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DEVELOPMENT OF A PROJECT PROBLEM-BASED OUTDOOR LEARNING MODEL AND ITS IMPLEMENTATION IN ENVIRONMENTAL LAW LEARNING AT GEOGRAPHY SENIOR HIGH SCHOOL STUDENT

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Abstract. This research aims to develop a Project-Problem Based Outdoor Learning (PjPBOL) model and analyze its application in terms of learning outcomes and student learning activity in environmental law in geography. This research uses the Research and Development with the ADDIE model followed by a mixed method (pretest-postest control group design and case study) at SMAN 1 Samaturu, Kolaka. The students in experimental 59 and control 66, total 125 students. Data collection instruments include expert validation sheets, learning activity observation sheets, multiple choice comprehension tests, and in-depth interviews. Data was analyzed by MANOVA and descriptively qualitatively. The first research results, the PjPBOL model has been successfully developed through 6 syntaxes that integrate PjBL, PBL, and outdoor study with highly feasible validation, average score 93,95 (>86). Second, the learning outcomes gainscore have 0,001 significancy, by mastery of the material above the minimum completeness criteria and student comfort in practicing PjPBOL. Third, the learning activity gainscore have 0,001 significancy, characterized by high levels of collaborative participation during field investigations, enthusiastic discussions, and active involvement in socioscientific problem-solving. The research bimplications can be adopted by teachers in implementing the PjPBOL model to contextualize environmental law material, thereby simultaneously improving learning outcomes and student activity.

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INTRODUCTION

The Ministry of Primary and Secondary Education grants educational institutions the flexibility to implement the *Kurikulum Merdeka* (Independent Curriculum) as a means to address learning loss and foster the character traits outlined in the Pancasila Student Profile. A key characteristic of this curriculum is the use of project-based and experiential learning, which empowers schools to contextualize material within their local environments (Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi [Kemendikbudristek], 2022). Currently, the implementation of geography instruction in senior high schools often remains confined to conventional, text-based approaches (Nursalam et al., 2025). Students tend to view geography merely as rote memorization regarding geospheric phenomena; consequently, their ability to construct knowledge and analyze the interconnections between natural and human phenomena, as well as their overall understanding and active engagement, remains very low (Miftachurohmah et al., 2022).

Real-world observations reveal challenges in improving learning outcomes and student engagement in senior high schools. Preliminary observations and literature reviews indicate that most students struggle to critically analyze environmental issues or formulate logical arguments based on field data, with an average learning outcome of 67 across all classes and an average activeness score of 21. Students are unaccustomed to processes involving verification and in-depth analysis, resulting in limited comprehension of the subject matter and correspondingly

low levels of active learning. This lack of effective instructional implementation aligns with findings from previous studies suggesting that student learning outcomes and engagement require interventions based on more comprehensive and contextual learning models (Chen, 2015; Pardo, 2014; Sari & Masruri, 2017).

In the context of geography education, specifically regarding topics such as coastal environments and environmental law, students are expected not only to grasp theoretical concepts but also to investigate authentic issues, such as marine pollution caused by mining, climate change, and unsustainable resource exploitation. Knowledge of environmental regulations and laws is crucial, enabling students to formulate scientifically grounded solutions and policies. Fostering geographical understanding and active engagement requires guiding students to examine geosphere-related issues from multiple perspectives, evaluate evidence, and construct written arguments that are structured in accordance with academic writing standards (Ennis, 1996; Yuliarto et al., 2026).

A viable approach to addressing these needs is the development of the Project Problem-Based Outdoor Learning (PjPBOL) model. The PjPBOL model is an innovative synthesis integrating Project-Based Learning (PjBL), Problem-Based Learning (PBL), and outdoor study methods. The integration of PjBL, PBL, and outdoor study is designed to fulfill three pillars of deep learning (Barfield & Nakayama, 2023; DongJin & Ashari, 2024; Jeet & Pant, 2023). First, mindful learning, which encourages critical thinking and academic writing skills through structured outdoor projects. Second, meaningful learning, which emphasizes contextual learning through direct environmental exploration, thereby making the educational experience more relevant. Third, joyful learning, which provides opportunities for students to collaborate and learn within a dynamic natural setting.

PjBL provides a macro-framework for students to create products themed around environmental law through in-depth investigation. PBL embeds specific, structured problem-solving tasks within the project, challenging students to analyze coastal phenomena, formulate research questions, and evaluate environmental law data. The novelty of the PjPBOL model lies in the incorporation of an outdoor study method. The natural coastal environment (such as mangrove ecosystems, sandy beaches, or areas affected by mining) offers a rich and dynamic natural laboratory. Hands-on field experience (outdoor study) deepens conceptual understanding, validates empirical data, and fosters student concern for sustainable environmental management (Mahapatra & Vijayalatha, 2024; Wardhani & Mahendradhani, 2024).

Using PjBL and PBL models in isolation within the classroom often results in a lack of authentic data and limits students' sensory engagement with actual environmental issues. Students may grasp environmental law theory but fail to contextualize it with the reality of environmental degradation in their surroundings (Hsbollah & Hassan, 2022). Conversely, outdoor study methods lacking a problem-solving foundation (PBL) and a project framework (PjBL) risk becoming mere recreational activities or superficial observations devoid of measurable academic outcomes (de la Vega, 2022). PjPBOL addresses this gap by requiring students to collect primary data in the field, analyze it, and present their findings through a project grounded in environmental law.

