



## Implementation Process of Research-Based Learning (RBL) for Doctoral Education Program Students: An Exploratory Case Study

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### Abstract

Research-based learning (RBL) is a learning model that involves research activities in the learning process. The higher education system must be connected to learning and research activities. This study aims to present a case study that explores the learning experiences of five students in the doctoral education program and how their research skills differ before and after implementing research-based learning in a local-based science learning development course. This research was conducted at Bengkulu University. Data collection methods include interviews, learning notes, product assessments, and questionnaires. Data analysis consisted of examining, categorizing, and recombining the quantitative and qualitative evidence to discuss the research's initial propositions. Research results show that the ability of doctoral program students to apply knowledge in practical contexts, research skills, critical and analytical thinking, and scientific communication skills could be improved through research-based learning.

**Keywords:** Research skills, doctoral students of education, research-based learning, case studies.

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## INTRODUCTION

Along with realizing the vision and mission of the University of Bengkulu in developing world-class education and research, learning in higher education requires a transformation from imparting knowledge to producing knowledge. Conventional learning systems no longer support the realization of this transformation. In the twenty-first century context, there is a need to make educational students who have a reflective spirit by changing classrooms and schools to meet the demands of changing needs as well (Brew & Saunders, 2020). Educators need to prepare solutions to these problems.

Doctoral students in education face challenges in mastering various subjects. They are not only required to master material on educational theories but also material on the concentration of the chosen field. In science concentration courses, students choose two courses. This research focuses on local-based science learning development courses. As producers of knowledge, doctoral program students need to put forward ideas or ideas as solutions to problems that occur in the context of locally based science. The emerging solutions need support from survey results, reviews of various supporting literature, research activities, and conclusions. They are no longer just waiting for instructions from educators, but they can develop critical thinking skills through mastering research skills.

Based on this, educators need to change the learning strategies that are commonly used so that learning becomes meaningful. This is by research conducted by (Estuhono, 2022; Usmeldi et al., 2017) through the application of RBL in improving critical thinking skills and student learning outcomes. This research is in line with (Suyatman et al., 2021). Improving students' analytical thinking skills can be done through the application of RBL.

The research-based learning model integrates research into learning. However, teachers report a low integration of actual research into their current teaching practices (Nozaleda, 2021). Meanwhile, research-based learning is considered the panacea for effective instructional design in higher education settings (Wessels et al., 2021a). However, out of 3,280 universities in Indonesia, both private and public, only 15 implement research-based learning in class. This data is based on published research-based learning model implementation data. The low number of universities that apply research-based learning models in class is due to many factors. These factors include a long time to use it, not all lecturers mastering research methodology, and a lack of knowledge about research-based learning models (Shaban & Abdulwahed, 2012; Svensson, 2016). Other research reveals that implementing RBL is tricky because it requires money, and the lecturers' ability to implement RBL is still low (Rimawati & Sula, 2020). Even though there are these factors, research (Sumbawati & Anistiyasari, 2018) reveals that most students feel satisfied and comfortable attending classes with research-based learning. Many studies have also confirmed that RBL can be applied in the classroom to improve student performance. There are several significant differences between before and after using this research-based learning (Sutrisna & Nisya, 2020). However, more research is still needed on how the RBL model influences doctoral students' learning experiences in the context of academic development in higher education.

The locally based science learning development course is for science education concentration doctoral program students. The learning process is designed effectively, consistently, and meaningfully. This course aims to explore the potential, culture, and local wisdom of the Bengkulu people and integrate them into science learning. As a researcher and teacher, I have taught this course twice, in 2021-2022. The primary teaching method used in class at that time was discussion. Based on my previous teaching experience, I found that students needed help learning. These problems include, among other things, students needing to be more productive in producing learning products, having fewer in-depth discussion activities, and being able to integrate local science concepts into classroom learning. Based on this problem, Fuad's (2020) research results state that the discussion method is only suitable for divergent and convergent learning styles. Apart from that, Abdulbaki et al. (2018) noted that the discussion method focuses on improving students' thinking abilities, helping to encourage intellectual growth and character development. Students' abilities in doctoral education programs need to be strengthened in terms of the ability to systematically express local-based science learning problems, critical thinking skills, communication skills, mastery of research methodology, problem-solving skills, and ability to write scientific articles. The RBL model is implemented to create classes that support the development of students' abilities in doctoral education programs.

This study aimed to explore students' learning experiences in the doctoral education program and examine differences in students' research skills before and after implementing RBL in local-based science learning development courses. (Yin, 2018) states that exploratory case studies are a research approach initially used to explore contemporary phenomena that cannot be separated from the context in which they are located.

