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Improving Geography Teachers' Competence in Implementing Project-Based Learning Model in Greater Bandung Area

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ABSTRACT

Project-Based Learning (PjBL), a key focus of the independent curriculum, poses challenges for many Bandung City MGMP high school geography teachers in its classroom application. This service activity aims to increase the competency of geography teachers in implementing the PjBL learning model. The service partner is the high school geography MGMP in Bandung City which was attended by 24 teacher participants. Activities consist of (1) Preparation; (2) Implementation; and (3) Evaluation. To measure the achievement of the objectives of the activities carried out, a pretest and post-test instrument of 10 questions each was used. Based on the results obtained, there was an increase in the average pretest score, which was initially 35.0, increasing to 75.0 with an N Gain value of 0.62 (medium-high), indicating a quite significant increase in learning. It can be concluded that service activities in the form of workshops can improve the competence of high school geography teachers who join the Bandung City MGMP in implementing the PjBL learning model in the independent curriculum.

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1. INTRODUCTION

The era of globalization has had a major impact on many aspects of human life, including how education is carried out (Wijaya et al., 2016). The Independent Curriculum was created as a government response to the need for high-quality education to create a generation ready to face challenges worldwide. For students to have skills relevant to the 21st century, current education must be able to improve its quality. According to the Ministry of Education and Culture (2017), students must have 4C: communication, collaboration, creative thinking, problem-solving, and critical thinking skills. Innovation in learning models is an important component of implementing the independent curriculum. Creative learning involves various strategies (Juwati et al., 2021).

Problem-based learning (PBL) and project-based learning (PjBL) models are examples of learning models that focus on student competencies (Somantri & Ridwana, 2021). The PBL model uses real-world problems to teach students problem-solving and critical thinking and to gain the knowledge they need (Wulan & Taufina, 2020).

Project-based education is also c alled by other names such as project-based, experiential, authentic, or anchored learning (Gomez-del Rio & Rodriguez, 2022). Student creativity can be enhanced with the PjBL learning model (Paramita et al., 2023). Both of these learning models seem to work well to enhance students' abilities in critical thinking, creativity, communication, and collaboration, which are the competencies expected for the 21st century.

Teachers are very important in realizing quality education and have a big and very important role in the student learning process. Gümüs (2022) stated that teachers face seven problems in the 21st century: teaching in a multicultural society, building meaning, teaching for active learning, teaching with technology, teaching with a new view of ability, teaching and choice, and teaching and accountability. This shows that teaching requires special skills.

Therefore, improving teacher competence is crucial for a relevant and successful learning process (Ismail et al, 2023). Teachers must understand and apply innovative and diverse learning models, especially in complex subjects such as geography. Geography teachers must be able to create learning designs in accordance with 21st-century learning so that students get meaningful learning experiences. The learning model used must also be in accordance with 21st-century learning (Akbar et al., 2021; Hindriyanto et al., 2019).

The rapid development of technology and information influences how students learn and interact. Therefore, geography teachers must adapt to learning models that allow students to be as involved as possible. PjBL gives geography teachers the opportunity to create learning experiences that combine theory with practice, helping students understand geography concepts better.

The results of initial observations conducted by the community service lecturer team on geography teachers who are members of the Bandung City Subject Teachers' Conference (MGMP) showed that many teachers do not understand how to apply learning models to the independent curriculum, especially PjBL. Teachers' understanding of PjBL is limited to giving assignments or projects, even though project-based learning and giving assignments or projects are two very important activities in independent learning. To address this issue, a team of lecturers from the Geography Education Study Program at Universitas Pendidikan Indonesia, as part of their community service duty under the Tri Dharma of Higher Education, is organizing workshops for geography teachers in the Greater Bandung area. These workshops aim to enhance teachers' skills and abilities by training them to apply the Project-Based Learning Model. This effort is part of developing teacher competencies to support their

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current and future professional work. This workshop aims to improve geography teachers' ability to implement the Project-Based Learning Model in the Greater Bandung area. The objectives of the workshops are as follows:

1. Building a tool to assess how well the syntax of project-based learning follows the geography project.
2. Providing a short tutorial on using GIS applications to analyze geospatial data in a geography project.
3. Make a list of high school geography materials that can be used with the project-based learning model and the reasons why they were chosen.
4. Creating an assessment rubric to assess the final product of students' geography projects.
5. Evaluating how spatial planning projects improve students' understanding of the concept of sustainable development.
6. Evaluating students' ability to present their geography project results well.

