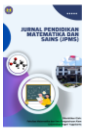

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Literacy and Research-Oriented Problem-Based Learning: Exploration of Implementation in Classroom Learning

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Abstract

Literacy and Research-Oriented Cooperative Problem-Based Learning (LIRACLE) is a new learning model developed for learning in higher education. LIRACLE is developed from problem-based, cooperative, research-oriented, and literacy-oriented learning. To complete the development of the LIRACLE model, a test of the implementation of the LIRACLE model is needed. The survey was conducted by asking for an assessment from two lecturers of the course of molecular dynamics. The research was conducted for one semester. The instrument used was an observation sheet for the implementation of learning. The results of this study are the level of implementation of learning which is in the excellent category (E). This is because the systematic preparation of LIRACLE, following the development of graduate skills, increases student enthusiasm, and has a clear basis for implementation. Therefore, the LIRACLE learning model can be said to have met the implementation test. This research is preliminary in the future development of the LIRACLE learning model.

Keywords: *Implementation test, LIRACLE learning model, Molecular dynamics*

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INTRODUCTION

The development of science and technology has caused the world to enter an era of disruption. The disruption era presents a tangible challenge that the global community, including Indonesia, must address. (Pratama & Rohaeti, 2023). The changes of this era have enabled Indonesia's youth to be qualified and competitive on a global scale, meeting the demands for future success in their careers. (Pratama et al., 2023). However, the formation of a quality young generation still faces many obstacles such as low enthusiasm for collaboration, lack of literacy skills, and low problem-solving skills (Edwards et al., 2023; Perry et al., 2023).

A country's young generation's quality can be seen in its undergraduate students' quality. This is based on the age range of undergraduate students who are generally between the ages of 18–23 years. Therefore, the development of student abilities must be pursued by providing quality and the best possible education (Pratama et al., 2023). However, research by the Program for International Assessment of Adult Competencies (PIAAC) in 2016 also showed that students are still very weak in literacy and problem-solving (Perry et al., 2020). The results of PIAAC showed that 70% of respondents from Indonesia had literacy skills at level 1 and below, indicating that the young generation of Indonesia is only able to read short texts with topics that are familiar to them and are only able to capture one message or information from the text (Keslair and Paccagnella, 2020).

Problem-based Learning (PBL) offers an alternative solution to develop literacy and problem-solving skills by integrating science into a real-life case (Akcay & Benek, 2024; Cavadas et al., 2022). This is because the main point of PBL is to encourage students to be active and improve the development of student abilities (Barret, 2017; Brilingaite et al., 2018). Therefore, PBL is included in the student-centered learning model and lecturers have a crucial role as facilitators for the success of learning. However, in addition to having many advantages, PBL has several disadvantages, namely the role of students in the learning process is difficult to change because they are used to being oriented towards subject matter and remembering facts (Grant, 2002). PBL also requires a lot of time to solve complex problems (Grant, 2002). In addition, assessment of learning outcomes will be difficult if done in a traditional way such as using written exams (Shankar, 2010). To minimize the shortcomings of PBL, lecturers must emphasize their role as facilitators (not just providing material directly to students). In addition, clear rules regarding learning and assessment must be agreed upon together (Shankar, 2010). Therefore, innovation to adapt PBL into a new learning model can be done to overcome the shortcomings of PBL.

Development of the LIRACLE Model

Previous studies have revealed the importance of chemical literacy skills, scientific thinking habits, and science process skills that must be possessed by undergraduate students in the science education group, especially undergraduate students in Chemistry Education (Pratama et al., 2024). However, in reality, there are still many cases of low chemical literacy skills among students (Muntholib et al., 2020). Students have not been able to connect the knowledge gained in class and in real life (Stasevic et al., 2023). In addition, in the psychomotor aspect, there were findings of a decrease in science process skills along with the increasing years of study of students (Çalık et al. 2015). The same results were stated by Cigdemoglu, et al (2017) who said that there was a decrease in student attitudes after receiving instructions, although not significant.

