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Implementing Project-Based Learning (PjBL) to enhance teaching materials based on Sentani local culture

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ABSTRACT

The development of innovative teaching materials that integrate local culture is an important effort to enhance teachers' competencies while supporting contextual and meaningful learning for elementary school students. This community service program aimed to improve teachers' knowledge and skills in developing Project-Based Learning (PjBL)-based teaching materials that integrate Sentani local culture at SD YPK Ifar Babrongko, Jayapura Regency, Indonesia. The program consisted of several stages: coordination and needs identification, preparation of training materials, training on PjBL concepts, workshops on integrating Sentani local culture, mentoring in teaching material development, assessment of product feasibility, and program evaluation and reflection. The participants were 12 teachers. Program outcomes were evaluated by comparing pretest and posttest scores, observing teachers' skills, and assessing the feasibility of the teaching materials produced. The results showed that the teachers' average scores increased from 53.75 on the pretest to 78.33 on the posttest, representing an increase of 24.58 points or 45.73 percent relative to the initial average score. Observational data also indicated that 9 out of 12 teachers (75 percent) met the established criteria in each of the assessed skill areas: applying PjBL syntax, integrating Sentani local culture, developing teaching modules, preparing student worksheets, and designing authentic assessments. Furthermore, the program produced 24 teaching modules, of which 22 (91.67 percent) were rated as feasible or highly feasible. These findings indicate that the training and mentoring program contributed to improving teachers' knowledge and produced teaching materials with the potential to support innovative, contextual, and culturally responsive learning. However, the direct impact of implementing these materials on students' learning outcomes and engagement has yet to be established and requires further evaluation through classroom implementation. Therefore, this program represents an initial step toward strengthening teachers' capacity to develop project-based learning that reflects the cultural context of the Sentani community.

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1. INTRODUCTION

Enhancing primary education quality is essential for developing 21st-century human resources. Elementary learning must transcend rote knowledge acquisition to foster critical thinking, creativity, communication, collaboration, and problem-solving through meaningful learning experiences. This paradigm shift demands that teachers design active, contextual, and student-centered instruction. Consequently, educators must go beyond content mastery to develop innovative teaching materials

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tailored to student characteristics and learning environments. Mastered competencies of this nature are vital for delivering quality instruction and driving educational policies centered on deep learning and student empowerment (Rahman et al., 2025).

Project-Based Learning (PjBL) is widely regarded as an instructional model capable of meeting these demands. This model positions students as active agents of learning through the completion of projects tied to real-world problems, thereby fostering higher-order thinking skills, creativity, collaboration, and learning autonomy (Ferrero et al., 2021; Syahlan et al., 2023; Zhang & Ma, 2023). Project-based instruction also enables students to bridge abstract concepts with everyday experiences, rendering the learning process more meaningful. Extensive research indicates that PjBL contributes to enhanced critical thinking, problem-solving abilities, learning motivation, and academic achievement, provided it is supported by systematically designed teaching materials tailored to student characteristics (Saputri & Mustofa, 2026; Syamsurijal et al., 2026). Consequently, the successful implementation of PjBL heavily relies on teachers' readiness to design instructional tools that fully accommodate the syntax of project-based learning.

In addition to adopting innovative instructional models, primary education must account for the social and cultural contexts of students. Integrating local culture into learning serves as a strategic approach to enhance material relevance through real-world experiences while strengthening cultural identity and character development (Hamzah et al., 2025; Qudwatullathifah et al., 2025; Wulanda et al., 2024). Local culture functions not merely as an object of preservation, but as an authentic learning resource to build contextual educational experiences. Culturally integrated learning has been shown to boost student engagement, facilitate conceptual understanding, and foster appreciation for local cultural values. Within project-based frameworks, local culture offers a foundational basis for designing student-centered project activities, thereby yielding a more meaningful and authentic learning process.

