

Teachers' Needs for Collaborative Project-Based Learning Model Innovation in Strengthening Deep Learning for Senior High School Students in Central Java, Indonesia

Alfiah

Universitas Negeri Semarang, Indonesia;
Universitas Persatuan Guru Republik Indonesia Semarang, Indonesia

Subyantoro*

Universitas Negeri Semarang, Indonesia

Hari Bakti Mardikantoro

Universitas Negeri Semarang, Indonesia

Tommi Yuniawan

Universitas Negeri Semarang, Indonesia

Abstract—This study aims to identify teachers' needs regarding the innovation of a collaborative project-based learning model for enhancing deep learning among senior high school students in Central Java, Indonesia. A survey was conducted using a questionnaire based on six components of the learning model: syntax, social system, reaction principles, support systems, instructional impact, and accompanying impact. Data were collected from Javanese language teachers in senior high schools across Central Java. The results show that teachers expressed a high need for clarity in instructional steps, interaction strategies, and the effectiveness of achieving learning objectives in the components of syntax, social system, reaction principles, and instructional impact. However, there was significant variation in responses regarding support systems and accompanying impacts, highlighting challenges related to the availability of facilities, institutional support, and the internalization of values such as learning autonomy, motivation, and social skills. These findings suggest that Javanese language teachers require a learning model that not only focuses on instructional outcomes but also considers the need for adequate support resources and accompanying impacts to foster deep learning. The study emphasizes the importance of developing a collaborative, project-based learning design that incorporates local Javanese cultural values, improves teacher competence, and ensures sufficient facilities and infrastructure to support effective teaching.

Index Terms—teachers' needs, learning innovation, Javanese language, collaborative projects, deep learning

I. INTRODUCTION

Language learning for senior high school students in the current digital era not only demands teachers' sensitivity to continuously adapt to technological revolutions but also necessitates the development of higher-order thinking skills, collaboration, and metacognitive abilities that underpin deep learning. In the context of Javanese language learning, this challenge becomes even more pressing as Javanese language teachers must cultivate contextual, interdisciplinary meanings that are relevant to students' cultural experiences. Consequently, there is a tangible need among teachers for an innovative Javanese language learning model that is authentic, collaborative, and project-oriented, so that curricular goals and the strengthening of 21st-century competencies can be achieved (Bal & Öztürk, 2025; Wu, 2024).

Empirical studies on Javanese language learning in Indonesia highlight issues related to teaching materials, curriculum alignment, and teachers' confidence in the Javanese language content, as well as its integration with Javanese culture. Some studies have found that Javanese language teachers report materials considered difficult for students, content that is not systematic or contextual, forcing teachers to create additional materials. Other studies show that teachers modify or independently create Javanese language teaching materials due to discrepancies with the prescribed curriculum textbooks. However, there is currently no theoretical model that links teachers' competence confidence with their readiness to adopt a Collaborative Project-Based Learning (PjBL) model as an outcome of deep learning in Javanese language teaching (Rahadini et al., 2022).

* Corresponding Author.

Regarding Project-Based Learning (PjBL), recent reviews emphasize that the PjBL approach in language learning can enhance intrinsic motivation, self-regulation, and academic achievement when designed with meaningful tasks and adequate teacher support (Boardman et al., 2024; Wu, 2024). On the other hand, deep learning as a learning objective requires strategies that encourage the integration of knowledge, critical reasoning, reflection, and transfer across contexts. Recent systematic reviews in the literacy domain suggest that approaches combining technology with deep pedagogy positively impact the quality of senior high school students' language skills. However, their effectiveness heavily depends on instructional design and the teacher's competence in orchestrating collaborative-reflective activities (Bal & Öztürk, 2025). These findings reinforce the urgency of teachers' need for concrete models and implementation guidelines, such as rubrics, project examples, and collaboration facilitation frameworks, to ensure that the desired learning outcomes are realized (Gao et al., 2024; Imran et al., 2024).

The discussion above reveals a practical gap between the idealism of a collaborative project-based innovation that fosters deep learning and the actual implementation in language classes, including Javanese language classes. The primary needs of teachers can be mapped into several areas: (1) a standardized but locally and culturally contextualized collaborative project-based learning model design; (2) formative-summative assessment tools to evaluate collaboration, metacognition, and the quality of language products; (3) ongoing professional development support and teacher learning communities to share projects, facilitation scenarios, and differentiation strategies; and (4) meaningful integration of technology to enrich student dialogue and foster reflection (Boardman et al., 2024; Gao et al., 2024; Potvin et al., 2021). Evidence that PjBL promotes self-regulation and collaborative participation in language classrooms underscores this urgency. Without systematic support for teachers, innovation risks being reduced to surface-level project activities, rather than fostering deep learning (Wu, 2024).

