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Lecturer-Informed Instructional Design Requirements for Developing a Project-Based Collaborative Learning Model toward SDG 4

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ABSTRACT

Objective: *To identify and prioritise lecturers' instructional needs and translate integrated evidence into lecturer-informed design requirements for developing a Project-Based Collaborative Learning (PjBCL) model in higher education. It also examined how the resulting requirements could support SDG 4 by strengthening contextually relevant and competency-oriented quality education.* ***Method:*** *The study employed the Preliminary Research phase of Educational Design Research. A needs-assessment questionnaire was pilot-tested with 11 lecturers and administered to 78 lecturers at an Indonesian public university using purposive sampling. Quantitative data were analysed using descriptive statistics and internal-consistency testing, while qualitative responses were examined through inductive content analysis. The two strands were integrated using Joint Display and Meta-Inference.* ***Results:*** *The analysis produced four interrelated instructional design requirements: local contextualisation, authentic collaborative learning, institutional readiness, and student competency development. Local-context integration received the highest quantitative rating ($M = 4.65$, $SD = 0.41$), and qualitative findings specified the cultural, pedagogical, organisational, and partnership conditions required to operationalise these priorities.* ***Novelty:*** *The study advances Educational Design Research by demonstrating a transparent evidence-to-design pathway that converts lecturers' quantitative priorities and qualitative explanations into explicit instructional design requirements before model development. This lecturer-informed process provides an empirical foundation for designing and iteratively refining a context-responsive PjBCL model aligned with SDG 4 (Quality Education).*

INTRODUCTION

Higher education is undergoing profound transformation as universities are increasingly expected to prepare graduates who are capable of addressing complex, interdisciplinary, and continuously evolving societal and professional challenges. These expectations align closely with Sustainable Development Goal 4 (SDG 4: Quality Education), which emphasises inclusive, equitable, and high-quality education that equips learners with the knowledge, competencies, and lifelong learning capacities required to contribute to sustainable development. Consequently, contemporary higher education is expected to move beyond the transmission of disciplinary knowledge toward learning environments that actively engage students in analysing authentic problems, collaborating with others, generating innovative ideas, and applying knowledge in real-world contexts. This paradigm shift has strengthened the emphasis on learner-centred instructional approaches that foster higher-order competencies while enabling students to construct knowledge through meaningful and authentic learning experiences (Biggs et al., 2022; Darling-Hammond et al., 2020; González-Domínguez et al., 2020).

Among the competencies expected of university graduates, problem-solving and creative thinking have become increasingly important because contemporary societal and professional challenges are typically complex, interdisciplinary, and characterised by uncertainty rather than predetermined solutions. Graduates are therefore expected not only to analyse problems critically but also to generate innovative ideas, evaluate alternative solutions, and apply knowledge flexibly across diverse contexts. Developing these competencies requires learning experiences that extend beyond conventional lecture-based instruction, which often emphasises knowledge transmission over active knowledge construction. Instead, higher-order competencies are more effectively fostered through authentic learning environments that engage students in inquiry, collaboration, reflection, and iterative problem-solving, enabling them to integrate theoretical understanding with practical application in meaningful real-world situations (Açıkgöz et al., 2022; Guaman-Quintanilla et al., 2023; Jonassen, 2011; Saenab et al., 2019). These educational demands have encouraged universities to adopt instructional approaches that integrate authentic learning with collaborative knowledge construction. Project-Based Collaborative Learning (PjBCL) is an integrated instructional approach that combines the complementary strengths of Project-Based Learning (Al Mulhim & Eldokhny, 2020) and collaborative learning to engage students in investigating authentic problems, co-constructing knowledge, developing feasible solutions, and reflecting on both learning processes and outcomes (Baser et al., 2017). By integrating inquiry, teamwork, and project completion within meaningful real-world contexts, PjBCL provides learning experiences that promote active participation (Rupavijetra et al., 2022), shared responsibility, and deeper conceptual understanding while supporting the development of higher-order competencies such as problem-solving, creative thinking, communication, and collaboration (Yeom et al., 2022). Previous studies have consistently reported that project-based and collaborative learning contribute positively to student engagement, higher-order thinking, and professional competence when supported by appropriate instructional facilitation, scaffolding, and assessment practices (Chen & Yang, 2019; Kokotsaki et al., 2016; Rofik et al., 2022).

Despite its considerable pedagogical potential, implementing PjBCL in higher education remains a complex undertaking. Effective implementation requires lecturers to design authentic projects, facilitate collaborative learning processes, provide appropriate instructional scaffolding, integrate meaningful assessment, and adapt learning activities to diverse student characteristics and institutional contexts. These responsibilities become even more challenging in higher education environments characterised by variations in students' prior knowledge, digital literacy, learning motivation, available resources, and institutional support (Utami et al., 2023). Consequently, adopting PjBCL without first understanding lecturers' instructional needs and the contextual conditions in which teaching occurs may result in instructional designs that are theoretically robust but difficult to implement consistently and sustainably in practice. Establishing an empirical understanding of lecturers' instructional needs is therefore a critical prerequisite for developing instructional designs that are pedagogically appropriate, contextually responsive, and practically feasible (Lewis et al., 2019).

Addressing these implementation challenges requires a systematic educational research and design process that identifies stakeholder needs and contextual conditions before instructional solutions are developed (Alibraheim & El-Sayed, 2021). Educational Design Research (EDR) provides such a framework by emphasising that instructional innovation should begin with rigorous Preliminary Research, during which existing instructional practices, contextual characteristics, and stakeholder needs are systematically examined to establish an empirical foundation for subsequent design decisions. Within this phase, lecturers play a pivotal role because they are directly responsible for planning, facilitating, and evaluating learning, making their instructional experiences and contextual perspectives an essential source of design evidence. Although previous studies have extensively investigated the implementation and effectiveness of project-based and collaborative learning after instructional interventions, comparatively little attention has been given to how lecturers' instructional needs can be systematically identified, prioritised, and translated into explicit instructional design requirements during the Preliminary Research phase of EDR (Cheng et al., 2017; Hadyaoui & Cheniti-Belcadhi, 2023; Zheng et al., 2020). Furthermore, limited evidence is available on how quantitative priority patterns and qualitative explanations can be integrated to derive lecturer-informed instructional design requirements before instructional model development begins. As a result, instructional design decisions may remain theoretically informed but insufficiently grounded in the contextual realities and implementation requirements experienced by lecturers, thereby limiting their practical relevance and sustainability (Akker et al., 2013; McKenney & Reeves, 2019; Plomp, 2013).

In response to these research gaps, this study aimed to identify and prioritise lecturers' instructional needs and derive lecturer-informed instructional design requirements to inform the future development of a PjBCL model aligned with SDG 4 (Quality Education). Rather than evaluating the effectiveness of an existing instructional intervention, this study focused on generating empirically grounded instructional design knowledge during the Preliminary Research phase of EDR. Its primary contribution lies in demonstrating a transparent evidence-to-design process through which quantitative priority patterns and qualitative explanations are systematically integrated using Joint Display and Meta-Inference to derive explicit instructional design requirements. Specifically, the study operationalises Preliminary Research in EDR through an explicit evidence-to-design workflow that integrates quantitative prioritisation and qualitative explanation using Joint Display and Meta-Inference. By providing lecturer-informed and evidence-based instructional design requirements before model development begins, this study extends the methodological application of EDR and offers an empirical foundation for the subsequent design of a contextually responsive and practically implementable PjBCL model. To achieve these objectives, the study addressed the following research questions:

RQ1. What instructional needs and priority areas do lecturers identify for the future development of a PjBCL model in higher education?

RQ2. How can quantitative and qualitative evidence be integrated to explain lecturers' instructional needs and inform the future development of a PjBCL model?

RQ3. What lecturer-informed instructional design requirements can be derived from the integrated findings to inform the future development of a PjBCL model?

RESEARCH METHOD

Research design

This study represents the Preliminary Research phase of EDR and was undertaken to establish an empirical foundation for the future development of a PjBCL model in higher education. Within EDR, Preliminary Research systematically examines educational challenges, stakeholder needs, and contextual conditions before instructional solutions are designed, thereby ensuring that subsequent design decisions are grounded in empirical evidence rather than theoretical assumptions alone (McKenney & Reeves, 2019; Plomp, 2013). The conceptual and methodological framework of this phase is presented in Figure 1.

