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Empowering Teachers Through Training in Designing Pancasila Student Profile (P5) Strengthening Projects for Chemistry Teachers Using the STEM Approach

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Abstract
This paper aims to empower chemistry teachers by providing training on designing projects that strengthen the Pancasila Student Profile (P5) through the Science, Technology, Engineering, and Mathematics (STEM) approach. The Pancasila Student Profile is an educational initiative in Indonesia that emphasizes the development of students' character, competencies, and values in line with Pancasila, the nation's philosophical foundation. The integration of STEM into this initiative seeks to equip teachers with the skills and knowledge necessary to foster a holistic learning environment. The training was conducted over several sessions, involving a combination of theoretical presentations and practical workshops. Data were collected through pre- and post-training assessments, observations, and interviews with participants. The results indicate a significant improvement in the participants' ability to design and implement P5 projects with a STEM focus, suggesting that such training can be an effective tool for enhancing educational quality in Indonesia.

Keywords: *Teacher Empowerment, Pancasila Student Profile, STEM Approach, Chemistry Education, Project-Based Learning, Teacher Training*

INTRODUCTION

Education is a critical factor in shaping the future of any nation, and Indonesia is no exception. The Indonesian government has emphasized the importance of developing a holistic educational framework that not only focuses on academic excellence but also instills strong moral and ethical values in students. This vision is encapsulated in the Pancasila Student Profile (P5), an initiative aimed at nurturing students who embody the values of Pancasila, the foundational philosophical theory of Indonesia (Badan Pengembangan dan Pembinaan Bahasa, 2017). Pancasila represents the five principles of Indonesian state ideology, which include belief in the one and only God, a just and civilized humanity, the unity of Indonesia, democracy guided by the wisdom of deliberations among representatives, and social justice for all Indonesians (Ministry of Education and Culture, 2019). These principles serve as a guide for character development and citizenship in Indonesian education.

The P5 initiative seeks to create well-rounded students who are not only academically competent but also possess a strong sense of national identity, social responsibility, and ethical integrity (Ministry of Education and Culture, 2020). Achieving this ambitious goal requires a significant transformation in teaching practices, particularly in how educators design and deliver their lessons. One promising approach to achieving these educational objectives is through the integration of Science, Technology, Engineering, and Mathematics (STEM) education with project-based learning, which can offer students a more practical and engaging learning experience (Capraro, R. M., & Slough, S. W., 2013).

STEM education has gained global recognition for its ability to develop critical thinking, problem-solving, creativity, and innovation skills among students (Bybee, 2013; National Research Council, 2012). These competencies are essential in preparing students for the challenges of the 21st century, where technological advancements and complex global issues require a workforce that is not only knowledgeable but also capable of thinking critically and creatively. In the context of Indonesia, integrating STEM into the P5 initiative offers an opportunity to align academic learning with the

nation's broader educational goals, fostering students who are not only skilled in science and technology but also deeply rooted in the values of Pancasila (Darmawan, 2020).

However, the successful implementation of STEM education within the framework of the P5 initiative depends heavily on the capacity and readiness of teachers. Teachers play a pivotal role in shaping the learning experiences of their students, and their ability to effectively design and implement STEM-based projects is crucial for the success of the P5 initiative (Kennedy, 2016). Unfortunately, many teachers, particularly those in the field of chemistry, face challenges in integrating STEM concepts into their teaching practices due to a lack of training and resources (Putra et al., 2021).

To address this gap, this study focuses on empowering chemistry teachers through targeted training that equips them with the skills and knowledge needed to design and implement P5 projects using the STEM approach. The training program aims to enhance teachers' pedagogical skills, deepen their understanding of STEM education, and provide them with practical tools for integrating STEM into their teaching practices. By doing so, the study seeks to contribute to the broader goal of improving the quality of education in Indonesia and ensuring that students develop both the academic competencies and the character traits necessary for success in the modern world.

This paper presents the findings of a study conducted to evaluate the effectiveness of this training program. The study explores the extent to which the training program improved teachers' abilities to design and implement STEM-based P5 projects, and it discusses the implications of these findings for future educational practices and policies in Indonesia.

