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Strengthening Elementary School Teachers' Competence through the Integration of Psychological Well-Being, TPACK, and Enjoyable Numeracy Learning

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Abstract: This community service program aims to enhance elementary school teachers' understanding of psychological well-being, learning motivation, Technological Pedagogical Content Knowledge (TPACK), and engaging numeracy instruction through an integrated professional development approach. Implemented in collaboration with SDN 200 Leuwi Panjang in Bandung, Indonesia, the program involved participatory training across four interconnected areas: teacher motivation and positive teacher–student relationships, psychological well-being, TPACK-based instruction, and engaging, context-based numeracy learning. The activities incorporated interactive presentations, guided discussions, and reflective learning experiences. Program outcomes were evaluated through pretest and posttest assessments administered using the Wayground platform, complemented by training observations and activity documentation. The evaluation included 36 teachers with valid paired assessment scores. The mean score increased from 19.509 to 24.960, representing an absolute gain of 5.451 points and a relative increase of 27.94%. Furthermore, 32 participants (88.89%) achieved higher posttest scores than their pretest scores. These findings indicate positive short-term improvements in participants' overall understanding of the training materials. The program highlights the potential of integrated professional development to promote psychologically supportive teaching, technology-enhanced instruction, and context-based numeracy learning in elementary education. However, further evaluation is needed to determine whether these improvements translate into sustained changes in classroom practice.

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Introduction

Numeracy remains a fundamental challenge in improving the quality of elementary education in Indonesia. According to the Programme for International Student Assessment (PISA) 2022, only approximately 18% of Indonesian students achieved at least Level 2 proficiency in mathematics, compared with the OECD average of 69% (OECD, 2023). These findings highlight the importance of strengthening foundational numeracy skills through meaningful and context-based learning experiences. Effective numeracy instruction requires teachers to possess not only mathematical content knowledge but also pedagogical competence in connecting mathematical concepts with students' everyday experiences (Hill et al., 2005, 2008). However, improving instructional quality also requires attention to teachers' psychological well-being, technological capabilities, and ability to identify students'

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diverse learning needs. Therefore, professional development initiatives should address these interconnected dimensions to support more engaging and responsive elementary education.

SDN 200 Leuwi Panjang, Bandung, Indonesia, was selected as the partner school for this community service program. Preliminary coordination with the school indicated the need to strengthen teachers' understanding of psychologically supportive teaching, technology-integrated instruction, and contextual numeracy learning. An initial assessment involving 36 teachers revealed heterogeneous levels of understanding of the training content, with a mean pretest score of 19.509. This variation indicated the importance of providing structured professional learning opportunities that accommodate differences in teachers' initial knowledge. In particular, the program identified three areas requiring instructional support: connecting mathematical concepts with meaningful everyday contexts, understanding the integration of technology through the TPACK framework, and recognizing students' psychosocial characteristics as considerations in learning. Furthermore, student psychosocial assessment had not been implemented as part of the program's preliminary activities, leaving the program team without student-level diagnostic findings to inform individualized instructional support. Although the initial assessment did not separately measure teachers' numeracy competence, TPACK proficiency, or psychological well-being, the findings provided a baseline for designing an integrated capacity-building intervention responsive to the partner school's professional development needs.

Addressing these needs requires an approach that considers the relationship between psychological well-being, pedagogical competence, and technology integration. Self-Determination Theory emphasizes autonomy, competence, and relatedness as fundamental psychological needs that influence motivation and well-being (Ryan & Deci, 2020). In educational contexts, teachers' well-being and positive interpersonal relationships contribute to supportive learning environments and professional functioning (Hascher & Waber, 2021). Meanwhile, the Technological Pedagogical Content Knowledge (TPACK) framework highlights the importance of integrating technological, pedagogical, and content knowledge to facilitate meaningful instructional practices (Mishra & Koehler, 2006). In numeracy education, these competencies are particularly relevant because students need opportunities to explore mathematical ideas through familiar situations, active participation, and contextual problem-solving. Formative assessment further complements this approach by enabling teachers to use evidence of students' learning and development to inform instructional decisions (Black & Wiliam, 2009). Integrating these perspectives provides a foundation for developing learning environments that are psychologically supportive, technologically adaptive, and responsive to students' numeracy needs.