SD YPK Ifar Babrongko in Jayapura Regency is a primary school situated within the Sentani indigenous community, an area rich in local cultural heritage. The school environment encompasses diverse learning resources, including Lake Sentani, folklore, community traditions, indigenous crafts, local economic activities, and preserved traditional wisdom. This wealth of cultural assets presents significant potential for developing contextual learning resources across subjects, particularly through Project-Based Learning. These cultural assets serve as an essential foundation for supporting teacher professional development initiatives.

Despite this immense potential, situation analysis and preliminary discussions with school stakeholders revealed that the integration of Sentani local culture into instructional practices remains suboptimal. Teachers generally rely on generic teaching materials without systematically embedding local cultural elements into learning objectives, project activities, student worksheets, or assessment frameworks (Jayanti & Krisdiana, 2023; Nuro & Kusumaningtyas, 2024; Rahardjanto et al., 2025; Septaria et al., 2025). Consequently, instruction does not fully reflect the learners' immediate environment, leaving opportunities for contextual learning underutilized. This gap underscores a clear disconnect between the available cultural learning resources and actual classroom practices.

Another key challenge faced by the partner school is teachers' limited competence in developing Project-Based Learning (PjBL) teaching materials. Most educators have not received specialized training regarding the concepts, characteristics, syntax, or instructional design of PjBL. Consequently, teachers struggle to design project activities, develop project-based student worksheets, and construct authentic assessment instruments aligned with project-based learning principles. This situation results in instruction remaining predominantly conventional and transmission-oriented, which hinders the optimal development of active student engagement. If left unaddressed, fostering 21st-century competencies and realizing student-centered learning will remain difficult to achieve.

Extensive research indicates that enhancing teacher competence in implementing innovative learning models requires systematic training, continuous mentoring, and exemplar teaching materials for instructional reference. Numerous community service reports further demonstrate that training models integrating hands-on instructional design practice effectively improve teachers' pedagogical competence, creativity, and readiness to implement classroom learning innovations (Naila et al., 2026; Septaria et al., 2025).

This community service program was designed using a participatory and collaborative approach, ensuring teachers not only gain conceptual reinforcement regarding Project-Based Learning (PjBL) but are also introduced to exemplar instructional materials, including teaching modules, project-based student worksheets, and authentic assessment instruments, that integrate Sentani local culture as a learning resource. This approach is expected to enhance teachers' understanding of PjBL implementation while strengthening their ability to develop instructional practices that are contextual, innovative, and student-centered. Beyond enhancing teachers' pedagogical competence, the program supports local cultural preservation by integrating Sentani cultural values directly into elementary school instruction.

Based on these considerations, this community service initiative aims to improve teachers' conceptual and operational understanding of Project-Based Learning, enhance their capability to integrate Sentani local culture into instructional materials, introduce PjBL-based teaching modules, worksheets, and authentic assessments, and foster teachers' readiness to implement project-based instruction at SD YPK Ifar Babrongko, Jayapura Regency. Achieving these objectives is expected to cultivate innovative, contextual, and student-centered learning environments, thereby contributing to enhanced primary education quality.

2. METHODS

Partners, Locations, and Target Audiences

This community service program was conducted at SD YPK Ifar Babrongko, Jayapura Regency, Papua, involving 12 elementary school teachers as the target audience. The initiative aimed to enhance teachers' capabilities in developing Project-Based Learning (PjBL) teaching materials that integrate Sentani local culture as a contextual learning resource. The program employed a participatory and collaborative approach, actively engaging teachers throughout the stages of learning need identification, instructional design development, mentoring, and product evaluation.

The implementation was grounded in the necessity for contextual learning tailored to the socio-cultural environment of the students. Sentani local culture offers substantial potential as an educational resource through environmental exploration, folklore, community traditions, indigenous crafts, and local wisdom values. Therefore, this program was designed to assist teachers in incorporating these cultural potentials into project-based instructional planning through systematic teaching materials that can serve as reliable guides for elementary classroom instruction.