Innovation in chemistry learning must be carried out to prepare students to become professional teachers in the future (Easa & Blonder, 2024). One form of this innovation is to develop a new learning model that is specifically intended for learning in higher education. However, there have not been many developments in learning models that focus on adult learning. The Literacy and Research-Oriented Cooperative Problem-Based Learning (LIRACLE) was developed to be an innovation. LIRACLE was developed specifically to develop chemical literacy skills, get used to scientific thinking, train science process skills, train cooperation, and get students used to research. LIRACLE is still in the development stage and has six syntaxes that must be run sequentially. The six syntaxes are combined with the concept of adsorption chemistry to create a learning environment that is oriented towards literacy and research to solve problems in everyday life cooperatively.

The research that has been conducted describes each syntax of the LIRACLE learning model. The first syntax begins with apperception activities, conditioning, and providing chemical literacy discourse. Students are then able to initiate problems in the chemical literacy discourse. The second syntax focuses on investigation and studying chemical concepts. This teaches students to think like scientists and connect chemical concepts to solve problems.

The third syntax, LIRACLE learning invites students to integrate the concept of adsorption that has been learned with the design of problem solving. Students will try to work together to integrate the chemical concepts that have been obtained into a complete chemical concept. If there is a misconception of the concept, peers in the team will be able to tell the correct chemical concept. If there is a misconception in one group, the lecturer can guide students to the correct concept.

The fourth syntax of the LIRACLE model is filled with the activity of designing experiments by determining tools, materials, procedures, data collection sheets, and data analysis. After all these activities are completed, the activity in the fifth syntax, namely compiling scientific articles, begins. The completed scientific article is then presented in front of the class according to the sixth syntax activity (Pratama et al., 2024).

The LIRACLE learning model has been completed theoretically. The arrangement is described in a book whose cover can be seen in Figure 1. However, the development of the LIRACLE model is not yet complete. Implementation testing must be carried out to determine the success of this learning model in the classroom. Therefore, the purpose of this study is to explore the application of the LIRACLE learning model in the classroom,

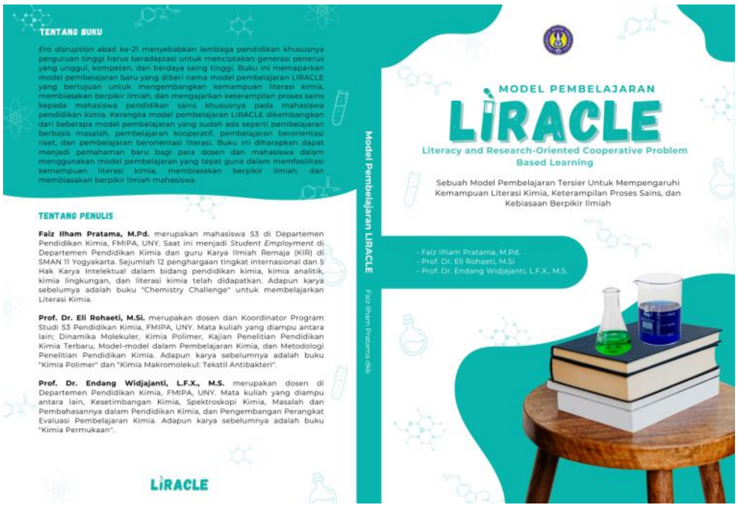

Figure 1. Cover of LIRACLE learning model book

RESEARCH METHOD

The research that has been carried out is quantitative research using a survey. The research was conducted at a university in Yogyakarta. The research was conducted during one cycle of the LIRACLE learning model. The respondents in this study were lecturers who taught the course "molecular dynamics". There were two respondents in this research. Respondents observed the implementation of learning using the LIRACLE learning model.

The data collection technique used is a non-test technique. The instrument used is an observation sheet on the implementation of the learning model. Before use, the observation sheet was validated by five expert judgments. As a result, the observation sheet was declared valid for use. Description of the observation sheet is described in Table 1.

Table 1. Description of the observation sheet

Number	Implementation Aspect	Indicator
1	Syntax	Implementation of all syntax of LIRACLE
2	Social system	Implementation of a democratic social system for all students
3	Reaction principle	Implementation of the role of lecturers as facilitators
4	Support system	Implementation of technical support such as facilities and media
5	Instructional impact	Implementation of LIRACLE's instructional impact
6	Accompaniment impact	Implementation of LIRACLE's accompaniment impact

The scale used in the observation sheet was the Likert scale with five alternative options. The scales were arranged in the form of a statement and followed by the responses in which the level was shown. The response options are VP (Very Poor) has 1 point, P (Poor) has 2 points, F (Fair) has 3 points, G (Good) has 4 points, and E (Excellent) has 5 points. The data that has been collected is then analyzed by assessing ideal criteria.

