



Culturally Responsive Teaching for Deep Learning: Exploring Pre-Service Teachers' Pedagogical Competence Across the Instructional Cycle

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Abstract: This study aims to examine pre-service teachers' pedagogical competence in implementing Culturally Responsive Teaching (CRT) to support deep learning pedagogy during mathematics lessons observed in their teaching practicum and to identify points at which implementation weakened across the instructional cycle. A qualitative descriptive design was employed, with structured 1–4 observation ratings used solely as descriptive supporting evidence rather than as a separate quantitative strand. Observations and document analysis involved 30 pre-service teachers, while interviews were conducted with 10 of these participants, four teacher educators, and 30 students. Data from observation protocols, semi-structured interviews, lesson documents, assessment tasks, and reflective journals were analyzed thematically and validated through source, method, and time triangulation. Descriptive ratings indicated stronger performance in inclusive classroom management ($M = 3.5$) and culture-based lesson planning ($M = 3.2$), but weaker performance in the use of culturally relevant media ($M = 2.8$) and culture-based assessment ($M = 2.6$). Triangulated evidence revealed a culturally responsive continuity gap: cultural responsiveness was evident in lesson planning and classroom interactions but diminished during assessment and critical reflection. When local cultural contexts were used as resources for mathematical reasoning rather than as decorative examples, students demonstrated clearer indicators of meaningful, mindful, and joyful learning. The study identifies authentic culture-based assessment, structured reflection, mentoring, and culturally relevant resources as priority areas for strengthening pre-service teachers' pedagogical competence during teaching practicum.

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Introduction

Cultural diversity has become a defining feature of contemporary classrooms, requiring teachers to make pedagogical decisions that are academically rigorous, inclusive, and responsive to students' identities and lived experiences. In this study, the empirical focus is the mathematics lessons taught by pre-service teachers during practicum. Mathematics is sometimes presented as culturally neutral and abstract, yet learners encounter quantity, pattern, space, measurement, and problem solving through language, community practices, and lived experience. Culturally responsive mathematics teaching therefore requires teachers to connect rigorous mathematical ideas with students' cultural and linguistic resources rather than adding culture as a decorative context after a task has been designed (Aguirre & Zavala, 2013; Mark & Id-Deen, 2022; Register et al., 2022; Thomas & Berry, 2019). This is particularly important during teacher preparation because pre-service teachers must learn to



maintain mathematical cognitive demand while making activity culturally meaningful. Their pedagogical and professional competence is closely related to instructional quality and students' opportunities to learn (König et al., 2021; Yang & Kaiser, 2022). The teaching practicum is a critical setting for developing this competence because pre-service teachers must translate university-based knowledge into decisions made under authentic classroom conditions (Zapatero-Ayuso et al., 2026).

Culturally Responsive Teaching (CRT) provides a framework for making those decisions in culturally diverse classrooms. Rather than treating culture as decorative or supplementary content, CRT positions students' identities, community knowledge, language, and lived experiences as pedagogical resources that should inform curriculum, classroom interaction, instructional activity, and assessment. Reviews of culturally responsive teacher preparation emphasize that competence is demonstrated not by isolated cultural examples but by coherent enactment across multiple stages of teaching (Chang & Viesca, 2022; Gulya & Fehérvári, 2024). In mathematics teacher education, this coherence also requires attention to mathematical thinking, language, culture, and participation when lessons are planned and analyzed (Aguirre & Zavala, 2013; Aga, 2025; Anderson, 2021). Empirical studies likewise associate culturally responsive dispositions and practices with stronger classroom participation, culturally responsive management, psychological adjustment, and more equitable learning environments (Comstock et al., 2023; Ialuna et al., 2025; Santiago-Rosario et al., 2023; Taylor & Wendt, 2022).

For pre-service teachers, however, knowing the principles of CRT does not necessarily mean being able to sustain them throughout an entire lesson cycle. During practicum they must simultaneously manage curriculum requirements, classroom interaction, instructional time, diverse learning needs, assessment demands, and post-lesson reflection. Research on teacher preparation shows that culturally responsive competence develops through authentic practice, feedback, and structured reflection, yet enactment remains uneven when novices move from conceptual understanding to classroom implementation (Gulya & Fehérvári, 2024). Examining what pre-service teachers actually plan, teach, assess, and reflect on is therefore necessary for identifying not only whether CRT appears in practice, but where it is sustained and where it breaks down.