The study focused on identifying and prioritising lecturers' instructional needs and translating them into lecturer-informed instructional design requirements. A literature-informed needs assessment instrument covering Project-Based Learning, collaborative learning, culturally responsive learning, problem-solving, creative thinking, and educational needs assessment was developed, pilot-tested, refined, and subsequently administered to lecturers. Quantitative and qualitative data were collected concurrently using a single integrated questionnaire, enabling quantitative priorities and qualitative explanations to complement one another in explaining lecturers' instructional needs.

As summarised in Figure 1, the study comprised four sequential stages: instrument development, pilot testing and refinement, the main lecturer needs assessment, and integrated quantitative–qualitative analysis. Quantitative findings identified lecturers' instructional priorities, whereas qualitative findings explained their contextual and implementation implications before both datasets were integrated through Joint Display and Meta-Inference.

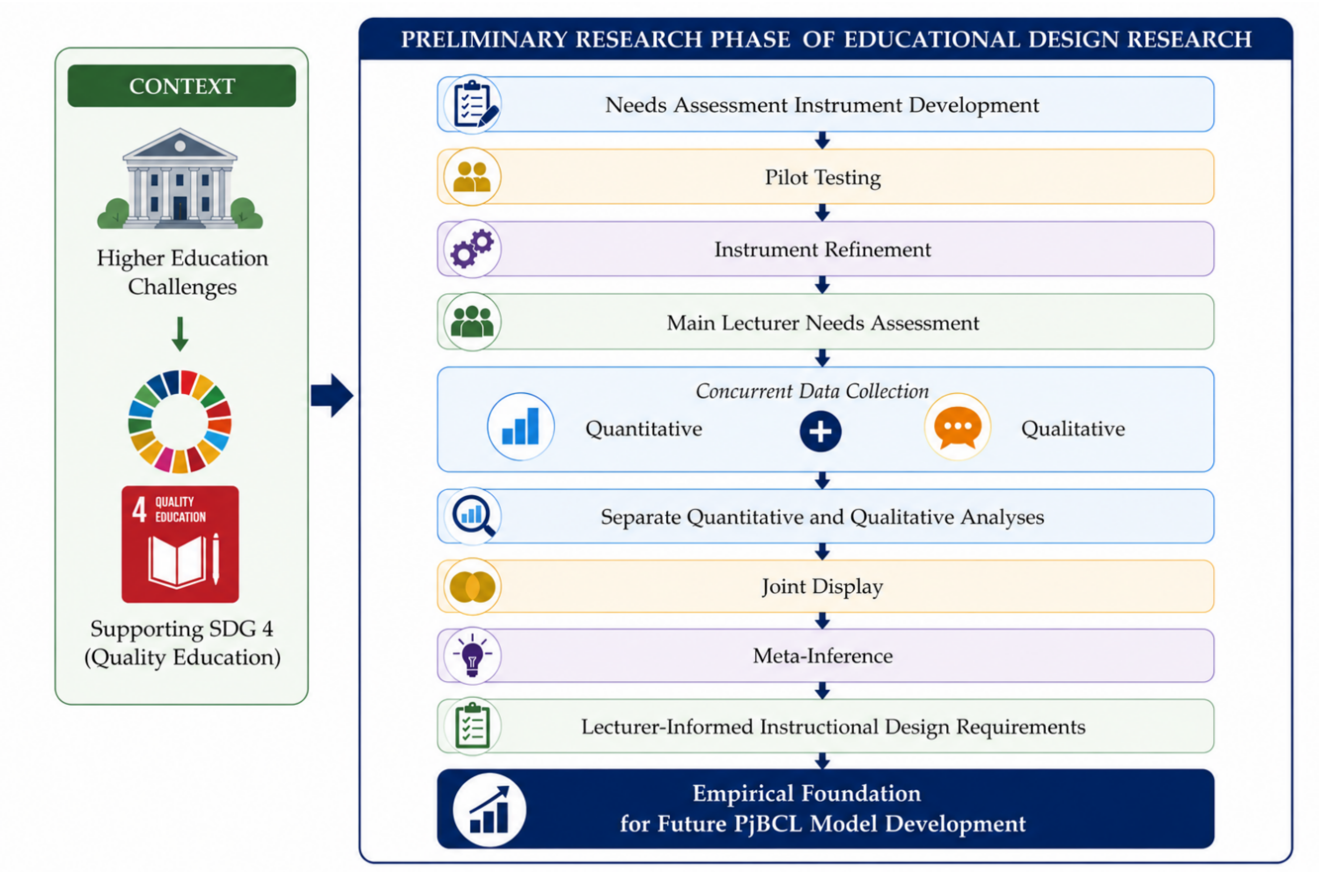

Figure 1. Conceptual and methodological framework of the preliminary research phase of EDR

Quantitative and qualitative datasets were analysed separately using procedures appropriate to each data type before being integrated through Joint Display and Meta-Inference, following established mixed methods integration procedures (Creswell & Plano Clark, 2017). The integrated findings were synthesised into lecturer-informed instructional design requirements, which constitute the principal outcome of the Preliminary Research phase and provide the empirical foundation for the subsequent design and iterative development of the proposed PjBCL model.

Instrument development and pilot testing

The needs assessment instrument was systematically developed to capture the instructional dimensions underlying lecturers' needs for the future development of a PjBCL model. Consistent with the Preliminary Research framework (Figure 1), item development was informed by the literature on Project-Based Learning, collaborative learning, culturally responsive education, problem-solving, creative thinking, instructional design, and educational needs assessment (McKenney & Reeves, 2019; Plomp, 2013). The pilot questionnaire comprised six theoretically derived quantitative constructs represented by 60 closed-ended items (10 items per construct), together with demographic questions and five open-ended questions designed to obtain qualitative feedback on contextual relevance, conceptual clarity, content coverage, and practical applicability.

The questionnaire was pilot-tested with 11 lecturers from the Faculty of Science and Engineering, Nusa Cendana University to evaluate preliminary item performance, examine internal consistency, and identify aspects requiring refinement before wider administration. As recommended for exploratory pilot studies (Hertzog, 2008; Teijlingen & Hundley, 2001), the findings were interpreted as evidence for instrument improvement rather than definitive confirmation of measurement quality. Quantitative evaluation employed corrected item–total correlations and Cronbach's alpha coefficients (Tavakol & Dennick, 2011). Items with weak statistical performance were reviewed alongside their conceptual relevance, while one zero-variance item (B2) was excluded from the reliability analysis but retained for conceptual review. The six constructs demonstrated acceptable preliminary internal consistency, supporting further instrument refinement. Detailed pilot psychometric results are provided in Supplementary Table S1.

Qualitative responses were analysed using inductive qualitative content analysis (Elo & Kyngäs, 2008). Coding and categorisation identified the need for clearer terminology, stronger representation of cultural and geographical diversity, greater consideration of institutional and technological support, and more systematic integration of authentic local knowledge and community participation. These findings informed revisions to the questionnaire instructions, item wording, and content coverage.

Following iterative refinement, the final instrument comprised 70 closed-ended items organised into seven quantitative domains and eight qualitative response fields. Four extended open-ended questions generated narrative data for qualitative analysis, while four additional response fields collected contextual information on implementation barriers, development priorities, implementation feasibility, and institutional support. The resulting instrument represented the outcome of literature-informed development, preliminary psychometric evaluation, qualitative refinement, and iterative revision, providing a conceptually comprehensive and contextually relevant basis for deriving lecturer-informed instructional design requirements.

Participants and research context

The main lecturer needs assessment was conducted at Nusa Cendana University, Indonesia, a public university located in the culturally and geographically diverse province of East Nusa Tenggara. This institutional context was considered appropriate for the Preliminary Research phase because the future Project-Based Collaborative Learning (PjBCL) model is intended to support contextually responsive learning that integrates local cultural, environmental, and geographical characteristics. The study involved 78 lecturers, all of whom completed the questionnaire, resulting in a complete dataset for subsequent quantitative and qualitative analyses.

