

ORIGINAL

Rethinking Pedagogical Sequences: Exploring the Syntax of Research-Based Learning in Undergraduate Primary Teacher Education

Repensando las Secuencias Pedagógicas: Explorando la Sintaxis del Aprendizaje Basado en la Investigación en la Formación de Maestros de Educación Primaria de Pregrado

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ABSTRACT

Introduction: research-based learning (RBL) has increasingly gained attention in higher education as a strategy to strengthen research competence and professional readiness among prospective primary school teachers.

Objective: this study aims to explore and reconsider the pedagogical sequences that shape the syntax of RBL in undergraduate primary teacher education.

Method: the research employed a qualitative approach with a case study design, involving three institutions: Universitas Pendidikan Indonesia, Universitas Negeri Malang, and Universitas Sultan Ageng Tirtayasa. The subjects consisted of 15 lecturers and 30 students selected through purposive sampling. Data were collected through interviews and documentation, then analyzed using an interactive model encompassing data reduction, data display, and conclusion drawing.

Result: the findings reveal variations in seven phases of the Syntax of RBL, namely: (1) formulating general questions, with differences in lecturer guidance and student independence; (2) literature review, emphasizing diverse forms of theory-practice integration; (3) formulating research questions, ranging from instrument design, field experience, to the development of critical proposals; (4) planning methods, with quantitative, qualitative, or mixed orientations; (5) data collection and analysis, highlighting the role of students as active researchers; (6) interpretation of results, with reflective, solution-oriented, or academic-productive orientations; and (7) reporting, producing outputs in the form of scientific articles, applicative reports, mini research, and publications.

Conclusions: these findings indicate that rethinking the Syntax of RBL provides a systematic framework to align pedagogical practices with the diverse needs of institutions while simultaneously strengthening the critical, reflective, and collaborative capacities of prospective primary school teachers.

Keywords: Research-Based Learning; Pedagogical Sequences; Learning Syntax; Student and Lecturer Perceptions; Primary Teacher Education.

RESUMEN

Introducción: el aprendizaje basado en la investigación (RBL) ha ganado cada vez más atención en la educación superior como una estrategia para fortalecer la competencia investigadora y la preparación profesional de los futuros maestros de primaria.

Objetivo: este estudio tiene como objetivo explorar y reconsiderar las secuencias pedagógicas que configuran la sintaxis del RBL en la formación universitaria de docentes de educación primaria.

Método: la investigación empleó un enfoque cualitativo con un diseño de estudio de caso, que involucró a tres instituciones: la Universitas Pendidikan Indonesia, la Universitas Negeri Malang y la Universitas Sultan Ageng Tirtayasa. Los sujetos estuvieron conformados por 15 docentes y 30 estudiantes seleccionados mediante muestreo intencional. Los datos se recopilaron a través de entrevistas y documentación, y posteriormente se analizaron utilizando un modelo interactivo que abarcó la reducción de datos, la presentación de datos y la extracción de conclusiones.

Resultados: los hallazgos revelan variaciones en siete fases de la sintaxis del RBL, a saber: (1) la formulación de preguntas generales, con diferencias en la orientación del docente y la independencia del estudiante; (2) la revisión de la literatura, que enfatiza diversas formas de integración teoría-práctica; (3) la formulación de preguntas de investigación, que abarca desde el diseño de instrumentos, la experiencia en el campo, hasta el desarrollo de propuestas críticas; (4) la planificación de métodos, con orientaciones cuantitativas, cualitativas o mixtas; (5) la recopilación y análisis de datos, que resalta el papel de los estudiantes como investigadores activos; (6) la interpretación de resultados, con orientaciones reflexivas, orientadas a la solución o académico-productivas; y (7) la elaboración de informes, produciendo resultados en forma de artículos científicos, informes aplicativos, investigaciones breves y publicaciones.

Conclusiones: estos hallazgos indican que repensar la sintaxis del RBL proporciona un marco sistemático para alinear las prácticas pedagógicas con las diversas necesidades de las instituciones, al tiempo que fortalece las capacidades críticas, reflexivas y colaborativas de los futuros maestros de educación primaria.

Palabras clave: Aprendizaje Basado en la Investigación; Secuencias Pedagógicas; Sintaxis del Aprendizaje; Percepciones de Estudiantes y Docentes; Formación de Maestros de Primaria.

INTRODUCTION

Twenty-first century education is characterized by the rapid advancement of knowledge, technology, and globalization.⁽¹⁾ Educational institutions are required to prepare students who are not only able to absorb knowledge but also possess higher-order thinking skills.⁽²⁾ Several core competencies that often serve as global benchmarks include critical thinking, problem solving, collaboration, creativity, decision making, and the ability to conduct research-based inquiry.^(3,4,5,6,7) These competencies are not only relevant for students in primary or secondary education but are also essential for prospective teachers, particularly primary school teachers who will play a role in shaping the thinking foundations of future generations. Prospective teachers need to be equipped with skills to analyze learning problems, design pedagogical solutions, and evaluate teaching practices reflectively. A teacher who is accustomed to conducting inquiry through mini classroom research will be better prepared to identify student needs, adapt instructional approaches, and make pedagogical decisions quickly and appropriately.^(4,8)

The development of modern learning theories demonstrates a fundamental shift from teacher-centered learning to student-centered learning.⁽⁹⁾ The traditional paradigm that positioned lecturers or teachers as the sole source of knowledge is no longer adequate. In today's open information era, students are required to actively search for, process, and construct knowledge through authentic learning experiences.⁽¹⁰⁾ Furthermore, student-centered approaches are often realized through various innovative models such as problem-based learning, project-based learning, inquiry-based learning, and research-based learning (RBL).^(7,11,12,13) RBL, in particular, provides opportunities for students to learn through the research process, starting from problem formulation, framework development, data collection, result analysis, to drawing conclusions. This model positions students not as consumers of knowledge but as active producers of knowledge.⁽¹⁴⁾

Several international studies highlight the positive contributions of RBL to various aspects of student development.⁽¹⁵⁾ emphasized that RBL can increase student participation in the academic community and foster their identity as researchers. Furthermore, students engaged in RBL experiences demonstrated stronger conceptual understanding compared to those taught through conventional methods.⁽¹⁶⁾ The RBL implementation significantly enhances cognitive abilities (critical thinking and problem solving), metacognitive awareness, and student self-regulation through the support of learning autonomy and lecturer guidance, making it effective in developing essential competencies for academic and professional success.⁽¹⁷⁾

As a learning model, RBL consists of pedagogical components described through syntax, social systems, reaction principles, support systems, as well as instructional and nurturant effects.⁽¹⁸⁾ The Syntax of RBL includes stages from problem identification, formulation of research questions, method design, data collection, analysis, to presentation of results, providing authentic learning experiences for students. The social system emphasizes interaction between students and lecturers and among students through group work, discussions,

and joint data analysis, with lecturers acting as facilitators. Reaction principles highlight how lecturers respond to students' thinking processes by providing feedback that strengthens arguments, improves research designs, and sharpens analysis. Support systems are required in the form of references, data access, technological facilities, and academic policies that support student research. Its instructional effect is mastery of knowledge and research skills, while its nurturant effects include the development of critical attitudes, self-confidence, collaboration skills, and readiness to become lifelong learners.

