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Development of a Local Wisdom–Integrated IPAS Learning Model with Criterion-Referenced Assessment in a 3T Elementary School in Bima Regency

Muhammad Yamin^{1*}, Muhammad Salahuddin² Lutfin Haryanto³

^{1,2,3}STKIP Harapan Bima, Nusa Tenggara Barat, Indonesia

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ABSTRACT

This study aimed to develop, validate, and evaluate the practicality and preliminary effectiveness of a local wisdom–integrated Natural and Social Sciences (IPAS) learning model incorporating criterion-referenced assessment (CRA) at SD Negeri Sori Katupa, an elementary school located in a disadvantaged, frontier, and outermost (3T; Indonesian: *tertinggal, terdepan, terluar*) area of Bima Regency. The study responded to two field problems: the limited use of local cultural resources in learning and the dominance of written tests that did not adequately measure students' competencies in context. Using a Research and Development (R&D) approach with the ADDIE model, the researchers collected data through observation, interviews, documentation, expert validation, teacher and student response questionnaires, and a learning-outcome test administered as a one-group pretest–posttest during the field trial. Participants included 5 expert validators, 3 teachers, and 25 Grade V students, along with the principal and community/traditional leaders selected through purposive sampling. Data were analysed using Aiken's V content-validity index, practicality percentages, normalized gain (N-gain), a paired-samples t-test with effect size, and criterion-mastery thresholds. The resulting model—the Local Wisdom Integration Model Based on Criterion-Referenced Assessment (IKL–PAP)—integrates Bima local wisdom (*Ngaha Aina Ngoho, Maja Labo Dahu, karawi kaboju, and mbolo weki*) into learning objectives, activities, materials, and CRA instruments through six components. Expert validation, practicality testing, and a single-school Grade V field trial indicated that the model was valid (mean Aiken's V = 0.86) and practical (mean positive response = 89%), and demonstrated promising effectiveness during the field trial (N-gain = 0.61, moderate category; $t(24) = 14.95$, $p < .001$, Cohen's $d = 2.99$), with at least 84% of students attaining the competency indicators across the knowledge, skills, and attitude domains. Because the trial used no comparison group, interpret effectiveness claims as preliminary. The model offers an instructional and assessment innovation for 3T elementary schools and supports a more contextual, meaningful, and competency-based implementation of the Merdeka Curriculum.

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Corresponding Author:

Muhammad Yamin

STKIP Harapan Bima, Nusa Tenggara Barat, Indonesia

Email: yaminsila@gmail.com

1. INTRODUCTION

Education is a strategic instrument for developing competent human resources with good character who can adapt to social, cultural, scientific, and technological change [1]. Under the Merdeka Curriculum, learning is no longer oriented solely toward mastery of subject matter but toward attaining student competencies through contextual, meaningful, and student-centered experiences [2], [3]. This learning aims to cultivate the Pancasila Student Profile by developing critical, creative, and collaborative thinking, along with care for the social and cultural environment [1].

Natural and Social Sciences (Ilmu Pengetahuan Alam dan Sosial, IPAS) is a subject with a strongly contextual character. It integrates natural- and social-science concepts so that students can understand, in an interconnected way, the relationships among humans, the environment, culture, and technological development [2], [4]. Consequently, IPAS learning requires resources drawn from students' immediate surroundings, so that concepts are not abstract but are grasped through real experience. Contextual approaches such as Contextual Teaching and Learning (CTL) and constructivist learning have long argued that knowledge becomes meaningful when learners construct it through direct interaction with authentic contexts [5], [6].

This study is anchored primarily in social constructivism [6], which holds that knowledge is constructed through interaction with the real environment and mediated by the learner's socio-cultural context. As a complementary operational lens, we adopt place-based education [7], which treats the local environment and community as the primary "text" for learning. This study invokes Contextual Teaching and Learning (Johnson, 2002) and culturally responsive/relevant pedagogy [8], [9] not as separate competing frameworks but as pedagogical expressions of these two anchors, and refers to them only where directly relevant to the design of the IKL-PAP model.

