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Strengthening Junior High School Teachers' Competence in Responsive Digital Assessment Using AABAI

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ABSTRACT

Digital transformation encourages teachers to develop assessment methods that are not only efficient but also capable of generating data-driven diagnostic feedback. This community service program aimed to enhance junior high school teachers' knowledge and skills in designing and implementing Automatic Assessment Based Artificial Intelligence (AABAI) in Bengkulu City. The program employed a Community-Based Participatory Research (CBPR) approach involving 25 teachers from 25 public junior high schools. Activities included needs assessment, AABAI dissemination, instrument development workshops, hands-on practice, implementation support, and monitoring and evaluation. Data were collected through pretest and posttest assessments, skill observations, product quality rubrics, questionnaires, interviews, and system usage documentation. The results demonstrated a substantial improvement in teachers' knowledge, with mean scores increasing from 50.0 ± 8.2 (pretest) to 90.0 ± 6.1 (posttest), representing a 40.0-point increase and a high normalized gain (N-gain = 0.80). The improvement was statistically significant ($Z = -4.72$, $p < 0.001$), with a large effect size ($r = 0.86$). All 25 participants (100%) successfully developed and pilot-tested AABAI-based assessment instruments, achieving an overall product quality score of 87.9% (very good category). These findings indicate that participatory, practice-based mentoring effectively strengthened teachers' knowledge and practical competencies in AI-assisted assessment.

INTRODUCTION

Assessment is an integral part of learning because the information it yields can be used to map achievements, identify learning difficulties, and determine appropriate instructional follow-up. Formative assessment becomes meaningful when the results do not merely remain as scores but are translated into feedback that helps learners understand their learning progress and assists teachers in adjusting their instructional strategies (Nicol & MacFarlane-Dick, 2006). Using evidence of learning formatively can strengthen the learning process (Black & Wiliam, 1998). Whereas Hattie & Timperley (2007) indicates that the quality of feedback is significantly influenced by the clarity of goals, information regarding progress, and guidance on follow-up actions.

In school practice, that diagnostic function does not always operate optimally. Manually grading answers is time-consuming, especially when a teacher handles multiple classes with a large number of students (Morris et al., 2024). Time constraints can result in feedback being provided late or consisting solely of a final grade (Webb & Galamba, 2026). At the same time, the demands of differentiated instruction require teachers to interpret error patterns, recognize varying levels of understanding, and use assessment results as a basis for decision-making (Varier & Yun, 2023; Alonzo et al., 2024). This situation demonstrates that the issue of assessment is not merely a matter of digital tools, but also requires strengthening teachers' competence in transforming student response data into pedagogical information (Banitalebi et al., 2025; Nguyen & Habók, 2024).

The development of artificial intelligence opens up opportunities to automate parts of the processes involved in response processing, answer classification, and the presentation of learning analytics. A systematic review indicates that AI has been used to support automated assessment, performance prediction, personalized learning, and the provision of feedback (Zawacki-Richter et al., 2019; Almasri, 2024; Mustafa et al., 2024). However, the benefits of technology do not materialize automatically. Systems must be designed to align with learning objectives, be explainable to users, and protect learner data, while ensuring that teachers remain the final decision-makers. This underscores the importance of a human-centric approach, transparency, privacy protection, and capacity building for educators in the use of generative AI and other AI systems (UNESCO, 2023).

Teacher readiness is a crucial factor in the implementation of AI in schools. Studies in primary and secondary education indicate that AI integration requires pedagogical competence, data literacy, the ability to evaluate system outputs, and an understanding of ethical risks (Yim & Su, 2025). In the Indonesian context, AI training activities for teachers have demonstrated that a hands-on approach can enhance understanding and encourage the use of technology to support professional work, although long-term sustainability still requires ongoing guidance and learning communities (Mandailina et al., 2024; Walter, 2024). Thus, the community service program needs to go beyond one-way dissemination and provide space for teachers to design, test, reflect on, and refine their own assessment products (Chiu et al., 2025).