While previous research has explored PjBL, PBL, and outdoor study partially, most studies have focused narrowly on variables such as learning outcomes and student engagement (Samsiyah et al., 2020; Sari & Masruri, 2017). However, previous studies have combined PjBL with PBL (Chen, 2015; Pardo, 2014) and PjBL with outdoor study (Samsiyah et al., 2020), but no study has combined PjBL, PBL, and outdoor study at the same time. The novelty and key distinguishing feature of this study lie in the specific development of the PjPBOL syntax and its application to instruction, specifically regarding student learning outcomes and engagement with the topic of environmental law. The study leverages the local potential of the coastal region (such as the Gulf of Bone and its surroundings) as a basis for problem-solving, aligning with the research roadmap and the institution's vision for the sustainable development of coastal natural resources.

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The development of the PjPBOL syntax was grounded in the syntax of PjBL, PBL, and outdoor study. The development process used combination and elimination. Combination involves at least two parts of a model or method syntax. Elimination is applied when two syntaxes cannot be combined. Besides combining and eliminating, the process includes substitution, adaptation, modification, alternative use, and rearrangement (Azizah et al., 2024). The development of the syntax is centered on the design phase; the five stages of the ADDIE model are interconnected, making the design process iterative and cyclical (Trust & Pektas, 2018). Given this need, developing the PjPBOL model is highly important. The model is expected not only to serve as an innovative and contextual alternative for high school geography instruction but also to equip students with 21st-century skills. This study aims to develop the PjPBOL model and analyze its implementation in terms of student learning outcomes and engagement regarding the subject matter of environmental law.

RESEARCH METHODS

The development of the PjPBOL model in this study utilizes the ADDIE framework as the basis for its design. ADDIE is a system-oriented instructional design model that encompasses all components of instruction. It originated from an instructional design (ID) model concept used by the US Army in the 1950s and was subsequently developed by the Center for Educational Technology at Florida State University in 1975 (Molenda, 2003). Educational practitioners have since adapted it into the ADDIE model, which serves as a reference for developing products such as instructional strategies, methods, models, media, and teaching materials.

The ADDIE model serves as a guide for developing the tools and infrastructure for training or instructional programs through a series of stages. These stages correspond to the instructional system development (ISD) process: Analysis, Design, Development, Implementation, and Evaluation (Molenda, 2003). A mixed-methods approach was combined with ADDIE: the implementation phase used a case study, and the evaluation phase used a quasi-experiment. The ADDIE stages applied to the development of PjPBOL are outlined below.

Analysis: This stage involves identifying shortcomings in the PjBL, PBL, and outdoor study methods, which have previously operated in isolation. The researcher identifies the causes of the gap, defines the objectives for developing the PjPBOL model (integrating the three aforementioned approaches), confirms development targets, identifies required resources, determines the delivery system, and formulates a plan for a coastal environment-based learning project.

Design: This stage encompasses creating a list of learning tasks, drafting performance objectives, formulating the PjPBOL model syntax, and determining assessment strategies to measure learning outcomes and student engagement regarding environmental law content. Development: In this stage, the designed PjPBOL model undergoes validation by experts, specifically, an instructional design expert and an environmental geography content expert. Revisions are made based on validator feedback prior to the model's pilot testing. Both expert validators held doctoral degrees in geography and had a track record of publications in development research.

Implementation: This stage involves the actual application of the PjPBOL model, conducted in conjunction with a qualitative case study approach. Implementation took place in the field (at SMAN 1 Samaturu), encompassing both classroom activities and outdoor study sessions in the coastal area of the Gulf of Bone to gather empirical data regarding environmental and legal issues. The coastal locations were Kajuangin coast, Cocoa coast, Mandra coast, and Mangrove By Pass Kolaka coast. Evaluation, the final stage, assessed the outcomes of the PjPBOL model through in-depth student interviews and analyzed improvements in learning outcomes and student engagement using a pretest-posttest control group design. The implementation took place in two Grade 11 classes at SMA Negeri 1 Samaturu, Kolaka Regency, Indonesia. The students consisted of four classes: XI Geo 3 and XI Geo 5 as the

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experimental classes (59 students), and XI Geo 2 and XI Geo 4 as the control classes (66 students). The model was applied in six meetings over six weeks.

These five stages are interconnected, making the design process iterative and cyclical (Trust & Pektas, 2018). Evaluation results from each stage can either advance the learning development to the next stage or necessitate revisions to a previous one; the final output of one stage serves as the initial input for the next.

Data collection involved the direct use of validation sheets completed by experts in learning and environmental geography content. The validation sheet consisted of 27 items covering the theoretical basis, learning model components (syntax, social system, principles of reaction, and support system), and model guidelines (Azizah et al., 2024). Each item was scored from 1 to 4, with a maximum score of 108 that was then converted to 100. Data regarding implementation were gathered using multiple-choice tests to assess learning outcomes and an assessment rubric to evaluate student engagement through classroom observation. The multiple-choice test consisted of 10 items developed from the curriculum and validated by two experts. The activeness rubric, covering questioning, answering, responding, and presenting, was modified from Sejati et al. (2020). In-depth interviews were also conducted to understand students' perspectives on the implementation of PjPBOL regarding their comprehension and level of engagement. Interviewees were selected from the experimental classes, with five students from each class, for a total of 10 students. The interview guidelines were developed theoretically from the concepts of mastery learning and student activeness (Mazlan et al., 2024).

