

Optimizing Teachers' HOTS Assessment Competence in Maritime-Based Schools Through Structured Training Intervention

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Article Info	Abstract
Article history: Received: November 14, 2025 Accepted: February 14, 2026 Published: March 14, 2026 Keywords: Contextualized training Higher Order Thinking Skills (HOTS) Maritime-based schooling Professional development Teacher assessment competence This article is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License © 2026 Bubungan Tinggi: Jurnal Pengabdian Masyarakat	This community service program aimed to improve teachers' competence in developing Higher Order Thinking Skills (HOTS)-based assessment items integrated with maritime contexts at SMPN 11 Tanjungpinang. The program employed a Participatory Action Research (PAR) approach, emphasizing collaborative problem identification, action, and reflection to ensure alignment with teachers' real instructional needs. The participants consisted of 24 teachers from various subject areas at a maritime-based junior high school in the Riau Islands. The program was implemented through three structured stages: (1) a needs analysis conducted through interviews and focused group discussions to identify challenges in HOTS-based assessment, (2) a training phase involving conceptual reinforcement of HOTS and 21st-century skills, guided practice in constructing C4–C6 assessment items using maritime-based stimuli, and collaborative review, and (3) a post-implementation stage focusing on evaluation and reflection. Program outcomes were evaluated using pre- and post-tests, a rubric-based HOTS item development task, and a participant satisfaction questionnaire. The results indicated a significant improvement in teachers' conceptual understanding, with a high N-Gain score (0.76) in the introductory module and moderate gains in subsequent technical modules. Teachers successfully produced high-quality HOTS assessment items that demonstrated strong alignment between learning objectives, cognitive levels, and maritime contextual relevance. Participant responses showed very high satisfaction (93.24%), indicating that the program was relevant, practical, and beneficial for professional development. In conclusion, the PAR-based structured training had a positive impact on strengthening teachers' HOTS assessment competence in a maritime-based school context. The program also contributed to increased readiness for sustainable implementation of contextualized HOTS-oriented assessment practices, highlighting the importance of continued mentoring and follow-up support. To cite this article: Sarkity, D., Fernando, A., Pratama, Y., Intasir, M. P., & Yunus, M. (2026). Optimizing teachers' hots assessment competence in maritime-based schools through structured training intervention. <i>Bubungan Tinggi: Jurnal Pengabdian Masyarakat</i>, 8(1), 224-238.

INTRODUCTION

Schools located in maritime and coastal regions operate within distinctive environmental, ecological, and socio-economic contexts that significantly influence instructional practices. In such settings, educational processes are expected not only to comply with national curriculum standards but also to integrate local maritime characteristics to ensure contextual relevance. Learning that is disconnected from students' coastal realities risks becoming abstract and less meaningful. However, assessment practices in many schools—including those situated in maritime environments—often remain predominantly focused on factual recall and routine comprehension, limiting opportunities for students to engage in analytical reasoning and contextual problem-solving ([Daryanes et al., 2022](#); [Riyadi et al., 2023](#)).

At SMPN 11 Tanjungpinang, a public junior high school located in the Riau Islands province, similar challenges were identified. Preliminary discussions with the school principal and teachers indicated that most evaluation instruments emphasized lower cognitive levels (C1–C2), while higher-order processes such as analysis, evaluation, and creation (C4–C6) were rarely incorporated. Furthermore, although the school is geographically situated within a maritime environment, assessment items seldom utilize coastal phenomena—such as fisheries activities, tidal changes, or marine environmental issues—as contextual stimuli. This gap suggests limited teacher competence in designing HOTS-based assessment instruments that are simultaneously cognitively rigorous and contextually grounded.