Automatic Assessment Based Artificial Intelligence (AABAI) is a digital assessment innovation developed through research by the project team. This product is designed to accommodate various forms of responses, such as essay answers, graph analyses, video and audio responses, and file uploads. The strength of the AABAI approach lies in its integration of technological convenience with the diagnostic function of assessment, rather than merely accelerating the scoring process. This approach aligns with the evolution of AI-based assessment systems, which not only automate the grading process but also generate diagnostic feedback to help teachers identify students' learning needs and support instructional decision-making (Gao et al., 2024; Vittorini et al., 2021). Thus, the use of AI in assessment is considered more valuable when it provides meaningful information for the learning process, rather than merely generating scores automatically (Martin et al., 2025).

A situational analysis conducted in collaboration with the Bengkulu City Education Office identified three primary needs through preliminary observations, interviews, and focus group discussions (FGDs) concerning teachers' assessment practices, digital literacy, and infrastructure constraints. The initial findings indicated that assessment practices among some junior high school teachers remained largely conventional, involving manual test preparation, item-by-item grading, and time-consuming score processing and tabulation. In addition, some teachers had limited experience using automated assessment applications to facilitate scoring and analyze student learning outcomes. These findings highlighted three priorities: (1) strengthening teachers' understanding of responsive assessment and the responsible use of AI; (2) developing their technical skills in designing assessment instruments, managing student responses, and interpreting analytical results; and (3) providing implementation guidance to ensure that assessment products are aligned with subject-specific learning objectives, student characteristics, and school infrastructure conditions. Based on these identified needs, the

community service program adopted a Community-Based Participatory Research (CBPR) approach, positioning teachers and the Bengkulu City Education Office as active partners in needs identification, program implementation, reflection, and evaluation.
This activity aims to enhance teachers' knowledge regarding responsive digital assessment, improve skills in designing and implementing AABAI instruments, and establish a mentoring mechanism and community of practice to ensure program sustainability. The novelty of the activity lies in the integration of three components: research-based assessment products, a practice-based competency development process, and an impact evaluation covering knowledge, skills, product quality, and user experience. This article describes the implementation process, program achievements, supporting and inhibiting factors, and the implications of using AABAI for the transformation of assessment practices in junior high schools in Bengkulu City.

METHOD

Activity Design and Partners

The community service program employed a Community-Based Participatory Research (CBPR) approach, which emphasizes equitable partnerships in problem identification, action planning, implementation, reflection, and the use of research findings (Israel et al., 1998; Israel et al., 2026). CBPR was selected because strengthening assessment practices requires more than technology transfer; it also requires teachers to participate actively as instrument designers, system users, and contributors to product refinement. Teachers and the Bengkulu City Education Office were involved as partners in identifying assessment needs, planning training activities, implementing AABAI, and reflecting on the feasibility of the resulting assessment instruments. One example of participatory refinement emerged during the practical sessions, when facilitator observations identified difficulties in developing sufficiently detailed assessment rubrics. In some cases, answer keywords lacked sufficient detail to accommodate variations in students' responses, resulting in low automated scores. In response, participants revised their rubrics by specifying assessment criteria more clearly and incorporating a wider range of possible answers. This adjustment illustrates how practice-based reflection informed the refinement of AABAI instruments and reinforced the role of teachers' professional judgment in the responsible use of automated assessment. The process also provided a basis for continued collaboration between the university, teachers, and the Bengkulu City Education Office in improving the implementation of responsive digital assessment.
The institutional partner is the Bengkulu City Education Office. The participants in this community service activity consisted of 25 teachers representing public junior high schools in Bengkulu City. Participants were selected purposively based on partner recommendations, taking into account school representation, willingness to participate in the entire program, access to digital devices, and commitment to implementing the resulting products. The activity was conducted in Bengkulu City from April to September 2026. The mentoring phase involved face-to-face meetings, online communication, and observation of implementation, tailored to the participants' needs.

Implementation Stages

The program was implemented through five sequential but interconnected stages. Each stage had a specific purpose and output, while feedback from participants and observations during training and mentoring informed adjustments to subsequent activities and the refinement of assessment products. The stages comprised (1) needs identification, (2) AABAI dissemination, (3) training and workshops, (4) implementation support, and (5) monitoring and evaluation. Although reflection and feedback were integrated into the implementation process, the program was not conducted as a repeated cycle in which all five stages were systematically restarted.