The research ethics in this study used codes for participants, from students 1 (S1) to students 10 (S10). The full names and other information, such as gender and student ID, were kept anonymous. For the outdoor activities, approval was obtained from the school principal, the geography teacher, and every parent through signed approval letters. Researchers are fully responsible for the safety of students while outdoors.

Data analysis during the development phase involved classifying validation results based on feasibility criteria (Arikunto, 2013): highly feasible (≥ 86), feasible ($\geq 71 - < 86$), moderately feasible ($\geq 56 - < 71$), less feasible ($\geq 41 - < 56$), and not feasible (< 41). Learning outcomes were measured against a Minimum Mastery Criterion (KKM) of 70 (applied at both individual and class levels), while learning engagement was assessed based on the frequency of asking questions, answering, responding, and making presentations. The gain scores for learning outcomes and learning activity were then analyzed using ANOVA with the omnistats application (Djidu, 2026). The gain scores had to satisfy the assumptions of normality and homogeneity. Interview results were analyzed using a descriptive-qualitative approach involving data reduction, data display, and conclusion drawing (Miles et al., 2014).

RESULTS AND DISCUSSION

A learning model is defined as a conceptual framework describing the systematic procedures for organizing learning experiences to achieve learning objectives optimally. The implementation of an effective learning model plays a strategic role in stimulating learning motivation. A comprehensive understanding of the learning model's components, as key ideas, is essential (Joyce & Calhoun, 2024). Based on this framework, the PjPBOL learning model developed in this study is constructed from six fundamental components: 1) syntax, 2) social system, 3) principles of reaction, 4) support system, 5) instructional effects, and 6) nurturant effects. The framework is shown in Figure 1.

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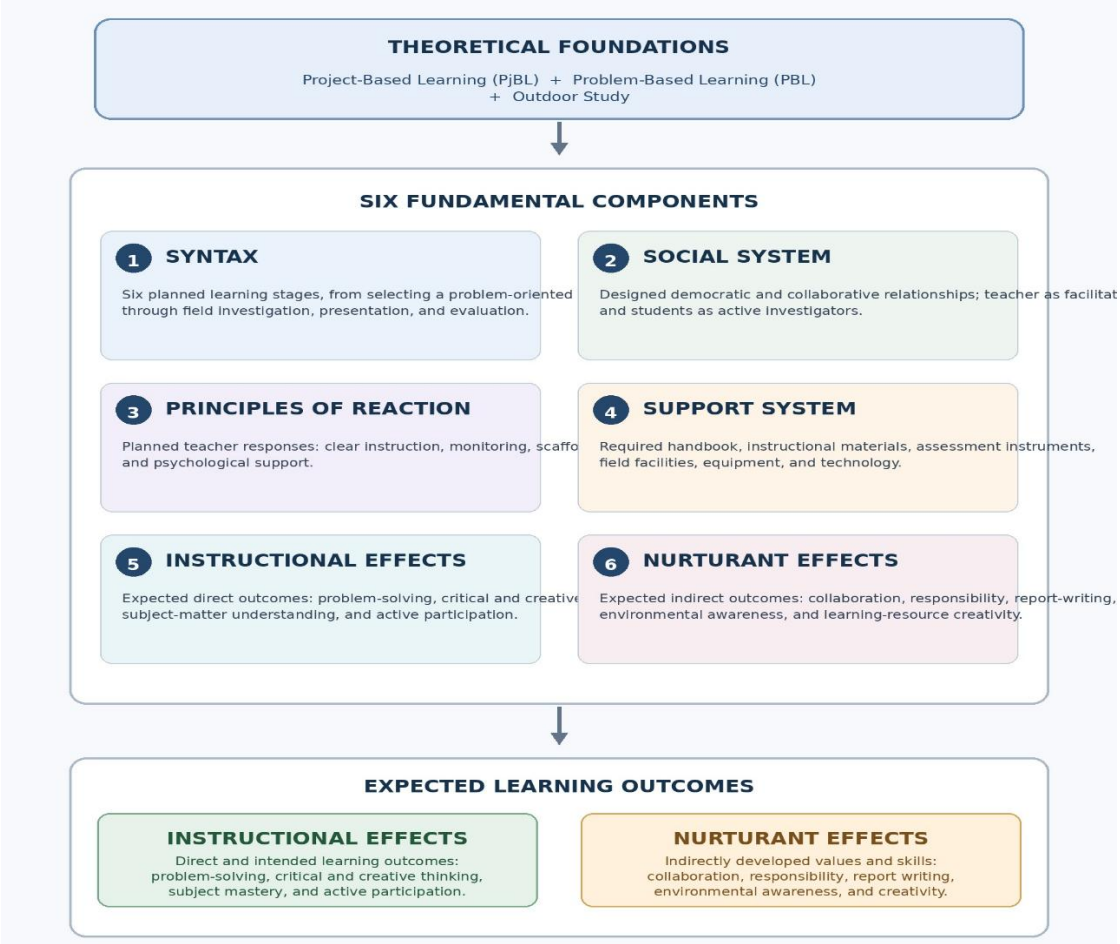


Figure 1. Conceptual Framework of the PjPBOL Learning Model

The syntax of a learning model outlines the sequence of steps within the learning process; these steps are also referred to as learning phases. The effectiveness of the learning process depends on this syntax. This model development research was conducted to formulate an appropriate learning syntax that integrates Project-Based Learning (PjBL) and Problem-Based Learning (PBL) with Outdoor Study activities. Table 1 below illustrates the differences between the syntax of PjBL and PBL and the syntax of the newly developed PjPBOL model.