The needs of Javanese language teachers in this study refer to six components of the learning model, as proposed by Joyce et al. (2009). These six components include syntax, social system, reaction principles, support systems, instructional impact, and accompanying impact. Syntax refers to the sequence of instructional steps that systematically guide the learning process. The social system encompasses the roles, rules, and patterns of interaction between teachers and students during the learning process. Reaction principles involve the ways teachers respond, provide feedback, and direct students' learning behaviors. Support systems include the conditions, facilities, and resources needed to optimally implement the learning model. Instructional impact refers to the direct learning outcomes that align with the planned learning objectives, while accompanying impact refers to indirect outcomes that emerge during the learning process, such as attitudes, values, and social skills developed by students (Joyce et al., 2009). In this study, these six aspects serve as the primary reference for designing and evaluating the effectiveness of a learning model, ensuring that the learning process not only results in cognitive knowledge but also shapes students' personalities and social skills.

Based on the discussion above, it can be concluded that the need for a collaborative project-based Javanese language learning model to strengthen deep learning is seen as a prerequisite for achieving meaningful Javanese language learning objectives in senior high schools. This study is therefore both relevant and urgent in mapping these needs and formulating a feasible model design, supported by implementation tools, and aligned with the linguistic and cultural characteristics within the context of Javanese language learning for senior high school students in Indonesia. Consequently, this study aims to identify teachers' needs for a collaborative project-based Javanese language learning model to strengthen deep learning for senior high school students. The subsequent research findings will be used to develop an innovative, contextual, in-depth, and meaningful collaborative project-based Javanese language learning model to strengthen deep learning for senior high school students.

II. LITERATURE REVIEW

A. Teachers' Needs for Javanese Language Model Innovation

In the field of language education, teachers' needs for innovation encompass (a) the need for a clear pedagogical framework, (b) support for professional development and communities of practice, (c) contextualized resources or curriculum, and (d) assessment and supportive technologies aligned with deep learning objectives. The core practices framework asserts that effective innovation requires a set of core practices that can be learned, practiced, and modeled across contexts (Pupik et al., 2023). In project-based learning (PjBL), these core practices are directed toward four goals: disciplinary learning, authentic work, collaboration, and iteration (Grossman et al., 2021; Pupik et al., 2023). These findings indicate that teachers require operational practice guidelines, not just general principles, in order for innovations in language learning models to be sustainably implemented in the classroom.

Researches on PjBL in language education (including English Language Arts) demonstrates that teachers need support to scale innovations, deepen their implementation, sustain them, and take ownership of project curricula (Potvin et al., 2021). Studies in secondary classrooms highlight the need for classroom orchestration (scaffolding, time management, co-constructing rubrics, repeated feedback) to achieve higher-level literacy goals. Furthermore, effective PjBL requires teachers to manage student collaboration and the revision-product cycle to stimulate deep learning (iteration practices, reflection, concept transfer), meaning teachers need ready-to-use task tools, artifact examples, and collaboration protocols (Boardman et al., 2024).

Recent studies in project-based language learning indicate that self-regulated learning (SRL) is a key mechanism for deepening learning. Teachers need explicit strategies to foster students' planning, monitoring, and reflection in projects (Wu, 2024). The direct implication is that teachers require SRL support tools (reflection checkpoints, team contracts) integrated into language project designs. Innovations in language learning models require practice-based professional development so that teachers can rehearse core practices (facilitating text discussions, guiding genre-based writing, framing authentic projects) and receive structured feedback. These findings emphasize the need for on-the-job coaching, collaborative lesson study, and a repository of validated practice examples.

In Indonesia, the declining use of the Javanese language has led to curricular demands for Javanese language learning that goes beyond declarative knowledge and promotes authentic linguistic practices (family, community, cultural realms). Policy studies reveal a mismatch between constitutional mandates and the implementation of regulations, indicating that schools and teachers need micro-level policies and teaching materials that position regional languages as sources of knowledge, identity, and cultural capital (Suwarno, 2020). Recent studies on the decline of Javanese language use in recreational contexts further underscore the urgency of pedagogical approaches relevant to adolescent literacy practices (e.g., digital media, community projects). Study on critical Javanese language awareness, highlight the variation in practices and the need for explicitly designed tasks that foster critical awareness as well as contextual teaching materials; their findings are particularly relevant for the secondary level, which demands more complex literacy skills (Yulianto et al., 2023).

