

Strengthening graduate profile dimensions through local wisdom-based experiential learning in elementary science and social studies

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ABSTRACT

Character formation among elementary school students faces increasing pressure from digital distractions, value erosion, and the demands of twenty-first-century competencies. Graduate Profile Dimensions (GPD) is the central character outcome across all subjects. Empirical evidence on culturally grounded interventions that strengthen these dimensions, however, remains limited. This study examined the effectiveness of an experiential learning model, grounded in the local wisdom of Giriwoyo, in strengthening four GPD dimensions during natural and social science instruction. The study employed a pre-experimental one-group pretest-posttest design with 17 fifth-grade students in a rural elementary school, selected through purposive sampling. A validated 31-item instrument measured four GPD dimensions before and after a three-session intervention that embedded the local wisdom of Giriwoyo in Kolb's experiential learning cycle. The results showed a statistically significant improvement in students' overall GPD achievement following the intervention, with the greatest gains observed in collaboration and creativity, while independence and critical reasoning improved more modestly. The novelty of the study lies in validating a subject-embedded GPD instrument and documenting a culturally anchored experiential model within the newly introduced 2025 deep learning policy, rather than the project-based contexts examined in prior work. The findings imply that local wisdom can function as a structured pedagogical resource for character education in natural and social science; however, the single-site design and small sample make the results context-specific and call for replication using control-group and longitudinal designs.

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1. Introduction

Character formation in elementary school sits at the centre of contemporary education debates. Global reports show a steady decline in social and emotional competencies among children, driven by intense screen exposure, weakening peer interaction, and the erosion of community-based learning opportunities (Uhls et al., 2014). The Organization for Economic Co-operation and Development (OECD) Learning Compass 2030 places knowledge, skills, attitudes, and values together as the four interdependent dimensions of competence that students need to thrive in uncertain futures. The collaborative for academic, social, and emotional learning promotes a parallel framework that emphasises self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Durlak et al., 2011). These global agendas converge on a single concern: cognitive achievement alone cannot prepare children for a world that demands ethical agency and collaborative action.

Indonesia has translated this global concern into a distinctive national framework. The GPD is the term used as the central character outcome across all subjects (Voogt & Pareja Roblin, 2012; Berkowitz & Bier, 2004). The 2025 refinement preserves the structure of the curriculum in Indonesia while introducing the deep learning approach, which emphasizes mindful, meaningful, and joyful learning to deepen student understanding rather than expand the curriculum content (Dolmans et al., 2016; Baeten et al., 2010). The framework articulates eight core dimensions, namely faith and devotion, citizenship, critical reasoning, creativity, collaboration, independence, health, and communication. Among these, four dimensions speak directly to social and intellectual character: collaboration, creativity, independence, and critical reasoning. To orient international readers, these national terms have direct conceptual equivalents: the GPD are Indonesia's national graduate-competency and character standard, comparable in function to the OECD Learning Compass and Advancing Social and Emotional Learning (CASEL) competency frameworks. The natural and social science subject integrates scientific and social inquiry in a single learning area and offers a particularly rich context for character formation because its content invites contextual exploration of the surrounding environment (Semken & Butler Freeman, 2008; Zeidler et al., 2005). The integrated nature of natural and social science allows teachers to address scientific concepts and social values simultaneously, which makes the subject a natural vehicle for character education that does not feel disconnected from academic content. Studies of the subject's implementation, however, show that teachers often struggle to balance scientific accuracy with character formation, and most rely on conventional lecture formats that limit student engagement (Lotter et al., 2007; Dong et al., 2020).

Theory and practice both suggest that experiential learning offers a powerful pathway for character formation, particularly under the deep learning approach that requires meaningful and reflective engagement. Kolb (2014) describes learning as the process whereby knowledge is created through the transformation of experience. The four-stage cycle of concrete experience, reflective observation, abstract conceptualisation, and active experimentation provides a structured way to translate lived events into transferable insight. Recent reviews confirm that experiential learning produces consistent positive effects on behaviour, attitudes, and knowledge across primary and secondary education (Ranken et al., 2025; Varman et al., 2021). The cycle becomes especially effective when the concrete experience holds personal and cultural meaning for the learner (Sakti et al., 2024a).

Local wisdom, understood as the accumulated knowledge, values, and practices of a community, provides a rich source of meaningful concrete experience. Bourdieu (1986) frames such knowledge as cultural capital that schools can mobilise to make learning relevant. Recent studies across Southeast Asia document the value of integrating indigenous knowledge into formal schooling. The Philippines embeds indigenous peoples' education within the national curriculum (Manns et al., 2025). Thailand grounds its education for sustainable development in the Sufficiency Economy Philosophy that promotes moderation, reasonableness, and self-reliance (Tan & Vickers, 2024). Indonesian scholars likewise report that local wisdom integration strengthens cultural identity and civic engagement (Fathurrochman, 2025; Gondwe & Longnecker, 2015).