In Indonesia, Teacher Education Institutions (LPTK) play an important role in preparing prospective primary school teachers. LPTK are not only responsible for instilling mastery of subject matter but also for shaping the pedagogical capacity of prospective teachers so that they are able to make quick, precise, and contextual classroom decisions.⁽¹⁹⁾ LPTK are expected to produce graduates who are more adaptive, critical, and innovative through research-based learning.⁽²⁰⁾ Future teachers who are accustomed to researching their classrooms will be more prepared to face the complexities of teaching, including student diversity, limited resources, and continuously changing curricula.⁽²¹⁾

Despite its potential, RBL implementation in Indonesia remains limited. Many LPTK still consider RBL as an ideal concept rather than a fully realized classroom practice. This can be understood due to several factors. First, the strong tradition of teacher-centered learning in universities, where lecturers dominate the flow of instruction through lectures.⁽²²⁾ Second, the limited capacity of lecturers to manage research-based learning, either due to workload or resource constraints.⁽²³⁾ Third, students are generally accustomed to conventional learning patterns, so their experience in conducting mini research remains very limited.⁽²⁴⁾ Furthermore, institutional support in the form of policies, facilities, or evaluation systems has not fully encouraged the implementation of RBL. Many courses still rely on individual or group assignments without involving systematic research processes. As a result, students often merely replicate or summarize theories without truly experiencing a complete research process. This leads to underdeveloped research skills, with learning orientation still limited to fulfilling academic requirements rather than building sustainable competence.^(11,25)

Some local studies only highlight small-scale RBL implementation, for example, in a single course or experimental class. While the results show improvements in student skills, no study has comprehensively mapped student and lecturer perceptions of all RBL components. For instance, the extent to which students understand Syntax of RBL and how social dynamics function within research groups. This study offers an integrative perspective by: (1) presenting both lecturer and student perceptions; (2) analyzing RBL implementation in study program documents; and (3) providing evidence from the Indonesian context, which is relatively underrepresented in international literature.

The urgency of this study lies in its contribution to enriching the literature by comprehensively highlighting perceptions of Research-Based Learning (RBL) implementation, thereby enhancing both theoretical and practical understanding of the effectiveness of this model in higher education. The findings are also expected to provide valuable input for lecturers in Teacher Education Institutions to design RBL strategies that are more effective, relevant, and aligned with students' real needs. Moreover, this research plays an important role in supporting the quality development of the Primary Teacher Education (PGSD) program to produce prospective primary school teachers with strong basic research skills, which will be an essential foundation in facing 21st-century educational challenges. Additionally, this study presents perspectives from a developing country regarding RBL practices in teacher education, thereby enriching international discourse and contributing to the development of global educational practices.

Based on the background explanation above, the purpose of this study is to analyze lecturer and student perceptions of Research-Based Learning (RBL) implementation in the PGSD program comprehensively in terms of pedagogical design, social dynamics, feedback mechanisms, and institutional support, as well as to identify areas for strengthening that impact learning quality and the professional readiness of prospective teachers.

METHOD

Research Design

This study employed a qualitative approach with a case study design. The qualitative approach was chosen because this research focused on gaining an in-depth understanding of lecturers' and students' perceptions of the implementation of Research-Based Learning (RBL) in courses within the Primary Teacher Education (PGSD) program. A case study design was selected to obtain a comprehensive overview of RBL implementation in PGSD courses.

Research Subject

The research subjects involved three campuses: PGSD Universitas Pendidikan Indonesia, Tasikmalaya Campus (UPI), PGSD Universitas Negeri Malang, Blitar Campus (UM), and PGSD Universitas Sultan Ageng Tirtayasa (Untirta), with five lecturers and ten students from each campus as the main participants. The total research subjects were 15 lecturers and 30 students. This number was determined based on the qualitative design of

the study, which prioritizes data richness and diversity over large sample sizes. The distribution across three campuses ensured representation of different institutional contexts, while the number of participants was sufficient to achieve data saturation.

The sampling technique used was purposive sampling, namely the selection of participants based on specific considerations relevant to the objectives of the research.^(26,27) Purposive sampling enabled the researcher to select subjects with direct experience in RBL implementation, ensuring that the data obtained were relevant, in-depth, and information-rich. However, this non-probability sampling approach also brings certain limitations. Because participants were intentionally selected rather than randomly chosen, the findings may not be fully generalizable to all primary teacher education contexts. In addition, the selection process may introduce selection bias, potentially shaping the perspectives represented in the data. These limitations should be taken into account when interpreting the results and their implications for broader educational settings.

The criteria for selecting research subjects were specified to ensure that the data collected were truly aligned with the objectives of the study. The criteria for lecturers included: (1) actively teaching in the PGSD program for at least the past 3 years; (2) having designed and implemented courses using the RBL approach; and (3) willingness to participate in in-depth interviews and provide access to supporting documents (lesson plans, teaching materials, assessment rubrics, etc.). Furthermore, the criteria for student participants included: (1) active students in the PGSD program, at least in the 5th semester; (2) having taken courses that used the RBL approach, either fully or partially; and (3) willingness to be interviewed and reflect on their learning experiences.

Data Collection Techniques

The data collection techniques in this study used a non-test approach consisting of in-depth interviews and document study. In-depth interviews were conducted with lecturers and students to explore their experiences, perceptions, and evaluations regarding the implementation of Research-Based Learning (RBL). The type of interview used was semi-structured, where the researcher prepared interview guidelines while still providing flexibility to explore participants' answers more broadly. The interview procedures included the preparation stage, namely developing interview guidelines based on the research focus, determining a conducive time and place, and requesting participants' consent for recording. The implementation stage was carried out either face-to-face or online with a duration of 45-60 minutes, starting with general questions and then proceeding to open-ended core questions.

The main interview questions were designed to align with the seven stages of the RBL syntax. The questions explored how participants formulated general research questions, conducted literature reviews, defined specific research problems, planned appropriate research methods, collected and analyzed data, interpreted results, and reported their findings. For example, the questions focused on how lecturers guided students in identifying and formulating initial research questions, the strategies used to review relevant literature and connect it to the topic, how specific research problems were finalized, how the selection of research methods was determined, how students were involved in data collection and analysis, how reflective and problem-solving approaches were applied in interpreting findings, and how students presented or published their research results.