B. Project-Based Learning Approach

Project-Based Learning (PjBL) is understood as an approach to learning where projects are central to instruction. Condliffe (2017) demonstrated that the potential of PjBL can drive deep learning, student engagement, and 21st-century skills; however, its implementation requires changes in teachers' roles, classroom management skills, and professional development support. Consequently, PjBL is closely related to deep learning in education. Previous literature defines deep learning as a concept widely used to address systems and implementations of learning that are deep, measurable, systematic, and meaningful (Biggs & Tang, 1999). The foundational argument for linking PjBL, deep learning, and collaborative learning is based on Vygotsky's theory about the role of social interaction, scaffolding, and more knowledgeable others in the construction of understanding, providing the theoretical foundation for collaboration (Vygotsky, 1978).

PjBL is viewed as a strategy that can foster deeper learning because it typically focuses on science, social studies, or foreign languages. However, there is still limited research that builds a theoretical framework that explicitly integrates PjBL principles with deep learning constructs (understanding, transfer, reflection) within the context of Javanese language learning (Biggs & Tang, 1999). Moreover, most studies assess the effects of PjBL on student outcomes but do not address teachers' needs. Yet, Javanese language teachers are the primary subjects who require attention, particularly regarding their needs. Thus, there is a need for a theoretical construct that outlines teachers' needs (pedagogical competencies, project design, TPACK/technology, institutional support, and ongoing PD) as prerequisites for the success of PjBL in fostering deep learning. For digital/online contexts, Zhao et al. (2024) showed that teacher TPACK support and peer support influence deep learning through mediators such as self-efficacy and academic emotions, which emphasizes the importance of integrating teacher support and technical readiness into the learning framework.

Many PjBL theories and models promoting deep learning have been developed and tested in developed countries or specific subjects; however, the adaptation of these concepts for teaching regional languages that involve cultural elements, dialectal variations, and local content has not been extensively theorized. Local empirical findings show issues with materials and their relevance to students' lives (Rahadini et al., 2022). In relation to this, PjBL requires assessments that represent higher-order thinking skills and transfer (deeper learning), yet there is a lack of consensus on how to measure deep learning in PjBL units. This becomes even more complicated when contextualized in regional language learning (language products, cultural performances, intertextual skills).

C. Deep Learning in Language Learning

Recent literature places deep language learning at the intersection of: (a) cognitively deep task designs (generative, problem-based, collaborative), (b) psychological (self-efficacy, self-regulation) and social (teacher-student interaction) factors, and (c) learning ecosystems (blended learning, authentic assessment, reflection). These findings support the development of a collaborative project-based language learning model that explicitly targets depth indicators (analysis, integration, creation, reflection), aligning with teachers' needs to reinforce deep learning in senior high schools.

In relation to task design and deep processing in lexical acquisition, Liao et al. (2023) compared various vocabulary task types within the depth-processing framework and discussed two classical models, the Involvement Load Hypothesis (ILH) vs. the Technique Feature Analysis (TFA). Their findings affirm that tasks requiring higher semantic/relational analysis lead to better retention compared to tasks with shallow cognitive engagement (e.g., copying/marking), highlighting the importance of aligning task features with the goal of achieving "deeper" learning outcomes. For language curricula (including regional languages like Javanese), collaborative projects should integrate generative/transformational tasks (e.g., discourse reconstruction, meaning expansion, intertextual bridging) rather than merely surface-level exercises.

Meanwhile, regarding psychosocial factors and classroom ecology that predict deep learning, Sixia and Mustapha (2024) examined self-efficacy, engagement, and teacher-student interaction as significant predictors of deep learning in blended learning-based English courses at the senior high school level. The study demonstrated a positive coefficient between self-efficacy and teacher-student interaction in relation to deep learning, with engagement serving as a mediator between self-belief and deep learning behavior (Dong, 2025). The relevance of this study to the current research is that the collaborative project model needs to inject efficacy support (scaffolding, formative feedback, challenging goals) and activity designs that enhance sustained learning outcomes across phases (pre-class, in-class, post-class).

In line with this, Zhang (2025) developed and validated a deep learning model for reading English at the senior high school level, based on deep learning theory and multi-dimensional assessment. The research emphasized the integration of conceptual understanding, problem-solving, collaborative creativity, and reflection in task designs and authentic assessments. For Javanese language, this principle can be adapted through cross-text/genre projects (e.g., traditional songs, proverbs, local cultural discourse) with performance indicators based on evidence (artifacts, reflective journals, peer assessments to capture the quality of “depth”).