The Concept of Appropriate Technology Applied

The appropriate technology (*Teknologi Tepat Guna*/TTG) applied in this initiative takes the form of a Project-Based Learning (PjBL) model grounded in Sentani local culture, operationalized through the development of instructional materials. This model serves as a learning approach that positions projects as the primary vehicle for achieving educational objectives. Sentani local culture is integrated by aligning instructional content with the ecological potential and social context of the local community, thereby rendering the learning process contextual and meaningful.

The application of this model was realized through the creation of teaching modules comprising learning objectives, PjBL syntax-based instructional steps, project activities, Sentani cultural integration, and authentic assessment designs. Supporting instructional materials included student worksheets (*Lembar Kerja Peserta Didik*/LKPD) designed to guide learners systematically through each project phase. Aligning learning objectives, project activities, local learning resources, and assessment mechanisms constituted a central focus during the material development process.

During implementation, educators utilized Microsoft Word to draft and refine teaching module documents, whereas Canva served to enhance the visual design and presentation of the instructional tools. While both software applications acted as digital tools for product development, the Sentani culture-based PjBL model remained the primary instructional framework operationalized through these materials.

Implementation proceeded through conceptual PjBL training, cultural integration workshops, instructional design mentoring, and product review and validation. Through these structured phases, teachers not only acquired a strong conceptual foundation in PjBL but also produced tangible outputs in the form of completed teaching modules prepared for classroom implementation.

Activity Implementation Method

The implementation methods of this activity encompassed partner coordination and need identification, training material and instrument preparation, training sessions, workshops, mentoring, instructional material validation, as well as evaluation and follow-up. A participatory approach was applied through discussions and active teacher involvement in developing instructional materials, whereas a collaborative framework was established through cooperation between the community service team and partners throughout the drafting and product refinement process.

Coordination and identification of partner needs

The initial phase was conducted from March to April through coordination with school administration and teacher need identification. This stage aimed to gain insights into instructional material development needs, learning constraints, and Sentani local cultural potential relevant to elementary school curricula. Accordingly, the identification outcomes served as the baseline for developing training materials and determining the direction of instructional material design.

Development of training materials and instruments

The material preparation stage was carried out from April to May. The community service team developed materials covering PjBL concepts and syntax, Sentani local culture integration, teaching module design, student worksheet development, and authentic assessment formulation. Exemplar instructional materials and instruments for assessing product completeness and feasibility were also prepared during this stage.

Training of PjBL concepts

Training sessions were conducted in May, involving 12 teachers. The material was delivered through presentations, interactive Q&A, and discussions focusing on PjBL concepts, characteristics, and syntax. Teachers were introduced to the phases of project-based instruction, spanning from identifying fundamental questions, designing projects, scheduling, monitoring activities, and assessing project outcomes, to evaluating the learning experience. Thus, this phase established a solid foundation for teachers to design instructional tools aligned with elementary school characteristics.

Workshop on integrating local Sentani culture

The workshop took place from May to June to identify and develop Sentani local cultural potentials as learning resources. Teachers, working alongside the community service team, discussed potential applications of the local environment, folklore, traditions, crafts, and local wisdom values within instruction. These cultural potentials were subsequently linked to specific learning objectives and project ideas that could be incorporated into the instructional materials.

Mentoring for the development of teaching materials

Mentoring was conducted from June to July through guidance on developing PjBL-based teaching modules. Teachers formulated learning objectives, selected project themes, designed instructional activities, integrated Sentani local culture, and prepared student worksheets alongside authentic assessment designs. The community service team provided exemplars, guidance, and feedback throughout the module development process. Microsoft Word was utilized for document drafting, whereas Canva was leveraged to enhance the visual design of the instructional materials. This phase resulted in 24 PjBL-based teaching modules developed through the training and mentoring program.

Product feasibility testing and validation

The feasibility and validation stages took place from July to August. The 24 generated teaching modules underwent validation to assess their suitability as supporting tools for project-based instruction. Evaluated aspects included the alignment of learning objectives, integration of PjBL syntax, incorporation of Sentani local culture, clarity of project activities, completeness of student worksheets, and appropriateness of authentic assessments.