In the Indonesian context, this issue intersects with the national emphasis on *Pembelajaran Mendalam* (deep learning pedagogy). National guidance describes this approach as learning that is mindful, meaningful, and joyful, with attention to conceptual understanding, reflection, and contextual application (Kementerian Pendidikan Dasar dan Menengah, 2025). Recent Indonesian scholarship likewise frames deep learning as a pedagogical orientation that connects conceptual understanding, reflection, engagement, and authentic experience (Andyanie et al., 2025; Feriyanto & Anjariyah, 2024; Siregar et al., 2025). The present study was situated in Bali, where local practices such as woven patterns, traditional markets, ceremonial objects, and community routines can provide culturally recognizable contexts for geometry, ratio, fractions, measurement, pattern, and quantitative reasoning; Balinese woven handicrafts, for example, contain tessellation structures that can be used as mathematics learning resources (Puspawati & Putra, 2014). The global relevance of this case lies not in claiming demographic representativeness of the partner schools, but in a pedagogical challenge shared across teacher-education systems: culturally familiar material must be transformed into rigorous disciplinary reasoning rather than used only as an engaging example (Aga, 2025; Anderson, 2021; Mark & Id-Deen, 2022).

Despite the expanding literature on CRT, three empirical gaps remain. First, many studies focus on student outcomes, teacher beliefs, or culturally responsive classroom



management rather than on the full pedagogical competence of pre-service teachers during authentic practicum. Second, limited attention has been given to the continuity of cultural responsiveness across lesson planning, classroom implementation, instructional media, assessment, and post-lesson reflection. Third, relatively few studies examine these stages together with observable indicators of mindful, meaningful, and joyful learning in the same instructional setting. These gaps matter because a lesson may appear culturally responsive at the level of examples or classroom discussion while reverting to conventional practices during assessment and reflection. Such discontinuity can obscure whether CRT has become an integrated pedagogical orientation or remains a set of isolated instructional moves.

Accordingly, this study aims to examine how pre-service teachers demonstrate pedagogical competence when implementing CRT to support deep learning during the mathematics lessons observed in teaching practicum and to identify the challenges that weaken the continuity of CRT across lesson planning, classroom instruction, instructional media, assessment, and reflective practice. By tracing these stages together, the study seeks to identify where culturally responsive competence is strongest, where it breaks down, and which features of teacher preparation require targeted support, particularly authentic culture-based assessment, critical reflection, mentoring, and culturally relevant instructional resources.

Research Method

This study employed a qualitative descriptive design (Sandelowski, 2000) to examine how pre-service teachers enacted pedagogical competence in culturally responsive mathematics teaching during their practicum. Structured four-point observation ratings were embedded only as descriptive supporting evidence to map relative strengths and weaknesses across observed components; they did not constitute an independent quantitative strand and were not used for inferential statistical testing or causal claims. The qualitative design was selected because the study sought a close description of instructional practices, participant experiences, implementation patterns, and constraints in authentic classroom contexts. The study was conducted during the second semester of the 2024/2025 academic year in a Teacher Professional Education program at a private university in Bali, Indonesia, and its partner schools; the institutional name is withheld to preserve blinded review.

The primary participants were 30 pre-service teachers whose observed practicum lessons involved mathematics teaching in partner schools. Criterion-based purposive sampling was used because participants needed direct experience relevant to the research objective. The inclusion criteria were: (a) enrollment in the Teacher Professional Education program, (b) active participation in the teaching practicum, and (c) direct responsibility for designing and delivering classroom instruction. Classroom observations and document analysis covered all 30 participants. For interview triangulation, 10 of the 30 pre-service teachers were purposively selected from the observed participants who met the inclusion criteria. The interview subsample was used to provide interpretive depth rather than statistical representation; variation identified in their accounts was interpreted against the observation and document corpus covering all 30 participants. Four teacher educators who supervised the practicum and 30 students from partner schools who had directly experienced the observed lessons were also interviewed. The three participant groups therefore contributed complementary perspectives: pre-service teachers on instructional decisions and challenges, teacher educators on competence development and supervision, and students on participation, inclusivity, and culturally meaningful learning experiences. Because participants came from

one Teacher Professional Education program and its partner schools, the study was designed for contextual depth rather than statistical generalization.