Koizumi and In'nami (2024) also explored the dimension of “depth” in lexical competence and its implications for instructional design. This study used Bayesian SEM to examine the breadth vs. depth of L2 vocabulary knowledge. The results showed that “size” (breadth) and “depth” are separate constructs but are closely correlated; both need to be measured and targeted in interventions. In the context of Javanese language learning, language project activities should target depth (collocation, polysemy, semantic networks, fluency of use) rather than merely expanding vocabulary. Assessment rubrics should include indicators of meaning relationships and flexibility of usage.

III. METHODOLOGY

A. Research Design

This study employs a descriptive survey approach. The descriptive survey approach aims to describe, explain, and map the characteristics of a phenomenon or a specific group factually and accurately (Singh, 2025; Sugiono, 2013). This approach was used to process survey data that describes teachers' needs regarding the innovation of a collaborative project-based Javanese language learning model. In this study, the descriptive survey approach is supported by a qualitative approach. The qualitative approach involves document analysis. Document analysis was used to deepen the survey results and uncover nuances in teachers' needs that were not captured in the survey. This approach is considered relevant to the study because it represents the initial phase of developing an innovative Javanese language learning model. The findings of this research will be used to map the teachers' needs in the empirical context, which will serve as the basis for the design of future interventions in the development of research products (Creswell & Creswell, 2018).

B. Sample and Data Collection

The subjects of this study are sixteen Javanese language teachers from several senior high schools (SMA) in Semarang, Central Java, Indonesia. The sample was selected using purposive sampling, which involves choosing respondents who are considered relevant to the research objectives, specifically teachers who actively teach Javanese language at the senior high school level and have direct experience in the teaching process. This technique was chosen to ensure that the data collected truly reflects the needs and perceptions of teachers regarding the innovation of the learning model (Etikan et al., 2016).

Data collection was carried out using a questionnaire developed based on six components of the learning model namely: (1) syntax, (2) social system, (3) reaction principles, (4) support systems, (5) instructional impact, and (6) accompanying impact (Joyce et al., 2009). The development of the research questionnaire was guided by the principles of content validity and reliability (Creswell & Creswell, 2018). In addition, document analysis was used to further explore the inhibiting factors, teachers' experiences, and the types of support needed. The questionnaire consisted of structured items with answer choices designed to probe teachers' perceptions, experiences, and needs related to the implementation of a collaborative project-based learning model for strengthening deep learning. The distribution of the questionnaire was done directly to the teachers after obtaining informed consent from the respondents. Participation in this study was voluntary. The collected data were then tabulated and analyzed descriptively to provide a comprehensive picture of the teachers' needs for innovation in Javanese language learning for senior high school students.

C. Data Analysis

The data in this study were analyzed using descriptive statistics to map the categories of needs among Javanese language teachers. The qualitative data were analyzed using thematic analysis techniques (Braun & Clarke, 2006), which included initial coding, identification of themes related to needs, and interpretation within the framework of innovative collaborative learning model development. The data analysis procedure included several stages: preparation stage, which involved developing and validating the questionnaire; data collection stage, which involved distributing the questionnaire and conducting document analysis; data analysis stage, which consisted of analyzing survey results descriptively and performing qualitative thematic analysis; and interpretation stage, which involved developing a profile

of teachers' needs as the basis for the development of a collaborative project-based learning model innovation framework to support deep learning.

IV. RESULTS AND DISCUSSION

The findings of this study focus on mapping the teachers' needs regarding the innovation of a learning model through the analysis of a questionnaire designed based on six key aspects of the learning model as proposed by Joyce et al. (2009), namely: syntax, social system, reaction principles, support systems, instructional impact, and accompanying impact. The research instrument contains a series of questions tailored to the characteristics of each aspect.

Specifically, the syntax, social system, reaction principles, and support systems components each consist of three questions that reflect teachers' needs in managing classroom interaction dynamics, pedagogical response strategies, and the readiness of supporting facilities and infrastructure. The instructional impact aspect consists of six questions that describe teachers' perceptions regarding the effectiveness of the learning model in achieving academic goals. The accompanying impact aspect includes four questions aimed at uncovering the indirect effects of learning, such as the enhancement of attitudes, social skills, and student motivation. Each aspect was presented with four response options (O1 to O4). Therefore, the presentation of the study's results aims to provide a comprehensive overview of the teachers' needs in each aspect and serve as the basis for formulating an innovation model that is relevant, contextual, and aligned with the demands of 21st-century learning. The summary of the respondents' answers is shown in Table 1.