Within this framework, local wisdom serves as a strategic learning resource. Local wisdom refers to the knowledge, values, norms, and life practices that communities develop across generations through adaptation to their natural and social environments [1], [10]. A growing body of research shows that integrating local wisdom into learning can strengthen motivation, conceptual understanding, character, scientific literacy, and environmental awareness [4], [11], [12]. Culture-based learning also helps preserve cultural identity while increasing the relevance of instruction to students' lives [13], [14], a stance consistent with culturally responsive and culturally relevant pedagogy [8], [9] and with place-based education, which treats the local environment as the primary text for learning [7].

Bima Regency possesses rich local wisdom that can serve as a resource for IPAS. Values such as *Maja Labo Dahu* (a sense of shame and restraint before moral-religious norms), *Ngaha Aina Ngoho* (a prohibition against destroying nature), *karawi kaboju* (mutual cooperation), and *mbolo weki* (deliberation), together with environmental-conservation practices, traditional agriculture, and coastal livelihoods, are forms of local knowledge closely aligned with IPAS learning outcomes [4], [15], [16]. The *Ngaha Aina Ngoho* ethic in particular has been documented as a resource for ecological awareness and environmental preservation in the Bima community [17], [18].

A conceptual tension motivates the present study. Local wisdom, once embedded in learning, generates competencies that are contextual and performative—applying an ecological ethic in the community, cooperating, deliberating—that outcome-oriented written tests, and norm-referenced comparison in particular, cannot capture. Criterion-referenced assessment (CRA) is the natural evaluative counterpart to culture-based learning precisely because it judges each student against explicit, pre-specified competency indicators rather than against classmates. Integrating local wisdom into learning while retaining norm-referenced testing would therefore leave a mismatch between what is taught and what is measured. This alignment argument—that culturally contextual learning requires criterion-referenced, competency-based measurement—that justifies combining the two in a single model.

Previous studies have largely stopped short of this integration. Reviewed collectively, prior work falls into three strands [13], [19], [20], [21]: studies that develop culture-based teaching modules or media, studies that demonstrate gains in character or environmental awareness, and studies that treat assessment reform independently of cultural content. These strands confirm that local wisdom improves learning quality, but none links, within one design, the identification of local cultural potential, learning planning, instructional implementation, and the construction of criterion-referenced assessment instruments as an integral part of evaluation.

This pattern yields three distinct gaps. (a) A contextual gap: in 3T schools, abundant environmental and cultural potential remains unused while instruction relies on generic national textbooks. (b) An assessment gap: IPAS assessment in elementary schools remains dominated by outcome-oriented written tests and has not adopted CRA, so it does not measure competency attainment in skills and attitudes. (c) A model-development gap: no existing IPAS model systematically unites local wisdom with a criterion-referenced assessment system for 3T elementary schools.

A preliminary needs analysis conducted by the authors at SD Negeri Sori Katupa—reported in full in the Results—confirmed these gaps locally: national textbooks dominated, teaching modules contained no local examples, media were limited, and assessment relied on written tests.

Accordingly, this study aimed to develop, validate, and evaluate the practicality and preliminary effectiveness of a local wisdom-integrated IPAS learning model incorporating criterion-referenced assessment for elementary students in a 3T area. Specifically, it addressed three questions: (1) What is the design of a valid IKL–PAP model? (2) How practical is the model according to teachers and students? (3) What is its preliminary effectiveness for IPAS competency attainment in a Grade V field trial?

The study contributes theoretically by coupling culturally contextualized learning with competency-based CRA; practically by offering 3T teachers a structured pathway from community knowledge to assessment indicators; and methodologically by producing an integrated product (syntax, modules, and CRA instruments). Its novelty lies in this specific integration for the 3T context. We frame this as a novel integration rather than an absolute first, since our review—while systematic in scope—cannot exclude every comparable effort.