METHODS

The community service program was designed to empower chemistry teachers by training them to integrate STEM (Science, Technology, Engineering, and Mathematics) into projects aimed at strengthening the Pancasila Student Profile (P5). The program was structured into three key phases planning, implementation, and evaluation.

Program Planning

The planning phase involved assessing the needs of chemistry teachers through surveys and interviews with both teachers and school administrators across Indonesia. This assessment identified gaps in understanding STEM and integrating it into P5 projects. The insights gained informed the design of tailored training modules. Collaboration with local education authorities and universities ensured the program aligned with regional educational goals and had the necessary support for successful execution.

Program Implementation

The program was conducted over two months, divided into three phases

- Phase 1 Training (Weeks 1-2)

Workshops were held to enhance teachers' understanding of STEM and its application within the P5 framework. The sessions included hands-on activities where teachers practiced designing P5 projects. Participants worked in groups to foster collaboration and received feedback on their work.

- Phase 2 Project Development (Weeks 3-4)

Teachers returned to their schools to develop P5 projects, with ongoing support provided through virtual meetings and an online platform. Facilitators offered templates and examples to help participants create interdisciplinary projects that integrated STEM concepts and Pancasila values.

- Phase 3 Implementation Support (Weeks 5-8)

Teachers implemented their projects in the classroom, with facilitators providing continuous support and troubleshooting assistance. Participants documented their experiences and outcomes, which were later shared in a reflection session.

Evaluation

The program's effectiveness was evaluated through participant feedback, project outcomes, and final reflections

- Participant Feedback

Participants completed a survey at the end of the program to evaluate the training quality, content relevance, and overall satisfaction. Open-ended questions allowed participants to share their experiences and suggestions for future improvements.

- Project Outcomes

The success of the P5 projects was assessed based on student engagement, the integration of STEM concepts, and alignment with Pancasila values. Participants submitted reports detailing their project outcomes, including student work and reflections.

- Final Reflection Session

A virtual session was held where participants discussed the impact of the training on their teaching practices. This session provided insights into the practical application of the training and the broader impact of the initiative.

RESULTS AND DISCUSSION

The results of the community service program indicate significant progress in empowering chemistry teachers to integrate STEM education into the Pancasila Student Profile (P5) projects. The analysis, supported by comparisons with previous studies, detailed case studies, participant feedback, and literature on the pros and cons of STEM integration in educational contexts, provides a comprehensive understanding of the program's effectiveness and highlights areas for future improvement.

Participant Demographics

The participant group was diverse, with a majority being female (66.7%) and a broad range of teaching experience, with most participants having 6 to 10 years of experience (40%). The inclusion of both urban (60%) and rural (40%) teachers ensured that the program's impact was widespread, addressing the needs of different educational contexts. This diversity suggests that the training program was inclusive, catering to a broad spectrum of educators and contributing to its overall effectiveness.

The inclusivity of the program is consistent with research by Darling-Hammond et al. (2017), who emphasize the importance of diversity in professional development to ensure that the training is relevant and effective across different educational settings. However, some studies, such as those by Desimone (2009), argue that while diversity in training is beneficial, it can also dilute the focus on specific content areas, potentially reducing the impact of the training on more specialized skills.

Table 1. Demographics of Participants

Category	***Number of Participants***	***Percentage***
Total Participants	30	100%
Gender Distribution		
- Female	20	66.7%
- Male	10	33.3%
Teaching Experience		
- 3-5 years	10	33.3%
- 6-10 years	12	40%
- 11+ years	8	26.7%
School Location		
- Urban	18	60%
- Rural	12	40%
Prior Experience with STEM		
- Limited or None	22	73.3%
- Moderate	6	20%
- Extensive	2	6.7%

Pre- and Post-Training Assessment Results

The average pre-training assessment score of 45% reflected a baseline understanding of STEM concepts and P5 project design, which was relatively low. However, the post-training assessment score improved significantly to an average of 82%, with an average increase of 37 percentage points. Notably, 93.3% of participants showed improvement.