The urgency of strengthening higher-order assessment practices is reinforced by national curriculum reform. The Merdeka Curriculum promotes inquiry-based learning, flexibility, and deep conceptual understanding ([Nahdiyah et al., 2023](#); [Saputra & Stiawan, 2024](#)). One of its central emphases is the development of Higher Order Thinking Skills (HOTS), which involve analytical, evaluative, and creative thinking processes based on the revised Bloom's taxonomy ([Harahap, 2024](#); [Jannah et al., 2024](#); [Saragih, 2025](#)). The development of HOTS is closely linked to the cultivation of 21st-century competencies, including critical thinking, creativity, collaboration, and communication ([Shanta & Wells, 2022](#); [Zubaidah et al., 2017](#)). These competencies are increasingly recognized as essential for addressing complex global and local challenges, including environmental sustainability in coastal communities ([OECD, 2019](#)).

From a theoretical perspective, HOTS-based learning requires alignment between learning objectives, instructional strategies, and assessment instruments. The revised Bloom's taxonomy positions analysis, evaluation, and creation as higher-level cognitive processes that demand complex reasoning and metacognitive engagement ([Zohar & Barzilai, 2015](#)). When assessment instruments fail to reflect these cognitive demands, instructional implementation of HOTS remains superficial. This misalignment is frequently observed in classroom practice, where teachers report difficulties in constructing assessment tasks that genuinely stimulate higher-order reasoning ([Daryanes et al., 2022](#); [Riyadi et al., 2023](#)). In maritime-based schools, the absence of contextual integration further weakens the authenticity of assessment practices.

Several community service (PKM) initiatives have attempted to strengthen teachers' competence in developing HOTS-based assessment instruments. Studies conducted by [Ariska et al. \(2024\)](#), [Armanto et al. \(2021\)](#), [Parisu et al. \(2023\)](#), [Shamdas et al. \(2023\)](#), and [Zulrafla et al. \(2023\)](#) reported improvements in teachers' conceptual understanding and confidence following workshop-based interventions. These programs demonstrated that structured exposure to HOTS principles can positively influence teachers' initial readiness to design higher-order questions. Nevertheless, many of these initiatives were delivered as

short-term training sessions with limited opportunities for guided practice, contextual adaptation, and systematic evaluation of teacher-generated products ([Sitompul et al., 2023](#)).

Moreover, previous programs rarely positioned local environmental characteristics—such as maritime contexts—as a central design principle in assessment development. As a result, contextual integration often remained peripheral rather than structurally embedded within assessment design. Research on effective professional development emphasizes the importance of sustained learning, active participation, practice-oriented engagement, and contextual alignment to produce meaningful instructional change ([Darling-Hammond et al., 2017](#); [Desimone & Garet, 2015](#)). Without these elements, improvements in teacher competence tend to be temporary and difficult to sustain in classroom practice.

Given these challenges, a structured and participatory professional development model that integrates contextual maritime adaptation, guided practice, collaborative review, and systematic evaluation is required. Therefore, this community service program aimed to enhance teachers' competence in developing HOTS-based assessment items integrated with maritime contexts through a Participatory Action Research (PAR)-based structured training intervention at SMPN 11 Tanjungpinang. By aligning curriculum demands, higher-order cognitive theory, and local coastal characteristics, the program sought to promote sustainable and contextually relevant HOTS-based assessment practices in a maritime-based educational setting. This initiative was expected to directly support teachers at SMP Negeri 11 Tanjungpinang in improving their assessment literacy, increasing confidence in constructing C4–C6 items, and integrating maritime contexts into daily classroom evaluation practices. In the long term, the program was intended to strengthen sustainable assessment practices within the school through continued collaboration, peer review, and institutional support.

METHODS

This community service program was implemented using a participatory training model grounded in Participatory Action Research (PAR) principles, emphasizing collaborative problem identification, action, and reflection. PAR emphasizes collaborative problem identification, collective action, and reflective evaluation involving both facilitators and participants ([Stringer & Aragón, 2020](#)).