RESULT AND DISCUSSION

The profile of the LIRACLE learning model developed from its components is described operationally in learning devices including the LIRACLE model book, LIRACLE model implementation book, Semester Program Plan (RPS), and Student Worksheet (LKM). The preparation of these learning devices aims to provide guidelines for lecturers to organize learning with the LIRACLE learning model. Concretely, the syntax of the LIRACLE learning model is described into steps and stages of learning activities in the RPS and LKM. A democratic social system by providing space and opportunity for each student to raise questions or opinions. Each student is given the right to express opinions and ask questions without discrimination. The principle of reaction contains the role and responsibility of lecturers in facilitating a series of activities in learning while creating a learning climate that can guide students to be able to solve the problems given. Components of the support system in the form of creating open and flexible communication patterns, as well as technical support in the form of complete learning media, facilities, and infrastructure that support learning activities. Thus, all learning activities using the LIRACLE learning model can influence students' chemical literacy skills, scientific thinking habits, and science process skills. These three components are the main impacts of the development of the LIRACLE learning model. In addition, the implementation of all learning activities supports the development of students' problem-solving skills, initiative skills, cooperation, and writing skills. The implementation of learning is assessed using the observation sheet that has been developed. Based on the results of data analysis, the achievement of practicality values from the two lecturers teaching the course is shown in Table 2.

Table 2. Observation sheet results

Implementation Aspect	Observer 1	Observer 2	Average	Category
Syntax	5	5	5	Excellent
Social system	5	5	5	Excellent
Reaction principle	5	5	5	Excellent
Support system	5	5	5	Excellent
Instructional impact	5	5	5	Excellent
Accompaniment impact	5	5	5	Excellent

Based on Table 2, all aspects observed in the learning implementation sheet are worth 5. This is because both lecturers gave an excellent assessment in every aspect of implementation observed. There are no additional notes in the form of suggestions or input for improving the LIRACLE learning model.

The "excellent" results obtained are supported by several general product advantages. The first advantage is that the learning model that has been prepared has fulfilled the components of a good learning model according to Joyce et al., 2015. These components include syntax, reaction principles, support systems, instructional impacts, and accompanying impacts. The implementation of the learning model also requires supporting devices such as model books and implementation books, worksheets, and assessment sheets. All of these product items are a unit that is interrelated with each other.

The second advantage of product development is that it follows the characteristics of chemistry learning at the undergraduate level which is oriented towards developing student abilities to produce quality graduates. These characteristics are in line with the principles of problem-based learning and cooperative learning as the main components that build the theoretical design of the LIRACLE learning model. With the problem-based learning component, students will be invited to try to design a solution to problems that exist in everyday life so that they get meaningful learning (Aslan, 2021).

The third advantage is related to the theoretical design of the LIRACLE learning model which is composed of components that support each other and are related to each other consistently. The components in question include philosophical foundations, learning theories, and components related to the characteristics of a good learning model. The theoretical construction is then described in the model book and the LIRACLE model implementation book. Furthermore, the theoretical construction is further described into a more practical form with the existence of worksheet and appropriate assessment instruments so that the LIRACLE learning model is obtained as a whole. The harmony between these components ultimately creates a new side and the usefulness of the learning model being developed.

In addition to strengthening the research results, the researcher asked a student to ask other students randomly related to the learning that had been done. The questions asked were related to "How was the learning of molecular dynamics during one semester?". Many students feel enthusiastic about participating in learning, feel more expressive, can explore the role of chemistry in life, and feel like doing learning activities again in other courses. Based on this, it can be said that the LIRACLE model has been successful in its practicality test. This success is certainly a good step in the development of the LIRACLE model.

CONCLUSION

The LIRACLE learning model is said to have successfully passed the implementation test based on the assessment of two lecturers in charge of the molecular dynamics course. This is based on the assessment category which is in the Excellent (E) category. The reason is the systematic arrangement of the model, in accordance with the development of graduate skills, and supported by a clear learning theory. These results can be used as a basis for the development of the LIRACLE learning model in the future.

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