Table 1. Stages and outputs of program implementation

No	Stages	Main activities	Stage output
1	Identification of needs	Preliminary observations, interviews, and focus group discussions regarding assessment practices, digital literacy, and infrastructure constraints.	Map of support needs and priorities.
2	AABAI Dissemination	Introduction to the concept of responsive assessment, AABAI features, AI usage ethics, data privacy, and the teacher's role as a decision-maker.	Initial understanding and agreement in principle regarding usage.
3	Training and workshops	Development of indicators, creation of items, configuration of response types, simulation of scoring, and interpretation of analytical results.	Draft AABAI instrument for each participant or group.
4	Implementation support	Instrument pilot testing, product revision, classroom implementation, and reflection on user experience.	Final products and implementation documentation.
5	Monitoring and evaluation	Measurement of knowledge changes, skills observation, product assessment, response questionnaires, interviews, and formulation of follow-up actions.	Performance data, recommendations for improvement, and sustainability plans.

Data Collection Instruments and Techniques

The program evaluation employed both formative and summative approaches. Formative evaluation was conducted during training and mentoring to identify participants' difficulties, adjust facilitation, and provide immediate feedback. Summative evaluation was conducted at the end of the program to assess changes in knowledge, practical skills, product quality, and participant experience. Knowledge was measured using pretest and posttest scores on a 0–100 scale, with changes analyzed using mean score differences and normalized gain (N-gain). Practical skills were assessed using an

observation sheet, while the quality of the developed AABAI instruments was evaluated using a rubric covering alignment with learning objectives, stimulus and item quality, clarity of assessment criteria, response-format variety, feedback and analytics, and classroom feasibility. Product quality scores were converted into percentages of achievement and interpreted according to the applicable assessment categories. Participant experience was measured using a five-point Likert questionnaire, with higher scores indicating more favorable perceptions of relevance, usability, usefulness, confidence, and mentoring support. Product assessments were conducted by [specify the actual assessor(s), e.g., the program facilitators or designated expert reviewers] using the same rubric for all submitted instruments. The evaluation instruments and their indicators are summarized in Table 2.

Table 2. Program evaluation instrument

Aspect	Instrument	Main Indicator	Time
Knowledge	Pre-test and post-test	Responsive assessment concepts, AI functions, analytical interpretation, ethics and privacy.	Before and after the training
Skills	Practice observation sheet	The ability to create classes, formulate indicators, input items, set up rubrics, and interpret results.	During the workshop and mentoring sessions
Product quality	Instrument assessment rubric	Alignment of objectives, quality of items, clarity of rubrics, variety of responses, quality of feedback, and feasibility of implementation.	After the product is finished
Participant experience	Likert scale questionnaire and open-ended questions	Ease, usefulness, relevance, self-confidence, intention to use, and need for support.	Conclusion of the activity
Implementation	System documentation, interviews, and reflection	Actual usage, constraints, changes in practice, and follow-up on learning.	Mentoring phase

Data Analysis Techniques

Quantitative data were analyzed descriptively using means, standard deviations, medians, ranges, frequencies, and percentages, as appropriate to the data characteristics. Changes in knowledge scores were evaluated by calculating the mean difference between pretest and posttest scores and the normalized gain (N-gain). The Shapiro–Wilk test was used to assess the normality of the paired differences and to inform the selection of the paired-samples t-test or the Wilcoxon signed-rank test. For the Wilcoxon signed-rank test, the effect size was calculated using ($r= \frac{|Z|}{\sqrt{N}}$), where (Z) represents the standardized test

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statistic and (N) denotes the number of valid paired observations included in the analysis. The sample size used in the effect-size calculation was checked against the number of valid pairs reported for each analysis. For paired-samples t-tests, effect size was quantified using Cohen's (d), with the specific paired-sample formulation stated where applicable. Product quality and skill levels were summarized as percentages of achievement and classified according to the predefined assessment categories.
Qualitative data from interviews, open-ended responses, and reflective notes were analyzed thematically through a process of reading the data, coding, grouping codes, formulating themes, and verifying their alignment with the data. Triangulation was conducted by comparing results from tests, observations, products, questionnaires, and interviews. The interpretation of the program's success was based not only on score improvements but also on the participants' ability to produce viable products and utilize them within a learning context