Participants were selected using purposive sampling because the study required lecturers who could provide informed professional judgments regarding instructional needs for the future development of the PjBCL model. To ensure adequate familiarity with the instructional context, participants were required to be permanent lecturers with at least two years of teaching experience, hold a minimum of a master's degree, and have current, previous, or prospective teaching responsibilities for the Culture, Dryland, Archipelagic Regions, and Tourism (CDAT) course. These criteria ensured that participants possessed sufficient pedagogical experience and contextual knowledge to evaluate instructional conditions and identify priorities for model development.

The participants represented diverse disciplinary backgrounds, including teacher education, agriculture and forestry, social sciences, law, marine and fisheries, health sciences, engineering, mathematics and natural sciences, and economics and business. This interdisciplinary composition was considered essential because the proposed PjBCL model is intended for implementation across diverse academic disciplines while remaining responsive to the educational, geographical, and socio-cultural characteristics of East Nusa Tenggara. The demographic characteristics of the participants are presented in Table 1, whereas their teaching context and experience with project-based learning are summarised in Table 2.

Table 1. Demographic characteristics of participants (N = 78)

Characteristic	Category	n	%
Gender	Female	39	50.0
	Male	39	50.0
Age group	Under 35 years	24	30.8
	36–45 years	22	28.2
	46–55 years	15	19.2
	Over 55 years	17	21.8
Teaching experience	Under 5 years	29	37.2
	5–10 years	9	11.5
	11–15 years	11	14.1
	Over 15 years	29	37.2
Highest educational qualification	Master's degree	65	83.3
	Doctoral degree	13	16.7
Employment status	Civil servant	61	78.2
	Non-civil servant	17	21.8
Academic rank	No academic rank	11	14.1
	Assistant Professor	29	37.2
	Associate Professor	19	24.4
	Senior Associate Professor	18	23.1
	Professor	1	1.3

Note. Percentages are based on the full sample because no demographic data were missing.

Table 2. Teaching context and project-based learning experience (N = 78)

Characteristic	Category	*n*	%
Experience or plan to teach the CDAT course	Currently teaching	42	53.8
	Previously taught	33	42.3
	Plans to teach	2	2.6

Characteristic	Category	*n*	%
Experience using project-based learning	No current plan	1	1.3
	Never	5	6.4
	Rarely, 1–2 times per year	1	1.3
	Sometimes, several times per semester	21	26.9
	Often, in almost every course	36	46.2
	Very often, as a main teaching method	15	19.2

Note. Percentages are based on the full sample because no data were missing for either variable. CDAT refers to the Culture, Dryland, Archipelagic Regions, and Tourism course.

Data collection

Following pilot testing and instrument refinement, the final needs assessment instrument was administered during the main lecturer needs assessment conducted at Nusa Cendana University as part of the Preliminary Research phase of the EDR project (2025–2026). Consistent with the methodological framework presented in Figure 1, quantitative and qualitative data were collected concurrently from the same participants using a single integrated questionnaire.

The questionnaire was distributed online through institutional and professional communication channels to lecturers who satisfied the predefined inclusion criteria described in Section 2.3. Participation was voluntary. Before accessing the questionnaire, prospective participants received information explaining the purpose of the study, the intended academic use of the data, confidentiality procedures, and their right to withdraw before submitting their responses. Electronic informed consent was obtained from all participants prior to participation. No personally identifiable information was collected, and all responses were stored anonymously for research purposes only. Participants were informed that no personally identifiable information would be collected and that all responses would be used solely for academic research purposes.

The final instrument integrated quantitative and qualitative components within a single questionnaire. The quantitative component comprised 70 closed-ended items measured using five-point Likert-type response scales appropriate to each construct. The qualitative component consisted of eight response fields, including four extended open-ended questions generating narrative responses for qualitative analysis and four additional response fields capturing contextual information regarding implementation barriers, development priorities, implementation feasibility, and institutional support. Collecting both forms of evidence from the same respondents enabled direct integration during the subsequent Joint Display and Meta-Inference stages of analysis, consistent with mixed methods integration procedures (Creswell & Plano Clark, 2017).

Following data collection, quantitative and qualitative responses were organised into separate analytical datasets. Quantitative data were prepared for statistical analysis using IBM SPSS Statistics Version 31, whereas qualitative responses were anonymised and organised for systematic coding. The final dataset comprised 78 complete quantitative cases, each linked to its corresponding qualitative responses through anonymous participant identifiers to facilitate integrated interpretation while maintaining participant confidentiality.

Data analysis

Consistent with the methodological framework presented in Figure 1, quantitative and qualitative data were analysed separately using procedures appropriate to each data type before being integrated through Joint Display analysis and Meta-Inference. This integrated analytical procedure enabled both independent examination of each dataset and integrated interpretation for deriving lecturer-informed instructional design requirements (Creswell & Plano Clark, 2017).

Quantitative analyses were conducted using IBM SPSS Statistics Version 31. Following preliminary data screening, composite scores were calculated by averaging the items representing each theoretical construct. Descriptive statistics, including means and standard deviations, were used to summarise respondent characteristics, current instructional conditions, and lecturers' perceptions of the instructional dimensions investigated. Internal consistency was evaluated using Cronbach's alpha coefficients for the theory-based multi-item scales in both the pilot and final datasets. The complete internal-consistency results for the final questionnaire are reported in Supplementary Table S2 to avoid interrupting the presentation of the principal findings. Conceptually distinct single-item indicators were excluded from reliability analysis. For the two-item Guidance and Policy Need scale, the inter-item correlation was also examined because alpha is sensitive to scale length. Item-level descriptive analyses were subsequently performed to identify the relative priorities of lecturers' instructional needs and the instructional dimensions requiring greatest attention in the future development of the PjBCL model (Tavakol & Dennick, 2011).

Qualitative responses from the four extended open-ended questions were analysed using inductive qualitative content analysis. Meaning units were coded, grouped into higher-order categories, and refined into overarching themes through iterative comparison. This analytical process generated 30 data-grounded codes, seven axial categories, and four overarching themes representing lecturers' instructional needs, implementation priorities, and contextual considerations relevant to future instructional design (Elo & Kyngäs, 2008).

The quantitative and qualitative findings were subsequently integrated through Joint Display analysis to identify areas of convergence and complementarity between statistical trends and contextual explanations. Building upon this integrated evidence, Meta-Inference was conducted to generate overarching interpretations that synthesised both datasets into a coherent explanation of lecturers' instructional needs. These integrated interpretations were translated into lecturer-informed instructional design requirements, which constitute the principal outcome of the Preliminary Research phase and provide the empirical foundation for the future development of the PjBCL model (Creswell & Plano Clark, 2017).

Trustworthiness and research quality

The trustworthiness of the qualitative findings was enhanced through an iterative and transparent coding process. Coding decisions were documented systematically to establish an audit trail and ensure consistency throughout the progression from meaning units to categories and themes. Continuous comparison among codes, categories, and themes supported refinement of conceptual interpretations while reducing redundancy.

Credibility was further strengthened by integrating quantitative and qualitative evidence through Joint Display analysis and Meta-Inference, enabling direct comparison between numerical trends and qualitative explanations (Creswell & Plano Clark, 2017). This integration established a transparent link between empirical evidence, meta-inferences, and the resulting lecturer-informed instructional design requirements, thereby enhancing the credibility, dependability, and confirmability of the study findings.

Ethical considerations

Participation in the study was voluntary. Before completing the online questionnaire, participants received information regarding the study objectives, confidentiality procedures, the intended academic use of the findings, and their right to withdraw before submitting the questionnaire. Electronic informed consent was obtained from all participants. Participants were also informed that no personally identifiable information would be collected and that all responses would be used solely for academic research purposes.

No personally identifiable information was collected. All quantitative and qualitative responses were anonymised prior to analysis and reported only in aggregated or anonymised form to protect participants' privacy and confidentiality throughout the research process.