Despite this growing interest, four research gaps demand attention. First, most studies on experiential learning in primary schools measure cognitive outcomes such as content mastery and literacy gains, while affective and character outcomes receive less attention (Ranken et al., 2025). Second, studies on local wisdom integration are predominantly qualitative and often stop at describing implementation processes rather than testing measurable effects (Novitasari & Walid, 2024; Arjaya et al., 2024). Third, empirical research on character outcomes within natural and social studies under the newly introduced deep learning approach is still emerging, since the approach was formally established only in 2025 (Zeidler et al., 2005). Fourth, the measurement of GPD dimensions remains under development, and most existing instruments focus on the project component rather than on subject-embedded character outcomes (Rachman et al., 2024).

The present study addresses these gaps by examining the effect of an experiential learning model rooted in the local wisdom of Giriwoyo on four GPD dimensions during natural and social studies instruction in a fifth-grade elementary classroom that operates under the 2025 deep learning approach. The study answers two research questions. First, does the local wisdom-based experiential learning model produce a significant change in GPD character scores? Second, which GPD dimensions respond most strongly to the intervention? The study contributes three novel elements. It validates a four-dimension GPD measurement instrument tailored to natural and social studies

contexts. It documents an ethnographically specific integration of Giriwoyo cultural practices into the Kolb cycle. It triangulates three indicators of effect, namely the paired t-test, Hake's normalised gain, and Cohen's d, to give a multi-faceted picture of the intervention's impact. Against the current state of the art, in which local wisdom and character studies remain predominantly qualitative and GPD measurement is largely confined to the project-based component, the novelty of this study is threefold (Ndiung et al., 2024). It supplies quantitative effectiveness evidence where description has dominated, it validates a subject-embedded GPD instrument where existing tools target the project, and it situates both contributions within the 2025 deep learning policy that, to date, no empirical study has examined for character outcomes in natural and social studies.

The setting of the study deserves particular attention. Giriwoyo District lies in the southern part of Wonogiri Regency, Central Java, and retains a strong rural community character. Daily life in the district remains organised around collaboration in farming, communal water management, and shared celebration of agricultural calendars. Children grow up observing and participating in these practices, which gives the local wisdom anchor a personal resonance for them. SD Kanisius Serenan operates within this community. The school therefore offers a productive site for examining how culturally grounded experiential learning can support the implementation of the deep learning approach in a rural Indonesian context.

The first aspect of this research is experiential learning. Kolb's experiential learning theory remains the most widely used framework for organising learning that begins with direct experience. The four-stage cycle starts with a concrete experience, moves into reflective observation of that experience, builds toward abstract conceptualisation, and completes through active experimentation that creates new experience (Kolb, 2014). Subsequent work refines the cycle into a developmental spiral and clarifies the role of learning spaces (Kolb & Kolb, 2017). Recent applications confirm the cycle's relevance across disciplines, settings, and age groups (Rossetti, 2023; Sindiani et al., 2025). The deep learning approach introduced in Indonesia aligns closely with Kolb's emphasis on reflection, meaningful experience, and active construction of understanding.

The strength of the Kolb framework lies in its flexibility. Each of the four stages can be operationalised through different activities according to the subject matter and the developmental stage of the learner. For elementary school students, the concrete experience stage typically involves direct sensory engagement with phenomena, the reflective observation stage involves guided discussion that names and orders the experience, the abstract conceptualisation stage involves teacher-supported linking of the experience to formal content, and the active experimentation stage involves applying the resulting understanding in a new task. A systematic review of forty-four primary studies on experiential learning with children aged four to fourteen reports consistent positive effects on academic and social outcomes, particularly when experiences are sustained and linked to authentic contexts (Ranken et al., 2025). Reviews of experiential learning effectiveness in primary education also report medium to large effect sizes for behavioural outcomes when interventions combine enjoyable practical activities with structured reflection (Varman et al., 2021).

The second aspect of this research is local wisdom as cultural capital. Local wisdom refers to the accumulated knowledge, beliefs, and practices that a community develops through long interaction with its environment (Sakti et al., 2024b; Latifa & Mahida, 2024). Bourdieu's concept of cultural capital helps explain why local wisdom matters in education. When schools recognise and mobilise the cultural resources that students already possess, learning becomes relevant and identity-affirming. Bibliometric mapping of Scopus-indexed publications between 2020 and 2024 shows a sharp rise in studies that integrate local wisdom into formal schooling, with Indonesia leading the field (Arjaya et al., 2024). Three pedagogical functions of local wisdom emerge from the literature: it provides authentic content that links classroom learning to community life, it offers a values framework that supports character formation through the modelling of behaviour by community members (Sakti et al., 2024a), and it presents an epistemological alternative that challenges decontextualised academic knowledge (da Silva et al., 2023).

The third aspect of this research is character education and the graduate profile dimensions. The Graduate Profile Dimensions framework represents Indonesia's distinctive contribution to global character education. While CASEL frames character through five interrelated competencies and the OECD Learning Compass through transformative competencies, the GPD framework, which superseded the Indonesian student profile, organises character through eight dimensions rooted in

national values (Eko et al., 2024; Puspitasari et al., 2023). Among these dimensions, collaboration (kolaborasi, embodying the cultural value of gotong royong) carries particular cultural weight. Studies of Indonesian social studies textbooks confirm that gotong royong functions as both a national value and a practical strategy for community problem-solving (Latifa & Mahida, 2024; Van Ryzin & Roseth, 2018). The GPD framework deserves to be read as a culturally anchored adaptation of global frameworks rather than as a parallel and unrelated initiative. This reading positions Indonesian character education research within the broader international conversation and invites comparative dialogue.