The training design was grounded in principles of effective professional development, particularly the importance of sustained learning, active participation, and alignment with teachers' instructional needs ([Darling-Hammond et al., 2017](#); [Desimone & Garet., 2015](#)). This integrated approach ensured contextual relevance, responsiveness to school needs, and gradual skill development through reflective practice ([Creswell & Creswell, 2018](#)).

The program was implemented at SMPN 11 Tanjungpinang, involving 24 teachers from various subject areas. The school coordinated participant selection to ensure representation across teaching assignments and learning needs ([Etikan et al., 2016](#)).

Formal institutional permission to conduct and publish this community service program, including the disclosure of the school's name and the use of visual documentation, was obtained from the school principal before implementation. Participants were informed that documentation from the activity might be used for academic publication purposes. As this initiative was conducted as a community service program rather than experimental human-subject research, no personal or sensitive data were collected.

The activity consisted of three sequential stages designed to support structured competence development. The three stages were designed as an interconnected cycle rather than isolated activities. Findings from the needs analysis informed the preparation of training materials and instructional instruments. The products generated during the training phase—particularly teacher-developed HOTS assessment items—became the focus of

rubric-based evaluation and structured reflection in the post-implementation stage. This design ensured coherence between problem identification, intervention design, implementation, and reflective improvement in accordance with Participatory Action Research (PAR) principles ([Stringer & Aragón, 2020](#)).

This community service program was carried out through structured participatory training stages consisting of needs identification, conceptual reinforcement, guided practice, collaborative review, and reflective evaluation.

Pre-Implementation

A preliminary needs analysis was conducted through interviews and a brief FGD to identify challenges in developing HOTS-based assessment instruments (Stringer & Aragón, 2020). Findings indicated that teachers required support in understanding cognitive levels, constructing C4–C6 items, and integrating maritime context into evaluation tools. Based on these results, training modules and evaluation instruments were designed.

Training Phase

The workshop delivered four core materials:

- 1) Conceptual foundations of HOTS and 21st-century learning,
- 2) Alignment of learning objectives with assessment indicators,
- 3) Use of maritime-based stimulus in item construction, and
- 4) Technical development of C4 (analysis), C5 (evaluation), and C6 (creation) items.

Participants practiced developing items under facilitator guidance and engaged in collaborative review to refine clarity, alignment, and contextual relevance. Workshop delivery incorporated guided practice and collaborative review to refine assessment quality (Kennedy, 2016).

Post-Implementation

Teacher-generated items were evaluated using a standardized rubric, followed by reflection to identify areas for improvement and ensure transfer of learning into classroom practice ([Taylor & Hamdy, 2013](#)). To clarify the sequence and interconnection among the implementation stages, the overall flow of the PAR-based structured training program is presented in Figure 1.