After the interviews, the researcher transcribed the recordings verbatim and conducted member checking with participants to ensure data accuracy. In addition to interviews, this study also used document analysis to strengthen and complement the findings. The documents analyzed included the study program curriculum, Semester Learning Plans (RPS), course modules, teaching materials, worksheets, assessment rubrics, student outputs (research reports or articles), lecturers' reflection notes, and study program policies related to RBL implementation. Document analysis provided additional evidence and enriched the interview data, resulting in a more comprehensive understanding of RBL practices in the PGSD program.

Data Analysis Techniques

Data analysis was carried out using interactive model, which consists of three main stages: data reduction, data display, and conclusion drawing/verification.⁽²⁶⁾ Data reduction was conducted by selecting, focusing, and simplifying data obtained from interviews and documentation, then organizing them according to the main research themes. The reduced data were then presented in the form of matrices, diagrams, tables, or narrative descriptions to facilitate understanding of patterns and relationships among findings. The final stage was conclusion drawing and verification, which were carried out continuously throughout the research process to ensure that the results were valid and accountable.

To ensure data trustworthiness, namely credibility, transferability, dependability, and confirmability.⁽²⁸⁾ Credibility was ensured through source and method triangulation, member checking, and sufficient researcher engagement during data collection. Transferability was achieved by providing thick descriptions of the context, subjects, and findings, enabling readers to assess the relevance to other contexts. Dependability was maintained

by documenting the entire research process in detail through an audit trail, allowing colleagues or supervisors to assess procedural consistency. Meanwhile, confirmability was achieved by maintaining researcher objectivity, providing supporting evidence for each finding, and engaging in reflexivity to minimize personal bias.

Ethical considerations were strictly followed throughout the research. All participants received informed consent forms explaining the objectives, procedures, and their rights, including the right to withdraw at any time. The confidentiality of participants' identities and data was guaranteed, and audio recordings were stored securely and used only for research purposes.

RESULTS

Lecturers' and students' perceptions regarding the implementation of Research-Based Learning (RBL) syntax revealed a shared view of the importance of following the stages systematically. The Syntax of RBL was carried out through seven main stages, namely formulating general questions, conducting a literature review, defining research questions, planning methods, collecting and analyzing data, interpreting results, and reporting. The lecturers emphasized that the implementation of these stages not only serves as a means for students to practice research skills, but also shapes critical, creative, and collaborative thinking, as well as the ability to integrate theory with real-world practice in the field.

Formulating General Question

The formulation of general questions in the implementation of Research-Based Learning (RBL) across the three teacher education institutions reflects a structured but contextually adaptive pedagogical design. Rather than being a mechanical starting point, this stage functions as a critical space for orienting students toward inquiry-based thinking and aligning research interests with course learning outcomes. Analysis of interviews, curricular documents, and course materials indicates three key tendencies: structured independence, guided framing, and conceptual reinforcement, each corresponding to the distinctive practices at UPI, UM, and Untirta.

At Universitas Pendidikan Indonesia, lecturers positioned students as active initiators of their research focus. One lecturer emphasized that this stage was designed to cultivate students' autonomy in problem identification through preliminary observations and theoretical exploration during the first seven weeks of instruction. He explained, "In the first to the seventh meetings we began with theory discussions, there were also presentations, then students carried out preliminary observations and child development analyses. From there, research problems usually emerged from the students." This intentional scaffolding embeds the formulation of research questions directly into students' early academic engagement, signaling a clear orientation toward critical inquiry and alignment with CPL4 and CPL7, which emphasize research literacy and critical-innovative thinking.

In contrast, at Universitas Negeri Malang, the formulation of general questions leaned toward guided framing, where lecturers provided explicit frameworks, observation protocols, and structured grouping. A lecturer described this pattern as "We provide guidance from the beginning, divide groups by dimension, explain the RBL sequence, and give observation guidelines according to provisions. So students remain on the track that has been set." This reflects a pedagogical strategy that balances structure with moderate flexibility, aiming to ensure methodological rigor and thematic consistency across student projects while still allowing for limited personalization within predetermined topic domains.

Meanwhile, Universitas Sultan Ageng Tirtayasa presented a distinctive conceptual reinforcement model. The formulation stage was deliberately preceded by an intensive conceptual briefing period, ensuring that students built a solid theoretical understanding before determining their research focus. As one lecturer noted, "At the beginning of the course we explain the contract, objectives, outcomes, and project sequence. Before the midterm exam, we first focus students on conceptual material so that they are better prepared to enter the research stage." This orientation shows a more scaffolded and sequenced instructional strategy, positioning research formulation as a product of structured conceptual mastery rather than exploratory field engagement alone.

These institutional patterns were mirrored in the student experiences. Students at UPI reported a high level of autonomy, noting that while the broad course structure guided them, they determined their own specific research problems. One student remarked, "Here we are free to decide topics according to our interests. We can also take trending issues or adjust to the conditions in the field where we conduct research." Conversely, UM students articulated a semi-structured autonomy—where the thematic domains were defined by the lecturer, but subtopics could be independently explored. At Untirta, students emphasized their opportunity to negotiate between conceptual material and real-world relevance, showing that conceptual reinforcement effectively fostered ownership of research direction.

The document analysis reinforced these observations. Curriculum and RPS documentation at UPI link the formulation stage to CPL4 and CPL7, with research-oriented courses such as Educational Research Methods, Data Analysis, Elementary Literacy, Learning Innovation, and Psychological Assessment serving as key platforms. At UM, the formulation stage often draws from Child Health and Elementary Science (IPA SD), involving issue

identification on nutrition, UKS programs, healthy canteens, epidemiology, misconceptions, and learning difficulties. Untirta's documentation highlighted courses such as Studies of Elementary Learning Problems, Elementary Learning Models, Basic Concepts of Social Studies, Research Methodology, Learning Evaluation, Research Proposals, and Undergraduate Theses as central to the RBL framework. This triangulation of lecturer interviews, student narratives, and curricular artifacts provides strong evidence that the formulation stage operates as both a pedagogical and epistemological anchor of the RBL process.

Figure 1 presents a synthesized model of how general research questions are formulated in the three contexts. Rather than serving as a decorative element, this figure maps the relationship between degrees of lecturer guidance, student autonomy, and conceptual reinforcement strategies across institutions. It visually positions UPI at the “high autonomy” end, UM at the “guided structure” midpoint, and Untirta at the “conceptual reinforcement” starting point. By integrating this figure into the narrative, the presentation underscores the analytical insight: the formulation stage functions differently across institutions, but all converge on one key pedagogical goal—equipping students to articulate relevant, researchable questions that anchor the subsequent six stages of the RBL syntax.