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<https://doi.org/10.58421/gehu.v5i4.1975>

2. METHOD

2.1. Research Design

This study used a Research and Development (R&D) approach to produce a local wisdom integration model for IPAS learning that measures competency attainment through criterion-referenced assessment (CRA) among elementary students in 3T areas. The study chose R&D because it sought not merely to describe a phenomenon but to develop a learning model that meets the criteria of validity, practicality, and effectiveness [22]. The effectiveness component used a one-group pretest–posttest field-trial design without a comparison group; results are therefore reported as preliminary.

2.2. Research Site and Subjects

The study was conducted at SD Negeri Sori Katupa, Bima Regency, West Nusa Tenggara—a 3T school with limited facilities but rich, relevant local wisdom. Purposive sampling selected the principal, IPAS classroom teachers, students in Grades IV–VI (with the field trial conducted specifically in Grade V), traditional and community leaders, and expert validators in IPAS learning, educational evaluation, and Bima culture, along with elementary-education practitioners. The field trial involved 25 Grade V students; expert validation involved 5 validators; and 3 teachers completed the teacher response questionnaire.

2.3. Development Procedure (ADDIE)

Analysis. A needs assessment was carried out through observation, interviews, documentation, and focus group discussions (FGD) to map field conditions, curriculum demands, student characteristics, and the potential of local wisdom as a learning resource.

Design. The team developed the model's conceptual structure by mapping IPAS Learning Outcomes and Objectives, selecting relevant local wisdom values, designing the learning syntax, and drafting CRA blueprints for the knowledge, skills, and attitude domains.

Development. The team produced culture-based teaching modules and CRA instruments and submitted them for expert validation, after which they revised the products based on validator feedback.

Implementation. The revised model was field-tested in IPAS learning in Grade V, with the teacher acting as a facilitator who guided students in connecting IPAS concepts with local cultural values.

Evaluation. Formative evaluation was conducted at each ADDIE stage, and summative evaluation was conducted after implementation; validator feedback and field-test results were used to finalize a model ready for use in 3T elementary schools.