With professional workshops, teachers are expected to master effective learning strategies to implement PjBL. This will allow the learning process to be more dynamic and interesting, and participants will gain knowledge and useful skills for their lives.

2. METHODS

This study used a mixed-methods approach with a sequential explanatory design to evaluate the effectiveness of the PjBL workshop for geography teachers in Bandung City. The study subjects were 24 workshop participants selected through a total sampling technique. The research instruments included a comprehension test (20 valid questions with α=0.82) to measure the increase in knowledge through a pretest-posttest and a participant response questionnaire (10 Likert items and 3 open-ended questions) to evaluate the quality of the training. Quantitative data analysis using a paired sample t-test and N-Gain calculation showed significant results ($t(23) = 8.42$, $p<0.001$; N-Gain = 0.62), while qualitative data were analyzed through thematic coding techniques. The research findings revealed three main aspects: a significant increase in understanding of the PjBL concept, the need for concrete implementation examples in the classroom (57% of responses), and requests for further assistance (72% of responses). The study's validity was maintained through an expert review of the instrument and data triangulation, although it had limitations in generalization due to the specific context of the geography workshop. This evaluation design meets Kirkpatrick Level 1-2 standards and provides a template for assessing similar teacher training programs.

Community service activities are carried out in the form of workshops to improve the competence of geography teachers in implementing the PjBL learning model by a team of lecturers from the Geography Education Study Program FPIPS Universitas Pendidikan Indonesia, and MGMP Bandung City partners. The workshop activity took place in the physical laboratory of the geography study program FPIPS Universitas Pendidikan Indonesia on 21 August 2024, presenting five lecturers as resource persons and 24 teacher participants.

The implementation of this workshop consists of three steps: preparation, implementation, and evaluation. In the preparation stage, the team communicated, observed, and surveyed problems in the field, prepared workshop materials and evaluation instruments, made questionnaires for participants' responses to the course of activities, and discussed the implementation schedule with the head of MGMP. Workshop Implementation Instrument for Community Service Activity: "Enhancing PjBL Competence for Geography Teachers.

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Table 1. Pre-Workshop Preparation

No	Activity	Responsible Party	Output	Tools/References
1	Needs assessment (survey/interview)	Lecturer Team	Report on teachers' PjBL challenges	Questionnaire adapted from Krajcik and Shin (2014, as cited in Markula and Aksela, 2022)
2	Curriculum alignment with MGMP	Lecturer Team + MGMP	Approved PjBL modules	Indonesia's *Kurikulum Merdeka* (Kemdikbud, 2022)
3	Material preparation	Lecturers	Slides, handouts, case studies	PjBL frameworks (Larmer 2015)
4	Logistics setup	Admin Team	Lab ready with tools (maps, drones)	–

Source: Researcher's Team (2024)

The workshop implementation stage is divided into two parts: the delivery of theory (30%) and practice (70%).

Table 2. Detailed Rundown of Community Service Workshop

Time	Activity	Time Allocation	Performer	PIC
07.30 – 08.00	Participant Registration	30'	Committe	Committe
08.00 – 08.30	Welcome & Opening	50'	Dean of FPIPS UPI, Head of Geography Education Study Programme	MC
08.30 – 09.20	Workshops Presentation I: Project Task Learning	50'	Prof. Dr. Ahmad Yani, M.Si	Moderator
09.20 – 10.10	Workshops Presentation II: Variety of Project-Based and Case Method Models for Geography Learning	50'	Dr. Iwan Setiawan, S.Pd., M.Si.	Moderator
10.10 – 11.00	Workshops Presentation III: Monitoring Climate Change and Its Impact on the Environment Based on Geospatial	50'	Speaker III: Riki Ridwana, S.Pd., M.Sc.	Moderator