The integration of experiential learning and local wisdom rests on three theoretical convergences that align particularly well with the 2025 deep learning approach. First, both frameworks treat experience as the primary source of learning rather than as an illustrative supplement to instruction. Second, both frameworks privilege reflection as the bridge between doing and understanding. Third, both frameworks assume that meaning grows from authentic engagement with one's social and physical world. When local wisdom supplies the concrete experience and the Kolb cycle structures the reflective and conceptual movement, the resulting learning environment offers students both cognitive scaffolding and value congruence. This combination should strengthen character outcomes more effectively than either component alone, particularly for dimensions such as collaboration that are themselves cultural constructs (Rahmawati et al., 2023; Juliani et al., 2024).

Taken together, these convergences specify a testable conceptual model that Fig. 1 depicts and that the present study evaluates. The model runs in three linked stages. First, the local wisdom of Giriwoyo supplies the culturally meaningful concrete experience (input). Second, the four-stage Kolb cycle of reflective observation, abstract conceptualisation, and active experimentation transforms that experience into structured understanding under the mindful, meaningful, and joyful principles of the deep learning approach (process). Third, the four targeted Graduate Profile Dimensions, namely collaboration, creativity, independence, and critical reasoning, constitute the measured character outcomes (output). Because the cultural anchor models communal and creative practices more directly than individual-cognitive ones, the model predicts larger gains for collaboration and creativity than for independence and critical reasoning, an expectation tested directly in this study.

2. Method

2.1. Research design

This study employed a pre-experimental one-group pretest-posttest design. The design suited the present study for three reasons. The school context permitted only a single intact class. The intervention represented an exploratory effectiveness test rather than a confirmatory trial. Ethical considerations precluded withholding the intervention from comparable students. The design carries known threats to internal validity such as history, maturation, and testing effects (Varman et al., 2021). The study acknowledges these limits openly and frames the findings as evidence of within-group change rather than as causal proof against a counterfactual. To strengthen internal validity within these constraints, the study applied four safeguards (Creswell & Creswell, 2018; Fraenkel et al., 2019). The pretest and posttest used the identical instrument under standardised classroom conditions; the four-week interval between tests was kept short to limit maturation; the three sessions followed a written lesson protocol whose delivery an independent observer monitored to verify implementation fidelity; and each student served as their own control, so that the effect size and confidence interval are interpreted against a within-subject baseline. These safeguards mitigate, but do not eliminate, the absence of a comparison group.

2.2. Participants and sampling

Seventeen fifth-grade students at Kanisius Elementary School of Serenan, located in Giriwoyo District, Wonogiri Regency, participated in the study. The researcher used purposive sampling guided by three criteria. The school operated within a community that retained strong local wisdom traditions. The school principal and class teacher both consented to the research intervention. The class composition was homogeneous in age and grade level. Table 1 summarises participant characteristics.

Table 1. Participant characteristics (N = 17)

Characteristic	Category	Frequency	Percentage
Gender	Male	9	52.94%
	Female	8	47.06%
Age	10 years	6	35.29%
	11 years	11	64.71%
Prior natural and social studies experience	One semester	17	100.00%
Local wisdom familiarity	Daily exposure	17	100.00%

Table 1 shows a balanced gender composition (52.94 percent male and 47.06 percent female) and a homogeneous group, in that all 17 students had completed one semester of natural and social studies and reported daily exposure to local wisdom. This homogeneity supports the internal consistency of the single-class design, but it also means that the sample represents this specific rural cohort rather than a nationally representative population.

2.3. Intervention

The intervention consisted of three natural and social studies sessions of 90 minutes each, conducted over three consecutive weeks using a deep learning approach. Each session followed the four-stage Kolb cycle, with Giriwoyo's local wisdom serving as the cultural anchor for the concrete experience stage. The first session focused on community cooperation practices, including the cooperative cleaning of village wells and shared agricultural work. The second session examined traditional farming techniques, particularly the management of dry-land rice fields and the symbolic role of the rice harvest ceremony. The third session explored local craft traditions, with attention to bamboo weaving and the social meanings embedded in the production process. In every session, the teacher guided students from the concrete experience through reflective observation, then toward abstract conceptualisation that linked the experience to natural and social studies content, and finally toward active experimentation through small-group projects. Figure 1 visualises the conceptual framework.