Strengthening these interconnected competencies requires professional development that extends beyond theoretical knowledge transmission. Desimone (2009) identified content focus, active learning, coherence, duration, and collective participation as essential characteristics of effective teacher professional development. Similarly, Guskey (2002) emphasized that meaningful professional growth depends on opportunities to connect newly acquired knowledge with instructional practice. Accordingly, the community service program at SDN 200 Leuwi Panjang adopted an integrated training approach combining teacher motivation, psychological well-being, TPACK-based instruction, enjoyable contextual numeracy learning, and guidance on student assessment instruments. Rather than presenting these topics as independent components, the program emphasized their relationships in supporting teachers' understanding of student-centered instruction. This approach was intended to provide participants with conceptual and practical foundations for creating

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engaging learning experiences while recognizing the importance of students' psychological and academic needs.

Based on the partner situation analysis and the theoretical considerations outlined above, this community service program aimed to strengthen elementary school teachers' understanding of psychological well-being, TPACK, and enjoyable numeracy learning through integrated professional development. Conducted at SDN 200 Leuwi Panjang on 23–24 July 2026, the program provided intensive training on psychologically supportive teaching, technology-integrated instruction, contextual numeracy strategies, and guidance on identifying students' learning needs. Changes in teachers' understanding were evaluated using pretest and posttest assessments. The program was expected to establish a foundation for improving teachers' instructional readiness and supporting the future development of more engaging, inclusive, and contextually relevant numeracy learning environments in elementary schools.

Method

This community service program employed a participatory professional development approach to strengthen elementary school teachers' understanding of psychological well-being, Technological Pedagogical Content Knowledge (TPACK), and enjoyable numeracy learning. The approach emphasized active participation, collaborative reflection, and the integration of theoretical knowledge with practical teaching contexts, consistent with the principles of effective teacher professional development proposed by Garet et al. (2001) and Desimone (2009). Cilliers et al. (2022) similarly demonstrated that although professional development programs can strengthen teacher knowledge, improvements in instructional practices are more likely to persist when teachers receive continued coaching and implementation support. These findings suggest that short-term workshops may initiate professional learning, but sustained assistance is important for translating knowledge into practice. The program was implemented in collaboration with SDN 200 Leuwi Panjang, Bandung, Indonesia, on 23–24 July 2026. The intervention comprised four main stages: preliminary coordination, baseline assessment, intensive training, and program evaluation. The core training was organized into two thematic sessions per day, with activities concluding at 14:00 Western Indonesian Time (WIB).

The preliminary stage involved coordination with the partner school to identify professional development needs, arrange participants, and prepare the training activities. A pretest was administered to establish participants' initial understanding of the training content. Subsequently, the intensive training was delivered through interactive lectures, guided discussions, question-and-answer sessions, reflective activities, and contextual instructional examples. These activities encouraged teachers to connect the materials with their classroom experiences and consider their potential application in elementary school learning. The training covered four interconnected competency areas: teacher motivation, TPACK-based literacy, psychological well-being, and enjoyable numeracy learning. The intervention stages, facilitators, materials, implementation modes, and achievement indicators are presented in Table 1.

Table 1. Intervention Matrix of the Community Service Program

Stages	Speakers/Facilitators	Materials/Activities	Mode and Duration	Outputs/Achievement Indicators
Preliminary coordination	Community service team	Coordination, identification of	Preliminary stage, before core training	Baseline assessment data and identified