## **METHODS**

This case study uses an embedded mixed method (EMM) research design. Case studies use mixed methods; the researcher collects and analyzes quantitative and qualitative data to examine a case (Creswell, 2016). Case studies allow for the examination of phenomena from different angles "in their natural state" by triangulating research and ensuring the validity of findings (Yin, 2018). This case study explores students' learning experiences in the doctoral education program in implementing RBL in local-based science learning development courses.

The objective of the local-based science learning development course is to explore the potential, culture, and local wisdom of the Bengkulu community and integrate it into science learning. This study uses the RBL process designed by Trump (2010), namely formulating problems, conducting literature reviews, applying methods, developing research activities, conducting research, analyzing data, interpreting, concluding, and reporting product results and presentations. This process is implemented in local-based science learning development courses. Lectures are held online, one day per week, for 150 minutes. Lectures are filled with discussion activities about research that will be carried out individually. In this course, the teaching team consists of two people. Researchers took part in the initial lecture eight times over eight weeks. Before the lecture started, two experts were selected to check the validity of the lesson plan's content. The final lecture assignment was changed from assessing cognitive abilities to evaluating research reports in scientific articles. This adapts to the learning model applied in class, namely research-based learning. Research progress reports are required weekly, requiring each student to present their research progress.

The place of this research is at the University of Bengkulu. The time used in this study is 2022–2023, from February to May. The case study involved five doctoral students of education (3 males and two females) in the doctoral education study program who chose the concentration of science education at the University of Bengkulu, Indonesia. Their ages range from 30 to 45. Their undergraduate and postgraduate educational backgrounds include JC, DS, and R (Bachelor of Biology Education, Master of Biology Education), while AA (Bachelor of Physics, Master of Physics), and DJ (Bachelor of Biology - Master of Biotechnology). All students have worked as lecturers at universities in Indonesia.

Data was collected through interviews, learning notes, product assessments, and questionnaires.

1. Interview

Semi-structured interviews were conducted with students at the end of the semester. The interview started by asking open-ended questions about "what?" "Why?" and "How?" Examples of questions: "What experiences did you gain while studying RBL?" and "How has RBL changed your research skills after college?"

2. Learning Notes

Learning notes describe situations that occurred when RBL was implemented. This data comes from observing student activity in class.

3. Product Appraisal

The products assessed are scientific article drafts. Product evaluation guidelines include evaluating the title, abstract, introduction, methods, results, discussion, conclusions, and bibliography.

4. Questionnaire

The questionnaire measures students' research skills in lectures using RBL. This instrument collects respondents' perceptions of their research skills after learning to use RBL. Indicators of research skills include: 1) identifying valid scientific

opinions; 2) conducting effective literature searches; 3) understanding research design elements and their impact on findings; 4) creating appropriate graphs from data; 5) solving problems using quantitative skills; 6) making inferences, and 7) making predictions and drawing conclusions. A rating scale with a five-point scale was used in this study. Items 1 to 5 are categorized as "very skilled," "skilled," "moderately skilled," "unskilled," and "very unskilled," respectively, for a total of 7 questions. Cronbach's alpha coefficient is used to measure the consistency of the questionnaire.

Interview and observation data are described in full. This description includes the student's background and the RBL teaching process. The description is analyzed clearly and in detail. Students confirmed that the data was credible. The validity of the research was checked through triangulation using several data sources. The quantitative analysis focused on testing differences in students' research skills before and after RBL was implemented using the Wilcoxon test. The results of the study are presented in a qualitative and quantitative description.

## RESULTS & DISCUSSION

### A. Changes in Student Research Skills Through RBL

According to the results of the respondents' answers, the average value of the pre-test was 26.00, and the post-test was 28.40; this value was similar. From the analysis of the average indicators, the average that differs significantly is the indicator of understanding research designs. This happened because there were differences in educational backgrounds between undergraduate and graduate students in my class. Meanwhile, the significance value is  $0.041 < 0.05$ , and it is stated that there are differences in the research skills of doctoral education program students through RBL (Table 1).

Table 1. Means, Standard Deviation, And Signification of Pre-Test and Post-Test Scores for Research Skill

	Mean	SD	Sig.
Pre-test	26.00	3.391	0,041
Post-test	28.40	3.435	

In implementing RBL, students can analyze problems related to local potential and provide recommendations for solving them, although some have not been able to recommend solutions. An excerpt from one of the study notes on this subject is given below.

I observe that students from pure science backgrounds still need clarification about providing recommendations for solving local problems associated with learning. I found that students with an educational background found it easier to do so (such as JC, DS, and R) and put forward more ideas for local potential problem-solving recommendations associated with learning. (LN\_2001).

In addition, when I lead students to provide ideas about their research, it is possible to increase their understanding of their research designs through in-depth analytical studies.