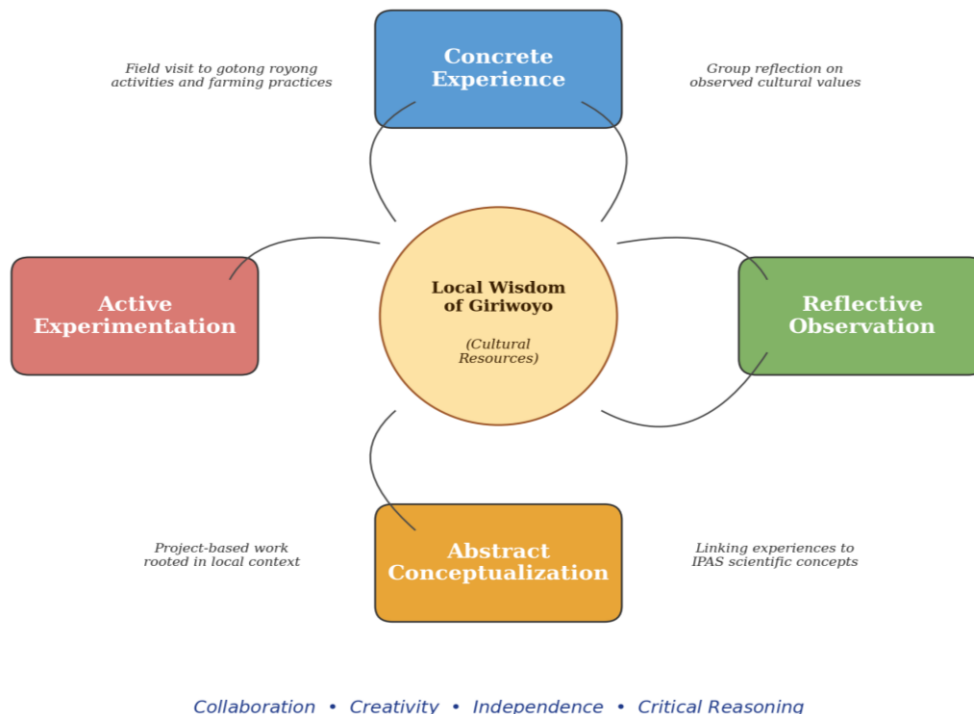


Fig. 1. Conceptual framework

The mapping between the Kolb cycle and the local wisdom activities deserves explicit description. In the concrete experience stage, students participated in or observed an authentic local practice. The teacher used field visits, community member visits, and short documentary clips

depending on the practical access of each session. In the reflective observation stage, students worked in small groups to identify the values, roles, and outcomes they noticed during the experience. The teacher used guided question prompts that focused on what happened, who participated, why they participated, and what mattered most. In the abstract conceptualisation stage, the teacher introduced the natural and social studies content that the experience illustrated, including ecosystem balance for the farming session and material properties for the bamboo session. The teacher then explicitly named the GPD dimensions that the experience modelled. In the active experimentation stage, students completed small-group tasks that applied both the natural and social studies content and the GPD dimensions in a new context, such as designing a school-yard cooperation project or planning a sustainable bamboo product.

This design directly operationalises three core principles of the deep learning approach. First, the principle of mindful learning is addressed through the reflective observation stage that invites students to attend to the values and processes they encounter. Second, the principle of meaningful learning is addressed through the cultural anchoring of the concrete experience in community practices that students already recognise. Third, the principle of joyful learning is addressed through the active experimentation stage that allows students to express their understanding through creative small-group projects. The intervention design therefore translates the abstract policy principles into concrete classroom routines. By integrating these three principles within a coherent experiential learning sequence, the model creates a learning environment that simultaneously promotes cognitive engagement, character development, and contextual understanding.

2.4. Instrument

The character measurement instrument consisted of forty items on a four-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). The instrument covered four GPD dimensions: collaboration, creativity, independence, and critical reasoning. The validation process moved through three layers. Two subject-matter experts in elementary education reviewed the items for content validity, with revisions accepted when both experts agreed. Construct validity was tested through item-total correlation, with a threshold of the *r*-table value at the 0.05 significance level. The reliability test used Cronbach's alpha, with a threshold of 0.70. After validation, 31 items remained valid out of 40, yielding a 77.50 percent retention rate. Table 2 reports the final item distribution.

Table 2. Final instrument blueprint by graduate profile dimension

Dimension	Initial items	Valid items	Retention rate
Collaboration (Kolaborasi)	10	8	80.00%
Creativity	10	8	80.00%
Independence	10	8	80.00%
Critical Reasoning	10	7	70.00%
Total	40	31	77.50%

The instrument was developed following established scale-construction guidance (DeVellis, 2017), with each dimension represented by an initial pool of ten behaviourally anchored items written for the natural and social studies context. Sample items include, for collaboration, "I share tasks fairly when my group works on a project"; for creativity, "I try more than one way to solve a problem in science or social studies"; for independence, "I finish my own learning tasks without being reminded"; and for critical reasoning, "I give reasons and evidence when I state an opinion." The nine items removed during validation were those whose item-total correlation fell below the *r*-table threshold. This refinement process strengthened the instrument's construct representation and ensured that only psychometrically sound items were retained for the effectiveness analysis. Table 3 reports the validity and reliability results.