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Stages	Speakers/Facilitators	Materials/Activities	Mode and Duration	Outputs/Achievement Indicators
and assessment	and school coordinator	training needs, participant preparation, and pretest		training needs
Day 1 – Session 1: Teacher Motivation	Prof. Dr. Mubiar Agustin, M.Pd.	Intrinsic motivation, positive teacher–student relationships, and supportive classroom interactions	Face-to-face, 23 July 2026; first session	Participation in teacher motivation training
Day 1 – Session 2: TPACK-Based Literacy	Dr. Asep Deni Gustiana, M.Pd.	Integration of technological, pedagogical, and content knowledge in instruction	Face-to-face, 23 July 2026; second session; daily activities ended at 14:00 WIB	Introduction to TPACK-based instructional approaches
Day 2 – Session 3: Psychological Well-Being	Dr. Idat Muqodas, M.Pd., Kons.	Teacher well-being, emotional regulation, professional demands, and supportive learning environments	Face-to-face, 24 July 2026; first session	Participation in psychological well-being training
Day 2 – Session 4: Enjoyable Numeracy Learning	Dr. Fitri Kania, M.Pd.	Contextual numeracy strategies, interactive learning, and guidance on student assessment instruments	Face-to-face, 24 July 2026; second session; daily activities ended at 14:00 WIB	Introduction to contextual numeracy approaches and assessment guidance
Program evaluation	Community service team	Posttest, participant reflection, and descriptive evaluation	Following the core training	Paired assessment data and evaluation of participants' learning progress

On the first day, the training addressed teacher motivation and TPACK-based literacy. Prof. Dr. Mubiar Agustin, M.Pd., facilitated the session on teaching motivation, emphasizing intrinsic motivation, positive teacher–student relationships, and emotionally supportive classroom interactions. Dr. Asep Deni Gustiana, M.Pd., subsequently introduced TPACK-based literacy, focusing on the integration of technology, pedagogy, and subject content in elementary education. On the second day, Dr. Idat Muqodas, M.Pd., Kons., discussed psychological well-being, particularly teachers' emotional health, professional demands, and supportive learning environments. The final session, delivered by Dr. Fitri Kania, M.Pd., focused on enjoyable numeracy learning through contextual and interactive strategies. Participants were also introduced to guidance on using assessment instruments to identify students' psychosocial characteristics, learning motivation, and numeracy-related needs. The assessment instruments were presented as instructional resources; student-level administration and evaluation were not conducted within this program.

Program evaluation employed a descriptive pretest–posttest approach supported by qualitative observations and activity documentation. Quantitative assessment was conducted through the Wayground digital platform before and after the training to examine changes in

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participants' overall understanding. The assessment system recorded 41 participant entries, of which 36 provided usable paired pretest and posttest scores for comparative analysis. The evaluation focused on participants' immediate learning outcomes, consistent with the distinction between learning outcomes and behavioral changes in the training evaluation framework proposed by Kirkpatrick & Kirkpatrick (2006). As Wayground incorporates gamified scoring mechanisms that may be influenced by response accuracy, speed, and platform features, the scores were interpreted as indicators of training performance rather than standardized measures of professional competence.

Quantitative data were analyzed descriptively using mean scores, score differences, percentage change, and the proportion of participants demonstrating improvement. The percentage change was calculated using the following formula:

$$\textbf{Percentage Change } (\%) = \frac{(\textbf{Mean Posttest} - \textbf{Mean Pretest})}{\textbf{Mean Pretest}} \times 100$$

Individual paired scores were examined to identify participants whose posttest scores exceeded their pretest results. Qualitative information obtained through training observations, participant discussions, facilitator reflections, and activity documentation was used to complement the quantitative findings. Observations focused on participant engagement, responses to the training materials, and the relevance of the topics to elementary classroom contexts. Documentation included attendance records, training photographs, assessment records, and learning materials. These qualitative records were summarized descriptively to identify recurring observations regarding participants' engagement and understanding.

The partner school contributed to participant coordination, logistical preparation, and facilitation of the training activities. Program effectiveness was evaluated primarily through changes in participants' overall pretest–posttest performance and their engagement during the training. The evaluation did not separately measure individual competencies in numeracy, TPACK, or psychological well-being, nor did it assess classroom implementation or student-level outcomes. Therefore, the findings were interpreted as evidence of short-term improvements in participants' understanding rather than direct evidence of sustained instructional changes or improvements in students' learning achievement.