TABLE 1
SUMMARY OF RESPONDENT ANSWERS

ASPECT	QN	O1	PERCENT	O2	PERCENT	O3	PERCENT	O4	PERCENT	NR
SYNTAX	1.	7	43.75	5	31.25	2	12.5	2	12.5	16
	2.	12	75	3	18.75	1	6.25	0	0	16
	3.	14	87.5	0	0	2	12.5	0	0	16
SOCIAL SYSTEM	1.	15	93.75	1	6.25	0	0	0	0	16
	2.	11	68.75	3	18.75	2	12.5	0	0	16
	3.	12	75	2	12.5	2	12.5	0	0	16
REACTION PRINCIPLES	1.	13	81.25	2	12.5	1	6.25	0	0	16
	2.	12	75	2	12.5	2	12.5	0	0	16
	3.	15	93.75	1	6.25	0	0	0	0	16
SUPPORT SYSTEMS	1.	8	50	3	18.75	5	31.25	0	0	16
	2.	14	87.5	1	6.25	1	6.25	0	0	16
	3.	9	56.25	1	6.25	1	6.25	5	31.25	16
INSTRUCTIONAL IMPACT	1.	13	81.25	1	6.25	2	12.5	0	0	16
	2.	16	100	0	0	0	0	0	16	
	3.	13	81.25	1	6.25	1	6.25	1	6.25	16
	4.	14	87.5	1	6.25	1	6.25	0	0	16
	5.	13	81.25	2	12.5	1	6.25	0	0	16
	6.	10	62.5	2	12.5	3	18.75	1	6.25	16
ACCOMPANYING IMPACT	1.	12	75	0	2	12.5	2	12.5	16	
	2.	13	81.25	1	6.25	0	0	2	12.5	16
	3.	12	75	1	6.25	2	12.5	1	6.25	16
	4.	11	68.75	3	18.75	1	6.25	1	6.25	16

A. Syntax

In the syntax component, the questionnaire focused on three aspects: (1) the technique of initiating learning, (2) active participation of students in reflecting, evaluating, and connecting their learning experiences with real-world contexts that support meaningful learning, and (3) reflection that involves active participation to allow students to understand the values of each learning experience and reinforce connections between learning content and real life.

Based on the data summary, it can be seen that for item 1, the majority of teachers (43.75%) chose O1, followed by O2 (31.25%). However, 12.5% chose O3 and O4. For item 2, most teachers overwhelmingly selected O1 (75%), while only 18.75% selected O2, with almost no one choosing O3 and O4. For item 3, the majority of respondents chose O1 (87.5%), with only 12.5% choosing O3. This suggests that the syntax aspect is positively perceived, with a tendency for teachers to choose O1 (>70% for items 2 and 3), indicating that teachers consider the steps and phases of the learning process to be clear and relevant, although there is still some variation in perspectives for item 1.

B. Social System

The social system component of the questionnaire addressed (1) the creation of a positive, respectful collaborative atmosphere, (2) reflecting Javanese cultural values such as *tepa slira*, *andhap asor*, *guyub rukun*, and *gotong royong* to strengthen social dynamics and deepen students' awareness of others' roles in the group, and (3) providing equitable roles, opportunities to express ideas, and evaluations among members. Based on the analysis, for item 1, nearly all respondents (93.75%) chose O1. For item 2, the majority (68.75%) selected O1, followed by O2 (18.75%) and O3 (12.5%). For item 3, most respondents selected O1 (75%), with the remaining choices spread across O2 and O3. The

analysis suggests that the social system in learning is highly appreciated by the teachers, with most respondents indicating that interaction, cooperation, and social roles in learning are functioning well. However, some teachers (around 12–18%) noted the need for improvement, particularly in items 5 and 6.

C. Reaction Principles

The reaction principles component focused on (1) teacher feedback to build students’ awareness of the thinking process and collaboration to form collaborative character and reflective skills more deeply, (2) ensuring all students actively participate, and (3) the teacher’s role in wisely responding to various situations to maintain deep, collaborative, and meaningful learning.

Based on the analysis, for item 1, 81.25% of respondents selected O1, while O2 and O3 were lower at 12.5% and 6.25%, respectively. For item 2, the majority (75%) selected O1, with 25% distributed between O2 and O3. For item 3, almost all respondents (93.75%) chose O1. The results suggest that the reaction principles (how teachers respond and facilitate students) are considered good, with the majority of teachers selecting O1. However, some teachers believe that more variety in reactions is necessary during the learning process.