IMPLEMENTATION TECHNOLOGY

AABAI serves as a digital assessment platform that enables teachers to develop assessment instruments using text, graphics, audio, video, and file-based responses. In practical use, teachers first define learning indicators, assessment questions, answer keys or scoring rubrics, and feedback criteria. AI is then used to assist in processing student responses, assigning scores according to the configured assessment criteria, categorizing response patterns, and presenting assessment results and feedback. For example, when students submit written answers, the system generates preliminary scores and feedback based on the assessment settings established by the teacher. Teachers review the results by checking the scores and feedback against the answer keys or rubrics, examining potentially inaccurate or inappropriate outputs, and revising the assessment criteria when necessary before using the results to inform instructional decisions. Regarding student data protection, teachers are expected to minimize the use of identifiable student information, restrict access to assessment records to authorized users, and handle student responses and results in accordance with applicable school policies and data protection requirements. Thus, AABAI supports the efficiency of assessment processing, while teachers retain responsibility for verifying the accuracy of scores and feedback, interpreting students' learning needs, and determining appropriate follow-up actions.

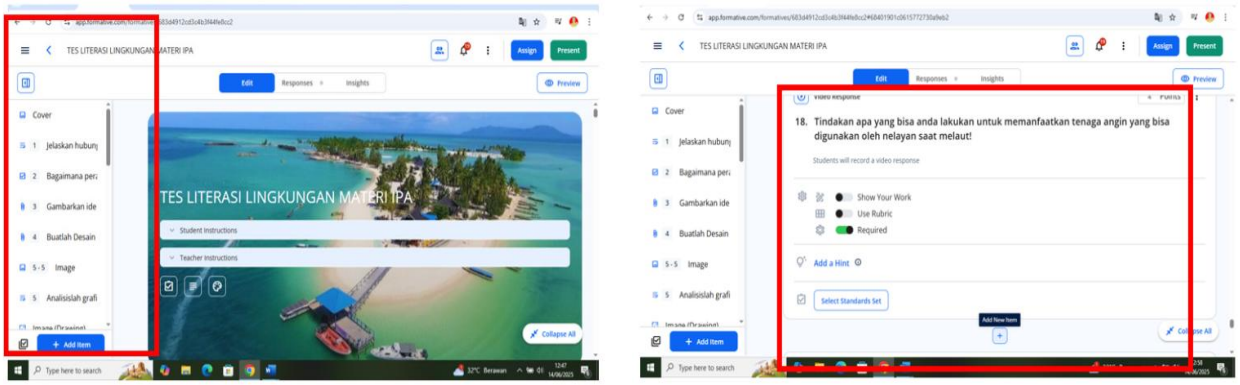


Figure 1. Example of the interface and response variations in AABAI

The training material is divided into four sections. The first section covers the principles of formative, diagnostic, and responsive assessment. The second section addresses the design of indicators and rubrics. The third section focuses on the technical use of the platform, including class management and analytics. The fourth section discusses the ethics of AI usage, output verification, student identity protection, and data usage limits. Each section is followed by exercises and feedback to ensure participants understand not only the features but also the pedagogical rationale behind their use.

RESULT AND DISCUSSION

Implementation and Participation Profile

The main activity involved 25 teachers from 25 public junior high schools in Bengkulu City. Attendance reached 100 percent of the designated number of participants. The participants represented various subject areas including Natural Sciences, Mathematics, Indonesian, English, and Informatics and possessed teaching experience ranging from 3 to 20 years.

The program was conducted in Bengkulu City from April to September 2026 through seven sessions totaling 32 lesson hours. The sessions followed a sequential implementation structure, progressing from needs identification and initial orientation to practical training, assessment-instrument development, implementation support, and evaluation. The activities comprised needs assessment and identification of teachers' priorities (Session 1); introduction to responsive assessment and AABAI features (Session 2); training in developing learning indicators, assessment items, and scoring rubrics (Session 3); guided practice in configuring instruments and processing student responses (Session 4); assessment-product development and review (Session 5); implementation support, product refinement, and participant reflection (Session 6); and presentation of results, evaluation, and follow-up planning (Session 7). Across these sessions, participants engaged in conceptual discussions, guided practice, product development, presentations, and reflection. All 25 participating teachers completed the mentoring phase and finalized their assessment instruments. Feedback collected during practical activities informed adjustments to the assessment products, particularly the refinement of scoring rubrics and assessment criteria.