RESULTS AND DISCUSSION

Results

Pilot test results: Instrument quality

The pilot study provided preliminary evidence regarding the psychometric quality of the needs assessment instrument before its administration in the main lecturer needs assessment. Of the 60 closed-ended items, 47 achieved corrected item–total correlations of at least .30. Twelve items with lower corrected item–total correlations and one zero-variance item (B2) were reviewed and refined before the main survey. Construct-level Cronbach's alpha coefficients ranged from .693 to .823, indicating acceptable preliminary internal consistency for an exploratory pilot study (Tavakol & Dennick, 2011). Rather than removing statistically weaker items automatically, refinement decisions considered both quantitative evidence and conceptual relevance to ensure adequate content coverage. Collectively, these findings supported the refinement of the instrument prior to its use in the main lecturer needs assessment. Detailed pilot psychometric results are available in Supplementary Table S1. An overall summary of the pilot psychometric evaluation is provided in Supplementary Table S3 to facilitate interpretation of the instrument refinement process.

Dataset screening, data completeness, and final-scale reliability

All 78 questionnaires satisfied the predefined inclusion criteria and were retained for analysis. Complete responses were obtained for all 70 quantitative questionnaire items, resulting in 5,460 valid item-level observations without missing or out-of-range values. Consequently, no imputation or case deletion was required, and the complete quantitative dataset was analysed as originally collected.

Completion rates for the qualitative response fields were also high. Seven of the eight qualitative questions were completed by all participants, whereas the optional additional-comments question was completed by 69 lecturers (88.5%). Overall, the high level of quantitative and qualitative data completeness provided a robust basis for the separate analyses and their subsequent integration through Joint Display and Meta-Inference.

Internal consistency was examined for the ten theory-based multi-item scales before composite scores were calculated. Cronbach's alpha coefficients ranged from .780 to .944, indicating acceptable to excellent internal consistency across all scales. The highest coefficient was observed for *Implementation Support Required* (α = .944), followed by *Learning-Model Development Priority* (α = .938) and *Implementation Barriers* (α = .920). The two-item *Guidance and Policy Need* scale also demonstrated acceptable reliability (α =

.780). Three conceptually distinct single-item indicators—perceived difficulty integrating local context, current student problem-solving ability, and current student creative-thinking ability—were excluded because Cronbach's alpha is not applicable to single-item measures. Collectively, these findings supported the calculation of composite scores for the subsequent quantitative and integrative analyses. Detailed internal-consistency results are provided in Supplementary Table S2.

Current instructional conditions

Table 3 presents lecturers' perceptions of current instructional practices together with their assessments of students' current problem-solving and creative-thinking abilities. Overall, lecturers reported that current contextual, project-based, and collaborative instructional practices were implemented relatively well (M = 4.35, SD = 0.55). In contrast, students' current problem-solving (M = 3.74, SD = 0.73) and creative-thinking abilities (M = 3.73, SD = 0.80) received noticeably lower ratings. These findings suggest that although lecturers perceived current instructional practices positively, substantial opportunities remain to strengthen students' higher-order competencies through future instructional innovation.

Table 3. Current instructional conditions and perceived student abilities (N = 78)

Dimension	Indicator type	Minimum	Maximum	Mean	SD
Current contextual, project-based, and collaborative teaching practices	Composite mean, 10 items	2.80	5.00	4.35	0.55
Perceived current student problem-solving ability	Single-item indicator	2.00	5.00	3.74	0.73
Perceived current student creative-thinking ability	Single-item indicator	1.00	5.00	3.73	0.80

Note. Scores were measured on a five-point scale. The first dimension was computed as a composite mean across ten items, whereas problem-solving and creative-thinking abilities were each represented by a conceptually distinct single-item indicator. Higher scores indicate stronger perceived current practice or ability.

Current instructional practices showed relatively low variability (SD = 0.55), indicating greater agreement among lecturers regarding existing teaching practices. In contrast, ratings of students' problem-solving and creative-thinking abilities displayed higher variability (SD = 0.73 and SD = 0.80, respectively), reflecting more diverse perceptions across respondents. Mean differences of approximately 0.61 for problem solving and 0.62 for creative thinking indicate that lecturers generally perceived students' higher-order competencies to lag behind current instructional practices. These findings establish an empirical baseline for identifying instructional priorities presented in the following section.

Development-relevant dimensions

Table 4 presents the composite dimensions that informed the future development of the proposed PjBCL model. All eight development-relevant dimensions received high ratings, with mean scores ranging from 4.38 to 4.65 on the five-point scale. The consistently high ratings indicate broad agreement among lecturers regarding the instructional priorities that should guide the subsequent design phase of the PjBCL model.

Table 4. Development-relevant dimensions for the proposed PjBCL model (N = 78)

Development-relevant dimension	Mean	SD
Perceived educational value of local-context integration	4.65	0.41
Contextual and collaborative design support for problem solving	4.61	0.46
Contextual and innovative design support for creative thinking	4.60	0.46
Priorities for learning-model development	4.60	0.45
Implementation support required for PjBCL	4.58	0.50
Need to improve student creative-thinking processes	4.47	0.57
Need to improve student problem-solving processes	4.46	0.64
Need for lecturer guidance and institutional policy support	4.38	0.76

Note. Scores were measured on a five-point scale, with higher scores indicating stronger perceived value or need. Dimensions were ordered descriptively by their mean scores. Two dimensions shared the same rounded mean and were therefore assigned the same rank. Rankings are intended to facilitate descriptive comparison and do not indicate statistically significant differences between dimensions.

All development-relevant dimensions received mean scores above 4.30, indicating consistently positive perceptions across all instructional priorities. The highest-rated dimension was the perceived educational value of local-context integration (M = 4.65, SD = 0.41), followed by contextual and collaborative design support for problem solving (M = 4.61, SD = 0.46). The need for lecturer guidance and institutional policy support received the lowest mean score (M = 4.38, SD = 0.76), although it remained strongly endorsed by participants. Overall, the findings indicate that lecturers considered local contextualisation, authentic collaborative learning, competency development, and implementation support to be complementary priorities for the future development of the proposed PjBCL model.

Item-level priority analysis

The item-level analysis complemented the composite-dimension findings by identifying the specific instructional components that received the highest priority ratings. Across all development-related items, mean scores ranged from 4.33 to 4.82, indicating consistently strong endorsement of the instructional components considered relevant to the future development of the PjBCL model. Table 5 presents the eight highest-rated items.

Table 5. Highest-rated instructional components

Item	Construct	Mean	SD
East Nusa Tenggara local wisdom is important to integrate into learning	Local-context integration	4.82	0.42
Learning should integrate theory with field practice	Development priorities	4.76	0.46
Developing students' creative thinking is an important learning need	Creative-thinking needs	4.72	0.48
Collaboration with local communities is required in learning implementation	Implementation support	4.69	0.49
East Nusa Tenggara local wisdom can enrich problem-solving learning when properly integrated	Problem-solving needs	4.69	0.46
Students need opportunities to collaborate in problem solving to gain diverse perspectives	Problem-solving needs	4.67	0.50

Item	Construct	Mean	SD
Traditional knowledge and practices of East Nusa Tenggara communities can enrich modern academic learning	Local-context integration	4.65	0.58
Authentic problems from the local East Nusa Tenggara environment are important for developing students' problem-solving ability	Problem-solving needs	4.65	0.55

Note. Items were ranked descriptively according to their mean scores. Equal means were assigned the same rank. Rankings do not indicate statistically significant differences between items.

The highest-rated items consistently emphasised three complementary priorities for future PjBCL development. First, lecturers strongly endorsed integrating East Nusa Tenggara local wisdom and authentic local contexts into learning. Second, they highlighted the importance of connecting theoretical learning with field-based experiences through collaboration with local communities. Third, they emphasised the development of higher-order competencies, particularly creative thinking and collaborative problem solving. These findings indicate that future instructional design should simultaneously strengthen contextual relevance, authentic learning experiences, and higher-order competency development.

Qualitative findings

The qualitative analysis initially generated 439 meaning units from the four extended open-ended questions. Following the exclusion of eight incomplete or non-substantive entries, 431 meaning units were retained for analysis. Open coding generated 30 data-grounded codes, which were progressively organised into seven higher-order categories and four overarching themes. Table 6 summarises the resulting thematic structure and the distribution of coded meaning units across the four themes.