Three complementary instruments were used. First, a classroom observation protocol examined five dimensions of pedagogical competence: culture-based lesson planning, inclusive classroom management, culturally relevant instructional media, culture-based assessment, and reflective teaching. The protocol also recorded indicators of deep learning pedagogy, including mindful attention and reasoning, meaningful connections between concepts and lived experience, joyful engagement, and transfer across contexts. Each observation item was rated on a four-point scale (1-4), with lower scores indicating absent or limited evidence and higher scores indicating consistent or integrated evidence for the specified indicator. Second, semi-structured interview guides for pre-service teachers, teacher educators, and students explored understandings of CRT, perceived benefits, implementation challenges, and support needs. Third, a document-analysis checklist was used to examine lesson plans, teaching modules, student worksheets, assessment tasks, and reflective journals. The instruments were reviewed by two experts in teacher education and qualitative research for content relevance and clarity before data collection.

Table 1. Analytical Framework and Evidence Sources

Analytical focus	Operational indicators	Primary evidence
Culture-based planning	Local cultural contexts in objectives, materials, and learning activities	Observation; lesson plans/modules
Inclusive classroom management	Equitable participation, respectful interaction, culturally safe classroom climate	Observation; student interviews
Culturally relevant media	Use of local artefacts, images, video, or contextual resources as substantive learning tools	Observation; learning documents
Culture-based assessment	Tasks requiring application of concepts in culturally meaningful or authentic contexts	Observation; assessment documents; interviews
Reflective practice	Reflection on how cultural responsiveness affected participation, understanding, and teaching decisions	Reflective journals; interviews
Deep learning pedagogy	Mindful reasoning, meaningful connections, joyful engagement, and transfer across contexts	Observation; student interviews

Data were collected over one academic semester through classroom observation, semi-structured interviews, and document analysis. The 30 pre-service teachers were observed during practicum with attention to planning, classroom interaction, media use, assessment, and reflection. Field notes and structured ratings were completed in relation to the observation protocol. Interviews with the selected pre-service teachers, teacher educators, and students lasted approximately 30-45 minutes, were audio-recorded with participants' consent, and were transcribed for analysis. Teaching documents were examined to determine whether cultural responsiveness appeared only as contextual illustration or was sustained in learning objectives, activities, assessment, and reflection. The research documentation also indicates that data were collected at different stages of the practicum, allowing time triangulation alongside source and method triangulation.

The data were analyzed thematically using the interactive qualitative analysis process described by Miles et al. (2014). First, interview transcripts, observation notes, and teaching documents were condensed and coded for evidence related to pedagogical competence, CRT implementation, deep learning indicators, and implementation constraints. Coding was conducted manually by the researchers without the use of Computer-Assisted Qualitative Data Analysis Software (CAQDAS). Second, coded evidence was organized in displays that enabled comparison across participant groups and data sources. Third, themes were developed by examining convergence, divergence, and recurrent patterns across observations, interviews, and documents. Finally, conclusions were verified against the original evidence. The mean observation scores were calculated only to summarize the relative profile of the five observed pedagogical components and were interpreted alongside qualitative evidence rather than as stand-alone quantitative outcomes. Trustworthiness was strengthened through source triangulation among pre-service teachers, teacher educators, and students; method triangulation across observation, interview, and document analysis; and time triangulation through data collection at different stages of the practicum.

Results and Discussion

The observation data showed a clear unevenness across the five pedagogical components assessed. Inclusive classroom management received the highest mean score ($M = 3.5$), followed by culture-based lesson planning ($M = 3.2$) and reflective teaching practice ($M = 3.1$). Culture-based instructional media received a moderate score ($M = 2.8$), while culture-based assessment received the lowest mean score ($M = 2.6$). Because these values were descriptive summaries within a qualitative study, the pattern was interpreted through interviews and document evidence rather than as an inferential comparison. Across the three data sources, the same pattern emerged: cultural responsiveness was more visible in planning and classroom interaction than in assessment and critical reflection. This cross-stage weakening is referred to in this study as a culturally responsive continuity gap.

