the necessary material in a logical and orderly manner. The plan is essential for effective teaching and learning and ensures that teachers communicate effectively, manage time efficiently, engage students, and provide accurate assessments and evaluations.

Furthermore, in regards to the interview results, the researchers designed questions based on five aspects expressed by Koesnadi and Astuti (2024), namely (1) characteristics of students; (2) formulation of learning objectives; (3) selection of subject matter; (4) learning strategies; (5) design of learning activities; (6) preparation of authentic assessment measurements; and (7) reflection and evaluation activities of learning. The first aspect is student characteristics. The teacher stated that the number of students in 5th grade between male and female students was balanced, namely 10 female students and 8 male students. The small comparison percentage required the teacher to use more flexible teaching techniques to avoid a negative impact on the learning project. As explained by König et al. (2021), lesson planning requires teachers to meet various cognitive demands; for instance, teachers must adjust their teaching decisions with their students' learning tendencies. A teacher can also shape students based on their respective characteristics so that teachers can develop their pedagogical strategies (Ibragimovich et al., 2021). Moreover, for teachers, personality appears to be a hidden curriculum, which affects the way of teaching and educating (Lukman et al., 2021). Moreover, with the differences in student characteristics, in the opinion of Arifudin & Ali (2022), everyone appears to absorb a behaviour from what is displayed by others, especially an educator as someone close to him or her in the educational milieu. Therefore, in planning learning, teachers should be able to understand the

distinction in student characteristics in the classroom.

The second aspect is the formulation of learning objectives. The results of teacher interviews suggested that teachers prepared tools, materials, learning resources, and facilities that promote the project. In addition, teachers also anticipated student learning achievements by directly testing student understanding at each step of project-based learning, so that at the end of the learning project, students have been able to master all aspects of learning outcomes, especially cognitive learning outcomes. This is corroborated by Nurtanto et al. (2021), who express that the benchmark for successful learning is the achievement of learning objectives. It often happens that teachers in the learning process lose context and are far from the discussion, and even the timeliness is inaccurate. For this reason, a learning plan is put together in order to achieve learning objectives. This is also affirmed by Choirudin et al. (2023) that improving learning, which includes all components of the education system, one of which is learning objectives, is one effort to optimise learning. Teaching is a means to achieve goals. Having clear goals helps focus teacher planning and direct actions toward desired results (Sumandya et al., 2023).

The third aspect is the selection of learning materials. This study focuses on the material of ecosystem harmony with a learning project in the form of composting. The teacher stated that the achievement of cognitive learning outcomes would be ensured before students took part in learning with the syntax of the PjBL model. According to Iqbal et al. (2021), lesson plans help teachers to utilise time, resources, materials, and techniques at an optimal level. Lesson plans and lessons harmonise like motor vehicles and fuel. Motor vehicles cannot function without fuel. Teacher performance is also shown in implementing learning in schools in line with the established process standards to achieve quality educational outcomes (Rostini et al., 2022). This aspect is also interlinked to teacher competence in managing classes whose situations change to maximise student learning achievement (Nguyen et al., 2022). Therefore, teachers must have professional abilities to develop their teaching materials rather than

just using previously developed teaching materials by others (Yunus et al., 2022). Thus, the selection of teaching materials becomes the main point for a teacher in planning learning, because this is pertinent to the quality standards of educational outcomes based on the curriculum.

The fourth aspect is learning strategies. The strategy prepared by the teacher was to provide reading materials to enrich students' knowledge. The reading materials were also adjusted to the learning procedures in the teacher's manual that implemented the PjBL model. As expressed by Aldila and Rini (2023), teachers should be creative and innovative in providing learning resources, one of which is by developing themes provided by the government that are adjusted to the needs and characteristics of students. Furthermore, teachers develop cognitive fluency and flexibility in each main domain, such as content knowledge, pedagogical knowledge, and technological knowledge, which are interrelated (Shabira et al., 2024). Apt teaching depends on having well-considered preparation of strategies and techniques, depending on the specific context and situation (Matsumoto-Royo & Ramírez-Montoya, 2021).

The fifth aspect is the design of learning activities. In the ecosystem material, the composting learning project did not require special tools and materials, so the school only provided printers and paper to print reading materials prepared by the teacher. Fostering learning resources with these reading materials aims to provide a foundation of knowledge about ecosystem harmony for students before they make fertiliser. Furthermore, considering that PjBL is associated with psychomotor learning outcomes, the teacher could ensure the achievement of cognitive learning outcomes first before starting the project with students. Thus, students know what to do when making projects together. Farhang et al. (2023) explain that teachers should also design a lesson plan in which educational content, teaching methods, media, and educational aids are predicted and taught according to the plan. A similar explanation is also suggested by Azubike (2021), stating that the design of learning activities resembles an instructor's roadmap of what students need to learn and

how it should be done effectively during the class period. Also, planning learning functions as a process that allows teachers to provide a step-by-step structure to the student learning mechanism (Ali, 2021). In line with this statement, Pender et al. (2022) explain that effective teaching allows students to progress at their own pace and ensures that they master all predetermined learning outcomes before moving on to the next level.