Table 3. Achievement of program implementation

Implementation indicators	Target	Realization	Information
Registered participants	25 teachers	25	All participants are taking part in the program.
Participants attended the training	>= 90%	100%	Full attendance

Implementation indicators	Target	Realization	Information
Participants complete the product.	>= 80%	100%	25 instruments completed and deemed suitable
Instruments undergoing simulation or pilot testing	Reported based on implementation records	To be verified	Evidence from instrument testing or system logs
Instruments used in actual classroom learning	Reported based on implementation records	To be verified	Evidence from classroom implementation records
The school is represented	State Junior High Schools in Bengkulu City	25 schools	Representation requirements have been met

Initial Conditions and Teacher Needs

A needs assessment reveals that some junior high school teachers in Bengkulu City still face limitations in utilizing digital technology to support the learning assessment process. Assessments tend to rely on conventional methods such as manual test creation, item by item answer grading, and time-consuming score processing and tabulation. Furthermore, some teachers lack sufficient experience with automated assessment applications capable of streamlining the creation, grading, scoring, and analysis of assessment results. Consequently, the use of technology in assessment remains suboptimal, and teachers expend considerable time and effort to obtain information on student learning outcomes. Therefore, practical, hands-on training is required to enhance teachers' competence in using automated assessment applications, thereby making the assessment process more effective, efficient, and objective, while providing more meaningful insights into student capabilities.

Increased Knowledge about AABAI

To evaluate the effectiveness of the community service program in improving teachers' knowledge of AABAI, pretest and posttest scores were compared. The analysis examined changes in overall knowledge and in three specific areas: responsive assessment concepts, the use and interpretation of AABAI, and ethics, verification, and data privacy. The results, including mean scores, score differences, normalized gain (N-gain), statistical significance, and effect sizes, are presented in Table 4.

Table 4. Changes in participants' knowledge before and after the activity

Variable	n	Pretest	Posttest	Difference	N-gain	Difference test	Effect size
Pengetahuan	25	50,0 ± 8,2	90,0 ± 6,1	40,0	0,80	Z=-4,72; p<0,001	r=0,94
Responsive assessment concept	25	52,3	91,7	39,4	0,83	Z=-4,61; p<0,001	r=0,84
Use and interpretation of AABAI	25	45,7	88,7	43,0	0,79	Z=-4,55; p<0,001	r=0,83
Ethics, verification, and privacy	25	56,0	89,7	33,7	0,77	Z=-4,32; p<0,001	r=0,79

Knowledge scores increased from 50.0 to 90.0, with the N-gain value falling into the high category. The results showed Z = -4.72 ($p < 0.001$) and an effect size of r = 0.94, indicating a significant effect. The Wilcoxon signed-rank test indicated a statistically significant difference between pretest and posttest scores ($Z = -4.72$, $p < 0.001$), with an effect size reported as r = 0.86. These findings show an improvement in participants' knowledge after the program, although the one-group pretest–posttest design does not establish that the program alone caused it. The observed increase may reflect the combined impact of conceptual explanations, demonstrations, hands-on practice, and case discussions. This interpretation is consistent with research suggesting that AI training for educators should extend beyond introducing technological features to include evaluating AI outputs and aligning their use with learning objectives (Yim & Su, 2025). It also highlights the importance of developing teachers' AI literacy in understanding system functions, assessing limitations, verifying outputs, and making informed professional decisions, rather than focusing solely on operating applications (UNESCO, 2023; Yim & Su, 2025).

Enhancement of AABAI's Skills and Product Quality

Participants' skills were assessed during the practical activity and through the final product. The assessment evaluated not only the functionality of the instrument but also the appropriateness of the objectives, the quality of the stimulus, the clarity of instructions, the quality of the rubric, the variety of response formats, and the feedback design. The results of the product assessment are presented in Table 5.