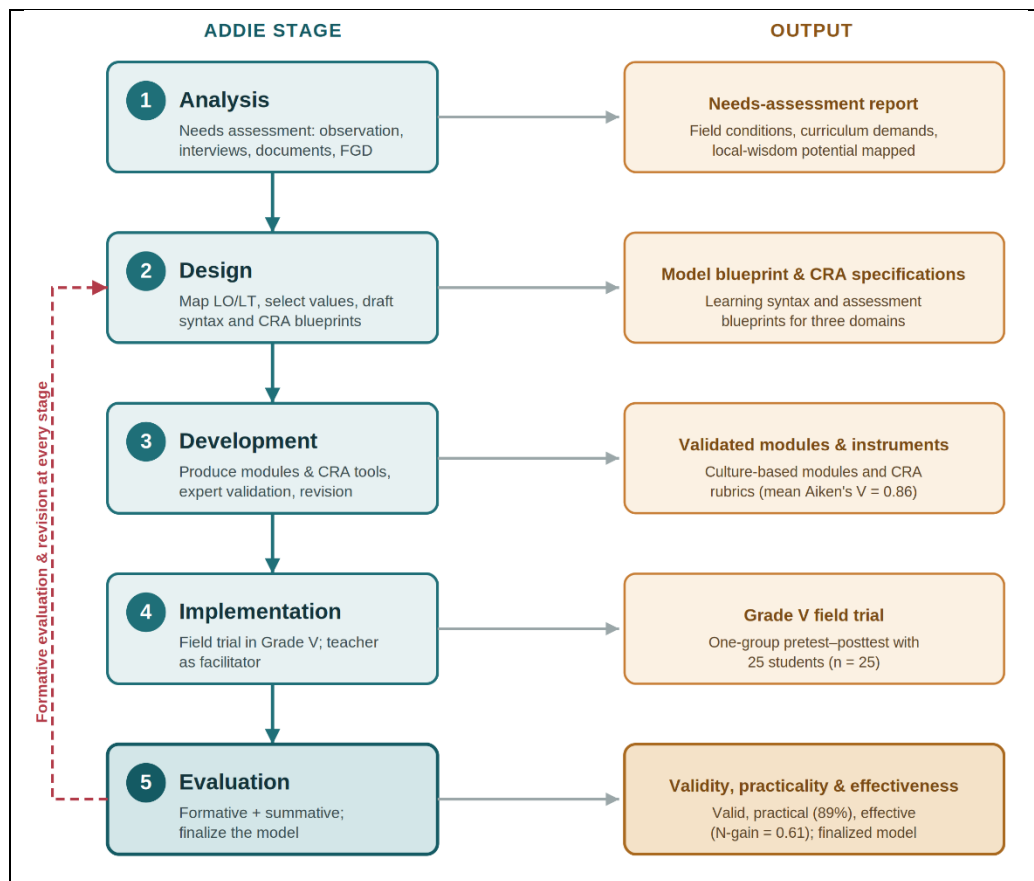


Figure 1. Development flow of the IKL-PAP model (ADDIE)

2.4. Instruments

Data were collected using seven instruments: (1) learning observation sheets; (2) interview guidelines; (3) expert validation sheets; (4) teacher response questionnaires; (5) student response questionnaires; (6) criterion-referenced assessment rubrics; and (7) a learning-outcome test administered as a matched pretest and posttest, which served as the effectiveness instrument.

2.5. Validity, Reliability, and Trustworthiness

Content validity of all instruments was established through expert judgment and quantified with Aiken's V [23], computed as $V = \sum s / [n(c - 1)]$, where $s = r - l_0$, r is each rater's category, l_0 is the lowest category, c is the number of categories, and n is the number of raters. Ratings used a 1–4 scale from 5 validators. A threshold of $V \geq 0.80$ was adopted as indicating high content validity for the given number of raters and categories.

For the observational domains (skills and attitudes), which involved more than one assessor, inter-rater agreement was examined using Cohen's κ , with $\kappa = 0.82$ indicating strong agreement. At the Analysis stage, qualitative trustworthiness was addressed through source and technique triangulation, member checking with teachers and community leaders, and an audit trail.

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2.6. Data Analysis

Qualitative data were analysed through data condensation, display, and conclusion drawing (Miles et al., 2014). Practicality was computed as the percentage of positive responses; the $\geq 80\%$ threshold follows the convention that a majority-plus margin indicating broad acceptability is required before an educational product is deemed field-ready.

Effectiveness was examined through the normalized gain, $N\text{-gain} = (\text{posttest} - \text{pretest}) / (\text{maximum} - \text{pretest})$ [24], calculated for each student individually and then averaged, and interpreted using low (< 0.30), moderate ($0.30\text{--}0.70$), and high (> 0.70) categories. Beyond the mean, standard deviation and minimum–maximum scores were reported. A paired-samples t-test was used to test pretest–posttest differences, with Cohen's d as the effect size.

Criterion attainment (CRA) was operationalized as follows: for each domain, a student was classified as having mastered the competency when their rubric score met or exceeded the pre-set cut-off of $\geq 75\%$ of the maximum rubric score. The knowledge, skills, and attitude domains were scored with separate rubrics and were equally weighted. A domain was considered achieved at the class level when $\geq 80\%$ of individual students reached mastery.

2.7. Ethical Considerations

The study involved elementary-school children and therefore observed the following procedures: institutional permission from the school principal and the local education office; written informed consent from parents/guardians; verbal assent from participating students; and guarantees of confidentiality and anonymity, with participation voluntary and withdrawable at any time.