D. Support Systems

The support systems component focused on (1) the availability of resources that support the creation of meaningful and contextual learning experiences, (2) the involvement of external parties (partners), and (3) the adequacy of facilities and infrastructure. For item 1, the responses were fairly distributed: O1 (50%), O2 (18.75%), and O3 (31.25%). For item 2, most respondents selected O1 (87.5%), with the remaining responses being O2 and O3. For item 3, a more balanced distribution was found, with O1 (56.25%) and O4 (31.25%) being the most selected options. Therefore, the support systems (facilities, resources, media, and learning environment) showed greater variation, with some teachers evaluating the support as insufficient (as seen in items 2 and 3). This indicates a clear need for improvement in facilities and technical support.

E. Instructional Impact

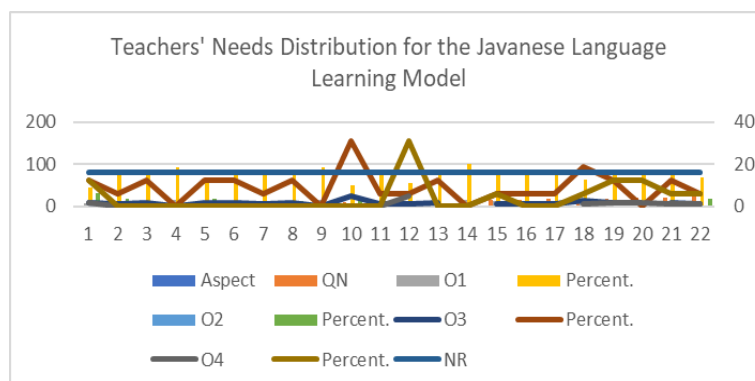
Instructional impact relates to (1) strengthening critical thinking skills, meaningful collaboration, and reflective awareness that promote exploration and deep reflection, (2) encouraging students to think critically and reflectively about the surrounding culture, (3) communication and presentation in conveying ideas, research results, and cultural narratives clearly and confidently, (4) communication skills that reflect the ability to convey cultural values meaningfully, (5) encouraging students to produce authentic learning products, and (6) students’ reflection on the outcomes of their products.

Based on the analysis, items 1–5 show that the majority of respondents selected O1 (81.25–100%). Item 2 showed more variation, with O1 (62.5%), O2 (12.5%), O3 (18.75%), and O4 (6.25%). This indicates that the instructional impact is generally perceived very positively. However, item 6 shows more variation, suggesting that in some cases, the results were not as optimal.

F. Accompanying Impact

Accompanying impact relates to (1) the development of mutual support and responsibility in the collaborative process to produce group products, (2) internalization of love for local culture and social empathy towards the surrounding environment, (3) awareness of independent learning and reflection on personal learning progress, and (4) students’ awareness of environmental issues and active involvement of the community in the learning process.

Most respondents chose O1 (75%), but some respondents selected O3 and O4 (12.5% each) for item 1. For item 2, the majority (81.25%) selected O1, with 12.5% choosing O4. For item 3, most respondents selected O1 (75%), with the rest spread across O2, O3, and O4. For item 4, 68.75% selected O1, with the remaining responses distributed across O2, O3, and O4. These results suggest that awareness of independent learning, reflection on learning progress, and awareness of environmental issues need more attention from Javanese language teachers. Based on all the analysis results of the six learning aspects, a distribution of Javanese language teachers’ needs can be seen in the following chart.



Accompanying impact relates to (1) the development of mutual support and responsibility in the collaborative process to produce group products, (2) internalization of love for local culture and social empathy towards the surrounding environment, (3) awareness of independent learning and reflection on personal learning progress, and (4) students' awareness of environmental issues and active involvement of the community in the learning process.

The collaborative project-based language learning model is highly effective in enhancing students' collaboration skills and creativity at the secondary school level. Rohmaniyah and Asih (2024) found that PjBL creates an active learning environment that significantly improves collaborative skills and creativity among senior high school students. Student engagement, intrinsic motivation, and deep understanding of the material also increased, although challenges such as time and resource limitations and insufficient teacher training remain.

Apoko (2024) emphasized that PjBL-based training integrated with teaching can strengthen students' collaborative communication skills, which are a crucial foundation for successful teamwork in language classes. From a creativity perspective, PjBL provides space for students to design authentic products, experiment, and find alternative solutions. Yu (2024) also found that project-based learning had a significant impact on improving creative thinking skills because students were given the freedom to explore ideas in relevant contexts. This confirms the findings of Fitrah et al. (2025) which claimed that the integration of PjBL with the flipped classroom approach positively affects higher-order thinking skills, including critical and creative thinking.