Table 3. Validity and reliability test results

Dimension	Initial items	Valid items	Retention rate
Test Type	Statistic	Value	Interpretation
Content Validity	Expert agreement	100%	All retained items approved
Construct Validity	Item-total correlation	> 0.482	31 of 40 items valid
Reliability (Pretest)	Cronbach Alpha	0.9682	Very high

2.5. Procedure and data analysis

Data collection followed a five-week timeline. In week 0, the researcher administered the pretest under standard classroom conditions. In weeks 1 to 3, the researcher delivered the three intervention sessions. In week 4, the researcher administered the posttest using the same instrument and conditions. Quantitative analysis proceeded through five steps using IBM SPSS Statistics 26 (Field, 2018). Descriptive statistics summarised mean, standard deviation, and percentage scores for the overall composite and for each dimension. The Shapiro-Wilk test examined the normality of pretest and posttest distributions. The paired sample t-test examined whether the pretest-posttest difference was statistically significant. Hake's normalised gain (N-Gain) measured the proportion of possible improvement the class achieved (Nissen et al., 2018). Cohen's d measured the magnitude of the effect (Cohen, 1988; Sawilowsky, 2009). The triangulation of three effect indicators offered a multi-faceted reading of intervention impact. The study received approval from the school principal and informed written consent from parents or guardians of all participating students. Student names appeared in coded form, and participation remained voluntary throughout.

3. Results and Discussion

Composite character scores rose from a pretest mean of 58.06 (SD = 8.42) to a posttest mean of 69.41 (SD = 7.65), an absolute gain of 11.35 points on the 0 to 100 scale. The standard deviation decreased slightly from pretest to posttest, indicating that the spread of student scores narrowed after the intervention. Table 4 reports the descriptive statistics for the overall composite and for each GPD dimension.

Table 4. Descriptive statistics of pretest and posttest scores

Variable	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gain
Composite Score	58.06	8.42	69.41	7.65	+11.35
Collaboration	55.20	9.10	70.75	7.84	+15.55
Creativity	60.10	8.65	73.14	7.32	+13.04
Independence	58.50	8.78	64.71	7.91	+6.21
Critical Reasoning	58.40	8.96	62.97	8.05	+4.57

Table 4 shows that every dimension improved from pretest to posttest, but the gains were uneven. Collaboration (+15.55) and creativity (+13.04) rose roughly twice as much as independence (+6.21) and critical reasoning (+4.57). The posttest standard deviation was smaller than the pretest value for the composite and for every dimension, which indicates that the class became more homogeneous after the intervention as lower-scoring students moved closer to their peers.

Both pretest and posttest distributions met the normality assumption required for parametric testing. The Shapiro-Wilk test produced $W = 0.953$ ($p = 0.510$) for pretest and $W = 0.961$ ($p = 0.643$) for posttest. The paired sample t-test produced a significant difference between pretest and posttest scores. The 95 percent confidence interval of the mean difference excluded zero, confirming that the intervention produced a measurable change in character scores. Table 5 reports the test statistics.

Table 5. Paired sample t-Test results (N = 17)

Comparison	Mean Diff.	SE Diff.	t	Df	p-value	95% CI
Posttest – Pretest	11.35	2.025	5.6051	16	< 0.001	[7.06, 15.64]

Table 5 confirms that the 11.35-point composite gain is statistically significant, with $t(16) = 5.61$, $p < 0.001$, and a 95% confidence interval of the mean difference ranging from 7.06 to 15.64, entirely above zero. These findings indicate a reliable improvement following the intervention. However, the confidence interval spans more than eight points, reflecting the small sample size and indicating that the true magnitude of the gain is estimated with limited precision.

Two complementary indicators measured the magnitude of the effect. Cohen d for the paired design reached 0.52, which falls within the medium effect category (Cohen, 1988; Sawilowsky, 2009). The class N-Gain reached 0.1722, which falls within the low category (Hake, 1998). The two indicators provide different but complementary perspectives. The medium Cohen d indicates a

meaningful change relative to the variability among students. The low N-Gain indicates that the class captured only a small fraction of the maximum possible improvement, partly because the intervention spanned only three sessions. Table 6 summarises both indicators.

Table 6. Effect size and normalised gain analysis

Indicator	Value	Category	Interpretation
Cohen's d (paired)	0.52	Medium effect	Meaningful change relative to within-group variability
N-Gain (Hake)	0.1722	Low	Small share of maximum possible improvement captured

The four GPD dimensions responded to the intervention at different rates, indicating that the learning model had varying effects across character domains. Collaboration demonstrated the greatest improvement, with a gain of 15.55%, followed by creativity, which increased by 13.04%. In contrast, independence and critical reasoning showed more modest gains of 6.21% and 4.57%, respectively, suggesting that these dimensions may require longer or more intensive interventions to achieve greater improvement. Figure 2 presents a comparison of the pretest and posttest mean scores across all four GPD dimensions, illustrating the relative magnitude of change in each dimension.