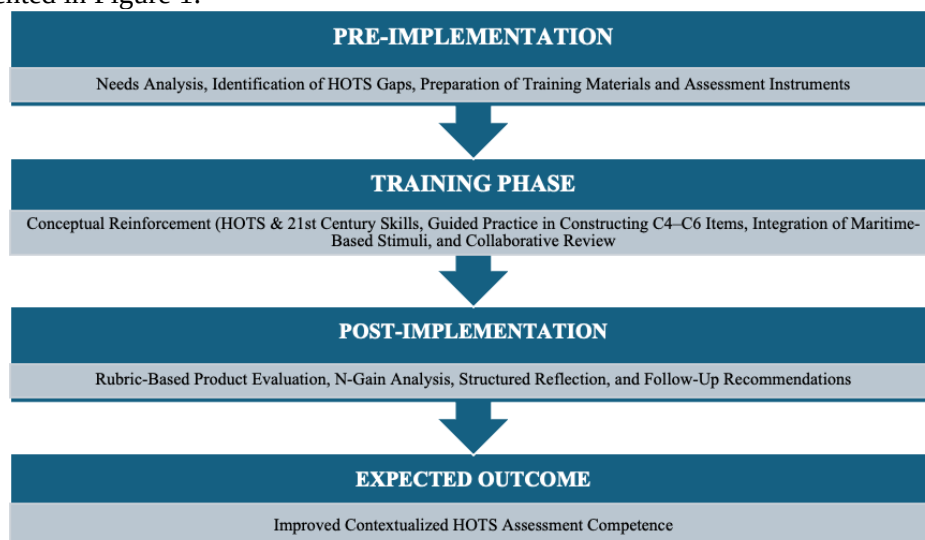


Figure 1 Structured implementation flow of the PAR-based HOTS training program

Three forms of data were collected to measure program outcomes:

Pre-test and Post-test

The development of the pre-test and post-test indicators was grounded in established theoretical and policy frameworks. Indicators related to 21st-century competencies were adapted from the OECD Learning Framework 2030 ([OECD, 2019](#)), which emphasizes critical thinking, problem-solving, and contextual reasoning. The classification of HOTS cognitive levels (C4–C6) was based on the revised Bloom’s taxonomy as articulated by Anderson and Krathwohl, and further elaborated in HOTS-oriented assessment literature ([Harahap, 2024](#); [Zohar & Barzilai, 2015](#)). Additionally, the emphasis on contextualized maritime-based assessment aligns with principles of authentic assessment that integrate learning objectives, stimulus materials, and real-world relevance ([Creswell & Creswell, 2018](#); [Sugiyono, 2019](#)). These theoretical foundations ensured that the structured test blueprint reflected both cognitive rigor and contextual alignment.

Changes in conceptual understanding were measured before and after each module using structured test blueprints. The distribution of indicators and items for Modules 1–3 is presented in Tables 1, 2, and 3, ensuring systematic alignment with targeted competencies.

Table 1 Blueprint for pre-test and post-test items on 21st-century learning and the urgency of HOTS

No.	Indicator	Number of Items
1	Explaining the concept of 21st-century skills	1
2	Stating the reasons for the importance of HOTS-based assessment	1
3	Identifying problems that arise when HOTS is not developed	1
4	Explaining the urgency of HOTS in relation to PISA results	1
5	Describing the teacher’s role in promoting HOTS	1
Total		5

Table 1 presents the blueprint of pre-test and post-test items used to measure teachers’ conceptual understanding of 21st-century skills and the urgency of HOTS-based assessment. Each indicator represents key competencies expected to be strengthened through the training program.

Table 2 Blueprint for pre-test and post-test items on developing maritime-based HOTS questions

No.	Indicator	Number of Items
1	Explaining why HOTS items must be contextual	1
2	Describing how to construct relevant HOTS questions	1
3	Identifying expected student outcomes related to HOTS	1
4	Explaining the urgency of HOTS items based on daily activities	1
Total		4

Table 2 describes the distribution of assessment indicators used to evaluate teachers’ understanding of developing HOTS questions integrated with maritime contexts. The indicators emphasize contextual relevance and the connection between HOTS and students’ daily coastal environments.

Table 3 outlines the indicators used to assess teachers’ technical competence in constructing HOTS-based assessment items, including error identification, stimulus selection, and alignment of operational verbs with the revised Bloom’s taxonomy.

Table 3 Blueprint for pre-test and post-test items on techniques for developing HOTS questions

No	Indicator	Number of Items
1	Identifying errors in developing HOTS items	1
2	Analyzing the characteristics of effective HOTS questions	1
3	Evaluating the selection of maritime-based stimuli	1
4	Determining the sequence of steps in developing HOTS indicators	1
5	Selecting operational verbs aligned with the revised Bloom's taxonomy	1
Total		5

HOTS Item Development Task

Each participant developed three assessment items (C4–C6) using a maritime-based context. The products were evaluated using a four-indicator rubric assessing cognitive alignment, stimulus clarity, coherence with objectives, and contextual relevance. The rating scale for HOTS items consisted of 4 (Very Good), 3 (Good), 2 (Fair), and 1 (Poor).