Furthermore, Aliah et al. (2024) revealed that collaborative PjBL effectively enhances speaking skills in English language students at the secondary level. This approach showed significant effects with a large effect size ($d = 0.87$), and it also encouraged increased motivation, self-confidence, and critical thinking skills among students. Although focused on English, these findings are relevant and can be translated into the context of Javanese language learning as a regional language. The deep learning approach, which encompasses mindfulness, meaningfulness, and joyfulness in learning, serves as a key foundation for strengthening learning.

The mindfulness aspect in the deep learning approach has been shown to contribute to competence and language skills (Babanoğlu & Atalmış, 2025; Zeilhofer & Sasao, 2022), while the meaningfulness aspect through authentic tasks encourages deep processing, creativity, and language proficiency. Meanwhile, the joyfulness aspect, especially foreign language enjoyment, is positively correlated with motivation and learning outcomes in language learning at the secondary school level (Zhang et al., 2024). Conceptually, a "deep approach" to language learning indicates that self-regulation and good learning design can lead students from surface learning to deep learning.

Rohmaniyah and Asih's (2024) study also indicated that teachers confirmed a need for professional development and institutional support for the effective implementation of PjBL. Similar challenges were observed by Suwarni and Natsir (2024) in the context of English language learning, such as time management and students' readiness for collaborative work. Additionally, Adnyana (2024) who studied the application of deep learning through PjBL in speaking skills, found obstacles such as time, facilities, and students' preparedness, which are also relevant in the context of Javanese language learning.

Maas et al. (2022) highlighted the importance of social support for teachers' deep needs, such as a sense of community within the school team, which aligns with the social system and support aspects in the learning model. Solheim et al. (2018) and Farmer et al. (2018) explored the personal factors affecting teachers' motivational styles, closely related to reaction principles (pedagogical responses) and teachers' perceptions in managing classroom interactions and dynamics. Meanwhile, Sánchez and Reyes (2025) presented a systematic framework for strengthening the implementation of PjBL, addressing structural design, institutional support, and psychosocial aspects, including indirect effects (such as student motivation and social skills), aligning with accompanying impact.

The analysis of this study shows that collaborative PjBL holds significant potential to strengthen deep learning in Javanese language learning for senior high school students in Indonesia. Empirical findings from various studies support the effectiveness of PjBL in improving students' collaboration, creativity, motivation, and deep understanding. However, for successful implementation, including in this context, teacher training, support facilities, and authentic, contextual project designs that stimulate reflection and holistic student engagement are needed.

V. CONCLUSION

Based on the research findings regarding teachers' needs for the innovation of a collaborative project-based Javanese language learning model to strengthen deep learning at the senior high school level, several key conclusions can be drawn. First, the majority of respondents, who are Javanese language teachers, perceived the syntax, reaction principles, social system, and instructional impact aspects positively, with a very high tendency toward O1 choices (>80%). This indicates that teachers have a clear understanding of the steps in learning, response strategies, and the importance of social interaction that supports the creation of collaborative and meaningful learning. Second, although these aspects are already strong, the study also revealed the need for improvement in the support systems and accompanying impact aspects. Variations in responses for these aspects show that some teachers still face obstacles related to facilities, external partners, and the reinforcement of accompanying values such as learning autonomy, environmental awareness, and the internalization of local culture.

Third, the results of this study emphasize that an innovative Javanese language learning model based on collaborative projects is needed not only to ensure instructional success but also to optimize supporting and accompanying factors.

Thus, the development of an innovative model should focus on integrating clear syntax steps, strengthening social interaction, and providing adequate support systems to create deep learning experiences. Practically, these findings imply that Javanese language teachers at the senior high school level require support in the form of contextual, culturally-based collaborative learning designs, supported by infrastructure and conducive learning environments. This is expected to improve not only students' academic skills but also their social character, creativity, and awareness of local culture and social issues in their surroundings.

This study has several implications. First, Javanese language teachers can use these findings as a foundation for designing more collaborative, contextual project-based learning rooted in local culture. Teachers' readiness to facilitate social interaction, provide varied pedagogical responses, and foster values of mutual cooperation and self-reflection are key to successful learning. Second, by implementing this model, students will have the opportunity to develop collaboration, creativity, and learning independence. Furthermore, they can cultivate social awareness and a love for local culture through real projects that connect learning to daily life.