These results align with previous research highlighting the effectiveness of targeted professional development in improving teacher competency (Kennedy, 2016). The significant improvement supports the view that when teachers are provided with relevant, context-specific training, they are

more likely to implement new practices effectively (Guskey, 2002). However, Garet et al. (2001) caution that while such improvements are promising, the sustainability of these gains over time is often a challenge, particularly if ongoing support is not provided.

Table 2. Pre- and Post-Training Assessment Results

Assessment	Average score	Percentage
Pre-training	45	
Post-training	82	
Improvement		
- Average increase		37 percentage points
- Participants improved	28	93.3%
-No significant change	2	6.7%

Project Development and Implementation Outcomes

Out of the 30 projects developed, a majority focused on Environmental Sustainability (40%), followed by Technological Innovation (26.7%). High integration of STEM concepts was observed in 60% of the projects, and 73.3% of the projects strongly aligned with Pancasila values. The focus on Environmental Sustainability and Technological Innovation reflects both global and national priorities, indicating that teachers are aligning their projects with relevant and impactful areas.

One participant developed a project on water conservation that not only integrated STEM principles but also engaged students in community outreach, reflecting the Pancasila value of social justice. This project led to a significant increase in student awareness and community involvement, showcasing the practical application of the training.

While this focus on sustainability and innovation is commendable, critics like Allan and Hogan (2019) argue that the integration of STEM with socio-cultural values can sometimes be superficial, failing to truly engage students in critical thinking about these issues. To counter this, Shulman (1987) emphasizes the importance of deep content knowledge combined with pedagogical skills to ensure that such integrations are meaningful and impactful.

Table 3. Project Themes and STEM Integration

Category	Number of projects	Percentage
Total projects developed	30	100%
Project themes		
- Environmental sustainability	12	40%
- Technological innovation	8	26.7%
- Community health and wellbeing	6	20%
- Cultural heritage & identity	4	13.3%
Integration of stem concepts		
- High integration	18	60%
- Moderate integration	10	33.3%
- Low integration	2	6.7%
Alignment with pancasila values		
- Strong alignment	22	73.3%
- Moderate alignment	6	20%
- Weak alignment	2	6.7%

Participant Feedback

Feedback from participants revealed a high level of satisfaction with the training, with 73.3% being very satisfied. Additionally, 80% found the content highly relevant, and 66.7% felt highly confident in implementing what they learned. These results suggest that the training not only addressed the specific needs of the teachers but also empowered them to apply the new knowledge effectively in their classrooms.

One participant shared, "*The training opened my eyes to the potential of integrating STEM with Pancasila values. My students were not only learning science but also understanding their role in society.*" This testimonial echo the findings of Villegas-Reimers (2003), who argues that professional

development programs that connect pedagogical strategies with teachers' cultural and ethical values are more likely to be successful. However, Knight (2007) cautions that while teacher satisfaction is an important indicator, it does not necessarily equate to student outcomes. Therefore, ongoing monitoring of student performance and engagement is crucial to determine the true impact of such programs.

Another participant shared, "*The hands-on approach during the training really helped me understand how to incorporate STEM activities in a way that is both engaging and meaningful for my students. Before, I was unsure how to balance theoretical lessons with practical applications, but now I feel more confident in creating lessons that bridge that gap*." This feedback highlights the importance of experiential learning in professional development. When teachers have the opportunity to actively engage with new methods and tools, they are more likely to integrate them effectively into their teaching practices. The participant's comment also underscores the value of providing clear examples of how abstract concepts can be translated into classroom activities, a crucial factor in helping teachers overcome the challenge of making STEM content accessible to students of varying levels.

Incorporating more practical demonstrations and collaborative exercises in future training sessions may further enhance teachers' ability to implement STEM education effectively, particularly in contexts where resources are limited or traditional methods have dominated the classroom environment.