Table 2. Mean Observation Scores of Pre-Service Teachers' Pedagogical Competence

Pedagogical competence aspect	Mean score (1-4)	Descriptive finding
Culture-based lesson planning	3.2	Good; cultural integration was mainly limited to contextual examples
Inclusive classroom management	3.5	Very good; students actively participated in learning
Culture-based instructional media	2.8	Moderate; conventional media still predominated
Culture-based assessment	2.6	Lowest component; authentic culture-based assessment was limited
Reflective teaching practice	3.1	Good; reflection mainly addressed technical teaching issues

Culture-Based Planning and Inclusive Classroom Practice

Document analysis showed that most lesson plans and teaching modules incorporated local cultural contexts such as Balinese weaving patterns, traditional markets, ceremonial activities, Balinese food, and ogoh-ogoh. These contexts helped pre-service teachers connect mathematical ideas with familiar experiences. However, cultural integration was often concentrated in lesson openings, examples, or selected activities rather than sustained through learning objectives, tasks, and assessment. This was consistent with interview evidence



indicating that pre-service teachers understood CRT as important but were still developing the ability to translate that understanding into a coherent instructional sequence.

Classroom observations showed that most pre-service teachers created respectful and participatory learning environments. Group discussion, contextual questioning, and collaborative tasks encouraged students to contribute ideas and connect academic concepts with local experience. Students described these lessons as more engaging when cultural references were used substantively. One student commented, 'It is more fun when ogoh-ogoh or Balinese cakes are used' (Student-09, translated). At the same time, observations indicated that not all participants sustained this inclusivity equally; some quieter students participated less when instruction reverted to teacher-centered explanation.

Instructional Media and Culture-Based Assessment

Instructional media included PowerPoint slides, videos, textbooks, and student worksheets. Several pre-service teachers introduced images of temples, traditional clothing, local markets, or other cultural artefacts, but these resources often functioned as illustrations rather than as tools for inquiry or problem solving. A stronger example occurred when a video of a traditional Balinese market was used to support ratio and price-comparison tasks, enabling students to connect mathematical relations with everyday transactions. Overall, however, conventional media still predominated, which is consistent with the moderate observation score for this component.

Assessment was the most consistent area of difficulty and the clearest point at which cultural responsiveness weakened. Most assessment tasks remained multiple-choice items or short constructed-response questions that emphasized factual or procedural knowledge without requiring students to apply concepts in culturally meaningful situations. Only a small number of tasks used authentic contexts, such as analyzing the use of fractions in family crop distribution. Interview evidence converged with the document analysis. One pre-service teacher stated, 'I tried using ogoh-ogoh for solid geometry, but I was confused about how to write examination questions' (PST-07, translated). A teacher educator similarly noted, 'Culture often appears only at the beginning; it does not reach the assessment' (Teacher Educator-2, translated). These accounts explain why culture-based assessment received the lowest descriptive score.

Reflective Practice and Deep Learning Indicators

Reflective journals were commonly completed after teaching, but most entries focused on technical concerns such as voice projection, student attention, time management, or classroom control. Only a small proportion examined how cultural contextualization influenced students' understanding, participation, or transfer of knowledge. One reflective entry described how connecting fractions with a local ceremonial context made the concept easier for students to understand and prompted the pre-service teacher to plan similar contextualization in future lessons. Such evidence shows that critical culturally responsive reflection was possible, but it had not yet become a routine part of practicum practice.

Across observations and interviews, indicators of meaningful, mindful, and joyful learning were most visible when cultural contexts were integrated into the substance of the learning task. Meaningful learning appeared when students connected academic concepts with practices from home, community, or local culture. Mindful learning emerged during reflective questioning, problem solving, and opportunities to explain reasoning. Joyful learning was visible in enthusiasm, collaborative interaction, and a positive classroom climate. Importantly, these indicators were less consistent when culture appeared only briefly in the lesson opening, suggesting that culturally familiar content alone was insufficient unless it shaped the learning process itself.

Implementation Challenges and Support Needs

Four recurring constraints emerged from interviews, observations, and teaching documents. First, pre-service teachers had limited confidence in designing authentic culture-based assessment. Second, they found it difficult to adapt instruction to differences in academic ability, participation style, and cultural background within limited lesson time. Third, limited teaching experience made it challenging to balance curriculum requirements, classroom management, and culturally responsive strategies simultaneously. Fourth, participants reported limited access to examples of culturally relevant worksheets, assessment tasks, and teaching materials. Both pre-service teachers and teacher educators proposed targeted workshops, repositories of culture-based assessment examples, structured mentoring, and closer collaboration with partner schools as practical supports.