Result and Discussion

The community service program was implemented at SDN 200 Leuwi Panjang, Bandung, Indonesia, on 23–24 July 2026, through four integrated training sessions addressing teacher motivation, TPACK-based literacy, psychological well-being, and enjoyable numeracy learning. The activities employed interactive presentations, guided discussions, reflective activities, and practical instructional examples to strengthen teachers' understanding of psychologically supportive, technologically informed, and contextually meaningful teaching. The integration of these components reflected the importance of providing coherent professional learning experiences that connect pedagogical knowledge with teachers' professional and classroom contexts (Desimone, 2009; Garet et al., 2001).

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Figure 1. Teachers' participation in interactive training activities at SDN 200 Leuwi Panjang, Bandung.

The program evaluation began with a pretest administered through the Wayground digital platform to identify participants' initial understanding of the training materials. Of the 41 participant entries recorded in the assessment system, 36 provided usable paired assessment scores. The pretest results demonstrated considerable variation, with scores ranging from 5,793 to 29,576 points and a mean score of 19,509 points. This variation indicated heterogeneous levels of initial understanding among participants and highlighted the importance of professional development that accommodates differences in teachers' existing knowledge and learning needs. However, because the assessment measured overall understanding, these scores did not provide separate estimates of teachers' initial competencies in numeracy, TPACK, or psychological well-being.

Following the training, participants demonstrated improved assessment performance. The mean posttest score increased to 24,960 points, representing a gain of 5,451 points or approximately 27.94%. Furthermore, 32 of the 36 participants (88.89%) achieved higher posttest scores, while the remaining four participants did not demonstrate an increase. The minimum score increased from 5,793 to 14,850 points, while the maximum score increased from 29,576 to 30,850 points. These findings indicate positive changes in participants' overall assessment performance following the training. A summary of the results is presented in Table 2.

Table 2. Comparison of Pretest and Posttest Results

Indicator	Pretest	Posttest	Change
Participants analyzed	36	36	–
Mean score	19,509	24,960	+5,451
Minimum score	5,793	14,850	+9,057
Maximum score	29,576	30,850	+1,274
Average improvement	–	–	27.94%
Participants showing improvement	–	32	88.89%

Note: Scores represent points generated by the Wayground platform. Percentage improvement was calculated based on the difference between mean posttest and pretest scores relative to the mean pretest score.

The increase in assessment scores suggests positive immediate learning outcomes following the intervention. This finding is consistent with Garet et al. (2001) and Desimone (2009), who emphasize content relevance, active participation, and coherence as important characteristics of effective teacher professional development. Through interactive discussions and practical examples, the program provided opportunities for participants to relate new concepts to their teaching experiences. Nevertheless, the improvement should be interpreted as a change in overall training assessment performance rather than definitive evidence of

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increased professional competence, particularly because the Wayground scoring system incorporates gamified features that may influence the final scores.

The first training component addressed teacher motivation and positive teacher–student relationships. Participants were introduced to the importance of intrinsic motivation, emotional engagement, and supportive interpersonal interactions in creating meaningful learning environments. The session emphasized that teaching involves not only instructional responsibilities but also the development of positive relationships that support students' participation and sense of belonging. These perspectives align with Self-Determination Theory, which identifies autonomy, competence, and relatedness as fundamental psychological needs associated with motivation and well-being (Ryan & Deci, 2020). Klassen et al. (2012) further demonstrated the significance of teacher–student relatedness for teachers' professional engagement and emotional functioning. Accordingly, the training provided a conceptual foundation for understanding the relationship between teacher motivation, interpersonal relationships, and supportive classroom environments.