When student A reports the progress of his research, other students listen and provide feedback. I asked all students to comment on the progress reports presented. Some students revealed that progress reports are important in this study because often, in conducting research, decisions are not quite right, such as selecting samples, selecting instruments, and determining data analysis.

Through research progress reports, I have observed that accuracy in collecting research data is more guaranteed. The essence of the progress report is not only explaining the stages of the research that has been carried out but also ensuring that the research is implemented according to the previous research design (LN\_3001). In addition, RBL is effective in increasing student learning achievement and creative thinking skills (Rohim et al., 2019). Apart from that, RBL affects problem-solving abilities, critical thinking skills, open-mindedness, responsibility, and collaboration (Jiang & Roberts, 2011; Rodniam et al., 2004; Walkington et al., 2011). I observed that the better their critical thinking and problem-solving skills, the better their research skills (LN\_5001). This study shows that the RBL approach increases scientific attitudes, knowledge of educational research opportunities related to local potential, and research skills. Two doctoral program students revealed the following:

Each class opens the insight that there is much local potential in the area that can be brought into the learning process in the classroom. I like a challenging class like this because, besides having to solve my research problems, I also have to criticize other people's research by providing feedback on different friends' progress reports. I am also very enthusiastic about presenting my research progress report at every meeting, so I would like to present it at the beginning before my friends. (Z\_7).

After this lecture, I understood that mastering the material content alone is not enough; as teachers, we must interestingly present the material. This is called professional competence. This research experience allowed me to learn about the importance of combining pure science content with educational science (AA\_87).

## **B. RBL Implementation Notes**

Some factors need to be considered when implementing RBL, such as the readiness of learning designs. These research designs are adjusted to the implementation time, assessment, and student characteristics. Based on this, I suggest the design of the implementation of learning and the discussion atmosphere as follows:

### *Learning Implementation Plan*

In terms of implementation, the RBL teaching process is dynamic. RBL can be designed flexibly according to the availability of study time, facilities, infrastructure, and learning objectives. Teacher as a facilitator. Teachers can assess students' learning progress through their research activities. Through RBL, students' activity changes significantly changed their research skills (Wessels et al., 2021b). This study also focuses on students' research skills in conducting educational research in the field of natural sciences. RBL is a research-based teaching and learning design that supports students in learning how to conduct academic research on practical issues (Jacobsen et al., 2018). For future teachers who want to implement RBL in class, I suggest they need preparation before implementing RBL. This will make it easier for students with a pure scientific background to adapt to educational research. In addition, I realize that I have yet to solve all the problems they face in class discussions. (LN\_5002). With this in mind, I gave directions to students to discuss their research problems in more detail. That will help them find solutions to the issues they face, as stated in a learning note:

I asked students to present their progress reports and research products in RBL mode. When they presented their progress reports and research products and explained the problems in detail, I observed that other students actively provided suggestions and comments. This is the strength of RBL: teachers as facilitators can help students develop their critical thinking skills and research abilities (Do Amaral & dos Santos, 2018; Ridlo et al., 2020).

### *Discussion Atmosphere*

The atmosphere of discussion took place through students' reporting of activities and research progress. They took turns conveying the research activities that had been carried out. Then, the teacher asks other students to listen and provide feedback. At first, the students looked awkward as they gave their comments. Teachers must start by delivering keyword directions to help them express their opinions. This is good because it can encourage students to begin their comments. Such feedback is needed to obtain other perspectives regarding the research being carried out, find more appropriate concepts, and learn to defend their views. I also suggest the following:

When submitting the research progress report, the instructor must provide additional material relating to the scope of the research being discussed or even strengthen the research methodology. That is a form of support, strengthening the research they are doing (LN\_1002).

Students look active in the discussion process with this RBL model. They think this teaching process is better, not only by prioritizing mastery of material content but also by practicing problem-solving skills, mastering educational research methodologies, improving communication skills, and improving teacher professional skills. One student stated:

I learned that the local potential in the area can be brought into learning as a medium, a learning resource, or material content used as a project. Whenever I listen to research progress reports and feedback from other friends, it gives me many new perspectives. This makes me like this course because it differs from other conventional learning courses. (DJ\_304). According to constructivist theory, learning should be built based on personal experience and interaction with the surrounding environment (Naylor & Keogh, 1999; Shumba et al., 2012). By bringing local potential into learning, students can relate lessons to their own experiences, which can increase their understanding of the subject matter. In the social context of learning, using local potential as a medium or learning resource can increase student motivation and involvement in the learning process (Avargil et al., 2012; Xie & Greenman, 2011; Yu et al., 2014).