The sixth aspect is the preparation of authentic assessment measurements. The teacher applied student assessment instruments that had been prepared together with the researchers and declared valid by experts to measure cognitive, affective, and psychomotor learning outcomes. Thus, the planning of the PjBL-based IPAS module learning had a valid document of learning outcome measurement instrument. As stated by Mok and Staub (2021), the clarity of the instrument is the main component for assessing learning. In addition, creating instruments and assessing attitudes, knowledge, and skills are evaluations that are frequently carried out by teachers, so they also need training to be proficient in compiling assessment instruments and conducting assessments (Estiani & Hasanah, 2022). The preparation of this instrument is an effort to measure the extent to which learning objectives have been achieved (Choirudin et al., 2023). Aligning with this result, Zuhdi et al. (2024) express that compiling exam questions is one of the crucial aspects of the learning evaluation process at various levels of education. Good exam questions should be able to measure students' understanding of the learning material and encourage them to apply the concepts they have learned.

The seventh aspect is the activity of reflection and evaluation of learning in planning. The principal and homeroom teacher held a joint meeting as a step to prepare learning resources and facilities that students might need for making learning projects. This is supported by the opinion of Abdelrahman and Wang (2023) that student learning achievement is not only determined by their ability to digest various learning concepts, but is also greatly influenced by the teacher's teaching strategy. A good teacher might optimise teaching strategies in the form of

learning materials, exercises, and problem-solving techniques so that students can achieve their learning goals. Christoforidou and Kyriakides (2021) reveal that teachers have different levels of professional competence; hence, reflection and critical analysis are important elements of the improvement process. However, at the same time, knowledge, skills, and the ability to act based on critical thinking are deemed prerequisites for effective reflection practice. Besides, every teacher must carry out learning assessments to provide learning support; ensure and improve accountability in the education sector (especially in classroom activities); evaluate the progress of teaching and learning; ensure and improve teacher effectiveness; and address the need for professional development or training (Osiesi, 2023). The seven aspects of learning planning that have been described provide an understanding that learning project planning is not only designing a project, but necessarily understanding various points of view, such as students' perspectives on teaching design planning, teachers' perspectives on student characteristics and assessment designs as well as forms of reflection and evaluation of learning. There have been many studies on learning planning, but only focused on lesson plan guidelines or RPP (Mubarak, 2022; Saitya, 2022; Apriyanti, 2023; Ramadhan, 2024). There has been no learning research that discusses seven aspects of learning planning that are applied directly in schools. Therefore, the results of each aspect of learning planning described here are novel related to learning planning, so that they can make an important contribution to the development of project-based learning planning strategies, especially in the 5th grade of elementary school. Through this study, teachers and principals, or education policy makers, will understand how to design project-based learning experiences in order to encourage students to achieve the three optimal domains of learning outcomes (cognitive, affective, and psychomotor).

CONCLUSION

Based on the results of the research and discussion, it can be summarized that the planning stages of the PjBL-based IPAS teaching module for 5th grade at SDN

Wonoboyo, Wonogiri Regency, Central Java are (1) analyzing student characteristics, (2) formulating learning objectives, (3) choosing learning materials, (4) determining learning strategies, (5) designing learning activities, (6) compiling assessment instruments, and (7) determining learning reflection and evaluation. In addition, the teaching module has also been created by the teacher for the material concerning ecosystem harmony. However, the glossary has not been written in the module. The principal also supports the implementation of PjBL, such as providing facilities needed by the homeroom teacher for student learning projects and holding joint meetings to discuss the implementation of science learning in the Merdeka Curriculum.

Considering the importance of PjBL in the Merdeka Curriculum, it is hoped that teachers, especially elementary school teachers, can design an IPAS learning program that is in line with the demands of the curriculum. Various parties need to be involved in the planning, implementation, and evaluation of project-based IPAS learning. Then, further research using the qualitative case study method should be focused on several schools to explore the planning stage of this project-based IPAS learning. The addition of participants, either homeroom teachers or principals, can be used as an extensive study material by comparing two or more schools so that the advantages in planning learning can be identified. Thus, the research results obtained can clearly describe the differences in learning planning in two different places with the same learning topic.

The results of this study imply that teacher instructional design planning is not only designing learning activities in the classroom, but also urging an assessment design that is structured holistically and authentically to assess various aspects of learning outcomes (cognitive, affective, and psychomotor). The assessment also focuses on the final outcome of the project and the processes that students undergo, including planning, implementation, and reflection. However, the results of this study also entail limitations, such as project-based teaching design planning is still limited to one school, one grade level, and one subject, so the results cannot necessarily be generalised. Based on

existing limitations, further research on project-based teaching design planning is recommended to be carried out with a wider scope, ranging from the level of education, subjects, to school background, thus the results are more representative and generalizable. Research should also combine quantitative and qualitative methods to get a more complete picture.

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