The psychological well-being component further emphasized the importance of teachers' emotional health and professional functioning. The materials addressed psychological balance, emotional regulation, professional demands, and the development of supportive classroom interactions. During the training, these topics were connected with common professional experiences, including workload, classroom management, administrative responsibilities, and emotional demands. Ryff (1989) conceptualizes psychological well-being through six dimensions: self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth. Similarly, Hascher & Waber (2021) highlight the importance of interpersonal relationships and working conditions in teacher well-being. By introducing these perspectives, the program encouraged participants to consider psychological well-being as an integral aspect of professional teaching. Collie et al. (2012) demonstrated that school climate and social-emotional conditions are associated with teacher stress, job satisfaction, and teaching efficacy. However, the program did not directly assess participants' psychological well-being or burnout levels; therefore, changes in these conditions cannot be inferred from the training evaluation.

Technology integration was addressed through the TPACK-based literacy session, which introduced the relationship between technological knowledge, pedagogical knowledge, and content knowledge. Participants were encouraged to understand digital technology not merely as an instructional tool but as a component of pedagogical decision-making that should be aligned with learning objectives and subject content. Jiménez Sierra et al. (2023) concluded that professional learning based on TPACK can provide opportunities for teachers to reconstruct their understanding of technology-supported pedagogy. This perspective is consistent with Mishra & Koehler (2006), who emphasize the interconnected nature of technological, pedagogical, and content knowledge in effective instruction. The use of Wayground during the evaluation also provided participants with direct experience of technology-supported assessment. Such exposure illustrated the potential of digital platforms to facilitate assessment activities while highlighting the importance of interpreting platform-generated information appropriately. Tondeur et al. (2012) similarly emphasize authentic technological experiences and reflection as relevant components of teacher preparation for technology integration. Similarly, von Hagen et al. (2025) emphasized that professional development in formative assessment should provide teachers with practical opportunities to interpret assessment information and translate it into classroom action. Therefore, providing

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teachers with an instrument alone would have been insufficient; the accompanying guidance and mentoring constituted an essential component of the program. Nevertheless, participants' independent ability to develop or implement TPACK-based instructional media was not evaluated during the program.

The enjoyable numeracy learning session focused on introducing contextual, interactive, and developmentally appropriate approaches to elementary mathematics instruction. Participants were introduced to learning strategies involving everyday mathematical situations, games, visual representations, and contextual problem-solving activities. These approaches emphasized numeracy as the ability to apply mathematical reasoning in meaningful situations rather than merely performing computational procedures. This orientation corresponds with the OECD (2023) framework of mathematical literacy, which emphasizes mathematical reasoning and the ability to formulate, employ, and interpret mathematics in real-world contexts. Hill et al. (2005, 2008) further demonstrate the importance of teachers' mathematical knowledge for instructional quality. Through this session, participants were encouraged to consider how mathematical concepts could be presented through familiar situations to promote student engagement and meaningful learning.

The *N Framework* proposed by O'Sullivan et al. (2025) strengthens this interpretation by emphasizing the interaction among numeracy knowledge, subject-specific knowledge, and pedagogical content knowledge. From this perspective, effective numeracy instruction depends on teachers' ability to transform mathematical ideas into meaningful and accessible experiences. The program's focus on contextual and enjoyable numeracy therefore provided an opportunity to strengthen not only teachers' understanding of numeracy but also their capacity to consider how mathematical content can be pedagogically reconstructed for elementary school students.



Figure 2. Presentation of contextual numeracy learning activities during the teacher professional development program.

An additional component of the numeracy session was the introduction of an assessment instrument and practical guidance intended to support the identification of students' psychological well-being, learning motivation, and numeracy-related needs. Participants received explanations regarding instrument administration, scoring procedures, preliminary interpretation, and the potential use of assessment findings for instructional decision-making. This approach reflects the principles of formative assessment proposed by Black & Wiliam (2009), who emphasize that assessment evidence becomes educationally meaningful when it informs subsequent teaching and learning activities. Schildkamp et al.

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(2020) similarly highlight the importance of assessment literacy and teachers' ability to interpret educational data. Although the instrument was introduced as a resource for supporting more responsive instruction, it had not been administered to students during the program. Consequently, no empirical findings regarding students' psychosocial profiles, learning motivation, or numeracy achievement were generated through this activity.