Table 1. Development of the PjPBOL Syntax

PjBL (Sumarmi, 2015)	**PBL (Arends, 2012)**	**PjPBOL (This Research)**
1. Determining the Project Theme	1. Orienting Students to the Problem	1. Determining the theme for a problem-oriented project involving outdoor study
2. Establishing the Learning Context	2. Organizing Students for Learning	2. Establishing the context for student learning organizations
3. Planning the Activities		3. Planning activities for a problem-oriented project involving outdoor study
4. Carrying Out the Activities	3. Guiding Individual and Group Investigations	4. Conducting activities for a problem-oriented project involving outdoor study
5. Implementing Activities to Complete the Project	4. Developing and Presenting Work Results	5. Developing and presenting the results of a problem-oriented project involving outdoor study
	5. Analyzing and Evaluating the Problem-Solving Process	6. Analyzing and evaluating the problem-solving process

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The syntax is described as a sequence of activities known as stages (Sari et al., 2021). Modifications to the syntax in the PjPBOL model development research draw upon Sumarmi (2015). The developed syntax comprises six learning stages. Specifically, the description of the PjPBOL model syntax resulting from this development is presented in Table 2 below.

Table 2. PjPBOL Model Syntax

No.	Stages	Learning Activities	
		Teacher	Students
1.	1. Determining the theme for a problem-oriented project involving outdoor study	1. The teacher identifies a real-world issue and formulates it into a driving question relevant to the learning objectives. 2. The teacher offers a choice of problem-based project themes. 3. The teacher prepares the class (class preparation) for the implementation of the outdoor study.	4. Students discuss real-world phenomena or issues in their local environment to understand the core of the driving question to be addressed. 5. Students select a theme for a problem-based project. 6. Students are ready to carry out the series of outdoor study activities.
2.	2. Establishing the context for student learning organizations	7. The teacher determines the location for field data collection (Selecting Area). 8. The teacher forms heterogeneous study groups (Group Dynamics), assigns specific roles to each member, and provides strict instructions regarding safety procedures and field ethics.	9. Students are informed of the location to be visited. 10. Students form study groups, assign individual roles and responsibilities, and listen to and agree upon field safety procedures.
3	3. Planning activities for a problem-oriented project involving outdoor study	11. The teacher facilitates students in designing data collection methods and ensures the readiness of instruments and safe equipment (Managing Equipment in the Field). 12. Ensures that the project instruments used by students are problem-based.	13. Students discuss in groups to design data collection methods, prepare the necessary instruments or tools, and practice using those instruments.
4.	4. Conducting activities for a problem-oriented project involving outdoor study	14. The teacher supervises and supports students during outdoor data collection, providing scaffolded and guided assistance as needed, and ensuring that safety protocols and time management are effectively implemented (Working Outdoors). 15. Ensuring that the project data collection undertaken by students is problem-based.	16. Students diligently conduct outdoor observations, data collection, or interviews according to the plan, while strictly adhering to established safety protocols.

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5.	5. Developing and presenting the results of a problem-oriented project involving outdoor study	17. The teacher guides students in processing raw field data into structured solutions or reports, while also facilitating the presentation of project results in creative and informative formats (Back in the Classroom and Final Student Report).	18. Students process raw data from their fieldwork into a report or creative solution, then present it clearly and engagingly to the class.
6.	6. Analyzing and evaluating the problem-solving process	19. The teacher leads a reflection session on the learning experience, provides constructive feedback on the students' processes and work outcomes, and plans concrete follow-up actions based on the solutions generated.	20. Students engage in critical reflection on the obstacles and successes encountered during the problem-based project, receive feedback, and formulate a follow-up plan to improve the solution in the future.

Phase 1: Establishing a Problem-Oriented Project Theme via Outdoor Study. In this initial phase, the teacher identifies real-world issues or socio-scientific problems (environmental and social) in the vicinity of the school and formulates them into a "driving question" relevant to the learning objectives. The teacher also prepares the class for the implementation of the outdoor study (Class Preparation). Students are invited to discuss the phenomenon, select a project theme, and prepare themselves both mentally and physically. Grounded in the theories of Bruner and Vygotsky, this phase trains students to observe surrounding facts, make inferences, and use theory as a basis for reasoning when formulating the essential questions to be answered through the project.

Phase 2: Establishing the Student Learning Organization Context. This phase focuses on creating a conducive and safe learning structure. The teacher determines the location for field data collection (Selecting Area), forms heterogeneous learning groups (Group Dynamic), assigns specific roles to each member, and provides strict briefings on safety procedures (OHS) and field ethics. Students familiarize themselves with the site to be visited, join their groups, divide responsibilities according to roles, and listen to and agree upon the established safety procedures to ensure the field activity proceeds in an orderly manner.

Phase 3: Planning Problem-Oriented Project Activities via Outdoor Study. The teacher facilitates students in designing data collection methods, ensuring the readiness of instruments and safe equipment (Managing Equipment in the Field), and guaranteeing that the project instruments are genuinely problem-based. Students discuss within their groups to design methods, prepare tools, and practice using them. This project planning activity encourages students to develop creativity in problem-solving. Students use theory as a foundation to construct a research framework and theoretical basis, and are encouraged to identify and select the best alternatives for solving the problem, as well as the most appropriate research methods.