Table 3. Integrated Evidence Across Observation, Interview, and Document Analysis

Aspect	Observation	Interview evidence	Document evidence
Lesson planning	Good; cultural contexts commonly used	CRT understood, but often concentrated in lesson introduction	Local contexts present; full integration remained partial
Classroom implementation	Very good; participation and inclusivity visible	Students felt more engaged and respected	Learning activities commonly used contextual examples
Learning media	Moderate; conventional media predominated	Need more concrete culture-based media examples	Cultural images often served as illustrations only
Assessment	Lowest component	Pre-service teachers reported difficulty developing culture-based assessment	Most assessment tasks remained conventional
Reflection	Good but mainly technical	Mentoring helped identify weaknesses	Reflective journals rarely analyzed CRT implementation

Discussion

The findings indicate that pre-service teachers had developed an emerging but uneven capacity to enact culturally responsive pedagogy. Their strongest performance occurred in inclusive classroom management and lesson planning, where local contexts helped create participatory and relevant learning environments. This pattern is consistent with research showing that pedagogical competence shapes instructional quality and students' opportunities to engage meaningfully with mathematical ideas (König et al., 2021; Yang & Kaiser, 2022). It also aligns with evidence that culturally responsive dispositions and classroom practices are associated with stronger participation and more inclusive learning climates (Comstock et al., 2023; Santiago-Rosario et al., 2023). The important point, however, is that competence was not equally developed across all stages of instruction.

The central contribution of this study is the identification of a culturally responsive continuity gap across the instructional cycle. Cultural responsiveness was comparatively visible in planning and classroom interaction, became weaker in instructional media, and was least developed in assessment; reflection was generally present but remained predominantly technical rather than critically focused on culture and learning. This pattern supports the argument that CRT should be understood as a coherent pedagogical orientation rather than a collection of isolated techniques (Chang & Viesca, 2022; Thomas & Berry, 2019). It also



extends the review by Gulya and Fehérvári (2024) by showing, within authentic practicum, a specific point at which pre-service teachers' culturally responsive competence can break down: the transition from engaging contextualized instruction to assessment and reflective evaluation. When assessment returns to decontextualized tasks, alignment between culturally responsive learning experiences and evidence of learning is weakened. In mathematics education, such coherence is important because culturally responsive strategies are most educationally consequential when they shape mathematical reasoning, task design, and participation rather than functioning as occasional context (Aguirre & Zavala, 2013; Luzano, 2025; Register et al., 2022).

The particularly low score for culture-based assessment ($M = 2.6$) is not simply a matter of pre-service teachers forgetting to add cultural references. Designing a CRT-based mathematics assessment requires several simultaneous transformations: identifying mathematically productive structures within a cultural practice; converting those structures into a task that preserves cultural meaning while targeting a specified mathematical concept; and maintaining sufficient cognitive demand to elicit analysis, reasoning, justification, or transfer. By contrast, inserting an image of *ogoh-ogoh*, Balinese weaving, or a traditional market during a perception can be accomplished without redesigning the mathematical demand of the lesson. A weaving pattern, for example, must be mathematized into questions about tessellation, symmetry, transformation, or generalization, while a market context must be transformed into ratio, proportional reasoning, comparison, or optimization problems without allowing the cultural narrative to obscure the mathematical goal. This work requires pedagogical content knowledge, task-design knowledge, and cultural sensitivity simultaneously. Previous studies similarly show that pre-service teachers can value culturally responsive mathematics while still struggling to integrate culture without reducing disciplinary rigor or cognitive demand (Aga, 2025; Aguirre & Zavala, 2013; Mark & Id-Deen, 2022; Register et al., 2022). Indonesian work on ethnomathematical task design also shows that transforming local wisdom into higher-order thinking skills (HOTS) mathematics problems requires an explicit design process rather than simple contextual substitution (Mulyatna et al., 2021; Nur et al., 2020).

The study also clarifies the relationship between cultural contextualization and deep learning pedagogy without making a causal claim. When familiar community practices were embedded in problem solving, discussion, and reasoning, students showed more visible indicators of meaningful connection, mindful engagement, and joyful participation. This observation is compatible with discussions of deep learning pedagogy that emphasize contextual meaning, reflection, and positive engagement (Feriyanto & Anjariyah, 2024; Siregar et al., 2025). However, the findings also show that mentioning local culture did not automatically produce these indicators. They were most evident when the cultural context functioned as a resource for thinking and participation rather than as a decorative example.