Table 6. Qualitative themes derived from lecturers' open-ended responses

Theme	Related axial categories	Frequency	Percentage
Authentic collaborative learning processes	Authentic PjBCL process; collaboration ecosystem	154	35.73
Local contextualisation	Contextual and cultural foundation	135	31.32
Institutional readiness	Institutional conditions; capacity and resources	105	24.36
Student competency development and sustainability	Student competence and engagement; sustainability and impact	37	8.58
Total		**431**	**100.00**

Note. Frequencies represent coded meaning units rather than numbers or percentages of participants. A single lecturer could contribute multiple meaning units to one or more themes. Percentages may not sum exactly to 100.00 because of rounding.

Authentic collaborative learning processes accounted for the largest proportion of coded meaning units (35.73%), followed by local contextualisation (31.32%), institutional readiness (24.36%), and student competency development and sustainability (8.58%). These frequencies indicate the relative representation of themes within the coded qualitative dataset and should not be interpreted as participant endorsement rates.

Authentic collaborative learning processes

Authentic collaborative learning processes constituted the most frequently represented theme, comprising 154 meaning units (35.73%). Lecturers emphasised the need for authentic projects, field-based learning, collaboration with local communities, and partnerships with external stakeholders. Community partnership was the most frequent open code within this theme, accounting for 68 meaning units. Respondents identified community members, local government agencies, practitioners, businesses, and other organisations as potential partners in identifying problems, implementing projects, providing expertise, and evaluating project outcomes.

Lecturers also highlighted the importance of connecting academic theory with practical activities through projects addressing observable local problems. Other recurring elements included interdisciplinary teamwork, shared student responsibility, authentic assessment, reflection, systematic documentation, and flexible project organisation. Collectively, these responses portrayed PjBCL as a learning process that should extend beyond classroom-based project completion through structured collaboration with communities and other external stakeholders.

Local contextualisation

Local contextualisation accounted for 135 meaning units (31.32%). The most frequent open code within this theme concerned the local cultural context, accounting for 72 meaning units. Lecturers consistently identified local culture, Indigenous and community knowledge, customary practices, regional characteristics, and locally relevant issues as important resources for learning and project development.

Respondents also identified the dryland and archipelagic characteristics of East Nusa Tenggara as an important contextual basis for project design. Frequently mentioned contexts included agriculture, water-resource management, livestock, tourism, environmental conditions, local economic activities, and cultural diversity. Lecturers expected these contextual elements to be incorporated into curricula, learning materials, project topics, field activities, and assessment tasks rather than being treated merely as supplementary examples.

Institutional readiness

Institutional readiness comprised 105 meaning units (24.36%). Lecturer capacity and curriculum integration were the most frequently represented components within this theme, each accounting for 28 meaning units. Other responses addressed infrastructure, technology, institutional policy, implementation resources, time allocation, and financial support.

Lecturers identified a need for professional development in contextual project design, collaborative-learning facilitation, technology integration, assessment, and the incorporation of local knowledge. They also emphasised the importance of contextual teaching materials, digital resources, institutional policies, adequate funding, and sustainable partnerships. Reported implementation challenges included limited time, lecturer workload, uneven infrastructure, technological constraints, and insufficient financial resources.

Student competency development and sustainability

Student competency development and sustainability comprised 37 meaning units (8.58%). Responses within this theme focused on problem solving, creative thinking, student engagement, innovation, and the capacity to generate contextually relevant solutions. References to creative thinking and innovation occurred more frequently than explicit references to problem solving within the coded qualitative responses.

Lecturers also expected project outcomes to extend beyond classroom assessment through continued mentoring, monitoring, evaluation, documentation, replication, and ongoing collaboration with community partners. Additional responses addressed inclusivity, social impact, sustainability, and the practical usefulness of project outputs for students and participating communities.

Collectively, the qualitative findings identified four interrelated themes: authentic collaborative learning processes, local contextualisation, institutional readiness, and student competency development and sustainability. The findings not only identified the instructional and contextual priorities expressed by lecturers but also clarified the processes, resources, partnerships, and implementation conditions through which these priorities could be operationalised. These themes provided the qualitative evidence for subsequent integration with the quantitative findings through Joint Display analysis.

Joint display

The quantitative and qualitative findings were integrated through a side-by-side Joint Display to identify areas of convergence, complementarity, and expansion between the two datasets. This integration enabled quantitative priorities and qualitative explanations to be examined simultaneously before deriving lecturer-informed instructional design requirements.

Table 7. Joint display integrating quantitative and qualitative findings

Integrated theme	Quantitative findings	Qualitative findings	Integrated Interpretation
Contextualisation through local wisdom and local realities	The perceived value of local-context integration received the highest composite mean (M = 4.65, SD = 0.41). The highest-rated individual item concerned the importance of integrating East Nusa Tenggara local wisdom into learning (M = 4.82, SD = 0.42).	The theme comprised 135 meaning units contributed by 52 lecturers. Lecturers emphasized local culture, dryland and island realities, tourism, local economic activities, community needs, local research, and contextual data.	Strong convergence: both strands identified local contextualisation as a central requirement for model development.
Authentic PjBCL process and collaborative ecosystem	The priority for learning-model development was rated very highly (M = 4.60, SD = 0.45). Highly rated items included theory–field integration (M = 4.76, SD = 0.46), community collaboration (M = 4.69, SD = 0.49), and collaborative problem solving (M = 4.67, SD = 0.50).	This was the largest theme, comprising 154 meaning units contributed by 59 lecturers. Responses emphasized authentic projects, field practice, community partnerships, interdisciplinary collaboration, teamwork, assessment, reflection, and flexible implementation.	Strong convergence and elaboration: quantitative priorities identified the central process features, while qualitative findings described how these features should operate in practice.

Integrated theme	Quantitative findings	Qualitative findings	Integrated Interpretation
Institutional readiness and implementation capacity	Implementation support was rated very highly (*M* = 4.58, *SD* = 0.50), as was the need for lecturer guidance and institutional policy (*M* = 4.38, *SD* = 0.76). Perceived implementation barriers (*M* = 3.29, *SD* = 0.87) and difficulty integrating local context (*M* = 3.38, *SD* = 1.35) were moderate.	The theme comprised 105 meaning units contributed by 51 lecturers. Responses identified lecturer capacity, learning resources, technology, facilities, institutional policy, time, and funding as implementation requirements.	Convergence and expansion: both strands indicated a strong need for implementation support, while the qualitative findings specified the forms of support required.
Student competency development and sustainable impact	Current student problem-solving ability (*M* = 3.74, *SD* = 0.73) was lower than the perceived need for improvement (*M* = 4.46, *SD* = 0.64). Current creative-thinking ability (*M* = 3.73, *SD* = 0.80) was also lower than the improvement need (*M* = 4.47, *SD* = 0.57).	The theme comprised 37 meaning units contributed by 26 lecturers. Responses addressed problem solving, creative thinking, student engagement, innovation, sustainability, and community impact.	Convergence and complementarity: quantitative findings established the competency-development needs, while qualitative findings extended the expected outcomes to engagement, sustainability, and social usefulness.

Note. Qualitative frequencies represent coded meaning units, whereas lecturer coverage indicates the number of respondents who contributed at least one meaning unit to a theme. These values should not be interpreted as endorsement percentages.

Overall, the Joint Display demonstrated consistent convergence across the four integrated themes. Local contextualisation and authentic collaborative learning received strong support from both quantitative and qualitative findings, whereas institutional readiness and student competency development were further elaborated by the qualitative evidence. Together, these integrated findings established a coherent empirical basis for the subsequent meta-inference process through which lecturer-informed instructional design requirements were derived.

Meta-inference

The integration of quantitative and qualitative findings through Joint Display yielded four overarching meta-inferences that synthesised the principal instructional priorities identified by lecturers. These meta-inferences represent the integrated interpretation of both datasets and provide the empirical basis for deriving lecturer-informed instructional design requirements for the proposed PjBCL model.