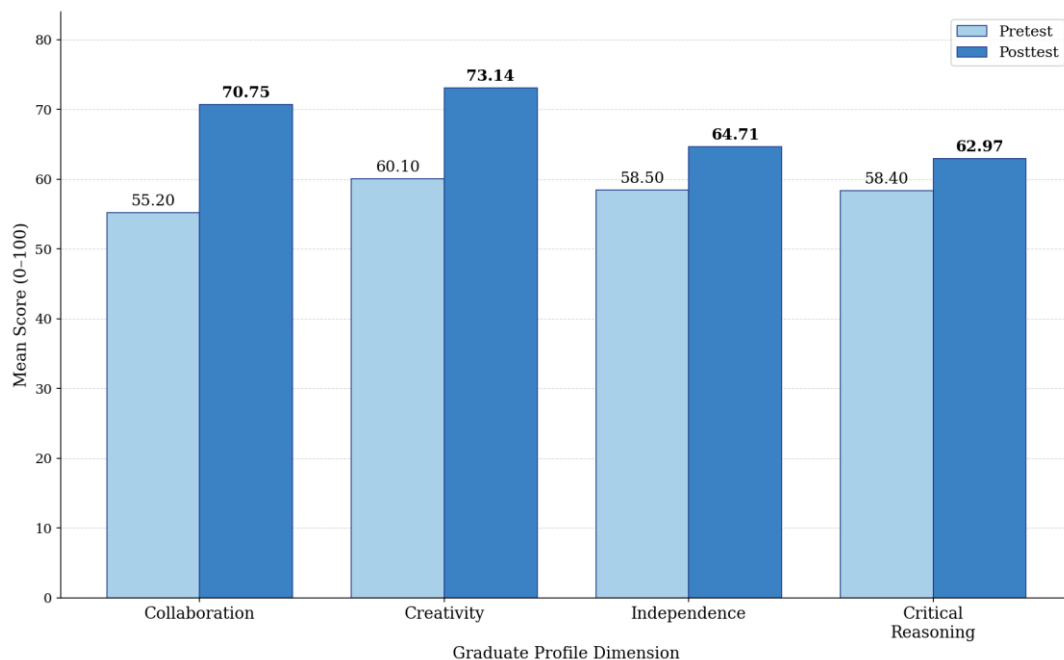


Fig. 2. Pretest and posttest mean scores across the four Graduate Profile dimensions

Figure 2 clearly illustrates the differential responsiveness of the four GPD dimensions to the intervention. All four dimensions began within a relatively similar pretest range of approximately 55–60 points, indicating comparable baseline performance. Following the intervention, however, the posttest scores for collaboration and creativity increased more substantially than those for independence and critical reasoning. As a result, the gap between the communal–creative dimensions and the individual–cognitive dimensions became more pronounced, suggesting that the intervention was particularly effective in strengthening collaborative and creative competencies.

Figure 3 presents the absolute percentage gains for each GPD dimension relative to the overall composite gain. Collaboration and creativity demonstrated the largest improvements, with percentage gains approximately twice those observed for independence and critical reasoning. This pattern indicates that the intervention was more effective in enhancing the communal–creative dimensions than the individual–cognitive dimensions. The findings are consistent with the cultural foundation of the intervention, as the local wisdom of Giriwoyo places strong emphasis on collective participation, mutual cooperation, and creative community practices in everyday life.

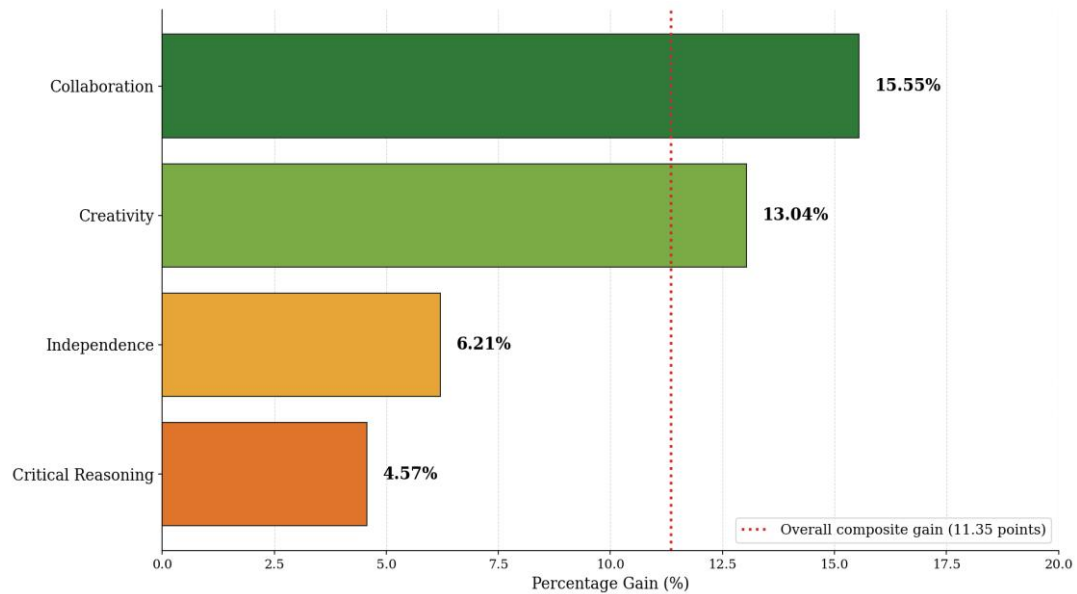


Fig. 3. Absolute percentage gains by Graduate Profile dimension

Figure 3 plots the gain for each dimension against the dotted reference line. Only collaboration and creativity sit to the right of the line, while independence and critical reasoning fall to its left, which confirms at a glance that the two communal-creative dimensions accounted for most of the measured improvement and that the two individual-cognitive dimensions trailed the overall average. The visual distribution of gains also reinforces the quantitative findings by highlighting differential intervention effects across the four GPDs.