Figure 1. The process of formulating research questions

The synthesized findings reveal that while the formulation of general questions is operationalized differently, the underlying epistemic function remains constant: initiating students into a structured yet inquiry-driven research process. UPI privileges student-driven exploration, UM balances structure and flexibility, and Untirta emphasizes conceptual mastery. These variations suggest that RBL syntax is adaptable without losing its core logic, allowing each institution to align the stage with its curricular priorities, pedagogical culture, and learner profiles.

Conducting a Literature Review

The literature review stage in the Research-Based Learning (RBL) syntax functions as a critical bridge between theoretical perspectives and classroom realities. Analysis of lecturer interviews, student narratives, and document evidence across Universitas Pendidikan Indonesia (UPI), Universitas Negeri Malang (UM), and Universitas Sultan Ageng Tirtayasa (Untirta) indicates a shared pedagogical goal: aligning literature with authentic teaching-learning contexts, though each institution operationalizes it through different strategies.

UPI emphasizes the interpretive function of literature review as a follow-up to classroom and field observations. A lecturer explained, “Initial field observations are the key to seeing the alignment between the theories studied by students and the practices carried out by teachers.” This reflects a bottom-up orientation, where theory is used to validate and refine empirical findings.

UM combines classroom observation with interview activities as a way of reinforcing theoretical positioning. According to one lecturer, “Field observations are always combined with interviews, because the two reinforce the positioning of theory in a real context.” This represents a dual anchor strategy, situating theoretical review within lived classroom realities.

Untirta, meanwhile, integrates literature review earlier in the process, emphasizing conceptual clarity before field engagement. One lecturer stated, “We encourage students to conduct literature reviews from the beginning so they can identify research problems more clearly.” This reflects an early scholarly orientation, prioritizing theoretical consolidation.

Document analysis supports these patterns. UPI maps literature review activities directly to CPL2 (professional sustainability), CPL4 (research principles), and CPL7 (critical and innovative thinking), embedded in courses such as Basic Concepts of Learning and Multicultural Education. UM applies literature more contextually through Child Health and Elementary Science, using it to deepen practical discussions. Untirta focuses on theoretical strengthening and academic writing through Research Methodology, Scientific Writing Techniques, and Research Statistics.

Synthesizing these findings shows that all institutions value literature as a foundation for constructing research focus, but the sequence and emphasis differ: UPI uses it after empirical exploration, UM integrates it with contextual inquiry, and Untirta begins with theoretical framing. This stage functions not merely as reference searching but as a strategic intellectual structure guiding problem definition, methodological planning, and subsequent data collection.

Defining Research Questions

The stage of defining research questions in the three institutions revealed a convergent pattern of connecting theoretical frameworks with empirical classroom realities, though each institution employed different operational strategies to achieve this alignment. The dominant theme emerging across all three campuses was the integration of students' early research activities with their course-based learning outcomes. This stage served as a crucial pivot between theoretical exploration and methodological planning, determining the clarity and direction of the students' research design.

At Universitas Pendidikan Indonesia, the process was driven by the development of learning instruments. Students were required to create materials such as worksheets, media, or test instruments immediately after the midterm period, which then informed the construction of their research questions. As a lecturer emphasized, "After the midterm exam, students are asked to develop instruments such as worksheets, teaching materials, multiple-choice or essay questions, and research instruments, which are then tested using applications. From there, the research questions can be more directed toward the effectiveness of the instruments they created." This structured approach positioned instrument development not merely as a product, but as a conceptual bridge between theoretical knowledge and practical application.

At Universitas Negeri Malang, the emphasis shifted toward conceptual validation through field-based exploration. Students observed classroom situations or conducted interviews to identify educational issues, after which their questions underwent academic refinement through consultation. A lecturer articulated this process, "Students usually develop instruments from observation or interview results, but they must still be consulted with the lecturer to avoid conceptual errors and ensure alignment with theoretical foundations." The institutional culture prioritized avoiding conceptual drift through tight lecturer guidance.

Meanwhile, Universitas Sultan Ageng Tirtayasa encouraged students to anchor their research questions in systematic proposal writing. Early proposal drafts were used as a framework to refine research directions. One lecturer noted, "We encourage students to write a simple proposal along with pre-research instruments, then discuss them with the lecturer so that the research questions emerge from a clear framework." This indicates that the Untirta approach favored structured academic writing to stabilize the formulation of research problems.

Across all three campuses, students confirmed that discussion and lecturer involvement were central. A UPI student shared that their questions typically focused on HOTS test development or media effectiveness and required frequent lecturer consultation. Meanwhile, UM students reported that questions mostly arose from field observations such as literacy gaps or lack of engaging media, and Untirta students highlighted collaborative formulation through peer discussion and consultation. These narratives collectively underline that defining research questions was never an isolated activity but rather a guided, iterative process linking observation, analysis, and supervision.

The presence of well-equipped academic libraries at UPI and UM provided a supporting infrastructure that strengthened students' question formulation process. This resource availability is documented in figure 2, which depicts the institutional library facilities that allowed students to access relevant research references, course documents, and theoretical frameworks to sharpen their research focus. Rather than functioning as a decorative image, figure 2 supports the data by showing tangible academic environments that facilitated literature-supported research question development.

Curriculum documentation further illuminated systematic differences in institutional orientation. At UPI, the derivation of research questions was clearly aligned with CPL4, CPL KU-1, and CPL KK-1, directing students to critically analyze misconceptions, literacy strategies, and evaluate learning designs. At UM, the emphasis was applied: students in Child Health were required to conduct UKS or healthy canteen observations (meetings 10-12) before formulating research questions; similarly, in Elementary Science (meetings 9-11), students were guided to analyze teaching approaches and media. In Untirta, the documentation reflected a strong theoretical foundation through courses such as Research Methodology, Scientific Writing Techniques, Research Proposal, and Selected Topics, where students critically examined issues like ethnopedagogical approaches or conceptual

misunderstandings in science and social studies.

This triangulation of interview evidence, student narratives, and curriculum documents reveals a shared logic across institutions: research questions are defined through interaction between academic theory, field realities, and structured institutional support. However, each institution demonstrates a distinct emphasis—UPI anchors on structured instrument development; UM focuses on validating field-based issues through lecturer consultation; and Untirta relies on proposal-based academic structuring.