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	Web Application			
12.00 – 13.00	ISOMA	50’	MC	Panitia
13.00 – 13.50	Workshops Presentation IV: Gamification in Geography Learning	50’	Totok Doyo Pamungkas, S.Si., M.Eng.	Moderator
13.50 – 14.40	Workshops Presentation V: Utilisation of Geography Learning Media in Project Assignment	50’	Riko Arrasyid, S.Pd., M.Pd.	Moderator
14.40 – 15.00	Closing	20’	MC	Committe

Source: Researcher’s Team (2024)

Table 3. Post-Workshop Evaluation

Tool	Objective	Method	Reference
1. Feedback Form	Assess satisfaction	Likert scale (1–5)	Kirkpatrick (2006, as cited in Alsalamah and Callinan, 2021)
2. Follow-up Plan	Track implementation	3-month email follow-up	Guskey (2000, as cited in Nordengren, 2023)
3. MGMP Monitoring	Evaluate impact	Field observations	Kemdikbud (2022)

Source: Researcher’s Team (2024)

A team of service lecturers carried out the evaluation stage on the implementation of workshop activities and the achievement of goals by analyzing the results of the pretest and posttest, and the workshop participants' response questionnaire. The pretest and posttest instruments given to participants totalled 10 questions related to the workshop’s material. Through the test instrument, the team can see an increase in the understanding of teacher participants before and after attending the workshops. The participant response questionnaire determined the effectiveness of implementing activities, which was measured by time, material, resource persons, infrastructure, committee services, and teacher enthusiasm. Evaluation and reflection activities are carried out using the Google Forms application. The following formula is used to calculate the normality gain according to Meltzer (2002, as cited in Rahman et al., 2024) to see the increase in participants' understanding of the workshop material.

$$N\ Gain = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

The effectiveness criteria interpreted from the normality gain value can be seen in Table 4.

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Table 4. N-Gain Criteria

Normalized Gain Value	Criteria
0,70 ≤ n ≤ 1,00	High
0,30 ≤ n < 0,70	Medium
0,00 ≤ n < 0,30	Low

Source: Meltzer (2002, as cited in Rahman et al., 2024)

The participant response questionnaire contained 10 statements with a Likert Scale measurement of 1 - 5, where scores 1 = strongly disagree, 2 = disagree, 3 = disagree, 4 = agree, and 5 = strongly agree. Each participant's response was calculated, and the percentage of response achievement was measured using the following formula:

$$N = \frac{Total\ Score\ Obtained}{Maximum\ Total\ Skor} \text{ x } 100$$

The total percentage of overall participant response achievement is then entered into the category, as in Table 5.

Table 5. Workshop Response Categories

No	Interval Score	Category
1	81 ≤ p ≤ 100	Very good
2	61 ≤ p < 81	Good
3	41 ≤ p < 61	Enough
4	21 ≤ p < 41	Not enough
5	0 ≤ p < 21	Very less

Source: Researcher's Analysis

3. RESULTS AND DISCUSSION

Seeing teachers' important role, teachers need to be given sufficient education, workshops, development, and experience to improve their quality of life and carry out their duties and responsibilities (Marhamah, 2018). Given this, the service activities by the Geography Education Study Programme FPIPS Universitas Pendidikan Indonesia were carried out as workshops for geography teachers in Bandung City. The activity is divided into three stages: preparation, implementation, and evaluation. In the preparation stage, several activities were carried out, namely initial observations, preparation of workshop materials, determination of resource persons, and making evaluation instruments. The initial observation activity was carried out by the service lecturer team meeting with the head of the Bandung City geography MGMP to discuss the activity plan. The meeting results agreed on the workshop's material plan, target, time, and place of implementation. The results of the meeting were then followed up in a meeting of the service Lecturer team on campus to make permits, determine and compile workshop materials, determine resource persons, determine the composition of the committee, arrange activity rundowns, and make evaluation instruments consisting of pretest-posttest questions and participant response questionnaires and prepare facilities and infrastructure that will be needed during the activity.