Phase 4: Conducting Problem-Oriented Project Activities via Outdoor Study. This is the field execution stage (Working in the Outdoors). The teacher supervises and supports students during data collection, providing scaffolding when necessary and ensuring that safety protocols and time management are effectively maintained. Students diligently carry out observations, empirical data collection, or interviews outdoors in accordance with the plan. This phase fosters students' metacognitive awareness, specifically, the ability to independently plan, organize, and monitor the inquiry task to achieve the intended goals.

Phase 5: Developing and Presenting Problem-Oriented Project Results via Outdoor Study. Upon returning to the classroom (Back in the Classroom), the teacher guides students in processing raw field data into structured solutions or reports and facilitates the presentation of project outcomes. Students transform the empirical data into reports or creative solutions, such as artifacts, and then present them clearly and engagingly to the class. This stage of creating the final product (artifact) is specifically designed to encourage students to fully utilize their

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imagination and creativity in communicating solutions to the problem under investigation.

Phase 6: Analyzing and Evaluating the Problem-Solving Process. In this concluding phase, the teacher leads a reflection session on the learning experience, provides constructive feedback on the students' processes and work, and plans concrete follow-up actions based on the generated solutions. Students critically reflect on the obstacles and successes encountered during the project, receive feedback, and formulate plans for future improvement. From a cognitive perspective, this stage guides students to reconstruct and summarize key concepts from the beginning to the end of the project, thereby enabling them to acquire knowledge that is more meaningful and deeply internalized.

The social system within an instructional model describes the atmosphere, activities, norms, and culture that prevail for both teachers and students during the learning process (Sari et al., 2021). This social system serves as an interaction framework that defines how roles, responsibilities, and interpersonal relationships are constructed within the learning environment. In the PjPBOL model, the social system is characterized by balanced, democratic, and collaborative relationships between teachers and students, whether in the classroom or in outdoor settings.

Unlike conventional instruction, which tends to be teacher-centered, the PjPBOL social system positions students as active agents responsible for investigation, exploration, and problem-solving in the field. Teachers no longer act as the sole source of knowledge; instead, they transform into learning partners who guide, facilitate, and support students as they engage in authentic learning experiences. The learning atmosphere fostered is open, participatory, and contextual, encouraging students to interact directly with the natural environment, community resource persons, and the socio-scientific phenomena serving as the subjects of study.

Learning norms and culture in PjPBOL also encompass aspects of safety (safety culture), environmental ethics, and collective responsibility. Students are trained to value the environment as a second teacher alongside the classroom instructor, to preserve the objects of their study, and to collaborate effectively within their investigative groups. The resulting social interactions extend beyond student-student and student-teacher relationships to include interactions with the surrounding community, field resource persons, and the natural ecosystem itself. This aligns with the principles of experiential learning and mindful learning that underpin the PjPBOL model.

To clarify the dynamics of the social system within the PjPBOL model, the roles of teachers and students are detailed in Table 3 below.

Table 3. The Social System of PjPBOL Model

Teacher's Role	Description
Facilitator	Provide learning resources, investigative tools, and support materials for outdoor study activities (such as student worksheets, environmental measuring instruments, location maps, etc.) that encourage students to undertake structured, problem-based projects.
Motivator	Offer encouragement, reinforcement, and advice to build students' confidence in facing field challenges, solving authentic problems, and producing original scientific work.
Consultant	Guide students in generating project ideas, formulating research questions, and overcoming conceptual or technical obstacles during the development of their projects and the writing of investigation reports.
Moderator	Facilitate presentations, class discussions, and reflection sessions to ensure they proceed in an orderly, smooth, and efficient manner, while guaranteeing that every group has a fair opportunity to present their findings and arguments.

With the structured social system described above, the PjPBOL model not only creates an active and meaningful learning environment but also shapes students into individuals who are critical, collaborative, and creative, while fostering a sense of care for the environment and surrounding social issues. This balanced pattern of interaction between teacher and student

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serves as the primary foundation for realizing learning that is mindful, meaningful, and joyful, the core aspirations behind the development of the PjPBOL model.

The reaction principle refers to the pattern of responses provided by the teacher regarding the activities and stimuli demonstrated by students during the learning process. This principle guides teachers in acknowledging, guiding, and directing student learning behaviors to ensure they remain aligned with achieving learning objectives. Based on observations of the model's implementation, the reaction principle in PjPBOL is operationalized through four key teacher activities:

First, providing optimal instruction: Teachers design and deliver instructions clearly, in a structured manner, and in accordance with the lesson plan, whether during classroom guidance or briefings prior to outdoor study activities. Second, monitoring the learning process at every stage of the model's syntax: Teachers actively oversee and direct student behavior across all phases (from theme selection, planning, and field investigation to report compilation), ensuring that student activities remain focused on solving authentic socio-scientific problems.

Third, assisting students facing difficulties: Teachers are prepared to offer scaffolding or incremental support, whether to individuals or groups, when students encounter conceptual hurdles, technical issues in the field, or challenges in transforming empirical data into scientific writing. Fourth, providing psychological support: Teachers create a conducive learning atmosphere and offer motivational reinforcement to build student confidence, particularly when students face challenges related to teamwork or presenting project results.