First, both strands consistently identified local contextualisation as the primary foundation for PjBCL development. Quantitatively, local-context integration received the highest composite score, while the highest-ranked individual item emphasized the importance of integrating East Nusa Tenggara local wisdom into learning. Qualitatively, lecturers repeatedly highlighted local culture, dryland and island characteristics, community knowledge, and regional problems as essential components of project-based learning. Together, these findings indicate that local contextualisation constitutes the principal instructional foundation for the proposed PjBCL model.

Second, the integrated findings identified authentic collaborative learning processes as the central instructional mechanism of PjBCL. High quantitative ratings for theory-to-field integration, collaborative problem solving, and community collaboration were reinforced by qualitative evidence describing authentic projects, field experiences, interdisciplinary teamwork, stakeholder partnerships, reflection, and authentic assessment. Across both datasets, lecturers consistently indicated that project-based collaborative learning should extend beyond classroom activities through meaningful engagement with authentic community contexts.

Third, the findings demonstrated that successful implementation depends on institutional readiness and implementation support. Quantitative results showed strong endorsement for implementation support and lecturer guidance, while qualitative responses further specified the required forms of support, including lecturer professional development, curriculum alignment, learning resources, technological infrastructure, institutional policies, partnerships, time allocation, and funding. The integrated evidence therefore indicates that effective implementation requires alignment between instructional and institutional readiness.

Finally, the integrated findings identified student competency development as the intended educational outcome of the proposed model. Quantitative findings revealed substantial needs for improving problem-solving and creative-thinking competencies, whereas qualitative responses extended these expectations to include student engagement, innovation, sustainability, and community impact. Collectively, the evidence indicates that lecturers expect PjBCL to support not only higher-order thinking skills but also meaningful learning outcomes that are applicable beyond the classroom.

Collectively, the four meta-inferences identified local contextualisation, authentic collaborative learning processes, institutional readiness, and student competency development as four interrelated empirical foundations for the future development of the proposed PjBCL model. Rather than representing final model components, these integrated foundations informed the formulation of lecturer-informed instructional design requirements that will guide the subsequent design and iterative refinement of the proposed PjBCL model in later phases of EDR.

Lecturer-informed instructional design requirements

Building upon the integrated meta-inferences, four lecturer-informed instructional design requirements were derived as the principal empirical output of this Preliminary Research phase of EDR. Rather than representing a completed instructional model, these requirements constitute evidence-based design specifications that will inform the subsequent development of the proposed PjBCL model. The resulting lecturer-informed instructional design requirements are presented in Table 8.

Table 8. Lecturer-informed instructional design requirements for pjbcl development

Empirical foundation	Lecturer-informed instructional design requirement
Local contextualisation	Learning should be organised around authentic local contexts by integrating regional culture, dryland and archipelagic characteristics, community knowledge, and locally relevant issues into project activities.

Empirical foundation	Lecturer-informed instructional design requirement
Authentic collaborative learning	Learning activities should engage students in authentic projects that combine collaboration, field experiences, interdisciplinary teamwork, stakeholder partnerships, structured reflection, and authentic assessment.
Institutional readiness	The instructional model should be supported by lecturer professional development, curriculum alignment, implementation guidelines, learning resources, technological infrastructure, institutional policies, and sustainable partnerships.
Student competency development	Learning activities should intentionally foster problem solving, creative thinking, engagement, innovation, and sustainable project outcomes that generate educational and community benefits.

Collectively, the four lecturer-informed instructional design requirements describe the essential instructional, contextual, and organisational conditions identified by lecturers for the future development of the proposed PjBCL model. Rather than representing final model components, these evidence-based requirements function as design specifications that will guide the subsequent design and iterative refinement of the proposed PjBCL model in later phases of EDR. In this way, the Preliminary Research phase fulfils its intended role within EDR by providing a transparent evidence-to-design pathway grounded in lecturers' instructional needs.

Discussion

Local contextualisation as the primary foundation for PjBCL design

The integrated findings from the Joint Display and Meta-Inference identified local contextualisation as the primary foundation for the future development of the proposed PjBCL model. Rather than functioning as supplementary content, authentic local contexts emerged as the organising principle for project selection, inquiry, collaboration, knowledge application, and assessment. Across both quantitative and qualitative findings, lecturers consistently highlighted local culture, community knowledge, dryland and archipelagic characteristics, regional economic activities, and context-specific social and environmental issues as essential foundations for instructional design. These findings indicate that contextualisation should be embedded throughout the learning process as a core instructional design principle.

This interpretation aligns with previous studies showing that project-based learning is most effective when students investigate authentic problems situated in meaningful social and professional contexts (Chen & Yang, 2019; Kokotsaki et al., 2016). The present study extends this literature by demonstrating that authenticity should be operationalised through locally relevant cultural, geographical, environmental, and community realities identified empirically during the Preliminary Research phase of EDR.

Authentic local contexts also contribute to the cognitive complexity required for higher-order learning. Issues related to dryland agriculture, water-resource management, island environments, tourism, local economic development, cultural diversity, and community practices require students to analyse evidence, integrate disciplinary knowledge, evaluate multiple perspectives, and develop contextually appropriate solutions. These learning experiences directly support the development of problem-solving and creative-thinking competencies identified as major instructional priorities.

Meaningful contextualisation, however, involves more than incorporating local culture into learning activities. It requires deliberate pedagogical integration that enables students to critically examine local knowledge, compare Indigenous and scientific perspectives, and evaluate their contributions to understanding authentic problems. Thus, contextual responsiveness depends on the systematic integration of local knowledge into the instructional process rather than on the presence of contextual content alone.

From an EDR perspective, these findings demonstrate that instructional design should be grounded in empirical analyses of contextual conditions and stakeholder needs before design decisions are undertaken (Akker et al., 2013; McKenney & Reeves, 2019; Plomp, 2013). In this study, local contextualisation emerged from the integration of quantitative priorities and qualitative explanations through Joint Display and Meta-Inference, illustrating a transparent evidence-to-design process for deriving lecturer-informed instructional design requirements.

Accordingly, local contextualisation constitutes the first lecturer-informed instructional design requirement for the proposed PjBCL model. It should be systematically embedded through authentic project selection, contextual learning resources, stakeholder engagement, and authentic assessment, thereby providing an empirical foundation for subsequent model development. These findings reinforce the EDR principle that instructional innovation should be grounded in authentic contextual conditions identified during the Preliminary Research phase (McKenney & Reeves, 2019; Plomp, 2013).

Authentic collaborative learning as the core instructional mechanism

The integrated findings derived from the Joint Display, Meta-Inference, and lecturer-informed instructional design requirements identify authentic collaborative learning as the core instructional mechanism of the proposed PjBCL model. Building upon the contextual foundation established in the previous subsection, lecturers consistently viewed collaboration not merely as classroom group work but as the process through which authentic local contexts are transformed into meaningful learning experiences. Collaboration was perceived as involving shared inquiry, theory-to-practice integration, stakeholder engagement, collective reflection, and the co-construction of practical solutions, thereby linking contextual learning, project implementation, and higher-order competency development.

This interpretation is consistent with previous studies showing that project-based learning is most effective when students investigate authentic problems, participate actively in decision-making, collaborate throughout the learning process, and generate practically relevant solutions (Chen & Yang, 2019; Kokotsaki et al., 2016). The present study extends this literature by demonstrating that authentic collaboration emerged empirically as a lecturer-informed instructional design requirement during the Preliminary Research phase of EDR rather than merely as a pedagogical strategy. Consequently, collaboration functions as the organising mechanism integrating contextual learning, knowledge construction, and project implementation within the proposed instructional model.

The integrated findings further indicate that authentic collaboration should extend beyond classroom interaction by engaging community members, practitioners, government agencies, businesses, and other external stakeholders. These partners contribute authentic problems, contextual knowledge, professional expertise, learning resources, and formative feedback, making community engagement an integral instructional component rather than an optional extension of project activities.

Authentic collaboration also serves as a cognitive mechanism for developing higher-order competencies. By engaging with ill-structured problems, students analyse evidence, evaluate alternative perspectives, negotiate ideas, justify decisions, and integrate multiple sources of knowledge. Sustained interaction with peers and external stakeholders promotes critical reflection, collaborative reasoning, and creative problem solving, consistent with (Jonassen, 2011) conception of meaningful problem solving in complex situations. However, such collaboration does not emerge automatically from group work. Lecturers consistently emphasised the importance of instructional scaffolding, authentic assessment, structured reflection, flexible project organisation, and continuous facilitation to sustain meaningful participation throughout the project cycle.