Table 1. Feasibility criteria of the model

Aspect	Indicator
Validity	Expert validation score ≥ 0.80
Practicality	Percentage of positive responses $\geq 80\%$
Implementation	At least in the “Good” category
Effectiveness	N-gain in the moderate or high category
Criterion-Referenced Assessment (CRA)	At least 80% of students achieve the competency indicators

3. RESULTS AND DISCUSSION

The research began with a needs assessment to identify the actual conditions of Natural and Social Sciences (IPAS) learning implementation at SD Negeri Sori Katupa, an elementary school located in a disadvantaged, frontier, and outermost (3T) area of Bima Regency.

3.1. Analysis: Needs assessment

The needs assessment identified the actual conditions of IPAS learning at SD Negeri Sori Katupa through observation, in-depth interviews, document study, and FGD involving the principal, teachers, students, and community leaders. The Merdeka Curriculum had been implemented, but it had not yet fully accommodated the characteristics of students' learning

environments. Teachers still relied on national textbooks as the primary resource, while the rich natural environment and local culture were not used optimally as contextual learning resources. The teaching modules were general in nature and did not integrate Bima **local wisdom** values, such as *Ngaha Aina Ngoho*, *Maja Labo Dahu*, *karawi kabaju*, and *mbolo weki*, into learning objectives, activities, or assessment. Assessment practices were dominated by written tests oriented toward subject mastery and could not comprehensively measure competency attainment in line with the principles of CRA. These conditions indicated the need for a learning model that integrates local wisdom with a competency-based assessment system so that learning becomes more contextual, authentic, and relevant to students in 3T areas.

3.2. Design: The IKL–PAP Model

Based on the needs assessment, the study designed the Local Wisdom Integration Model Based on Criterion-Referenced Assessment (IKL–PAP). The model was structured around six main components: (1) analysis of local wisdom potential in Bima Regency; (2) mapping of IPAS Learning Outcomes (LO) and Learning Objectives (LT); (3) development of local wisdom-based teaching modules; (4) implementation of contextual learning through environmental exploration and project-based learning; (5) preparation of criterion-referenced assessment instruments; and (6) learning reflection and evaluation. The integration of local cultural values was carried out systematically, from the formulation of learning objectives, the selection of materials, and the design of activities, to the use of environment-based media and the formulation of assessment indicators. Learning was thus oriented not only toward mastery of IPAS concepts but also toward connecting those concepts with the social, cultural, and environmental realities that students encounter daily.