Based on the validation recapulation, 22 out of the 24 teaching modules were classified as feasible or highly feasible. Accordingly, the proportion of modules falling into these categories reached 91.67 percent. Meanwhile, the remaining two modules required revisions based on the evaluation results. These validation outcomes served as the baseline for reviewing product quality and finalizing instructional tools prior to classroom implementation.

Reflection, evaluation, and follow-up planning

Reflection and evaluation were conducted in August to review the achievement of program objectives based on teacher engagement, the number of generated products, and the validation outcomes of the instructional materials. Teachers and the community service team reflected on the training and mentoring processes while discussing readiness for classroom implementation.

Follow-up plans were directed toward implementing the 24 teaching modules in classroom instruction. This implementation phase needs to be accompanied by monitoring and evaluation to determine the materials' alignment with classroom conditions and their impact on student learning processes and outcomes. Therefore, improvements in student learning outcomes were not claimed as a measured impact of this specific training and mentoring program.

Report preparation and documentation of outputs

The final stage took place from August to September through activity report drafting, documentation organization, and the archiving of community service outputs. The primary output reported comprised the 24 validated PjBL-based teaching modules integrating Sentani local culture.

This documentation serves as empirical evidence of program execution and provides a reference for developing future mentoring initiatives.

Evaluation Plan and Success Indicators

Program evaluation was conducted to assess the achievement of project objectives based on quantitative indicators and product review outcomes. The primary indicators included the number of participating teachers, the quantity of generated teaching modules, and the number of modules categorized as feasible or highly feasible based on validation results.

The first indicator measured participant engagement, involving 12 teachers from SD YPK Ifar Babrongko. The second indicator focused on product outputs, comprising 24 PjBL-based teaching modules that integrated Sentani local culture. The third indicator evaluated product feasibility based on validation outcomes, where 22 out of 24 modules were deemed feasible or highly feasible. The achievement percentage for product feasibility was calculated using the formula in Equation 1 (Eq. 1).

$$P = \frac{Number\ of\ modules\ rated\ feasible\ or\ highly\ feasible}{Total\ number\ of\ validated\ modules} \times 100\% \quad \text{(Eq. 1)}$$

Based on the validation results, the calculation was executed using Eq. 1.

$P = \frac{22}{24} \times 100\% = 91.67\%$

These results indicate that 91.67 percent of the developed teaching modules fell into the feasible or highly feasible category based on the reported evaluation outcomes. Meanwhile, the remaining two modules did not meet this classification and required revisions in accordance with the validation feedback.

This percentage reflects the proportion of products categorized as feasible or highly feasible rather than an overall validation score percentage. Calculating the feasibility score percentage based on the assessment instrument requires specific score data and the maximum possible score across all evaluation items. Hence, the overall validation score percentage was omitted from this report as the score recapitulation was unavailable.

Overall, the successfully reported success indicators include the participation of 12 teachers, the generation of 24 PjBL-based teaching modules, and 22 modules validated as feasible or highly feasible. These findings demonstrate that the community service program yielded concrete product outputs that can serve as a foundational basis for preparing project-based instructional implementation utilizing Sentani local culture in primary schools. Nevertheless, the impact on classroom instruction and student learning outcomes requires further evaluation following the actual implementation of these instructional materials.

3. RESULTS AND DISCUSSION

Results

The community service program at SD YPK Ifar Babrongko, Jayapura Regency, involved 12 teachers and was carried out through stages of coordination, Project-Based Learning (PjBL) conceptual training, Sentani local culture integration, mentoring in instructional material design, product validation, and program evaluation. The implementation results were analyzed based on improvements in teacher

comprehension, instructional material design skills, appropriate technology product outputs, and their potential application to support innovative learning in elementary schools.