A teacher's appropriate and constructive response in applying these principles of reaction directly contributes to enhancing students' critical and creative thinking skills as well as their learning independence. A support system encompasses all the facilities, infrastructure, and tools required to implement the learning model optimally and achieve the intended goals. Ensuring the successful implementation of the PjPBOL model requires a comprehensive support system comprising five elements: first, the PjPBOL model handbook, serving as the primary guide and detailing the theoretical foundation, syntax, social system, principles of reaction, and implementation instructions. Second, instructional materials, including validated learning objective sequences and teaching modules that explicitly integrate the steps of PjBL, PBL, and outdoor study.

Third, assessment and observation instruments, such as model implementation observation sheets, student response forms, and standardized instruments for assessing learning outcomes and student engagement. Fourth, field facilities and infrastructure, including the availability of tools and materials for environmental investigation (e.g., simple testing kits, cameras for documentation, field observation sheets) and access to safe, conducive outdoor study locations (such as coastal ecosystems or the area surrounding the school). Fifth, technological support, including internet connectivity and devices (laptops or mobile phones) to facilitate the search for environmental law literature, data processing, and the preparation of reports or digital artifacts.

The application of the learning model is designed to support the achievement of learning goals optimally. The impact of using the PjPBOL model is categorized into two main types: instructional effects and nurturant effects. Instructional effects refer to learning outcomes that are immediate and directly measurable following the learning activity. Within the PjPBOL model, these effects include: first, the development of students' problem-solving abilities. Students are trained to identify, analyze, and formulate solutions for authentic environmental issues (such as pollution or resource exploitation) based on empirical data and environmental regulations. Secondly, critical and creative thinking skills are enhanced; through field investigations and the creation of artifacts, students are encouraged to verify facts, evaluate evidence, and generate original, innovative solutions. Thirdly, students are able to master the learning material. Abstract geographical concepts become more concrete and easier to grasp because students engage in direct learning and experiential learning within a real-world environment. Fourthly, students become more active participants in the learning process.

The ancillary impacts, values, attitudes, and additional skills acquired indirectly by

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students during the learning process offer long-term benefits. First, these impacts include enhanced collaborative skills; students become accustomed to working in diverse teams, delegating roles, and respecting each other's contributions during both fieldwork and classroom investigations. Second, there is an improvement in project report writing skills. Beyond purely academic aspects, students develop the habit of documenting processes and work outcomes systematically and responsibly. Third, the character traits associated with the *Profil Pelajar Pancasila* (Pancasila Student Profile) are strengthened. This learning approach naturally fosters critical thinking, creativity, *gotong royong* (collaborative cooperation), and noble character, particularly regarding environmental ethics and concern for sustainability. Fourth, creativity in sourcing learning materials is encouraged; teachers and students move beyond sole reliance on textbooks, actively utilizing the surrounding environment and local community as relevant, student-centered learning resources.

Validation by two expert validators rated the developed PjPBOL model as highly feasible. The first validator gave a score of 94.4 and the second validator gave a score of 93.5. The average score was 93.95, which is above 86 and falls within the highly feasible category. The first expert validator suggested clarifying the integration of the outdoor study method within the specific steps of the learning activities for both teachers and students. This feedback was addressed by incorporating six outdoor study steps aligned with the combined PjBL and PBL model. The second expert validator recommended retaining a standalone PBL step to complement the project. This input was incorporated into the sixth step of the PjPBOL syntax, where a pure PBL step was added to complement the project and outdoor study components. Expert feedback in development research is invaluable for refining the model designed by the researcher (HL et al., 2020, 2023, 2025).

Following the validation and revision stages, the PjPBOL model was implemented at SMAN 1 Samaturu to assess its effectiveness in a real-world context. Implementation results indicate highly positive learning outcomes that exceeded established targets. All students (100%) successfully achieved scores above the individual Minimum Mastery Criterion (KKM) of 70 on the test assessing their understanding of environmental law concepts. This achievement automatically met the indicator for 100% class-wide mastery. Table 4 shows the descriptive data.

Table 4. Descriptive Statistics by Group and Outcome

Group	Outcome	n	Mean	SD
Control	GAIN-OUT	66	8.94	6.36
Control	GAIN-ACT	66	37.88	5.89
PjPBOL	GAIN-OUT	59	17.46	12.50
PjPBOL	GAIN-ACT	59	61.97	6.59

According to Table 4, the mean learning outcome gain score was 8.94 in the control class and 17.46 in the experimental class. The mean learning activeness gain score was 37.88 in the control class and 61.97 in the experimental class. The activeness data for each category are shown in Table 5.