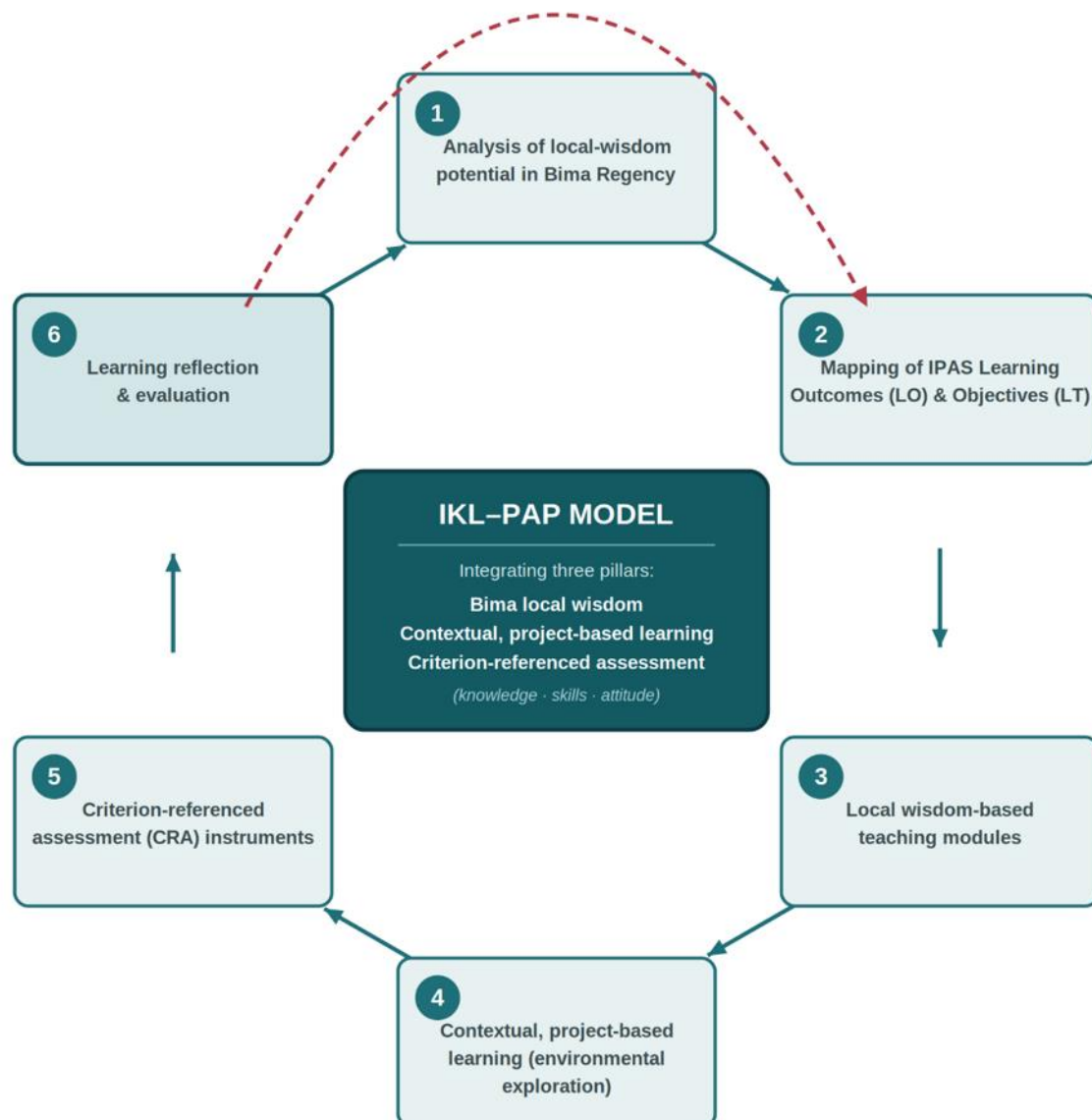


Figure 2. The IKL-PAP model: a local wisdom-integrated, CRA-based IPAS cycle

3.3. Development: Expert Validation

The model was validated by experts in IPAS learning, educational evaluation, and Bima culture, and by elementary-education practitioners. Validation focused on content feasibility, the suitability of the model syntax, the integration between local wisdom and learning outcomes, and the quality of the CRA instruments. The validators judged the model to be in the very valid category: the learning syntax was consistent with the Merdeka Curriculum, it systematically integrated local cultural values, and it provided clear assessment instruments based on the competency indicators students were to achieve. Suggestions for improvement included simplifying the language of the teaching modules, adding contextual examples from the Bima environment, and refining the skills and attitude rubrics so that they would be easier for teachers to use. Across all aspects, the mean content-validity index reached Aiken's $V = 0.86$, exceeding the 0.80 threshold, and every aspect fell in the valid to very valid range, as summarized in Table 2.

Table 2. Summary of expert validation of the IKL–PAP model

Validation aspect	Score (Aiken's V)	Category
Content feasibility	0.88	Very valid
Suitability of the model syntax	0.90	Very valid
Local wisdom–learning outcome integration	0.86	Very valid
Quality of the CRA instruments	0.87	Very valid
Language and presentation	0.82	Valid
Overall mean	0.86	Very valid

3.4. Implementation: Field Test

The model was implemented in Grade V IPAS. Learning began with identifying environmental problems around the school, such as waste management, preserving water sources, agricultural land use, and coastal-area conservation. Students then conducted field observations, group discussions, and interviews with community leaders, and developed simple projects to address the identified problems. The teacher acted as a facilitator, guiding students to connect IPAS concepts with the local cultural values of the community. Student participation was higher than in previous learning because the material was directly related to their experiences and environment; learning became more contextual and meaningful and strengthened local cultural identity as part of the educational process. Student participation was higher than in previous learning sessions, and the learning process remained contextual.