In summary, the defining research questions stage across the three campuses reflects a theory-practice integration model, where conceptual clarity is achieved through structured guidance, academic support, and infrastructural resources. The analytical convergence points to a shared commitment to grounding research in authentic educational problems, while the institutional divergence lies in the modes of operationalizing this commitment—instrument development, field validation, or structured proposal writing. The role of academic libraries in figure 2 and curriculum design underscores how institutional infrastructure and learning outcomes collectively shape students' ability to define meaningful and methodologically sound research questions.

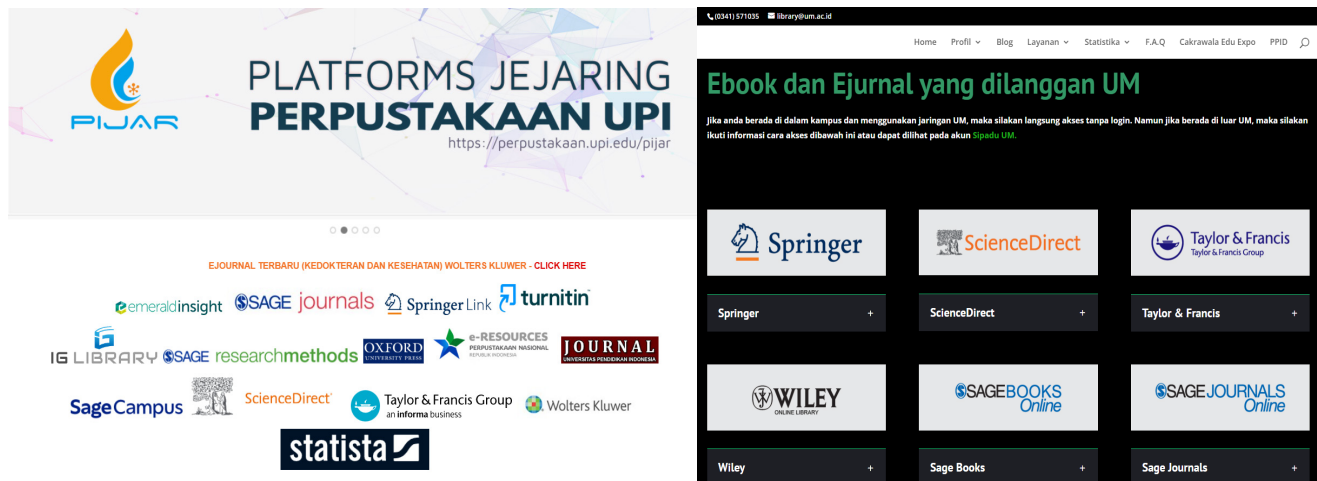


Figure 2. Institutional academic libraries as research question formulation support (In UPI and UM)

Planning Methods

The method planning stage across the three institutions revealed a shared emphasis on evidence-based decision-making in research design, while differing in orientation toward quantitative, qualitative, or mixed methods. This stage served as a critical bridge between preliminary field engagement and structured data collection, integrating student observations, lecturer guidance, and curriculum expectations.

A key pattern emerging from lecturer accounts was the principle that methodological design must be grounded in real classroom observations rather than predetermined frameworks. As one lecturer from UPI stated, “Students must first present their observation results, then from there they design methods, data analyses, and instruments processed using applications.” This perspective emphasized the role of data-driven planning and the early integration of analytic tools. A contrasting but complementary emphasis appeared at UM, where a lecturer explained that “We encourage students to write systematic reports based on observation and interview data so that the planning flow is clearer,” foregrounding structured reporting as a methodological foundation. Meanwhile, a lecturer from Untirta highlighted the importance of solution orientation, noting that “Students not only design research methods, but also design solutions that can be directly implemented in the field.”

The synthesis of student perspectives supported this pattern. Across institutions, students described parallel but context-specific practices that reflected their lecturers' orientations. UPI students emphasized quantitative rigor through structured reporting, instrument design, and software-based analysis using tools such as SPSS, Anates, and Winstep. UM students leaned toward qualitative case studies built on interview and observation guides, with simpler validation procedures. Untirta students integrated both approaches, often using mixed methods to design instruments while prioritizing applicability in classroom settings. Despite these variations, all students reported that every instrument required lecturer validation prior to implementation, highlighting a shared institutional norm of quality assurance.

Document analysis reinforced these convergences and divergences. At UPI, method planning was mapped to CPL4, CPL7, and CPL KK-5, emphasizing learning evaluation and the development of instruments to assess literacy, numeracy, and language learning in elementary education. UM documentation reflected a more applied orientation through courses such as Child Health and Elementary Science, where observation and interviews were the dominant methods. In contrast, Untirta demonstrated a broader methodological repertoire,

incorporating Project-Based Learning, Problem-Based Learning, flipped classrooms, simulations, case studies, and cooperative learning, all embedded with research instrument development. This alignment between curricular design and field practice revealed that each institution intentionally embedded methodological planning into its pedagogical structure.

These convergences and divergences indicate that while all three institutions positioned method planning as a key step in the RBL process, their methodological emphases differed according to institutional culture and curriculum design. UPI leaned toward quantitative and structured applications, UM toward qualitative and practice-driven strategies, and Untirta toward a mixed, solution-oriented approach. This pattern underscores how a shared framework like RBL can accommodate multiple methodological pathways while maintaining a consistent foundation of lecturer validation and evidence-based planning.

Collecting and Analyzing Data

At the stage of data collection and analysis, clear thematic distinctions emerged among the three institutions, reflecting differences in research orientation and pedagogical priorities. Across all sites, students were positioned as active agents who bridge theoretical foundations with real-world school contexts. Lecturers emphasized structured procedures, while students operationalized these procedures in the field, resulting in three distinct orientations: application-driven, theory-reinforcement, and implementation-focused.

From the lecturers' perspective, the starting point for data collection was always preliminary engagement with schools. A UPI lecturer explained, "Students usually practice teaching directly in partner schools to test the learning products they developed, so the data obtained are contextual and authentic." At UM, emphasis was placed on triangulating field data with theoretical concepts, as a lecturer noted, "Data are collected through field observations and interviews, aimed at reinforcing the theories studied in class." Meanwhile, at Untirta, a more solution-oriented stance was evident: "Students not only observe, but also prepare proposals and implement solutions in schools as part of the data collection."

These perspectives were reinforced by students' narratives, which collectively illustrated a shared commitment to authentic field engagement. A UPI student highlighted structured data procedures, stating, "We collected data from teacher and student interviews, classroom observations, test results, and sometimes secondary data such as election results." A UM student described the integration of descriptive field analysis, explaining, "Data collection was usually from observations and interviews, and the results were presented comprehensively, sometimes with additional products such as articles or learning media." An Untirta student underscored collaborative and scholarly outputs, adding, "We collected data through observations, interviews, and questionnaires. The results were written as mini theses or articles, then presented and discussed with peers and lecturers."