PjBL training and the integration of local Sentani culture

The community service program at SD YPK Ifar Babrongko, Jayapura Regency, involved 12 teachers and was executed through stages encompassing coordination, training on Project-Based Learning (PjBL) concepts, integration of Sentani local culture, instructional design mentoring, product validation, and program evaluation. The implementation results were analyzed based on enhanced teacher comprehension, instructional design proficiency, appropriate technology product outputs, and their potential applicability to support innovative learning in primary education.



Figure 1. Training on the PjBL concept and discussion on the integration of local Sentani culture

Enhancement of teachers' understanding

The enhancement of teachers' understanding was evaluated by comparing pretest and posttest scores among the 12 participants. The measurement results indicated that the mean pretest score of 53.75 increased to 78.33 on the posttest, reflecting an average gain of 24.58 points. These findings demonstrate a marked improvement in teachers' comprehension following their participation in the training program.

Table 1. Recapitulation of pre-test and post-test results regarding teachers' understanding

Indicator	Result
Number of teachers	12 teachers
Mean pre-test score	53.75
Mean post-test score	78.33
Mean score increase	24.58 points
Relative increase based on group mean score	45.73%
Mean individual relative improvement	47.03%

The relative increase based on the group mean score was calculated using the formula ((78.33-53.75)/53.75 × 100% = 45.73%). Meanwhile, the number of 47.03 percent represents the mean percentage improvement of individual teachers as detailed in the data recapitulation. These two figures rely on different computational bases.

These results indicate that the training contributed to enhancing teachers' comprehension of PjBL and instructional material development. This finding aligns with Syahlan et al. (2023), who discussed the

implementation of PjBL in elementary schools, as well as Fatih et al. (2024), who examined instructional design training for educators. Nevertheless, these pretest and posttest results only indicate score changes following the training and do not inherently prove that all observed modifications were exclusively caused by the program.

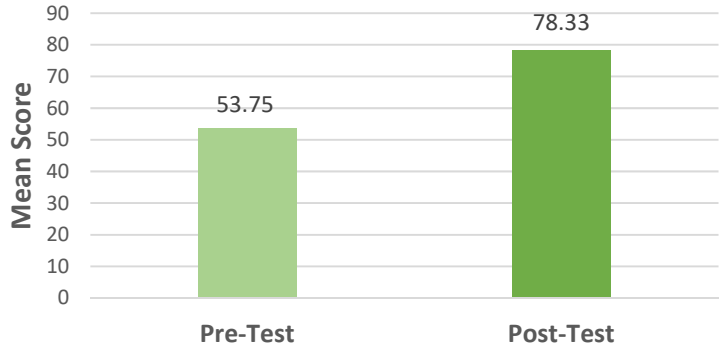


Figure 2. Comparison of teachers' average pretest and posttest scores

Results of teachers' skill observations

In addition to conceptual understanding, teacher skills were evaluated through observations across five aspects, namely the implementation of PjBL syntax, the integration of Sentani local culture, teaching module formulation, student worksheet development, and authentic assessment design.

Table 2. Results of teachers' skill observations

Skill Aspect	Teachers Meeting Criteria	Percentage (%)
Implementing PjBL syntax in instructional designs	9 out of 12	75
Integrating Sentani local culture into project designs	9 out of 12	75
Formulating PjBL-based teaching modules	9 out of 12	75
Developing project-based student worksheets	9 out of 12	75
Designing authentic assessments	9 out of 12	75

The observational results indicate that across each aspect, 9 out of 12 teachers, or 75 percent, met the established criteria. These data illustrate skill attainment based on observation criteria rather than the percentage increase in skills from baseline conditions. Accordingly, these findings complement the pretest and posttest data in illustrating the achievements of the training and mentoring program.

Product outcomes and validation of teaching materials

Mentoring was conducted through demonstrations and hands-on practice in developing PjBL-based teaching modules that integrate Sentani local culture. Teachers utilized Microsoft Word to draft documents and Canva to support the visual design of the instructional materials. This activity resulted in 24 teaching modules developed by the 12 teachers.