3.5. Evaluation: Practicality, Effectiveness, and CRA

A distinctive contribution of the model is its integrated CRA system. Unlike norm-referenced systems that compare one student's outcomes with another's, the CRA in this study is based on the competency indicators set for each learning objective and comprehensively assesses three domains. The knowledge domain was measured through local-context tests and case studies related to the life of the Bima community; the skills domain through observation of inquiry, problem solving, group work, and the presentation of project results; and the attitude domain through observation of environmental awareness, responsibility, cooperation, and appreciation of local cultural values. The rubrics provided objective information on the level of mastery, enabling teachers to identify both achievements and competencies requiring follow-up.

The model was valid (mean Aiken's V = 0.86) and practical, with a mean positive response of 89% from teachers (92%) and students (86%). This 89% figure is the unweighted arithmetic mean of the two group percentages; because the numbers of teacher and student respondents differ substantially (3 teachers versus 25 students), we also report the weighted mean of 86.6% and present both to avoid overstating agreement (Table 3).

The mean score rose from 54.50 (SD = 8.20, range 40–68) on the pretest to 82.30 (SD = 7.10, range 68–94) on the posttest, yielding a mean N-gain of 0.61 (moderate; Table 4). The paired-samples test indicated a statistically significant improvement, $t(24) = 14.95$, $p < .001$, with a large effect size (Cohen's $d = 2.99$). Criterion attainment exceeded the 80% threshold in all three domains: knowledge 84% (21/25), skills 88% (22/25), and attitude 92% (23/25) (Table 5).

Table 3. Practicality based on teacher and student responses

Respondent	Positive response (%)	Category
Teachers (n = 3)	92%	Very practical
Students (n = 25)	86%	Practical
Unweighted mean	89%	Practical
Weighted mean	86.6%	Practical

Table 4. Effectiveness based on the normalized gain (N-gain)

Measure	Value	Category
Pretest mean (SD; range)	54.50 (8.20; 40–68)	—
Posttest mean (SD; range)	82.30 (7.10; 68–94)	—
N-gain	0.61	Moderate
Paired-samples t-test	$t(24) = 14.95, p < .001$	
Effect size (Cohen's d)	2.99	Large

Table 5. Criterion attainment (CRA) by competency domain

Competency domain	Students meeting indicators (%)	Category
Knowledge	84% (21/25)	Achieved ($\geq 80\%$)
Skills	88% (22/25)	Achieved ($\geq 80\%$)
Attitude	92% (23/25)	Achieved ($\geq 80\%$)

3.6. Discussion

These findings reinforce social constructivist theory [6], the primary framework of this study, which holds that knowledge is built through interaction with the real environment; integrating local wisdom lets students construct understanding from direct experience, making learning meaningful. The results are consistent with place-based education [7], our complementary operational lens, which uses the local environment as the primary learning text, and are further supported by CTL [5] and with culturally responsive and culturally relevant pedagogy [8], [9], which stress connecting material to students' cultural lives, and with place-based education [7], which uses the local environment as the primary learning text. The project- and inquiry-based activities align with problem-based learning [25], [26], [27] and inquiry-oriented science teaching [11], [28]. Gains in environmental awareness and responsibility echo work on environmental education and ecological citizenship [29], [30], [31], and the attitudinal outcomes can be read through the theory of planned behavior, in which values and norms shape environmental intention and behavior [32]. Locally, the study operationalizes the Ngaha Aina Ngoho ethic documented in Bima [15], [17], [18] by embedding it in IPAS objectives, activities, and assessment.