The findings align closely with Kolb's prediction that learning grounded in concrete experience produces deeper engagement than abstract instruction (Kolb, 2014; Kolb & Kolb, 2017). The findings also align with the principles of the deep learning approach, which calls for mindful, meaningful, and joyful learning (Baeten et al., 2010). The innovation in the present study lies in the cultural anchoring of the concrete experience. Rather than relying on classroom simulations, the intervention drew on community practices that students already encountered in daily life. This anchoring strengthened the affective resonance of the experience and shortened the gap between school content and lived meaning. Sakti et al. (2024a) report a similar effect in early childhood ethnopedagogy. The present findings extend that evidence to upper-elementary natural and social studies instruction and confirm that culturally anchored experience amplifies the character formation potential of the Kolb cycle within the deep learning framework. This result is the central contribution of the study to current knowledge. It converts a claim that has so far rested mainly on qualitative description into quantitative effect estimates, and it does so within the newly introduced 2025 deep learning policy and for subject-embedded GPD outcomes that prior instruments, built for the project, were not designed to capture.

The dimension-level pattern offers the most theoretically interesting result. Collaboration and creativity showed substantial gains, while independence and critical reasoning showed modest gains. Two explanations help to interpret this pattern. First, the local wisdom of Giriwoyo centres on communal practices such as gotong royong, traditional farming, and craft cooperation, all of which model collaborative behaviour and creative problem-solving in tangible ways (Van Ryzin & Roseth, 2018; Latifa & Mahida, 2024). Students therefore had abundant opportunities to observe and practise these dimensions during the intervention. Second, independence and critical reasoning typically require more sustained scaffolding and extended practice across multiple contexts. Three sessions provided limited opportunity for the kinds of metacognitive coaching that critical reasoning demands (Daga et al., 2022; Yani & Tirtoni, 2024). The pattern reflects both the cultural strengths of the local context and the developmental requirements of different character dimensions.

The pattern also raises an important design consideration for future iterations of the model. If schools wish to strengthen the individual-cognitive dimensions alongside the communal-creative ones, the intervention design needs to incorporate explicit metacognitive scaffolding within the reflective observation and abstract conceptualisation stages. This might include structured

argumentation routines, peer questioning protocols, and individual reflection journals that complement the group-based reflection used in the present intervention. The cultural anchor itself does not need to change, but the supporting pedagogical routines need to be adapted to address the developmental needs of dimensions that the cultural setting does not directly model.

The findings join a growing body of Asian research on culturally grounded character education. Indigenous Peoples Education in the Philippines uses ancestral knowledge systems to anchor scientific and civic learning (Manns et al., 2025; Bansilan et al., 2023). Thailand's Sufficiency Economy Philosophy provides a similar cultural anchor for school-based character formation (Tan & Vickers, 2024). Malaysian and Indonesian programmes increasingly position local wisdom as both content and pedagogy (Damopolii et al., 2024; Fathurrochman, 2025). The present study contributes to this regional movement by providing quantitative evidence that culturally grounded experiential learning can shift character outcomes within a short instructional window. The contribution matters because most prior Asian studies have used qualitative methods that, while rich in description, do not directly test effectiveness.

Three patterns emerge when the present results are placed alongside Asian comparators. First, communal dimensions of character respond strongly to culturally grounded interventions because the cultural context already models these values. Second, individual dimensions of character, such as critical reasoning and independent decision-making, require more deliberate scaffolding and longer interventions because they often run against the communal grain of the cultural setting (Daga et al., 2022). Third, the success of culturally grounded interventions depends on the extent to which teachers themselves understand and value the cultural references they invoke (Syofyan et al., 2024). The present study illustrates all three patterns within a single Indonesian classroom and therefore offers an illustrative single-case starting point for regional comparison rather than confirmatory cross-national evidence. The deep learning approach mandated for 2025/2026 provides a timely policy framework that supports this kind of culturally grounded pedagogy.

The triangulation of three effect indicators clarifies what a small intervention can achieve. The significant t-test confirms a real change. The medium Cohen *d* places that change in perspective relative to within-group variability and approaches Sawilowsky's threshold for practical importance (Sawilowsky, 2009). The low N-Gain indicates that the class still has substantial room to grow toward maximum scores. The apparent tension between the medium *d* and the low N-Gain is not a contradiction. Cohen *d* standardises the change against student variability, while N-Gain standardises it against the maximum possible change (Nissen et al., 2018). A medium *d* with a low N-Gain indicates an efficient intervention with room for dose extension. The reading suggests that future implementations should preserve the cultural design while extending the intervention duration.