From an EDR perspective, these findings demonstrate that authentic collaboration should be derived from systematic analyses of stakeholder needs rather than predetermined solely by collaborative learning theory (McKenney & Reeves, 2019; Plomp, 2013). By integrating quantitative priorities with qualitative explanations through Joint Display and Meta-Inference, the study provides a transparent evidence-to-design process for deriving lecturer-informed instructional design requirements.

Accordingly, authentic collaborative learning constitutes the second lecturer-informed instructional design requirement for the proposed PjBCL model. It should be systematically embedded through stakeholder engagement, collaborative inquiry, structured reflection, authentic assessment, and sustained interaction with local communities, thereby connecting contextual learning with higher-order competency development. Successful implementation, however, depends on lecturer capacity, curriculum alignment, institutional support, learning resources, and organisational coordination, which form the basis of the third lecturer-informed instructional design requirement discussed in the following subsection.

Institutional readiness as a prerequisite for sustainable PjBCL implementation

Building upon local contextualisation and authentic collaborative learning, the integrated findings establish institutional readiness as the organisational condition required to sustain the proposed PjBCL model. The Joint Display and Meta-Inference indicate that authentic contextual and collaborative learning cannot be implemented effectively without adequate institutional support. Rather than viewing institutional factors as external administrative conditions, lecturers identified professional competence, curriculum alignment, learning resources, technological infrastructure, organisational policies, external partnerships, time allocation, and funding as integral components of instructional design that determine implementation feasibility and long-term sustainability.

This interpretation aligns with previous research demonstrating that project-based learning is difficult to sustain without lecturer preparation, instructional resources, implementation time, and organisational support. (Kokotsaki et al., 2016) identified staff development, institutional commitment, technological support, effective group management, and appropriate assessment as critical conditions for successful project-based learning, whereas (Lewis et al., 2019) highlighted the complexity of designing and facilitating authentic project-based learning in higher education. Extending this literature, the present study shows that institutional readiness should be established during the Preliminary Research phase rather than addressed only during implementation, thereby emerging as an explicit lecturer-informed instructional design requirement.

Lecturer capacity represents the core dimension of institutional readiness because implementing PjBCL requires roles extending beyond content delivery. Lecturers are expected to design authentic projects, integrate disciplinary knowledge with local contexts, facilitate collaborative inquiry, coordinate community partnerships, provide instructional scaffolding, monitor project progress, and conduct authentic assessment. These responsibilities require competencies in contextual instructional design, collaborative facilitation, educational technology, partnership management, and authentic assessment. Accordingly, professional development should be viewed as a strategic investment in instructional innovation rather than remediation of individual capability gaps.

Institutional readiness also depends on curriculum alignment with the demands of authentic project-based learning. Authentic projects require sufficient instructional time, flexible learning arrangements, appropriate assessment systems, and formal integration into programme curricula. Institutional policies, technological support, and partnership mechanisms further enable ethical field engagement, student safety, sustainable collaboration with external stakeholders, and reciprocal community partnerships.

From an EDR perspective, these findings contribute both methodologically and practically. Consistent with Educational Design Research, which emphasises analysing contextual conditions and stakeholder needs before instructional design begins (Akker et al., 2013; McKenney & Reeves, 2019; Plomp, 2013), institutional readiness was derived empirically through the integration of quantitative priorities and qualitative explanations using Joint Display and Meta-Inference. The resulting evidence provides a transparent evidence-to-design pathway through which stakeholder perspectives inform instructional design requirements and subsequent model development.

For the subsequent design phase, institutional readiness should be operationalised through lecturer guidelines, professional development, curriculum mapping, authentic assessment frameworks, technology support, partnership protocols, and resource-planning strategies. These supporting components should preserve the core instructional principles of PjBCL while allowing adaptation across disciplinary and contextual settings. Involving institutional leaders during the subsequent design and formative evaluation phases will further strengthen organisational coherence, implementation feasibility, and long-term sustainability.

Accordingly, institutional readiness constitutes the third lecturer-informed instructional design requirement derived from the integrated findings. Aligning lecturer capacity, curriculum structures, institutional policies, learning resources, technology, external partnerships, and organisational commitment provides the essential organisational foundation for the proposed PjBCL model and prepares the transition to the final instructional design requirement: student competency development. From an EDR perspective, these findings demonstrate that institutional conditions constitute essential contextual inputs for subsequent instructional design decisions.

Student competency development as the intended educational outcome

Building upon the contextual, collaborative, and institutional foundations identified in the preceding subsections, the integrated findings establish student competency development as the intended educational outcome of the proposed PjBCL model. The Joint Display, Meta-Inference, and lecturer-informed instructional design requirements consistently revealed a perceived gap between the implementation of contextual, project-based, and collaborative learning and students' problem-solving and creative-thinking abilities. Because these findings are based on lecturers' perceptions rather than direct measurements of student performance, they should not be interpreted as objective evidence of competency levels. Instead, they identify an empirically grounded need to strengthen the alignment between instructional design and higher-order competency development.

This interpretation aligns with contemporary expectations that higher education should prepare graduates capable of analysing complex situations, evaluating evidence, generating innovative ideas, and applying disciplinary knowledge to authentic problems. Project-based learning has consistently been shown to foster these competencies through sustained inquiry, collaborative decision-making, and meaningful problem solving (Chen & Yang, 2019; Kokotsaki et al., 2016). Likewise, (Jonassen, 2011) argued that meaningful problem solving develops through engagement with complex, ill-structured situations rather than routine procedures. The present study extends this literature by demonstrating that higher-order competencies do not emerge automatically through project-based or collaborative learning but require deliberate instructional sequencing, contextual learning, scaffolding, authentic assessment, and sustained engagement with meaningful local problems.

Beyond strengthening higher-order competencies, the lecturer-informed instructional design requirements demonstrate how the proposed PjBCL model can operationalise SDG 4 (Quality Education) through contextually responsive, collaborative, learner-centred, and competency-oriented instructional design. SDG 4 emphasises inclusive and equitable quality education that equips learners with the knowledge, skills, values, and competencies required to address contemporary social, environmental, and economic challenges (UNESCO, 2020; United Nations, 2015). By integrating contextual learning, collaboration, problem solving, and creative thinking into a coherent instructional design, the proposed model is expected to improve instructional quality while preparing graduates to address sustainability challenges through authentic learning experiences.

The findings further indicate that problem solving and creative thinking should be viewed as complementary rather than independent outcomes. Authentic local problems rarely have single correct solutions, requiring students to analyse evidence, evaluate alternatives, generate innovative ideas, implement solutions, and refine decisions through reflection. Problem solving provides the analytical structure for inquiry, whereas creative thinking supports the generation of original and contextually appropriate solutions. Together with student engagement, collaborative responsibility, innovation, sustainable project outcomes, and meaningful community contribution, these competencies represent a broader conception of learning that encompasses cognitive, social, creative, and contextual dimensions.

This broader competency orientation is particularly relevant within the authentic contexts of East Nusa Tenggara, where challenges related to dryland environments, island communities, tourism, agriculture, water-resource management, local economies, and cultural diversity require students to integrate disciplinary knowledge with contextual understanding while adapting solutions to community realities. Such experiences enable higher-order competencies to become both academically rigorous and socially meaningful.

From the perspective of EDR, these findings provide both methodological and pedagogical contributions. Consistent with the principle that instructional innovations should be grounded in systematic analyses of stakeholder needs and contextual conditions before design begins (Akker et al., 2013; McKenney & Reeves, 2019; Plomp, 2013), the present study translated lecturers' competency priorities into explicit lecturer-informed instructional design requirements through Joint Display and Meta-Inference, thereby demonstrating a transparent evidence-to-design process.