Participant Satisfaction Questionnaire

A 16-item Likert-scale questionnaire was used to measure participant perceptions toward the training. The instrument consisted of four indicators—quality of training materials, facilitator competence, relevance of the program to teacher needs, and professional development benefits—with each indicator represented by four items, as shown in Table 4.

Table 4 Blueprint of the participant response questionnaire

No.	Indicator	Number of Items
1	Quality of training materials	4
2	Facilitator competence	4
3	Relevance of the training to teacher needs	4
4	Professional development benefits	4
Total		16

Table 4 shows the blueprint of the participant satisfaction questionnaire, detailing the main indicators and the number of items used to capture teachers' perceptions of the training program. Each statement was rated using a five-point Likert scale ranging from *Strongly Agree* to *Strongly Disagree*, which was assigned numerical values from 5 to 1 ([Sugiyono, 2019](#)). Higher scores reflect stronger agreement and more positive perceptions of the training. Interpretation of participant satisfaction response scores consists of a scale of 5 (Strongly Agree), 4 (Agree), 3 (Neutral), 2 (Disagree), and 1 (Strongly Disagree).

Data Analysis

Pre- and Post-Test Analysis

Mean scores were compared and analyzed using N-Gain to determine improvement effectiveness. Interpretation followed the classification shown in Table 5, categorizing gain as high, moderate, or low ([Hake, 1998](#)).

Table 5 Interpretation of n-gain scores

No.	N-Gain Score	Improvement Category
1	$\langle g \rangle \geq 0.7$	High
2	$0.3 \leq \langle g \rangle < 0.7$	Medium
3	$\langle g \rangle < 0.3$	Low

Table 5 presents the criteria used to interpret N-Gain scores, which indicate the effectiveness of the training in improving teachers' conceptual understanding.

HOTS Product Analysis

Scores were averaged for each cognitive level and rubric indicator, then converted into percentage values and categorized according to the predetermined rubric criteria.

Satisfaction Analysis

Total scores were converted into percentages using standard calculation procedures and categorized using the criteria in Table 6 ([Creswell & Creswell, 2018](#); [Sugiyono, 2019](#)).

Table 6 Categories of participant satisfaction responses

No.	Percentage Score	Category
1	$75\% \leq P \leq 100\%$	Very Good
2	$50\% \leq P < 75\%$	Good
3	$25\% \leq P < 50\%$	Poor
4	$0\% < P < 25\%$	Very Poor

Table 6 outlines the percentage-based categories used to classify participant satisfaction levels toward the training program.

RESULTS AND DISCUSSION

Implementation of the Training Program

The community service program titled “Optimizing 21st-Century Learning in Maritime Areas through HOTS-Based Assessment Training for Teachers of SMPN 11 Tanjungpinang” was conducted in September 2025 at SMPN 11 Tanjungpinang. The training involved 24 participating teachers and was delivered through presentations, discussions, and guided practice sessions. This phased capacity-building approach is consistent with previous community service initiatives that strengthened teachers' assessment competence through structured workshops and hands-on development activities ([Armanto et al., 2021](#); [Shamdas et al., 2023](#); [Sitompul et al., 2023](#)). Similar outcomes were also reported in recent PKM studies emphasizing HOTS-oriented training through workshop-based learning and contextualized practice, which demonstrated improvements in teachers' assessment competence across different subject areas ([Ariska et al., 2024](#); [Parisu et al., 2023](#); [Zulrafla et al., 2023](#)).

Day One introduced 21st-century learning and the urgency of HOTS, emphasized the role of 4C competencies, and addressed challenges in current assessment practices. Participants identified gaps related to the predominance of recall-level questioning, consistent with national findings during curriculum transition ([Harahap, 2024](#); [Nahdiyah et al., 2023](#); [Riyadi et al., 2023](#)). Implementation on Day One is documented in Figure 2, showing the delivery of foundational material and teacher engagement.