The integration of the four training components represents an important characteristic of the community service program. Teacher motivation and psychological well-being provided perspectives on the personal and relational dimensions of teaching, while TPACK and contextual numeracy addressed technological and pedagogical aspects of instruction. Guidance on student assessment further introduced the importance of identifying students' learning needs when considering instructional strategies. Rather than presenting these topics as unrelated areas, the program positioned them as interconnected elements of professional teaching. This orientation is consistent with Desimone (2009), who emphasizes coherence and content relevance in teacher professional development. The combination of these topics provided participating teachers with an integrated conceptual framework for considering psychologically supportive, technologically appropriate, and contextually meaningful learning experiences.

The quantitative evaluation provides evidence of the program's immediate contribution to participants' learning, as reflected in the 27.94% increase in mean assessment scores and the improvement demonstrated by 88.89% of the analyzed participants. However, several limitations should be acknowledged. First, the evaluation assessed overall understanding rather than measuring changes in specific competency domains. Second, the assessment relied on a gamified digital platform rather than a standardized competency instrument. Third, the program did not include post-training classroom observations, independent evaluation of instructional practices, or student-level assessments. Therefore, the findings cannot establish whether participants subsequently implemented the introduced strategies or whether the program produced improvements in students' psychological well-being and numeracy achievement.

Overall, the findings indicate that the integrated training program was associated with positive short-term improvements in participating teachers' understanding of the materials. By connecting psychological well-being, teacher motivation, TPACK, contextual numeracy, and assessment guidance, the program introduced a multidimensional approach to elementary teacher professional development. Future community service activities should incorporate structured mentoring, classroom implementation, competency-specific evaluation, and student-level assessment to determine whether the immediate learning gains observed during training can be translated into sustainable instructional practices and meaningful educational outcomes.

Conclusion

The community service program at SDN 200 Leuwi Panjang, Bandung, demonstrated positive short-term outcomes in strengthening elementary school teachers' understanding of psychological well-being, learning motivation, TPACK-based instruction, and enjoyable contextual numeracy learning. Through an integrated two-day training program, participants were introduced to psychological, pedagogical, and technological perspectives that support more responsive and engaging elementary education. The evaluation results showed that the mean assessment score increased from 19,509 to 24,960 points, representing a 27.94% improvement, with 32 of the 36 participants (88.89%) achieving higher posttest scores. These

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findings indicate improved overall understanding of the training materials and highlight the potential of integrated professional development as an approach to teacher capacity building. However, the evaluation was limited to immediate learning outcomes and did not assess changes in classroom practices or student achievement. Therefore, sustained mentoring, classroom implementation, and further evaluation are recommended to determine the long-term contribution of the program to teaching quality and students' learning experiences.

Recommendation

Educational institutions and school leaders should provide sufficient institutional support for teachers to apply the acquired competencies, including opportunities for peer discussion, collaborative lesson planning, reflective practice, and sharing of successful classroom strategies. Such support is important to ensure that the outcomes of the program are sustained beyond the formal period of community service.

For future implementation, the training model should be expanded by incorporating longer mentoring periods, classroom observation, follow-up evaluation, and repeated assessment of both teacher competence and student outcomes. These components would provide stronger evidence regarding the long-term effectiveness of the intervention and its contribution to changes in classroom practice.

Local education authorities and other relevant stakeholders are also encouraged to consider this integrated training model as a potential approach for broader teacher capacity-building programs. Replication in other elementary schools should be accompanied by an initial needs assessment so that the content, mentoring strategies, and assessment instruments can be adapted to local conditions. Collaboration among universities, schools, and education authorities will be essential to ensure that the program remains contextually relevant, scalable, and sustainable in supporting teacher competence, student well-being, learning motivation, and numeracy literacy.

Future community service programs should prioritize sustained mentoring rather than relying solely on short-term training activities. The partner school is encouraged to integrate the knowledge and practices introduced through the program into regular teacher professional development activities, particularly those related to psychological well-being, student motivation, TPACK-based instruction, and contextual numeracy learning.

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