Table 5. The Activeness Data

Class	Mean Initial Activeness						Mean Final Activeness					
	Question	Answer	Respond	Presentation	Σ	Konvert to 100	Question	Answer	Respond	Presentation	Σ	Konvert to 100
Control	1	1	1	1	3	20.9	2	2	2	3	9	58.8
Experimen	1	1	1	1	3	20.8	3	3	3	3	13	82.7

Multivariate normality testing using Mardia's test indicates that the data meet the assumption of multivariate normality, both in terms of skewness (Mardia skewness = 6.198, p = .185) and kurtosis (Mardia kurtosis = 0.000, p = 1.000). Univariate homogeneity of variance

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testing via Levene's test shows that the variance for the GAIN-ACT variable is homogeneous ($F(1, 123) = 1.360$, $p = .246$), whereas the GAIN-OUT variable exhibits heterogeneity of variance ($F(1, 123) = 32.853$, $p < .001$). A MANOVA was conducted to examine the effect of group differences (GROUP: DIRECT vs. PjPBOL) on the combined dependent variables, GAIN-OUT and GAIN-ACT. The multivariate statistical results reveal a highly significant main effect for the group factor: Pillai's Trace = 0.802, $F(2, 122) = 246.71$, $p < .001$, partial eta-squared = 0.802. These findings are consistent with the Wilks' Lambda statistic (Wilks' Lambda = 0.198, $F(2, 122) = 246.71$, $p < .001$, partial eta-squared = 0.802). The partial eta-squared effect size of 0.802 indicates that 80.2 percent of the combined variance in the dependent variables can be explained by group membership, which falls into the category of a very large effect (Cohen, 1988).

This improvement in learning outcomes is attributed to the integration of PjPBOL, which transformed abstract environmental law concepts, such as Law No. 32 of 2009 concerning Environmental Protection and Management, into concrete realities. Instead of merely memorizing legal articles, students grasped the substance of the law through direct observation of coastal phenomena in the Gulf of Bone, thereby making the knowledge construction process more meaningful (Andrews et al., 2023). These results align with the findings from student interviews. The interview results were reduced to three themes: PjPBOL and learning outcomes, PjPBOL and student activeness, and PjPBOL and both learning outcomes and activeness. Students S1 to S10 were coded according to interview numbers 1 to 10. The theme of PjPBOL affecting learning outcomes is detailed below.

> "…..My grades used to be average because I relied on memorizing theories from textbooks. However, after participating in the field project, I truly understood the connection between environmental damage and the relevant legal regulations. I performed well on tests because I could answer multiple-choice questions based on genuine understanding rather than mere rote memorization…..." (Student 1 (S1), Category: Significant Improvement in Cognitive Learning Outcomes)
>
> "…..This project made me realize that environmental damage in Kolaka is a real issue and that there are laws in place to address it. Group discussions became more dynamic because we had factual data from the field, not just assumptions. I became more motivated to complete my assignments, and as a result, my daily assignment grades were much better compared to the previous semester….." (Student 3 (S3), Category: Engagement and Learning Product Achievements)

This success is inseparable from the integration of the outdoor study method, which fundamentally shifts the learning paradigm from textual rote memorization to meaningful contextual understanding (Harianto et al., 2019). Abstract regulatory concepts, such as those found in Law No. 32 of 2009, are effectively internalized when students directly confront them with the empirical reality of coastal degradation in the Gulf of Bone. This is confirmed by the shift in students' cognitive and affective responses; firsthand field experience breaks the reliance on theoretical memorization, enabling students to construct a deep understanding of the correlation between environmental damage and the relevant legal framework, which directly results in higher comprehension test scores (Huang & Liao, 2024). Validating factual data from the field not only fosters critical awareness (mindful learning) regarding local issues in Kolaka but also enlivens group discussions grounded in evidence rather than mere assumptions (Barfield & Nakayama, 2023). The resulting enthusiasm and quality of empirical arguments ultimately lead to improved project outcomes and higher daily assignment grades (Lawless et al., 2018). PjPBOL successfully bridges the gap between rigid environmental legal theory and field realities, creating a dynamic learning ecosystem, achieving cognitive learning objectives, and fostering critical, evidence-based environmental legal literacy.

Observations of student engagement across six sessions indicate that students were predominantly active throughout all stages of the learning process. Engagement indicators measured included the frequency of asking questions, providing answers, responding to others, and delivering presentations (Sejati et al., 2020). In contrast to conventional learning, which

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tends to be passive, the implementation of PjPBOL stimulates high levels of group interaction and dynamism (Astaifi, 2024; Xu, 2024). Students appeared enthusiastic during discussions on designing field instruments, proactive in collecting primary data, and confident in presenting arguments during the project results presentation session (Lustyantie et al., 2023; Virijai et al., 2023). A collaborative atmosphere was fostered in both the classroom and the field, with students complementing each other's roles in accordance with the task distribution agreed upon during the learning organization phase (Astaifi, 2024). The interview results for the theme of PjPBOL affecting learning activeness are presented below.

> ".....I usually feel shy when asked to give a presentation. But because this was a group project and we gathered the data ourselves in the field, I felt more confident in making arguments. Learning felt more exciting and less stressful. I became more active because I felt my opinions were heard, and most importantly, I truly understood the exam material because I had experienced it firsthand in the field....." (Student 3 (S3), Category: Increased Engagement and Deep Understanding)
> ".....I used to rarely speak up in class for fear of being wrong or appearing like a know-it-all. But during the field activities, since we had our own data, I felt bolder about asking the resource persons questions and responding to other groups' presentations. It felt like being a real researcher....." (Student 4 (S4), Category: Increased Verbal Engagement and Confidence in Arguing)
> ".....The clear division of roles within the group meant I had to be active and responsible. I was assigned the task of recording data and handling documentation in the field. That responsibility kept me focused; I engaged in frequent discussions with my peers and couldn't just sit passively like I would during a classroom lecture....." (Student 2 (S2), Category: Collaborative Engagement and Responsibility)
> ".....Learning outside the classroom is exciting and never boring. We were more motivated to complete the project because the issues were real, not just theories from a book. Group discussions became livelier because everyone had opinions based on what they had seen and encountered firsthand in the Gulf of Bone....." (Student S6 (S6), Category: Enthusiasm and Active Involvement)