Day Two focused on the technical development of HOTS items using maritime-based contexts, including coastal waste, tidal changes, and local fishing activities relevant to students' daily environments. Contextual integration has been shown to strengthen reasoning in coastal learning settings ([Nusivera et al., 2023](#); [Saputra & Stiawan, 2024](#); Saragih, 2025).



Figure 2 Day 1 of the community service activity

Activities are shown in Figure 3, illustrating guided practice and peer review during item refinement.



Figure 3 Day 2 of the community service activity

The program concluded with structured reflection sessions in which teachers reported increased confidence in developing HOTS-based assessment items and greater clarity regarding cognitive levels. Participants also expressed the need for continued mentoring and classroom-based support to ensure sustained implementation, a pattern commonly observed in capacity-building initiatives that require gradual skill consolidation ([Darling-Hammond et al., 2017](#); [Kennedy, 2016](#)). Overall, the training successfully strengthened initial readiness and facilitated the transfer of newly acquired skills into a maritime-based learning context.

Improvement in Conceptual Understanding

Changes in teacher understanding are summarized in Table 7, comparing pre-test and post-test results across the three instructional modules.

Table 7 N-gain scores for all training modules based on pre-test and post-test results

No.	Module	N-Gain	Improvement Category
1	21st-Century Learning and the Urgency of HOTS	0.76	High
2	Developing Maritime-Based HOTS Items	0.49	Moderate
3	Techniques for Constructing HOTS Questions	0.44	Moderate

Table 7 summarizes the N-Gain scores for each training module, showing the level of improvement in teachers' conceptual understanding before and after the intervention. Module 1 achieved a high N-Gain (0.76), indicating substantial reinforcement of teachers' conceptual understanding of 21st-century learning and the urgency of HOTS. This stronger improvement is reasonable because conceptual clarity commonly serves as the foundation for accurate technical application, and research shows that teachers are more likely to implement assessment practices effectively when core principles are fully internalized ([Darling-Hammond et al., 2017](#); [Kennedy, 2016](#); [Zohar & Barzilai, 2015](#)). In comparison, Modules 2 (0.49) and 3 (0.44) demonstrated moderate gains, reflecting the gradual nature of skill acquisition in constructing and refining HOTS items—an outcome aligned with structured capacity-building processes that develop progressively through guided practice and repeated exposure ([Desimone & Garet, 2015](#)).

These results confirm that the PKM intervention effectively addressed the initial competency gaps identified during the needs analysis and supported meaningful shifts in assessment practice. The pattern of gradual improvement aligns with evidence showing that teacher capacity strengthens when training is contextualized, sustained, and directly connected to classroom realities ([Howells, 2018](#); [OECD, 2019](#); [Putra et al., 2024](#); [Zydzianaite et al., 2021](#)). Similar outcomes have also been reported in community service programs that integrate hands-on development and localized adaptation, demonstrating higher relevance and transferability to instructional practice ([Anoling et al., 2024](#); [Armanto et al., 2021](#); [Shamdas et al., 2023](#); [Sunarsi et al., 2024](#); [Suryadi & Jasiah, 2023](#)).

Participant Satisfaction Toward the Training

Participant perceptions are summarized in Table 8, which shows consistently positive responses across all four evaluation indicators. The overall mean score reached 93.24% (very good), with the highest rating recorded for perceived professional benefits—indicating strong relevance of the training to classroom application. These results align with evidence that professional learning is most effective when it directly supports instructional practice and responds to teachers' contextual needs ([Cirkony et al., 2024](#); [Fairman et al., 2022](#); [Ji, 2021](#)).