These findings also provide clear direction for the subsequent design phase of EDR. The proposed PjBCL model should embed higher-order competencies throughout the project cycle by integrating authentic problem identification, evidence-based analysis, brainstorming, experimentation, iterative refinement, solution implementation, reflective inquiry, and graduated instructional scaffolding that progressively promotes learner autonomy. Assessment should likewise move beyond evaluating final products by incorporating multiple sources of authentic evidence, including problem analyses, project plans, reflective journals, peer feedback, stakeholder evaluations, presentations, iterative product revisions, and authentic performance tasks. Such an approach enables lecturers to evaluate both learning processes and outcomes while maintaining alignment with the intended instructional objectives.

Accordingly, student competency development constitutes the fourth lecturer-informed instructional design requirement derived from this Preliminary Research phase. The proposed PjBCL model should intentionally cultivate problem-solving and creative-thinking competencies while simultaneously promoting engagement, innovation, collaboration, sustainability, and meaningful community contribution. Together with local contextualisation, authentic collaborative learning, and institutional readiness, this requirement completes the integrated empirical foundation guiding the subsequent design and formative evaluation phases of EDR. These findings further reinforce the EDR principle that instructional design should explicitly address the competencies expected from future learning environments.

Contributions of Lecturer-informed instructional design requirements to EDR

The principal contribution of this study lies not only in identifying lecturers' instructional needs but also in demonstrating how integrated quantitative and qualitative evidence can be translated into explicit instructional design requirements during the Preliminary Research phase of EDR. By integrating quantitative priorities, qualitative explanations, Joint Display, and Meta-Inference, the study generated four interconnected design requirements—local contextualisation, authentic collaborative learning, institutional readiness, and student competency development—that constitute the principal design artefact and empirical foundation for the subsequent development of the proposed PjBCL model.

From a theoretical perspective, the study extends the conceptualisation of Preliminary Research within EDR. Whereas previous studies on project-based and collaborative learning have primarily examined instructional implementation and learning outcomes following educational interventions (Chen & Yang, 2019; Kokotsaki et al., 2016; Lewis et al., 2019), this study demonstrates how stakeholder evidence can systematically inform instructional design before model construction begins. Preliminary Research is therefore positioned not merely as a descriptive needs assessment but as a phase that generates empirically grounded design knowledge for subsequent instructional design decisions.

Methodologically, the study demonstrates a transparent evidence-to-design process consistent with EDR principles (Akker et al., 2013; McKenney & Reeves, 2019; Plomp, 2013). Quantitative priorities and qualitative explanations were integrated through Joint Display and Meta-Inference to derive explicit design requirements before model development, providing a transparent, traceable, and potentially reproducible analytical procedure for Preliminary Research. The study also highlights lecturers as key sources of contextual and professional knowledge whose perspectives shape instructional priorities, implementation requirements, and intended learning outcomes, thereby strengthening the contextual relevance of subsequent model development.

Practically, the four design requirements provide preliminary specifications for the proposed PjBCL model by informing project selection, instructional syntax, learning resources, stakeholder engagement, organisational support, instructional scaffolding, and authentic assessment. Although requiring further refinement through iterative design and formative evaluation, these requirements also constitute an evidence-based framework for operationalising SDG 4 (Quality Education) within contextually responsive higher education. By supporting learner-centred, competency-oriented, and stakeholder-informed learning environments, the proposed evidence-to-design process aligns with UNESCO's vision of promoting critical thinking, creativity, collaboration, and competencies for sustainable development (UNESCO, 2020).

Although developed within a single institutional context, the analytical procedure may inform Preliminary Research in comparable higher education settings. While the resulting design requirements remain context dependent, the evidence-to-design process offers broader methodological value for instructional designers, curriculum developers, and higher education institutions seeking to derive contextually responsive instructional design requirements from stakeholder evidence.

Several limitations should nevertheless be acknowledged. The findings were derived from lecturers at a single Indonesian public university and therefore represent perceived instructional needs rather than evidence of the validity, practicality, or effectiveness of a completed instructional model. In addition, the study did not include direct measures of student competencies or multi-institutional comparisons, limiting the transferability of the findings. Consequently, the proposed design requirements should be regarded as preliminary specifications requiring further refinement during subsequent design, formative evaluation, and implementation phases of EDR.

Overall, this study demonstrates how systematically integrated quantitative and qualitative evidence can be translated into instructional design requirements during the Preliminary Research phase of EDR. The resulting evidence-to-design framework provides an empirically grounded foundation for developing a contextually responsive Project-Based Collaborative Learning model that supports SDG 4 (Quality Education). Through local contextualisation, authentic collaborative learning, institutional readiness, and student competency development, the study illustrates how Preliminary Research can generate evidence-based instructional design requirements that operationalise SDG 4 within higher education.

CONCLUSION

Fundamental Finding: This study demonstrates that lecturers' instructional needs can be systematically transformed into explicit instructional design requirements during the Preliminary Research phase of Educational Design Research. The integration of quantitative priorities and qualitative explanations through Joint Display and Meta-Inference produced four interrelated requirements: local contextualisation as the instructional foundation, authentic collaborative learning as the core learning mechanism, institutional readiness as the enabling organisational condition, and student competency development as the intended educational outcome. Together, these findings establish a transparent evidence-to-design foundation for developing a context-responsive PjBCL model that contributes to SDG 4 (Quality Education). **Implication:** The findings provide an evidence-based blueprint for instructional designers, lecturers, curriculum developers, and institutional leaders. The proposed requirements can guide authentic project selection, community and stakeholder engagement, instructional scaffolding, assessment design, lecturer professional development, curriculum alignment, and resource planning. Their integrated application may strengthen quality education by connecting local knowledge and real-world problems with collaborative inquiry, creative thinking, problem solving, and sustainable community-oriented outcomes. **Limitation:** The study involved 78 lecturers selected purposively from a single Indonesian public university and therefore reflects perceived instructional needs within one institutional and regional context. It did not include direct classroom observation, objective measurement of student competencies, or perspectives from students, institutional leaders, and community partners. Moreover, the research was limited to the Preliminary Research phase of EDR, so the identified requirements represent preliminary design specifications rather than evidence of the practicality or effectiveness of a completed PjBCL model. **Future Research:** Subsequent studies should translate the four requirements into concrete model components, learning syntax, implementation guidelines, learning resources, and authentic assessment instruments. These components should be examined through expert review, formative evaluation, pilot implementation, and iterative field testing. Future research should also employ direct measures of problem solving, creative thinking, collaboration, engagement, and authentic project performance; include multiple stakeholder groups; and compare implementation across disciplines, institutions, and geographical contexts to strengthen transferability and determine the model’s contribution to SDG 4.

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AUTHOR CONTRIBUTIONS

Zet Yulius Baitanu Conceptualisation, methodology, investigation, data curation, formal analysis, visualization, Writing—original draft, project administration. **Suryanti** Supervision, methodology, Writing—review and editing. **Lamijan Hadi Susarno** Supervision, Writing—review and editing.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no financial or non-financial competing interests that could have influenced the research reported in this article.

ETHICAL COMPLIANCE STATEMENT

Institutional permission to conduct the study was obtained from the State University of Surabaya (UNESA) through Research Permission Letter No. A/1522/UN38.1/PP.11.01/2025, dated 10 March 2025, and from Nusa Cendana University through Research Data Collection Permission Letter No. 1448/UN15.22/LT/2025, dated 15 September 2025. Pilot testing was conducted under separate institutional approval from the Faculty of Science and Engineering, Nusa Cendana University. Participation was voluntary, electronic informed consent was obtained from all participants, no personally identifiable information was collected, and all responses were anonymised and treated confidentially throughout the study.

STATEMENT ON THE USE OF AI OR DIGITAL TOOLS IN WRITING

During manuscript preparation, the authors used ChatGPT (OpenAI) to assist with language refinement and to perform a secondary consistency check of selected de-identified qualitative response units. AI was used solely to improve writing clarity and to identify potential inconsistencies in qualitative coding. It did not generate the codebook, assign qualitative codes, develop themes, interpret findings, or make methodological decisions. No personally identifiable participant information was shared with the AI system. All AI-assisted outputs were critically reviewed, verified, and approved by the authors, who accept full responsibility for the accuracy, originality, confidentiality, and integrity of the manuscript.

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