The PjPBOL model successfully transformed the learning ecosystem from a passive state into one that is highly participatory and collaborative. Possessing empirical data derived from field investigations fostered psychological safety and a sense of ownership, significantly breaking down affective barriers such as shyness and the fear of making mistakes (Suharini & Baharsyah, 2020). Students evolved from mere listeners into researchers who were confident enough to present arguments, question resource persons, and critically respond to their peers (Kim & Tan, 2013). This dynamic was reinforced by the model's social system, which assigned specific roles and established collective accountability, thereby demanding active engagement and full responsibility from every group member (Valentine & Edmondson, 2015). Extending the learning space to an authentic environment (Gulf of Bone), complete with real-world issues, proved to create a joyful learning atmosphere that eliminated boredom and sparked high levels of enthusiasm (Jeet & Pant, 2023). This demonstrates that integrating outdoor study within a problem-solving framework not only stimulates behavioral engagement (such as the frequency of asking questions, answering, and discussing) but also facilitates the deep internalization of environmental law concepts, fostering meaningful learning, as students construct knowledge through relevant, direct experiences (Astaifi, 2024; Virijai et al., 2023).

Qualitative data from interviews confirm that the PjPBOL learning experience yielded both psychological and academic impacts, specifically regarding student outcomes and engagement levels. The theme of PjPBOL affecting both learning outcomes and activeness is reflected in the following interview excerpts:

> ".....Previously, environmental law was just a matter of memorizing articles from a boring textbook for me. But when we went directly into the field, saw the condition of the mangroves firsthand, and linked it to the legal regulations, it all made much more sense. It became easier for me to grasp the material, and my test scores improved because I understood the context....." (Student 7 (S7), High Learning Outcomes

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> Category)
> ".....I usually feel shy about participating in Q&A sessions or giving presentations in front of the class. But since this was a group project where we gathered the data ourselves in the field, I felt more confident speaking up and presenting arguments. Learning felt more fun and less stressful. I became more active because I felt my opinions were heard and were useful for finding solutions to problems in our area....." (Student 2 (S2), Significant Increase in Engagement Category)
> ".....This project made me realize that environmental damage in Kolaka is real and that there are laws in place to protect the environment. Group discussions became livelier because we had factual data from the field, rather than just relying on assumptions. I felt more enthusiastic about working on the assignments and giving presentations....." (Student 3 (S3), Deep Engagement Category)

The implementation of the PjPBOL model successfully shifted the student learning paradigm from rote textual memorization to meaningful contextual understanding, simultaneously boosting both learning outcomes and active participation. Outdoor study experiences combined with real-world problem-solving have proven to yield significant psychological and academic impacts (Mahapatra & Vijayalatha, 2024; Wardhani & Mahendradhani, 2024). Direct observation of the mangrove ecosystem and its relationship with legal regulations transformed previously tedious material into a subject of meaningful learning; this resulted in improved test scores as students gained a holistic understanding of the context (Diastuti & Sulton, 2021). Possessing empirical data derived from field investigations instilled confidence and a sense of psychological security in students who were previously passive. Students felt more empowered to voice arguments and participate actively, recognizing that their contributions were valuable in addressing local issues, while the learning atmosphere became enjoyable and stress-free. At deeper cognitive and affective levels, students developed a mindful, metacognitive awareness of the environmental degradation in Kolaka, grounded in the relevant legal framework. Group discussions became dynamic and fact-based rather than reliant on mere assumptions, ultimately sparking high enthusiasm for assignments and presentations (Amaluddin et al., 2019). Integrating authentic field experiences within the PjPBOL framework not only validated abstract environmental law concepts but also stimulated active engagement and the comprehensive internalization of the subject matter.

These qualitative findings align with the principles of deep learning that underpin the PjPBOL model. Authentic field experiences validate empirical data and foster student concern, which in turn drives active engagement in solving socio-scientific problems. These findings reinforce previous studies indicating that a combination of Project-Based Learning, Problem-Based Learning, and outdoor study can significantly address the limitations of fragmented classroom instruction while simultaneously enhancing learning outcomes and student engagement (Mahapatra & Vijayalatha, 2024; Sari & Masruri, 2017; Wardhani & Mahendradhani, 2024). The PjPBOL model has proven to be theoretically sound, effective, and practical for transforming environmental law education in high schools into an experience that is meaningful, enlightening, and enjoyable.

CONCLUSIONS AND SUGGESTIONS

The PjPBOL model, developed through six integrated stages, has proven highly suitable for teaching environmental law in high schools. The MANOVA showed a significance value of 0.001, indicating that PjPBOL affected learning outcomes and learning activity. Implementing this model enabled students to achieve full class mastery and boosted learning engagement by fostering collaborative participation, the confidence to articulate arguments, and direct involvement in solving socio-scientific problems in the field, thereby creating a meaningful, mindful, and joyful learning ecosystem. This study was limited to a single school site (SMAN 1 Samaturu) and focused specifically on coastal environmental law. The generalizability of the findings to other school contexts or broader geography topics requires further investigation. Future research could evaluate the PjPBOL model's effectiveness on a larger scale using diverse

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geography topics and employ a more comprehensive quantitative experimental design to strengthen the model's external validity and the sustainability of its implementation.

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