Table 8 Summary of participant satisfaction responses toward the training

No.	Main Indicator	Score (%)	Response Category
1	Quality of training materials	91.74	Very Good
2	Facilitator competence	93.34	Very Good
3	Relevance of the training to teacher needs	93.48	Very Good
4	Benefits of the training for teachers' professional development	94.38	Very Good
Average		93.24	Very Good

Table 8 presents a summary of participant satisfaction scores across the main evaluation indicators, reflecting teachers' perceptions of the training quality and relevance. Although the overall response was very positive, the detailed breakdown—not shown in the summary table—indicated a lower score of 87.83% specifically for time sufficiency, suggesting that participants felt the duration of the program was not yet adequate for deeper mastery and

independent application. This condition aligns with broader findings indicating that short-term professional development often necessitates an extended duration and continued mentoring to ensure meaningful transfer into instructional practice ([Conradty & Bogner, 2022](#); [Kraft et al., 2018](#); [Sims et al., 2021](#); [Smith & Gillespie, 2023](#)). Overall, the results indicate that while the training successfully strengthened initial readiness, sustained follow-up remains necessary to support consistent implementation in classroom settings.

Quality of Teacher-Developed HOTS Items

The evaluation of teacher-developed assessment products revealed notably strong outcomes across cognitive levels, as summarized in Table 9. Performance ranged from 94.6% to 96.9%, with the highest achievement at the C6 level, indicating a strengthened ability to design creative and complex tasks. These results reflect improvements typically observed when structured practice and iterative feedback are incorporated into professional learning, enabling teachers to refine higher-order item construction over time ([Kennedy, 2016](#); [Zohar & Ben-Ari, 2022](#)).

Table 9 Quality assessment results of HOTS items developed by participants

No.	Level	Mean Score	Percentage (%)	Category
1	Analysis – C4 item	15.14	94.6	Very Good
2	Evaluation – C5 item	15.21	95.1	Very Good
3	Creation – C6 item	15.50	96.9	Very Good

Table 9 shows the quality assessment results of HOTS-based assessment items developed by participants across different cognitive levels (C4–C6). A closer examination of the rubric-based evaluation presented in Table 10 shows consistently strong performance across all assessed indicators. The highest score (98%) was achieved in the alignment between learning objectives and item formulation, reflecting improved coherence supported by guided task structuring ([Sims et al., 2021](#)). Meanwhile, the lowest score (93%) appeared in contextual relevance, suggesting that deeper integration of maritime contexts is still needed to strengthen analytical authenticity rather than surface-level adaptation, an outcome aligned with evidence that meaningful contextualization develops progressively through sustained instructional refinement ([Kraft et al., 2018](#)).

Table 10 Quality assessment results of participants' HOTS items by evaluation indicator

No.	Assessment Indicator	Mean Score	Percentage (%)	Category
1	Alignment with cognitive level (C4–C6)	3.90	97.5	Very Good
2	Clarity of stimulus and HOTS prompt	3.80	95.0	Very Good
3	Coherence among items, indicators, and learning goals	3.92	98.0	Very Good
4	Integration of local (maritime) context	3.72	93.0	Very Good

Table 10 presents the results of a rubric-based evaluation of HOTS items according to specific assessment indicators, highlighting strengths and areas for further improvement.

Implications for Professional Development and Maritime-Based Education

The findings of this community service program generate several important implications for teacher professional development and contextualized assessment practices. First, from a professional learning perspective, the results confirm that structured and participatory training models are more effective than one-time conceptual workshops. The measurable improvement reflected in N-Gain scores and rubric-based product quality indicates that

combining needs analysis, guided practice, collaborative review, and reflective evaluation strengthens teachers' assessment competence in a systematic manner. This finding aligns with research emphasizing that effective professional development should be sustained, practice-oriented, collaborative, and directly connected to teachers' instructional contexts ([Darling-Hammond et al., 2017](#); [Desimone & Garet, 2015](#); [Kennedy, 2016](#)). It also reinforces prior PKM findings that structured mentoring enhances teachers' ability to construct HOTS-oriented assessment instruments ([Ariska et al., 2024](#); [Parisu et al., 2023](#); [Zulraflī et al., 2023](#)).