Learning documentation substantiated these practices by mapping them to program learning outcomes (CPL). At UPI, data collection and analysis were explicitly linked to CPL4 and CPL9, focusing on evaluating ICT-based learning, identifying misconceptions, and processing outcome data. At UM, practices were embedded in applied courses such as Child Health and Elementary Science, where students analyzed learning environments like healthy canteens and PAIKEM BATIK classrooms to identify barriers to learning. At Untirta, data collection was structurally integrated into Research Methodology, Statistics, and Thesis courses, using a range of instruments—observations, interviews, questionnaires, and tests—followed by validity and reliability analysis to establish academic rigor.

Synthesizing across these strands reveals three overarching themes. First, UPI emphasized application-driven field practice supported by structured instruments and statistical analysis. Second, UM reinforced theoretical understanding through systematic observation and interviews, producing descriptive yet conceptually grounded findings. Third, Untirta integrated both orientations within an implementation and publication framework, encouraging students to transform field data into scholarly products.

In summary, the data collection and analysis stage functioned not merely as a procedural requirement but as a critical bridge between theory and practice across the three institutions. While differing in emphasis, all three cultivated student researchers capable of integrating observation, analysis, and academic validation to produce robust and contextually grounded research outputs.

Interpreting Results

At the stage of interpreting results, a clear thematic pattern emerged across all institutions: field findings were consistently anchored in theoretical frameworks, though the orientation of application varied. This stage functioned as the intellectual bridge between empirical observation and conceptual understanding, shaping how students transformed raw data into structured academic arguments.

From the lecturers' perspective, theory served as the interpretive foundation. A UPI lecturer asserted, "Students' research findings must always be linked back to theory so that they can find relevant solutions," emphasizing conceptual grounding. A UM lecturer highlighted the prevention of misinterpretation, stating, "We

always direct students so that the results are not merely descriptive, but also interpreted according to theory to prevent misconceptions.” Meanwhile, an Untirta lecturer underlined solution-oriented interpretation, explaining, “The data collected by students are processed and compared with theory, and from there research solutions that are implementable are developed.” These statements converge on the centrality of theoretical references while revealing variations in practical orientation: UPI stressed reflective connections, UM emphasized conceptual accuracy, and Untirta targeted implementable solutions.

Students’ perspectives reinforced this triadic orientation. A UPI student explained, “Our school findings were always compared with theory, for example whether the teacher’s strategy matched active learning theory,” illustrating reflective interpretation. A UM student emphasized the transformation of theory into practical interventions, stating, “We combined field results with theory, then interpreted them into solutions, such as developing learning media or small interventions, and then presented them in class for feedback.” An Untirta student described the academic productivity dimension, adding, “We wrote mini theses or articles, so field results were always connected to theory and expressed in scholarly work.” These three narratives collectively reveal how students operationalized theory in different but complementary ways—UPI through critical reflection, UM through contextual solutions, and Untirta through structured academic outputs.

Institutional documentation substantiated these interpretive practices. At UPI, result interpretation was explicitly tied to CPL4 and CPL10, requiring students to produce scientific articles and presentations after aligning field findings with theoretical constructs. At UM, interpretation activities were embedded in classroom discussions, as seen in the Child Health course where students compared health theories with UKS conditions, and in Elementary Science courses where students identified misconceptions and designed remedial steps. At Untirta, the process was more systematically embedded in Research Methodology, Statistics, and Thesis courses, emphasizing theory-based analysis, quantitative interpretation, and structured reporting.

Synthesizing across these sources reveals three conceptual tendencies. First, UPI employed a reflective-theoretical model—students critically engaged with theory to frame findings. Second, UM advanced a contextual-intervention model, encouraging interpretation as a pathway to practical action. Third, Untirta adopted a scholarly-production model, positioning interpretation as the basis for structured academic output.

In conclusion, interpreting results was not treated as a technical step but as a conceptual core of the research process. Across the three institutions, students were positioned as active interpreters who transform data into structured academic knowledge, supported by institutional frameworks and lecturer guidance. Although their emphases differed—reflective at UPI, contextual at UM, and scholarly at Untirta—they all shared a commitment to integrating theory with field findings to ensure research validity and academic rigor.

Reporting

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Students' Scientific Ability through Contextual Scientific-based Learning Tools During Covid-19 Outbreak

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Abstract

This study aimed to find out how students' scientific abilities are using contextual scientific-based learning tools during the Covid-19 pandemic. The method used in this research is descriptive quantitative. This research was conducted by conducting structured observations and questionnaires. In the data collection process, the researcher conducted three different ways of collecting data: the door-to-door system, the home visit system, and conventional learning. The results of students' scientific abilities using contextual scientific-based learning tools with door-to-door data retrieval systems of 81.56%, which are included in the very good category, in the home visit data collection system of 84.06% which are included in the very good category and the system data collection of conventional learning in class by 88% which is included in the very good category. Based on the study's results, it can be concluded that contextual scientific-based learning tools can be very well used in science learning after going through 3 different ways: the door-to-door system, the home visit system, and the conventional one.

Keywords: Learning Tools, Scientific Ability, Covid-19 Outbreak



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Profiling Eco-literacy in Elementary School Students: A Qualitative Case Study Approach

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Article Information	ABSTRACT
Received: October 4, 2024 Revised: October 25, 2024 Accepted: November 4, 2024 Online: December 12, 2024	<i>This study aims to describe the eco-literacy profile formulated by the Centre of Eco-literacy. The research design used in this article is qualitative with a case study approach. The research subjects consist of 5 students, two teachers, and the principal. The data collection techniques in this study used three techniques: observation, interviews, and documentation. The data analysis technique examines the data obtained from the beginning of data collection to conclude. The research result shows that: (1) in the cognitive aspect, students understand environmental issues and can connect this knowledge with concrete actions in their daily lives; (2) the emotional aspect shows that students are deeply aware of the interdependence between living beings and the environment, accompanied by empathy and care for nature; (3) the activity aspect is evident from students' involvement in using tools and resources wisely and integrating eco-literacy principles into various practical activities; and (4) the spirit aspect is reflected in the increased awareness of students regarding the relationship between humans and nature, manifested through actual actions born from their knowledge and care. This study concludes that students' eco-literacy profile is good, with skills encompassing cognitive, emotional, activity, and spirit aspects that mutually support understanding and responding to environmental issues effectively. This research is expected to serve as a reference for policymakers and schools in implementing eco-literacy in elementary schools.</i>
Keywords	
Eco-literacy Elementary Education Environmental Awareness	

Figure 3. Published student research articles as evidence of RBL outcomes (In Untirta)

The reporting stage of RBL implementation reflected institution-specific emphases that shaped how outputs were documented and disseminated. Across the three universities, a clear pattern emerged between academic publication orientation, technical reporting, and multimodal presentation formats. A UPI lecturer explained, “Students usually report research results in the form of articles, portfolios, or publish them in free journals,” reflecting a strong focus on scientific publication. A UM lecturer noted, “Students produce reports of research instruments, so the form is more technical and tailored to field needs,” underscoring applied reporting practices. An Untirta lecturer added, “Student outputs can be in the form of articles, mini theses, vlogs, or research seminars,” demonstrating flexibility in formats, including digital and non-textual media.