The instrument validation process strengthens confidence in the results. The retention of 31 valid items from 40 candidate items reflects a rigorous content and construct validity process. The very high Cronbach's alpha values for both pretest and posttest, both above 0.96, indicate internal consistency that exceeds conventional thresholds (Mendonça et al., 2024). The consistency between pretest and posttest reliability also indicates that the instrument behaves stably across measurement occasions. These properties matter because character measurement in elementary school carries known threats from social desirability and limited self-reflection capacity. The instrument therefore offers a reusable resource for future GPD-focused research in natural and social studies and related subjects under the deep learning approach.

Theoretical implications deepen three lines of work. First, the study extends Kolb's framework by showing that culturally anchored concrete experience strengthens affective and character outcomes in addition to cognitive ones (Kolb & Kolb, 2017; Sindiani et al., 2025). Second, the validated four-dimension GPD instrument adds to the slow but growing toolkit for measuring national character outcomes within subject instruction (Rachman et al., 2024). Third, the integration model may offer a preliminary template for other regional curricula that aim to ground character education in local culture, such as the Philippine IPed programme and Thailand's Sufficiency Economy curriculum, although transfer to those settings would require replication and local adaptation before it can be claimed.

Practical implications speak directly to teachers, schools, and curriculum developers under the new deep learning approach. Teachers gain a concrete blueprint for mapping each Kolb stage to community practices, with three sessions as a documented minimum dose for measurable change.

Schools gain evidence that natural and social studies can serve as a vehicle for character education without sacrificing scientific content (Novitasari & Walid, 2024; Zeidler et al., 2005). Curriculum developers gain support for the design choice that integrates character outcomes within subject instruction rather than confining them to the dedicated project component (Jeynes, 2019).

Policy implications extend to the national level. The findings support the localisation strategy embedded in the Kurikulum Merdeka and the 2025 deep learning refinement, in which schools draw on community resources to contextualise national learning outcomes. The findings also justify investment in teacher training that develops the cultural and pedagogical knowledge required to translate local wisdom into structured learning experiences (Semken & Butler Freeman, 2008; Syofyan et al., 2024). Such training should treat local wisdom integration not as an enrichment activity but as a core competency for elementary teachers operating under the deep learning framework.

The study carries five limitations that future research should address. The single-site design and small sample limit transferability rather than generalisability, and replication across schools and regions would strengthen external validity. The absence of a control group leaves open the possibility that maturation or testing effects contributed to the observed change, and future quasi-experimental designs with matched control groups would clarify this point. The three-session intervention represents a minimal dose, and longer interventions would test whether dimension gains converge or continue to diverge. The reliance on self-report measures introduces social desirability bias, and future studies should include behavioural observation or peer rating. The researcher served as both designer and implementer, which may have introduced enthusiasm effects, and independent implementation would test the robustness of the approach. Beyond these adjustments, future research should examine mediating and moderating factors such as student demographics, learning style, and prior cultural exposure.

Three additional research avenues deserve attention. First, longitudinal designs with follow-up measurements at six and twelve months would clarify whether character gains persist or fade after the intervention ends. Such persistence is a critical concern because character formation ultimately requires sustained practice rather than discrete intervention bursts. Second, multi-site comparative studies that pair Indonesian schools with comparable schools in the Philippines, Thailand, and Malaysia would clarify whether the integration model transfers across cultural settings or requires substantial local adaptation. Third, qualitative case studies that document the implementation process in detail would complement the present quantitative findings and identify the conditions that enable or constrain successful implementation under the deep learning approach.

4. Conclusion

The Experiential Learning model based on the local wisdom of Giriwoyo strengthened the four target GPD during natural and social studies instruction in a fifth-grade elementary classroom operating under the 2025 deep learning approach. The intervention produced a statistically significant gain in composite character scores, a medium effect size, and a low normalised gain that together indicate an efficient yet under-dosed intervention. Collaboration and creativity responded most strongly to the intervention, while independence and critical reasoning gained more modestly, reflecting both the communal nature of the local wisdom anchor and the developmental requirements of metacognitive dimensions.

Three implications carry forward. The study extends Kolb's framework by anchoring concrete experience in cultural context and demonstrates that this anchoring amplifies character outcomes. It contributes a validated GPD measurement instrument that complements existing project-focused tools. It offers an initial, context-specific model that other schools can adapt, and that requires replication before any claim of broad transferability can be made. Educators, school leaders, and policymakers who seek to translate the deep learning approach into measurable classroom outcomes should treat local wisdom not as a peripheral cultural reference but as a structured pedagogical resource at the centre of subject instruction. With appropriate scaling, sustained implementation, and continued empirical scrutiny, the model holds promise for elementary education in similar Indonesian settings, pending replication beyond this single classroom.

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Declarations

- Author contribution** : RP designed the study, collected data, analysed results, and drafted the manuscript. MI supervised the research design, provided methodological guidance, and revised the manuscript. SS contributed to the conceptual framework and reviewed the final manuscript. All authors read and approved the final version.
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