Second, the integration of maritime-based contexts into HOTS assessment design demonstrates that contextualization enhances instructional relevance without reducing cognitive rigor. Contextualized assessment allows students to connect abstract concepts with real-life situations, thereby promoting deeper reasoning and problem-solving ([OECD, 2019](#); [Shanta & Wells, 2022](#)). Although the overall product quality was categorized as very good, the slightly lower score in contextual integration suggests that authentic contextualization requires iterative refinement and sustained instructional practice. This observation supports theoretical arguments that meaningful contextual learning develops progressively through repeated design, feedback, and reflection ([Sims et al., 2021](#); [Zohar & Ben-Ari, 2022](#)).

Third, in maritime-based educational settings, aligning national curriculum demands with local environmental characteristics is essential for meaningful learning implementation. The Merdeka Curriculum encourages flexibility and contextual adaptation ([Nahdiyah et al., 2023](#); [Saputra & Stiawan, 2024](#)), yet such flexibility requires adequate teacher competence in designing assessment instruments that reflect higher-order thinking demands ([Harahap, 2024](#); [Jannah et al., 2024](#)). The present findings suggest that coastal phenomena—such as fisheries activities, tidal systems, and marine environmental issues—can function as authentic stimuli for developing C4–C6 assessment items, thereby strengthening the connection between curriculum policy and local educational realities.

Finally, the results indicate that short-term structured interventions can significantly improve initial readiness and technical competence; however, sustainable implementation requires continued mentoring and institutional support. Previous research has shown that professional development without follow-up reinforcement often leads to limited long-term classroom transfer ([Conradty & Bogner, 2022](#); [Kraft et al., 2018](#); [Sims et al., 2021](#)). Therefore, embedding periodic coaching, peer review mechanisms, and institutional monitoring into professional development programs may strengthen the sustainability of HOTS-based assessment practices in maritime-based schools.

CONCLUSION

This community service program successfully enhanced teachers' competence in developing HOTS-based assessment items within a maritime learning context at SMPN 11 Tanjungpinang. Improvements were evident not only in conceptual understanding, as reflected in the high N-Gain score for the introductory module, but also in the production of high-quality assessment items across C4–C6 cognitive levels. The consistently positive satisfaction responses further demonstrated that the training model was relevant, well-received, and aligned with the instructional needs identified during the preliminary analysis. Despite these achievements, the detailed evaluation indicated that limited time remained a constraint, particularly in enabling deeper contextual integration and independent application. These findings highlight the need for extended mentoring, classroom-based coaching, and periodic review of teacher-generated items to ensure sustained implementation and continuous refinement. Strengthening long-term support will be essential for embedding HOTS-oriented assessment practices in maritime-based schools.

and maximizing their contribution to the curriculum goals and 21st-century learning demands. The structured integration of contextual maritime elements and HOTS-based assessment training provides a replicable model for other coastal and island schools facing similar instructional challenges.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS STATEMENT

Conceptualization, DS; methodology, DS and AF; formal analysis, DS and YP; investigation and data curation, YP and MP; validation, DS and AF; writing—original draft preparation, DS; writing—review and editing, AF and YP; visualization, MP; project administration, DS and YP; supervision, DS; MY. contributed to supporting field implementation. All authors have read and approved the final manuscript.

AI DISCLOSURE STATEMENT

The authors used generative AI (ChatGPT) and language editing software (Grammarly) to refine language, paraphrase, and improve clarity. All conceptualization, data collection, analysis, interpretation, and final academic decisions were conducted independently by the authors. The authors take full responsibility for the content of this manuscript.

ACKNOWLEDGMENTS

The authors express sincere gratitude to the Faculty of Teacher Training and Education, Universitas Maritim Raja Ali Haji (FKIP UMRAH), for providing facilitation and funding support for the implementation of this community service program.

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