The study contributes to the literature by examining culturally responsive pedagogical competence at the point where pre-service teachers translate university-based preparation into classroom practice. Previous scholarship has established the importance of culturally responsive teacher preparation (Chang & Viesca, 2022; Gulya & Fehérvári, 2024) and of practicum for competence development (Zapatero-Ayuso et al., 2026). The present study adds a process-oriented account by tracing competence across planning, interaction, media, assessment, and reflection rather than treating implementation as a single undifferentiated construct. This perspective helps explain why a pre-service teacher may appear competent in culturally contextualizing instruction while still requiring substantial support to design aligned assessment and critical reflection.



These findings have practical implications for teacher education. First, coursework and practicum seminars should include explicit rehearsal of authentic culture-based assessment, including open-ended tasks, projects, performance assessments, and rubrics aligned with learning outcomes. Second, supervision should use structured reflective prompts that move beyond technical classroom issues and ask pre-service teachers whose experiences were represented, how students responded, and whether assessment captured meaningful mathematical application. Third, teacher educators and partner schools should collaboratively develop repositories of local cultural contexts, instructional resources, and assessment exemplars that can be adapted rather than copied. These supports are consistent with broader evidence on guided practice, professional learning, culturally responsive mathematics teacher preparation, and pedagogical competence (Aga, 2025; Setiawan et al., 2025; Zapatero-Ayuso et al., 2026).

Proposed CRT-Assessment Microteaching/Lesson Study Cycle

Based on these findings, a four-stage CRT-Assessment Microteaching/Lesson Study Cycle is proposed for use before and during practicum. Stage 1, Cultural-Mathematical Mapping, requires pre-service teachers to identify mathematical structures embedded in a local practice and align them with curriculum outcomes. Stage 2, Task and Rubric Co-design, requires the development of culturally authentic HOTS tasks and an analytic rubric addressing mathematical reasoning, cultural relevance, communication, and transfer. Stage 3, Microteaching or Lesson Study Enactment, allows peers and mentors to observe the task using the rubric and collect evidence of student reasoning. Stage 4, Evidence-Based Reflection and Redesign, uses observation evidence and sample student responses to revise the task, rubric, and lesson sequence. This framework adapts the logic of culturally responsive mathematics lesson-analysis tools, which make dimensions of mathematical thinking, language, culture, and participation explicit for planning and reflective dialogue (Aguirre & Zavala, 2013; Aguirre et al., 2012; Register et al., 2022).

Conclusion

Pre-service teachers demonstrated promising pedagogical competence in using local cultural contexts during mathematics lesson planning and classroom interaction, particularly in creating inclusive and participatory learning environments. However, triangulated evidence revealed a culturally responsive continuity gap: as instruction moved from planning and interaction toward media, assessment, and post-lesson reflection, cultural responsiveness became less systematic. Culture-based assessment was the weakest component, while reflective practice often remained technical rather than critically examining how cultural choices shaped student learning. Indicators of meaningful, mindful, and joyful learning were most visible when culture functioned as a substantive resource for mathematical reasoning and participation, not merely as an introductory illustration. The study therefore suggests that the quality of CRT implementation during practicum should be judged by its continuity across the instructional cycle. Strengthening authentic assessment, critical reflection, mentoring, and access to culturally relevant resources represents a practical pathway for developing more coherent culturally responsive pedagogical competence.

Recommendation

Teacher Professional Education programs should redesign a Design and Assessment in Mathematics Education course/module, or an equivalent component, so that CRT-based assessment is practiced before school placement rather than introduced only during practicum. A pre-practicum CRT-focused Microteaching Workshop should require each pre-

service teacher to develop at least one culture-based HOTS task and analytic rubric, test it through peer teaching, receive mentor feedback, and revise it before classroom use. During practicum, this work can continue through the CRT-Assessment Microteaching/Lesson Study Cycle described above. Universities and partner schools should also establish Professional Learning Communities (PLCs) linked, where appropriate, to Indonesian teacher working-group networks such as KKG (Kelompok Kerja Guru) and MGMP (Musyawarah Guru Mata Pelajaran). Future research should evaluate the effectiveness of these interventions across multiple teacher-education institutions and longer practicum periods.

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