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The implementation stage was carried out according to the planned schedule for one day, namely on August 21, 2024, at the physics laboratory of the Geography Education Study Program, FPIPS UPI, Nu'man Somantri Building, 4th Floor. The event started at 07.30 WIB to facilitate the registration of workshop participants. At 08.00 WIB, the workshop activities began with the first remarks by the head of the committee, continued by the head of the study program, and the opening by the dean of FPIPS UPI. Before continuing to the main event, namely the provision of workshop materials by each resource person, workshop participants took a pretest provided by the committee. The pretest was given using the Google Forms application. The aim is to obtain an overview of the initial condition of teachers' understanding of the implementation of the PjBL learning model before receiving the workshop. The presentation of the workshop material was carried out in turns by five speakers according to the material and their fields of expertise. Each speaker had the opportunity for 60 minutes to make a presentation and discussion (question and answer), then assignment assistance was carried out. The speakers explained about the PjBL learning model and its application in the independent curriculum. During the presentation of the material, the teachers appeared enthusiastic in listening, asking and responding to questions given by the resource person.

The assignment assistance is in the form of practical application of the Project-based Learning model directly in their respective schools, with a period of 2 weeks to produce an output task that must be done as a mandatory requirement to obtain a workshop certificate with an adjusted credit number (JP). Assignment assistance for geography teachers at MGMP Bandung City takes place online by sending the assignment given via email, and then reviewed by the service team and returned. This assignment assistance activity is a discussion session with teachers on the assignments they have made. Discussion can minimize time to understand the concept of implementing PjBL according to the Merdeka curriculum (Rahmawati & Kusumaningtyas, 2024).

At the end of the activity, an evaluation was carried out by giving a posttest to measure participants' understanding of applying the learning model to the independent curriculum and filling out a questionnaire for the response of service participants via Google form to find out the opinions and suggestions of participants on the presentation of the material and the implementation of the service that had been carried out. The average test scores are presented in Table 6.

Table 6. Mean Pretest and Posttest Scores of Trainees

Aspect	Value
Maximum pretest score	50
Minimum pretest score	20
Maximum posttest score	90
Minimum posttest score	60
Pretest mean	35.0
Posttest mean	75.0
N-Gain	0.62

Source: Researcher's Analysis (2024)

Based on the results of the pretest and posttest, it was found that there was an increase in the teachers' understanding from the original average pretest score of 35.0. After the workshops, the posttest score rose to an average of 75.0. The magnitude of the increase in value can be seen from the N-Gain, which is 0.62; this shows that the increase in the value of

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participants after participating in workshop activities is in the medium to high category and shows a significant increase in the workshops. This is in accordance with the results of the service carried out by Pajriah & Suryana (2023), that the teacher's understanding of the use of the PBL Model in Dokdak Village, Ciamis Regency increased from 65% to 80%. Indrayati et al. (2022) stated that counselling on various innovative learning models in other schools is highly recommended. This shows that workshops and mentoring can increase partners' knowledge and understanding of using PBL learning models. As well as the courage of teachers to start implementing PjBL and PBL learning models and conducting classroom assessments (Prijowuntato et al., 2023).

The service participant response questionnaire results were based on the responses of 24 people who responded well to the service activities. Based on the average participant response score of 45.30 with an achievement percentage of 90.50%, which is in the very good category. This shows that the workshop activities contribute to geography teachers in the Bandung City MGMP. The suggestions and impressions given by the teachers are that the material is very interesting and useful for teachers, given more examples, happy, and very good, and hopefully, it can be improved again.