The evidence from students and institutional documentation supports this thematic distinction. UPI structured reporting toward articles and learning modules, aligning with academic standards. UM prioritized applied reporting using digital platforms, particularly the SIPEJAR system that facilitates uploading and integrating student outputs directly into the learning management environment. Untirta emphasized formal academic outputs, including mini theses and journal publications, evidenced by their track record in international journal submissions in figure 3). These approaches reflect differentiated strategies to train research literacy and professional competencies through RBL.

The documentation analysis further consolidated this pattern. UPI linked reporting to CPL10, focusing on outputs such as scientific articles and project presentations relevant to literacy, numeracy, and English. UM's reporting structure integrated the SIPEJAR platform in courses like Child Health and Elementary Science, where students submitted structured reports, presentations, and projects as part of assessment (figure 4). Untirta required academic outputs—theses, articles, and research reports—with plagiarism checks and adherence to publication standards, providing tangible pathways to real journal submission.

Overall, the synthesis of lecturer interviews, student experiences, and document review indicates that RBL reporting operates as more than procedural documentation. It functions as a strategic mechanism for academic capacity building, with UPI focusing on article-driven scholarship, UM advancing applied technical competencies through SIPEJAR, and Untirta reinforcing formal academic traditions and publication culture. The figures serve as evidence-based representations: Figure 3 illustrates international publication outputs at Untirta, while figure 4 highlights the technological infrastructure that supports applied reporting at UM.

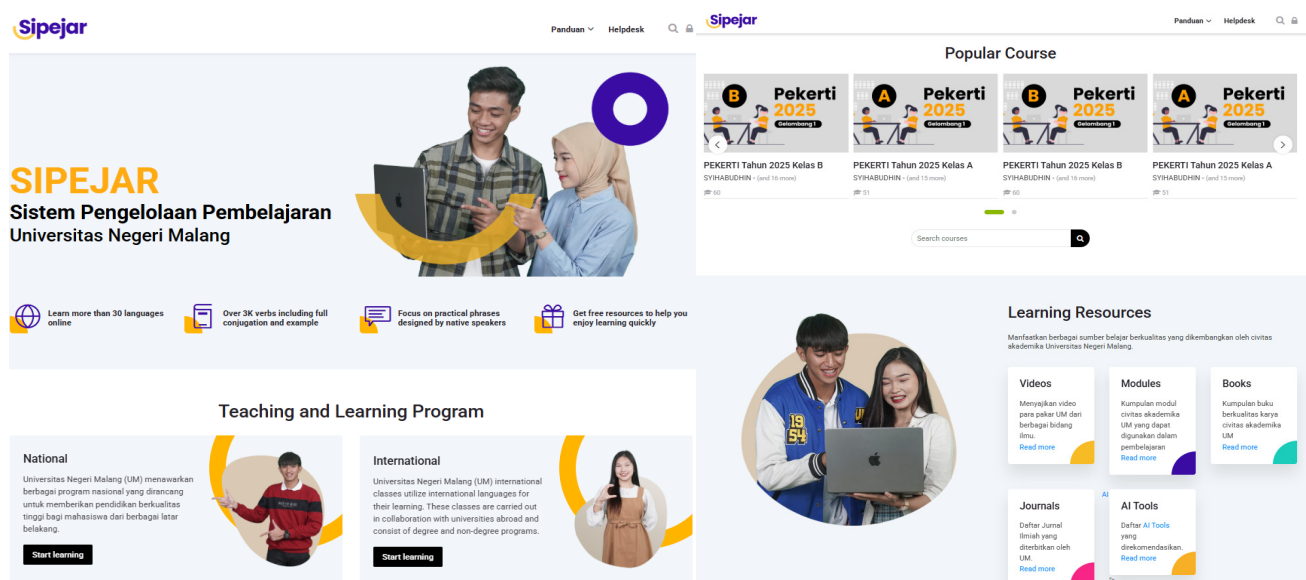


Figure 4. SIPEJAR platform showcasing applied student research reporting (UM)

DISCUSSION

The findings of this study reveal that the implementation of Research-Based Learning (RBL) in primary teacher education programs does not follow a single, uniform model but rather unfolds along what we term the “Scaffolded Autonomy Spectrum” (SAS). This spectrum reflects varying pedagogical philosophies that balance between structured guidance and student independence in research-based learning. Across all seven stages of the RBL syntax, institutions demonstrate different emphases, indicating deliberate strategies rather than random variation. These differences, when interpreted systematically, reveal deeper institutional choices about how future teachers are socialized into research culture, critical inquiry, and knowledge production.

Formulating General Questions

At the stage of formulating general questions, the findings revealed significant differences among institutional patterns. UPI emphasized student independence in identifying research problems, UM combined lecturer guidance with student subtopic choices, while Untirta provided full autonomy after conceptual strengthening. These differences can be interpreted through the lens of social constructivism, which stresses the importance of scaffolding as a bridge to intellectual independence.⁽²⁹⁾ On one hand, UPI’s approach aligns with discovery learning theory, which encourages students to find concepts through independent exploration.⁽³⁰⁾ On the other hand, UM’s semi-open pattern resonates with guided discovery theory, where direction is still necessary to ensure that exploration aligns with learning objectives.⁽³¹⁾ The success of the initial RBL stage is strongly influenced by how well lecturers guide students to formulate relevant and contextual questions.⁽¹⁰⁾ Thus, the three institutional approaches represent a spectrum of scaffolding strategies, ranging from strong direction to full independence, pedagogically reflecting diversified strategies to cultivate students’ critical capacity.