Subsequently, the 24 teaching modules underwent a validation process. The recapitulation results indicated that 22 modules were classified as feasible or highly feasible, whereas the remaining two modules did not yet fall into this category.



Figure 3. Mentoring for the development of PjBL teaching modules based on local Sentani culture

The feasibility percentage based on the number of modules was calculated by dividing the 22 modules categorized as feasible or highly feasible by the total of 24 modules, and subsequently multiplying by 100 percent. The resulting figure is 91.67 percent. This figure indicates the proportion of products based on the validation outcome categories rather than the overall validation score percentage.

Table 3. Quantitative achievements of appropriate technology (TTG) products

Indicator	Target	Result	Achievement
Teacher engagement	12 teachers	12 teachers	100%
Teaching module products	24 modules	24 modules	100%
Modules in feasible/highly feasible category	24 modules	22 modules	91.67%
Modules not yet in feasible/highly feasible category	—	2 modules	8.33%

These results indicate that the program yielded concrete outputs in the form of instructional materials that can serve as a foundation for preparing project-based learning. Furthermore, the two modules not yet categorized as feasible or highly feasible require follow-up revisions based on the validator's notes prior to classroom implementation.

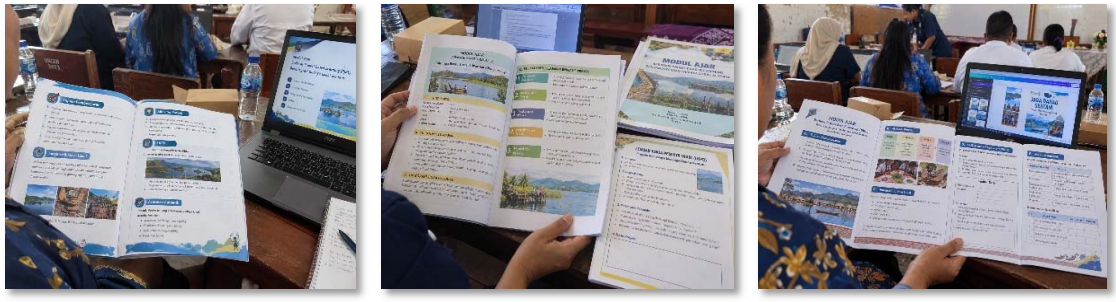


Figure 4. Example of a PjBL teaching module based on the local culture of Sentani, developed through community service activities

Evaluation and potential impact on student learning

Final evaluation was conducted through reflection on the implementation of the training, the outcomes of instructional material design, and teachers' readiness to apply them in the classroom. The resulting products were designed to support innovative learning through projects that connect subject matter with Sentani local culture.

Through the implementation of these teaching materials, students are expected to actively participate in project completion, collaborate, develop creativity, solve problems, and become familiar with local culture through contextual learning experiences. Nevertheless, because classroom implementation and the measurement of student learning outcomes were not reported in this activity, these impacts remain a potential that requires empirical testing through subsequent follow-up measures.

Discussion

The outcomes of the program indicate that the training and mentoring of Sentani local culture based PjBL achieved accomplishments across aspects of teacher comprehension, instructional material design skills, and product development. The mean comprehension score increased from 53.75 to 78.33, with a relative increase based on the group mean score of 45.73 percent. Furthermore, 75 percent of the teachers met the observation criteria across every skill aspect, while 24 teaching modules were successfully generated, 91.67 percent of which were classified as feasible or highly feasible.

These achievements support the program objective to strengthen teacher competence in designing innovative and contextual learning. This finding aligns with Akbar et al. (2023) and Fatih et al. (2024), who discussed teacher training and mentoring in competency and instructional material development. The present activity extends this approach by directing the development of teaching materials toward the integration of Sentani local culture.