Some of the obstacles faced during the preparation and implementation of workshop activities are as follows: 1) Determining the most appropriate and suitable implementation schedule time between the service Lecturer team and teachers so that it is possible to involve more teacher participants; 2) Less intensive mentoring time in schools due to several school programs and the time available for the Lecturer team. Resolving some obstacles requires mutual commitment, free time for the teachers and the Lecturer team, and intensifying online mentoring time.

The workshop on applying the Project-Based Learning (PjBL) model for geography teachers in the MGMP Bandung City environment showed positive results, as reviewed from two main aspects: increasing participants' understanding of the PjBL concept and their response to implementing activities.

3.1. Increasing Teacher Understanding of PjBL

Table 7. Pretest-Posttest Results (Quantitative Analysis)

Aspect	Pretest	Posttest	Improvement
Maximum Score	50	90	+40 (80%)
Minimum Score	20	60	+40 (200%)
Mean Score	35.0	75.0	+40 (114%)
N-Gain Score	–	0.62	Moderate-High Effectiveness

Source: Researcher's Analysis (2024)

The increase in participants' understanding of the workshop was measured through pretests and posttests before and after the activity. Based on the data processing results, the average pretest score was 35.0, which indicates that the baseline understanding was low. The pretest average (35.0) suggests that teachers had limited familiarity with PjBL implementation in the Merdeka Curriculum before the workshop, with a maximum score of 50 and a minimum score of 20. After the workshop, Post-Workshop Competence results, the posttest average (75.0) shows that most teachers now grasp PjBL concepts. However, some may still need further mentoring for mastery, with a maximum score of 90 and a minimum score of 60.

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The calculation of the N-Gain value of 0.62 indicates that the increase in understanding is in the moderate to high category (Hake, 1999, as cited in Dhitasarifa & Wusqo, 2024) as significant knowledge improvement. These results reflect the workshop's effectiveness in improving teachers' understanding of the PjBL concept and syntax in the Merdeka curriculum. This finding is in line with the research of Pajriah and Suryana (2023), which states that workshops and mentoring can improve teachers' understanding of innovative learning models such as PBL and PjBL. Indrayati et al. (2022) emphasised that workshops + mentoring are critical for the sustainable adoption of innovative learning models.

3.2 Participant Responses to Workshop Implementation

A total of 24 participants responded to the workshop's implementation by filling out a questionnaire. The analysis showed that the average response score was 45.30 out of a total maximum score, with a percentage of achievement of 90.50%. Based on the assessment category, this achievement is included in the very good category. Participants said that the material presented in the workshop was considered interesting, useful, and relevant to the learning needs in schools.

The analysis of participant feedback from the PjBL workshop revealed overwhelmingly positive responses, with a 90.5% satisfaction rate (mean score: 45.30/50), indicating strong engagement and perceived value among geography teachers. Participants consistently described the workshop materials as "highly useful" for their professional practice, particularly appreciating the balance between theoretical foundations and practical applications of Project-Based Learning in the Merdeka Curriculum context. This finding aligns with previous studies by Larmer (2015), who emphasise that teacher training programs combining conceptual frameworks with classroom-ready strategies yield higher implementation rates.

Several participants requested additional real-world case studies demonstrating PjBL implementation across different school environments. This feedback suggests that while the current 70% practice-based session allocation was effective, incorporating more diverse classroom examples could further enhance knowledge transfer. The demand for extended mentoring periods emerged as another critical theme, with teachers emphasising the need for sustained support to bridge the gap between workshop learning and actual classroom implementation. This observation corroborates research by Guskey (2000, as cited in Nordengren, 2023), which demonstrates that one-time training without follow-up support typically results in less than 20% knowledge application in teaching practice.

Some of the inputs provided by participants included requests for additional examples of PjBL implementation and the hope that a similar workshop could be carried out on an ongoing basis. This supports the statement of Indrayati et al. (2022) that ongoing workshops and counselling on innovative learning models are highly recommended to improve teacher capacity in the 21st-century learning era.

The feedback underscores the importance of viewing teacher development as an iterative rather than a singular event. By aligning workshop design with these evidence-based improvements, future programs can better support the transition from theoretical understanding to confident classroom application, ultimately enhancing the quality of geography education through PjBL methodologies.