Table 5. Quality of AABAI products developed by participants

Product components	Maximum score	Average achievement	Percentage	Category
Alignment of indicators and learning objectives	100	88,5	88,5%	Very good

Product components	Maximum score	Average achievement	Percentage	Category
Quality of stimulus and item	100	86,7	86,7%	Very good
Clarity of the rubric or assessment criteria	100	84,8	84,8%	Good
Variations in response forms and multimedia	100	90,2	90,2%	Very good
Quality of feedback and analytics	100	87,9	87,9%	Very good
Feasibility of classroom implementation	100	89,4	89,4%	Very good
Overall achievement	100	87,9	87,9%	Very good

All 25 participants (100%) successfully developed assessment instruments that met the program's product-completion criteria. The instruments incorporated different response formats, including multiple-choice and open-ended questions, as well as audio, video, graphical, and file-based responses. Although the participating teachers represented Natural Sciences, Mathematics, Indonesian, English, and Informatics, the subject distribution of the 25 completed instruments should be reported based on the submitted products rather than inferred from the participants' teaching assignments. For example, a Natural Sciences instrument could assess students' understanding of a scientific phenomenon through an open-ended response, while an Informatics instrument could require students to interpret graphical information or submit a digital file, provided that these examples reflect the actual products developed during the program.

Product quality was assessed using a rubric covering alignment with learning objectives, stimulus and item quality, clarity of assessment criteria, diversity of response formats, feedback and analytics, and classroom feasibility. The overall mean achievement was 87.9%, categorized as "very good" in the program's reported results. The final manuscript should specify the numerical cutoffs used for the "good" and "very good" categories and identify the personnel who assessed the products. Facilitator observations also identified rubric development as a practical challenge. In some instruments, answer keywords were insufficiently detailed to accommodate variations in students' responses, which could result in unexpectedly low automated scores. Teachers therefore revised the rubrics by clarifying scoring criteria and including a broader range of acceptable responses. This experience illustrates the importance of reviewing AI-generated scores against explicit assessment criteria and refining rubrics before using automated results to inform instructional decisions.

The quality of rubrics and feedback is crucial to the effective use of AABAI. Automated assessment that lacks clear criteria may yield rapid results but offer little meaningful insight. Conversely, well-defined indicators and validated rubrics help teachers verify result consistency and provide a clear rationale for the feedback given. This aligns with

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the view that AI should augment, rather than replace, the professional judgment of educators (Luckin et al., 2016; UNESCO, 2023). The following is documentation of the community service activities:



Figure 2. Training and Mentoring Program for Teachers on the Development of AABAI-Based Responsive Digital Assessment Instruments

Participant Feedback and Implementation Experience

Participant responses were analyzed to assess acceptance, usefulness, ease of use, and the need for support. A summary of the responses is presented in Table 6.

Table 6. Participants' responses to the activities and the use of AABAI

Response aspect	Average score	Percentage	Category	Summary of qualitative findings
Relevance to the teacher's duties	4,43	88,6%	Very good	Assists in preparing data-based evaluations.
Ease of use	4,27	85,4%	Very good	The interface is easy to understand after some practice.
The utility of analytics and feedback	4,53	90,6%	Very good	Helps identify patterns in students' errors.
Confidence to reuse	4,30	86,0%	Very good	Teachers are ready to develop independent instruments.
Satisfaction with the assistance provided	4,60	92,0%	Very good	Consistent support is considered helpful.

Overall, participant feedback was categorized as “Very good,” consistent with the classification reported for all items in Table 6. The percentages were calculated by

converting the mean scores obtained from the five-point Likert scale into percentages of the maximum possible score. The findings indicate that participants perceived AABAI as beneficial, particularly in facilitating the provision of data-driven feedback. However, participants also highlighted the need for follow-up guidance to support them in analyzing and interpreting student learning outcomes using the tool.

CONCLUSION

A community service program using AABAI was conducted for 25 teachers representing public junior high schools in Bengkulu City, Indonesia, employing a Community-Based Participatory Research (CBPR) approach that encompassed needs assessment, outreach, workshops, mentoring, and evaluation. Participants demonstrated improved competence in operating the platform, formulating assessment indicators, designing response formats, developing scoring rubrics, interpreting analytics, verifying outputs, and protecting student data. Practice-based mentoring and collaborative reflection helped teachers align the use of AABAI with their pedagogical needs. To sustain these outcomes, the program proposes establishing a community of practice supported by the Education Office and participating schools, with regular knowledge-sharing activities, follow-up mentoring, user-friendly guidelines, and ongoing support responsive to teachers' needs. These strategies are expected to facilitate continued collaboration and the integration of AABAI into classroom assessment practices.

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