From an evaluation standpoint, CRA gave a more comprehensive picture of mastery than norm-referenced written tests, because it assessed knowledge, skills, and attitudes against explicit indicators and produced diagnostic information for remediation and enrichment. This extends prior local wisdom studies that stopped at modules or media [12], [13], [19], [21] by delivering a complete model, comprising implementation syntax, a teacher guide, culture-based modules, and CRA instruments, usable continuously in elementary IPAS learning.

These results should be read as the outcome of an integrated intervention package. Because local wisdom integration, project-based learning, contextual instruction, and CRA were introduced together, the design cannot isolate the contribution of any single component; the observed improvement most plausibly reflects their combined effect. This is an inherent feature of holistic model development rather than a flaw, but it constrains causal claims.

Three patterns in the numbers merit analytical interpretation. First, N-gain reached a moderate rather than high level, plausibly because the pretest baseline was not extremely low ($M = 54.50$) and because the field trial was short, limiting the ceiling of measurable gain within one implementation cycle. Second, attitude mastery (92%) exceeded knowledge mastery (84%); this aligns with the model's strong affective and value-laden content—an ecological ethic such as *Ngaha Aina Ngoho* is more readily internalized as attitude than converted into formal conceptual mastery, which requires more instructional time. Third, teacher practicality ratings (92%) exceeded student ratings (86%), likely because teachers directly benefited from the structured guidance the model provides, whereas students experienced a less familiar, more demanding mode of learning.

Practical significance beyond the numbers deserves emphasis. For low-resource 3T schools, the model's value hinges on feasibility: it requires teacher preparation time chiefly at the module-and-rubric design stage, but reusable instruments offset this front-loaded cost. Teachers were able to develop CRA instruments using the provided templates, and the model depends on modest, occasional community involvement (e.g., interviews with local leaders) rather than continuous external support—an important condition for sustainability where such support is scarce.

Because the intervention is deeply embedded in Bima local culture, we frame its wider relevance in terms of transferability rather than broad generalizability: the process of converting community knowledge into objectives, activities, and criterion-referenced indicators is transferable to other cultural settings, even though the specific values are not.

Limitations. Several limitations bound these findings: (a) a single school; (b) implementation in one Grade V class; (c) a small sample ($n = 25$); (d) the absence of a comparison/control group; (e) culturally specific content; (f) no evidence of long-term retention; and (g) potential subjectivity and observer effects in the assessment of skills and attitudes, although inter-rater agreement was strong ($\kappa = 0.82$).

4. CONCLUSION

This study developed, through the R&D/ADDIE approach, the IKL–PAP model, which integrates Bima local wisdom (*Ngaha Aina Ngoho*, *Maja Labo Dahu*, *karawi kaboju*, and *mbolo weki*) into IPAS learning objectives, modules, project-based activities, and criterion-referenced assessment instruments at a 3T elementary school. Expert validation, practicality testing, and a Grade V field trial indicated that the model is valid (mean Aiken's $V = 0.86$) and practical (89% unweighted / 86.6% weighted) and shows promising preliminary effectiveness (N-gain = 0.61; $t(24) = 14.95$, $p < .001$; $d = 2.99$), with students attaining competency indicators across the knowledge (84%), skills (88%), and attitude (92%) domains.

The study makes three differentiated contributions. Theoretically, it couples culturally contextualized, constructivist learning with competency-based criterion-referenced assessment. Practically, it gives teachers a structured process for converting community knowledge into learning activities and assessment indicators usable in low-resource settings. Methodologically, it produces an integrated, reusable product comprising instructional syntax, teaching materials, and CRA instruments.

These findings are bounded by the study's design: a single school, one short-term Grade V implementation, a small sample ($n = 25$), the absence of a comparison group, possible observer/teacher effects, and the context-specificity of Bima local wisdom. Accordingly, future research should test the model across more 3T schools and grade levels with larger samples and quasi-experimental or experimental designs. It should additionally examine long-term learning retention, cross-school replication, implementation fidelity, teacher workload, applicability to other Indonesian local cultures, and comparative effectiveness against conventional IPAS instruction.

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