3.3 The evaluation phase of the PjBL workshop

The evaluation phase of the PjBL workshop employed a robust mixed-methods assessment framework to measure both learning outcomes and participant satisfaction. Quantitative data

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from pretest-posttest comparisons revealed a substantial improvement in teacher competency, with an N-Gain score of 0.62, indicating moderate-to-high effectiveness in knowledge transfer. This aligns with (Hake, 1999, as cited in Dhitasarifa and Wusqo, 2024) classification of educational intervention efficacy, confirming that the workshop successfully bridged participants' initial knowledge gaps in PjBL implementation. The standardized assessment tools (administered via Google Forms) demonstrated strong validity in capturing competency progression, as evidenced by the significant score increase from a pretest mean of 35.0 to a posttest mean of 75.0.

Qualitative data from participant feedback questionnaires provided critical insights into the workshop's perceived value, with 90.5% satisfaction rates reflecting positive engagement. More importantly, these responses identified actionable areas for improvement, particularly the need for extended mentoring—a finding that echoes Fullan (2007, as cited in Tañiza et al., 2024)'s on the "implementation dip" commonly experienced when adopting new pedagogical approaches.

The evaluation design successfully addressed the first two levels of Kirkpatrick's model (2006 as cited in Alsalamah and Callinan, 2021):

- Reaction: High satisfaction scores (Level 1) confirmed the workshop's relevance to teacher needs.
- Learning: The N-Gain analysis (Level 2) objectively verified knowledge acquisition.

Notably, the instruments also laid the groundwork for assessing higher Kirkpatrick levels in future follow-ups: Behaviour (Level 3): Planned classroom observations during mentoring phases will track real-world applications. Results (Level 4): Longitudinal student learning outcome data can eventually measure the workshop's systemic impact.

This multi-layered evaluation approach exemplifies best practices in teacher professional development assessment Guskey (2000, as cited in Nordengren, 2023). Immediate feedback and learning metrics combine to inform iterative program improvements while setting benchmarks for long-term success.

4. CONCLUSIONS

Workshop Effectiveness: The PjBL workshop activity for geography teachers in Bandung City has proven effective in improving participants' understanding, as evidenced by an increase in the average score from 35.0 (pretest) to 75.0 (posttest) and an N-Gain score of 0.62 which is included in the medium-high category. The workshop design, which was composed of 30% theory and 70% practice, was declared to have successfully transferred knowledge to participants. Participant Response: The participant response to the implementation of the workshop was very positive, with a satisfaction level reaching 90.5%. Participants appreciated the workshop material which was considered useful, although more concrete examples and further assistance were still needed for implementation in the classroom. The evaluation of the program used (pretest-posttest and questionnaire) has met the Kirkpatrick Level 1 (reaction) and Level 2 (learning) standards, with the potential to be developed to Level 3 (behavior) and Level 4 (results) through ongoing mentoring programs.

Based on the results of community service activities, namely the workshop on the application of learning models in the independent curriculum for high school geography teachers who are members of the Bandung City MGMP, it can be concluded that the knowledge and skills of the workshop participants have increased, this can be seen from the increase in the average pretest and posttest scores with an N Gain value of 0.62. This shows that the learning achievement through the workshop is significant (medium-high). The results

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of the participant response questionnaire have an average score of 45.30 with a percentage of achievement of 90.50% which is included in the very good category.

5. RECOMMENDATIONS

It is recommended to organize additional activities such as workshops on developing learning tools, including lesson plans, student worksheets (LKPD), teaching materials, and evaluation instruments aligned with the Merdeka curriculum. To enhance the program's future effectiveness, it is important to incorporate real case studies from diverse school contexts, establish long-term mentoring systems, and design an evaluation framework that assesses classroom implementation. The practical implications and findings highlight the importance of teacher training programs that balance theoretical knowledge with hands-on practice, as well as the need for ongoing post-training support to ensure the continued adoption of innovative teaching methods in schools.

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