Conducting a Literature Review

At the literature review stage, the three institutions showed different emphases although all oriented toward the use of scholarly literature. UPI focused on integration with learning outcomes (CPLs) and academic policies, UM stressed the application of theory in field observation, while Untirta placed strong emphasis on theoretical mastery from the early stages of research. Theoretically, literature review serves as a conceptual framework enabling researchers to identify knowledge gaps.⁽³²⁾ Literature reviews must be systematic to map theoretical and practical developments within a field.⁽³³⁾ These findings align with studies showing that students trained to conduct critical literature reviews develop stronger analytical skills.⁽³⁴⁾ Moreover, literature reviews not only serve as foundations but can also generate new conceptual models.⁽³⁵⁾ The contexts of UPI, UM, and Untirta show how literature review can be understood not only as an academic activity but also as a pedagogical strategy to foster scientific literacy and integrate theory with field experiences.

Defining Research Questions

At the stage of defining research questions, the data showed institutional variations: UPI emphasized learning instruments as triggers, UM highlighted field experiences validated by lecturers, while Untirta emphasized simple proposals rooted in critical analysis. Outcome-oriented learning can only be achieved if students are able to link learning experiences with conceptual frameworks.⁽³⁶⁾ Moreover, students are more engaged when

research questions emerge from contexts close to their own experiences.⁽³⁷⁾ Furthermore, the ability to define research questions is the most significant indicator of research literacy.⁽³⁸⁾ Meaningful questions drive students toward deeper critical reflection.⁽³⁹⁾ The variations among the three institutions highlight not just technical differences but also epistemological diversity in bridging theory with practical reality.

Planning Methods

At the method planning stage, the three institutions shared similarity in lecturer validation of instruments but differed in methodological orientation. UPI guided students toward quantitative methods supported by applications, UM stressed qualitative field methods, while Untirta combined both with an emphasis on practical solutions. Planning methods requires ensuring alignment between method, research objectives, and data context.⁽⁴⁰⁾ This finding resonates with perspectives stressing that method selection must consider flexibility, meaningfulness, and contextual sensitivity.⁽⁴¹⁾ Variations in RBL methods enrich student competencies since they not only learn one approach but also understand the strengths and limitations of multiple methods.⁽²⁴⁾ These findings show institutional efforts to equip students with methodological expertise relevant to elementary education realities.

Collecting and Analyzing Data

At the stage of data collection and analysis, the three institutions again revealed different orientations. UPI integrated teaching practice with statistical and narrative analyses, UM emphasized field observations, while Untirta combined both to generate applied solutions. The success of data analysis depends on the fit between techniques and research questions.⁽²⁶⁾ Sensitivity to context is also key so researchers do not merely process data but also understand its underlying meanings.⁽⁴²⁾ In qualitative analysis, interactive models—data reduction, data display, and conclusion drawing—remain relevant to educational research.⁽⁴³⁾ Direct student involvement in data collection increases both confidence and reflective skills.⁽⁴⁴⁾ Thus, variations in data collection and analysis illustrate flexibility that allows students to develop comprehensive research competencies.

Interpreting Results

At the result interpretation stage, institutional differences also emerged. UPI emphasized theoretical reflection, UM prioritized contextual solutions, while Untirta focused on systematic scholarly outputs. Research result interpretation must link data with theory to broaden conceptual understanding.⁽⁴⁵⁾ Moreover, interpretation is not just reading data but a hermeneutical process positioning researchers as active interpreters.⁽⁴⁶⁾ Within RBL, students must be regarded as knowledge builders capable of linking theory with field findings.^(11,25) Trustworthiness in qualitative research interpretation—credibility, transferability, dependability, and confirmability—is also essential.⁽²⁸⁾ These institutional orientations thus represent a spectrum of perspectives: reflective, practical, and formal academic.

Reporting

At the reporting stage, variations were evident. UPI stressed CPL integration through scientific articles, UM highlighted the use of the digital platform SIPEJAR and applied products, while Untirta emphasized formal academic traditions such as theses and journal publications. Academic writing skills are professional competencies inseparable from higher education. Academic writing serves as a means of entering the broader academic discourse community.⁽⁴⁷⁾ Furthermore, writing is not merely about grammar but also an academic socialization process shaping students' intellectual identity.⁽⁴⁸⁾ Writing is also a negotiation process of ideas among students, lecturers, and academic communities.^(8,17) The variations in reporting practices across the three institutions demonstrate that RBL does not end in documentation but also serves as an institutional strategy to strengthen students' professional competencies.

Importantly, this Scaffolded Autonomy Spectrum is not a hierarchy but a pedagogical ecology that reflects different strategic investments in shaping research competencies. High-autonomy models cultivate early independence but require strong prior conceptual readiness. Highly scaffolded models ensure conceptual and procedural clarity but may constrain creative exploration. Intermediate models attempt to harmonize these elements through structured autonomy. This finding contributes to RBL theory by reframing institutional variation as a coherent spectrum of pedagogical philosophies rather than fragmented practices.

The implications of this spectrum are significant. For researchers, SAS offers a conceptual lens to analyze and compare RBL implementations across contexts. For educators, it provides practical guidance in designing RBL structures that balance autonomy and scaffolding. For institutions, it informs strategic decisions regarding curriculum design, lecturer roles, and capacity building in research literacy. Ultimately, recognizing and intentionally positioning programs along the Scaffolded Autonomy Spectrum enables more transparent, purposeful, and theoretically grounded RBL practices in primary teacher education.

CONCLUSIONS

Based on the findings and discussion above, it can be concluded that there are variations in the seven phases of Syntax of RBL, namely: (1) general question formulation, differing in the degree of lecturer guidance and student independence; (2) literature review, highlighting diverse forms of theory-practice integration; (3) research question formulation, ranging from instrument design, field experience, to critical proposal development; (4) method planning, with quantitative, qualitative, or mixed orientations; (5) data collection and analysis, affirming students' role as active researchers; (6) interpretation of results, with reflective, solution-oriented, or academically productive orientations; and (7) reporting, with outputs such as scientific articles, applied reports, mini theses, and publications. These findings imply that Syntax of RBL is not singular but contextual according to institutional characteristics. Thus, lecturers may use the framework of seven RBL phases as a flexible guide to design research-based learning that fosters critical, reflective, and collaborative capacities among prospective primary school teachers.

This study has limitations as it only involved three Primary Teacher Education programs, namely at Universitas Pendidikan Indonesia, Universitas Negeri Malang, and Universitas Sultan Ageng Tirtayasa, so the findings regarding variations in Syntax of RBL remain limited to specific contexts. In addition, the number of participants—15 lecturers and 30 students—means the findings cannot yet be generalized widely. This limitation also affected the lack of representation of RBL practices from other institutions with different characteristics in terms of curriculum, academic culture, or education systems. Therefore, future research is recommended to expand subjects and research sites to more institutions, both nationally and internationally, to obtain a more diverse mapping of Syntax of RBL.

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CONFLICT OF INTEREST

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