Classroom Observations and Interviews

Classroom observations showed high student engagement in 60% of the classes and effective use of STEM tools in 66.7%. However, challenges such as technical difficulties (16.7%) and time constraints (26.7%) were reported. These challenges, particularly in adapting STEM to local contexts and balancing curriculum requirements, suggest areas for improvement in future programs. The literature supports the need for continuous professional development to overcome these challenges. Desimone and Garet (2015) emphasize the importance of ongoing support and collaboration among teachers to sustain the initial gains from training. Furthermore, Borko (2004) argues that professional development is most effective when it includes opportunities for teachers to practice and refine their skills over time. The successful integration of STEM education with Pancasila values in this program suggests a viable model for national curriculum reform, where character education is seamlessly embedded within academic subjects. This approach aligns with Indonesia's broader educational goals and could be expanded to other regions and subjects. However, as Cuban (2013) points out, educational reforms often face resistance at the implementation level, particularly when they challenge existing norms and practices. To mitigate this, future programs should consider including more follow-up support, additional resources, and strategies for contextual adaptation to ensure sustained success and impact. Longitudinal studies could also assess the long-term effects of such training on both teacher practices and student outcomes.

In terms of addressing the challenges identified, it is crucial to provide teachers with access to more robust technical support and tools, particularly in regions where resources may be limited. Moreover, additional training focused on time management strategies for integrating STEM content with the existing curriculum would be beneficial. By equipping teachers with these tools, they will be better prepared to overcome the obstacles they face, leading to more consistent and effective application of STEM in their classrooms. Finally, fostering a network of collaboration among educators, where they can share best practices and troubleshoot common issues, could further enhance the sustainability of the training's impact.

CONCLUSION

The results indicate that the community service program was highly effective in achieving its goals. The significant improvement in participants' knowledge and skills, the successful development and implementation of STEM-based P5 projects, and the positive feedback from participants all point to the program's success. However, the challenges identified through classroom observations and interviews suggest that there is room for improvement, particularly in providing ongoing support and resources to address technical and contextual challenges.

The program successfully empowered chemistry teachers to integrate STEM into the Pancasila Student Profile projects, contributing to the broader educational goals of Indonesia. The findings suggest that similar community service initiatives could be expanded to other regions and subjects, with modifications to address the specific challenges identified in this study. Future programs should

consider including more follow-up support, additional resources, and strategies for contextual adaptation to ensure sustained success and impact.

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REFERENCES

Allan, J., & Hogan, R. (2019). Superficial integrations: The challenge of connecting STEM education with socio-cultural values. *Journal of Educational Thought*, 53(2), 203-219.

Badan Pengembangan dan Pembinaan Bahasa. (2017). *Pancasila dalam pendidikan karakter bangsa*. Jakarta: Kementerian Pendidikan dan Kebudayaan.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.

Bybee, R. W. (2013). *The Case for STEM Education: Challenges and Opportunities*. NSTA Press.

Capraro, R. M., & Slough, S. W. (Eds.). (2013). *Project-Based Learning: An Integrated Science, Technology, Engineering, and Mathematics (STEM) Approach*. Springer.

Cuban, L. (2013). Inside the black box of classroom practice: Change without reform in American education. *Harvard Education Press*.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. *Learning Policy Institute*.

Darmawan, I. P. A. (2020). Integrating STEM education into Pancasila Student Profile for Indonesian students' character development. *Journal of Indonesian Education*, 9(2), 45-56.

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181-199.

Desimone, L. M., & Garet, M. S. (2015). Best practices in teachers' professional development in the United States. *Psychology, Society & Education*, 7(3), 252-263.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, 38(4), 915-945.

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice*, 8(3), 381-391.

Kennedy, M. M. (2016). How Does Professional Development Improve Teaching? *Review of Educational Research*, 86(4), 945-980.

Knight, J. (2007). *Instructional coaching: A partnership approach to improving instruction*. Corwin Press.

Ministry of Education and Culture. (2019). *Pendidikan karakter berbasis Pancasila*. Jakarta: Kementerian Pendidikan dan Kebudayaan.

Ministry of Education and Culture. (2020). *Profil pelajar Pancasila: Konsep dan implementasi*. Jakarta: Kementerian Pendidikan dan Kebudayaan.

National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. The National Academies Press.

Putra, P. D. A., Widjaja, Y. B., & Astuti, P. (2021). Challenges in integrating STEM into chemistry teaching: An Indonesian case study. *Journal of Science Teacher Education*, 32(4), 301-316.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-22.

Villegas-Reimers, E. (2003). *Teacher professional development: An international review of the literature*. UNESCO.