Regarding the products, the 24 teaching modules serve as concrete outputs of the application of appropriate technology in the form of Sentani local culture based PjBL. Validation results indicate that the majority of the modules have met the feasible or highly feasible categories. This finding is relevant to Ali et al. (2025), who discussed teaching materials integrated with Khombow local wisdom in relation to elementary school student learning outcomes in East Sentani. Both activities position local culture as a learning resource, whereas this community service program emphasizes the development of instructional materials through teacher training and mentoring.

The primary contribution of the program to innovative learning lies in the availability of instructional tools designed to connect learning objectives, project activities, authentic assessments, and the local cultural context. This approach possesses the potential to provide a learning experience closer to students' daily lives while supporting the development of creativity, collaboration, problem-solving skills, and appreciation for local culture. This aligns with Qudwatullathifah et al. (2025), who discussed the utilization of local culture in learning, as well as Syahlan et al. (2023), who examined the implementation of PjBL in elementary schools.

Nevertheless, the outcomes of this program primarily demonstrate achievements at the teacher level and in instructional product development. Direct impacts on student engagement, skills, or learning outcomes cannot yet be concluded because the classroom implementation of the teaching materials has not been quantitatively evaluated. Therefore, subsequent measures must encompass the application of the teaching modules, observation of student activities, assessment of project products, and measurement of learning outcomes. Consequently, the program's contribution to innovative learning can be substantiated through implementation data rather than relying solely on the potential of the developed materials.

4. CONCLUSION AND RECOMMENDATIONS

The community service activity at SD YPK Ifar Babrongko, Jayapura Regency, has achieved outcomes aligned with the objective of enhancing teacher competence in developing Sentani local culture-based Project-Based Learning (PjBL) instructional tools to support innovative learning in elementary schools. The evaluation results of 12 teachers demonstrated that the mean comprehension score increased from

53.75 on the Pre-Test to 78.33 on the Post-Test, representing a relative increase based on the group mean score of 45.73 percent. Observational findings also indicated that 9 out of 12 teachers (75 percent) met the criteria across each assessed skill aspect. Additionally, the activity generated 24 teaching modules, with 22 modules (91.67 percent) categorized as feasible or highly feasible based on validation results. These achievements demonstrate that the training and mentoring contributed to reinforcing teacher competence and produced instructional tools that can serve as a foundation for developing innovative, contextual, and Sentani local culture-oriented learning. These teaching tools possess the potential to foster students' active engagement, creativity, collaboration, and problem-solving abilities through project-based learning. Nevertheless, the direct impacts on the student learning process and outcomes cannot yet be concluded, as classroom implementation of the teaching materials was not evaluated in this activity. Accordingly, the program's success at this stage is primarily reflected in the increase in teacher comprehension scores and the resulting instructional product outputs.

Based on the outcomes and limitations of this activity, several recommendations for subsequent programs at SD YPK Ifar Babrongko are proposed as follows: (1) Classroom implementation of instructional tools. Conducting field trials of the 24 Sentani local culture based PjBL teaching modules within actual learning environments to ascertain the suitability of the materials with student characteristics and school conditions; (2) Evaluation of student impacts. Executing pre- and post-implementation measurements utilizing learning outcome tests, student engagement observation sheets, alongside assessment rubrics for creativity, collaboration, and problem solving to substantiate the impacts of innovative learning quantitatively; (3) Refinement and further validation of instructional tools. Following up on validation notes, specifically regarding the two modules not yet categorized as feasible or highly feasible, and conducting re-evaluations prior to classroom utilization; (4) Sustained mentoring for teachers. Organizing ongoing mentoring during PjBL implementation and best-practice sharing forums to assist teachers in addressing instructional challenges, refining teaching tools, and developing projects relevant to Sentani local culture; (5) Development of local cultural learning resources. Expanding the utilization of folklore, the Lake Sentani environment, traditional crafts, and other forms of local wisdom within cross-disciplinary teaching tools through collaboration with customary leaders, the community, and school stakeholders. Implementing these recommendations is expected to ensure that the program outputs extend beyond teacher competency enhancements and instructional product creation to provide empirical evidence regarding contributions to innovative learning and elementary student competency development.

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