Third, this study reinforces the relevance of the six aspects of the learning model, syntax, social system, reaction principles, support systems, instructional impact, and accompanying impact, as a framework for designing learning innovations oriented toward deep learning. Findings about teachers' needs for support systems and accompanying impact show the need for more contextual theory development in project-based learning, particularly in culturally-based subjects. Fourth, policymakers at the regional level can use these findings as a basis for developing programs to improve the competencies of Javanese language teachers, particularly in the application of innovative project-based learning models that align with 21st-century learning demands.

In-depth studies should be conducted on the role of support systems and accompanying impact, as these aspects show significant variation in teachers' needs. In this regard, further research is urgently needed, utilizing a mixed-methods approach or research and development (R&D) methodology to design, implement, and evaluate a more comprehensive innovation learning model. This can lead to the development of experimental models to test the effectiveness of the collaborative project-based Javanese language learning model in enhancing students' deep learning across cognitive, affective, and psychomotor domains.

ACKNOWLEDGEMENTS

The authors would like to thank the Ministry of Higher Education, Science and Technology of the Republic of Indonesia for accepting this research as a Doctoral Dissertation Research Scheme (PDD).

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Alfiah, M. Pd. Lecturer of PGRI University Semarang. He is currently completing his dissertation in the Doctoral program in Language Education at the Faculty of Languages and Arts, Semarang State University. Alfiah, S.Pd., M.Pd. teaches at the Regional Language and Literature Education Study Program, Faculty of Language and Arts Education, at PGRI University Semarang. He is actively conducting research in the field of Javanese language education. One of his latest works, published in 2023 entitled "*Optimizing informal education as an alternative to the preservation of the Javanese language*", explains the role of the family as the initial environment in maintaining regional languages. In addition, Alfiah wrote an article "*Learning character value analysis in literary texts has the potential to train students' high-level thinking skills*", also published in 2023. In 2022, he researched the competence of prospective educators in the assessment of

Javanese language learning in a publication in *Piwulang: Jurnal Pendidikan Javanese*. In 2024, Alfiah published the article "*Stylistic Analysis in the Javanese Song Widodari by Denny Caknan*" in *Kaloka: Journal of Regional Language and Literature Education*.



Subyantoro, M. Hum. Prof. Dr. Subyantoro, M. Hum. was born in Salatiga on February 13, 1968 and studied S1 at IKIP Semarang, S2 Linguistics at the University of Indonesia, and S3 Language Education at Jakarta State University. He is known as a professor in the field of Psycholinguistics with special expertise in psycholinguistics and forensic linguistics. Currently, he teaches at the Department of Indonesian Language and Literature, Faculty of Languages and Arts UNNES, as well as serving as the Head of the S2/S3 Indonesian Education Study Program at the UNNES Postgraduate Program since 2025. In addition, he is also trusted as the Rector of Ngudi Waluyo University, after previously serving as the Head of the Department at FBS UNNES. In the professional field, he has been active as a forensic linguist (expert witness) at the Central Java Police for more than a decade. He is also active in writing research articles in reputable national and international journals.

international journals.



Hari Bakti Mardikantoro, M. Hum. Prof. Dr. Hari Bakti Mardikantoro, M. Hum., is a Professor of Sociolinguistics at the Faculty of Language and Arts, State University of Semarang (UNNES). He actively teaches various programs—undergraduate to doctoral—including courses such as General Linguistics, Sociolinguistics, Linguistic Research Methodology, Linguistic Theory Studies, and Critical Discourse Studies. His research focus covers multilingual and multicultural societies in Central Java, including the study of diglossia and the preservation of local languages through a critical perspective of discourse. Many journal articles have been published, both in reputable national and international journals.



Tommi Yuniawan, M. Hum. Prof. Dr. Tommi Yuniawan, M. Hum., Dean of the Faculty of Languages and Arts UNNES as well as an expert in the field of ecolinguistics, who summarized the relationship between language, culture, and environmental conservation. He was inaugurated as a Professor of Ecolinguistics in February 2024 through a scientific oration entitled "*Ecolinguistics, Ikhtiar Memayu Hayuning Bumi*". In his academic career, he has published nine Scopus indexed international articles, 47 articles in Sinta-indexed national journals, as well as fourteen important book titles. One of its flagship publications, "*An Eco-linguistic Analysis of Conservation News Published by Mass Media in Indonesia*", explores the meaning of eco-lexicon in mass media texts from the perspective of UNNES ecolinguistics.