### **C. RBL Product Assessment Results**

Students stated that there were no significant problems in compiling scientific articles. Scientific articles are RBL products. One student revealed:

Writing scientific articles is relatively easy because we have trained these skills in our professional practice in class. Writing scientific articles is a task that has actual application in a professional context, and therefore, classroom practice can prepare individuals for real-world practical situations (Graham & Alves, 2021; Wan Yusof et al., 2022). However, there are different research directions. Previously, I focused on experimental research in the laboratory; however, in this class, I have to present findings that can be used as learning media for students. (R\_252). By studying research methodology together, students can develop collaboration skills and understand how work teams can contribute to more effective research (Qureshi et al., 2023; van Leeuwen & Janssen, 2019).

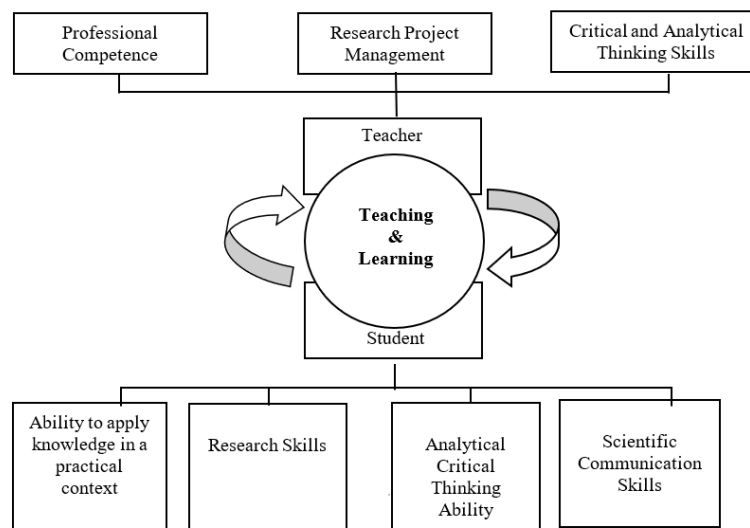
In the report, the products made had the theme of local potential, according to the name of the course being taken. This product takes the form of media, learning resources, the presentation of material about local potential in learning, and several student worksheets that integrate local potential. I found:

The differences in the research themes students choose lead to varied research methodologies. This helps students with pure science backgrounds and allows them to learn more about educational research methodology (LN\_4008).

#### D. Contributes Ideas in Implementing RBL

In particular, the integration of RBL into the learning of doctoral education program students can help teachers improve students' pedagogical competence and research skills by packaging local and regional potential into their students' learning tools, planning, implementing, and evaluating their learning with students; integrating research methodology education with pure science content; and improving critical thinking and problem-solving skills. Implementing RBL engagingly and effectively takes work. It is necessary to prepare for learning. Teachers or prospective teachers must consider the characteristics of learning materials, students, learning media, activities, and evaluation (Chusni & Suyatman, 2023). My experience shows that by designing suitable learning activities and evaluating each meeting, challenges in RBL implementation can be overcome.

I diagrammed the RBL cycle in learning, shown in Fig 1.



**Figure 1. Learning Cycle Diagram with RBL**

RBL implementation in class has improved my ability in the following aspects:

- 1) Professional competence: refers to increased ability in the field of educational research, an in-depth understanding of the material content in the field of study, and the ability to adapt to changes,
- 2) Research project management includes planning, implementing, and evaluating research projects.
- 3) Critical and analytical thinking skills: stimulate students to ask questions, analyze information, and evaluate arguments.

This is by et al. (2023); research-based learning involves incorporating scientific research methodology into all aspects of the educational process, from perception to practical application.

Then, these abilities will be given back to students through the RBL teaching process as follows:

- 1) Ability to apply knowledge in a practical context refers to theoretical knowledge with practical application, through which the concepts taught can be used in a professional context.
- 2) Research skills refer to the ability to identify valid scientific opinions, carry out effective literature searches, understand elements of research design and how they impact findings and conclusions, make precise graphs from data, solve problems using quantitative skills, make inferences and predictions, and draw conclusions based on quantitative data.
- 3) Critical and analytical thinking skills refer to asking questions and analyzing information.
- 4) Scientific communication skills refer to the ability to write scientific articles.

This is in line with research by Pirozhkova (2021), which suggests that research-based learning can develop Students' soft skills (independence, critical and analytical thinking, reasoning) and scientific skills (research planning and performance, academic presentations).

## CONCLUSION

Research-based learning can improve doctoral program students' ability to apply knowledge in practical contexts, research skills, critical and analytical thinking, and scientific communication skills. Students also deeply understand research methodology and how to apply RBL in their teaching. Future RBL research could explore how students structure their research reports. Future research could also record the process of reporting research progress in detail, as this is an essential part of RBL. This research contributes to the professional literature on RBL in student learning in doctoral education programs.

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