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The Development of ECIRR Learning Model Containing Archipelago Local Wisdom on Mechanics Topic

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Abstract

This study aimed to develop an ECIRR (Elicit, Confront, Identify, Resolve, and Reinforce) learning model containing Indonesian local wisdom on mechanics in Fundamental Physics lectures. The type of research was Research and Development with the ADDIE model. The number of samples in this study was 28, chosen by purposive sampling. The instruments of this research were validation sheets, observation sheets, and response questionnaires. Data analysis used the Aiken formula and descriptive statistics. Based on the results of the study, it was known that the validity of the content of the learning model was 1.00 with a valid category; the average implementation of lecturer activities was 4.56 with a very good category; the average implementation of student activities was 4.36 with a very good category; and the student response to the model was good. This research concluded that the learning model developed was valid, can be implemented in lectures, and gets a good response from students. Thus, the learning model that has been developed can be used on the topic of mechanics in Fundamental Physics lectures.

Keywords: Development; Elicit, Confront, Identify, Resolve, and Reinforce Learning Model; Local Wisdom

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INTRODUCTION

Innovation in learning needs to be done by lecturers to keep up with the times. In addition, this innovation is required so that students' demands can be met through education. These students' needs include achieving excellent learning outcomes consistent with the expected learning outcomes for graduates. Wulandari & Rusmini (2020) and Diani et al. (2020) explained that a further need for students is the elimination of misconceptions, as misconceptions can impede the process of understanding and learning.

The assessment results of the competence of students enrolled in Fundamental Physics courses on mechanics indicate that there are still students with low abilities. Few students can effectively grasp this topic. In actuality, prospective physics teachers

have misconceptions about the subject. This misunderstanding affects the subtopics of Uniform Linear Motion and Rectilinear Motion, vertical motion, circular motion, force, Newton's law, work, and energy. Serevina & Khaerunisa (2021) also stated that students had difficulty understanding the topic of Newton's laws. Likewise, Widiarini (2020) revealed that students' mastery of the style concept was low. Thus, learning innovations need to be carried out by lecturers so that the quality of learning is better and students also have good competencies (Sanjayanti et al., 2022).

Lecturers have developed the ECIRR (Elicit, Confront, Identify, Resolve, and Reinforce) learning model as one of their learning innovations. This learning model was proposed for the first time by Wenning (2008) (Ningrum & Suliyanah, 2021). This learning model has several advantages, namely eliminating misconceptions (Wulandari & Rusmini, 2020; Warsito et al., 2020; Diani et al., 2020), accommodating prior knowledge, and causing cognitive conflict that causes conceptual change (Ningrum & Suliyanah, 2021), increase the level of understanding (Wulandari & Rusmini, 2020), make retention of understanding very good (Warsito et al., 2020), improve learning outcomes (Diani et al., 2020), and improve scientific reasoning ability and learning motivation (Pahrudin et al., 2020).

Various previous studies have researched the ECIRR learning model. These studies include the development of student worksheets based on the ECIRR learning model (Wulandari & Rusmini, 2020), the ECIRR learning model to identify and correct misconceptions (Warsito et al., 2020), the ECIRR learning model with the pictorial riddle method (Diani et al., 2020), the ECIRR learning model to improve reasoning abilities and learn motivation (Pahrudin et al., 2020), as well as the ECIRR learning model to enhance learning outcomes for linear motion material (Ningrum & Suliyanah, 2021). This research tries to fill the void by developing an ECIRR learning model containing the archipelago's local wisdom on mechanics in Fundamental Physics lectures. The local wisdom of the archipelago is relevant to the subtopic of mechanics. The subtopics are rectilinear motion, uniform linear motion, circular motion, Newton's laws, types of force, work, and energy. The next difference from previous studies is the learning model developed to be applied in universities. Thus, this research had the excellence that the developed ECIRR learning model contained local archipelago wisdom and was used in lectures in higher education. This has never been investigated in previous studies.

This study was obtained to develop a valid, practically implementable, and well-received ECIRR learning model for mechanics in Fundamental Physics lectures that incorporated the local wisdom of the archipelago. Regarding the local wisdom of the archipelago concerning mechanics, projectile motion on *sepak takraw*, Newton's laws on the pedicab, forces on the delman, work, and energy on the oxcart and kite, and rectilinear motion with constant velocity on *Karapan Sapi*, rectilinear motion with constant acceleration on *Bahasinan* traditional game, vertical motion on *Basihi* traditional game, The validity, and implementation of the learning model are discussed in this article along with the reactions of the students to the lesson.

METHOD

This was a type of research and development. The model used was the ADDIE model. This model is used because it is proven to develop effective, practical, and feasible learning models. (Naezak et al., 2021; Hamzah et al.,

2022). Yao (2021) and Jonnalagadda et al. (2022) stated that this model is often used in designing learning. This is because lecturers can develop lecture content according to student needs in a flexible, simple, intuitive, and easy-to-work-on manner (Yao, 2021). This model consisted of five stages: analysis, design, development, implementation, and evaluation (Dick et al., 2001). Table 1 shows the research stages.

Table 1 The stages of research

Step	Activities	Outputs
Analyse	Analysis of need, clarification of the problem, and problem-solving plan	Students profile and solutions
Design	Course learning outcomes, lecture indicators, and learning strategies determination	Lesson Plan and assessment instruments
Development	Development of learning model and instruments of assessment, validation of expert	Learning model prototype and assessment instruments
Implementation	Use of learning model	Data from students and lecturer
Evaluation	Formative and summative evaluation, learning model revision	Learning model and research report

The study was conducted from March to July 2022. One of the universities in South Kalimantan was the setting where this study took place. There were 28 subjects in this study, all of whom were future teachers. The study started when they were taking a Fundamental Physics course on mechanics. Purposive sampling was the method of sampling that was used.

The data collection techniques used were observation and survey techniques. The research instruments were the weekly lesson plan validation sheet, lecturer and student activity observation sheets, and student response questionnaires. These instruments were adapted from research (Ita & Fitriah, 2022; Fitriah, 2021) and were tested for validity according to the criteria formula of Aiken (1985).

The data analysis technique used descriptive statistics in the form of an average. The average score obtained was then classified based on the criteria (Widoyoko, 2019). The validity of the Weekly Lesson Plan was determined based on the formula Aiken (1985).

RESULT AND DISCUSSION

Learning Model Validity

The validity of the ECIRR learning model, which contains the local wisdom of the archipelago, was known from the validity of the Weekly Lesson Plan. The weekly Lesson Plan itself contains complete learning steps. In addition, the Weekly Lesson Plan listed various components of lectures. The validity data based on the validation results of three experts on this Weekly Lesson Plan are presented in Table 2.

Table 2 Validity of weekly lesson plans

No.	Assessment Aspect	V_{count}	V_{table}	Category
1.	Completely written Weekly Lesson Plan Components	1.00	1.00	Valid
2.	The clarity and logic of the Weekly Lesson Plan to change students' conceptions	1.00	1.00	Valid
3.	Integration of Weekly Lesson Plan with local wisdom of the archipelago	1.00	1.00	Valid
4.	The latest learning strategies used	1.00	1.00	Valid

No.	Assessment Aspect	V_{count}	V_{table}	Category
5.	The learning strategies used to encourage students to participate in learning activities actively	1.00	1.00	Valid
6.	Learning activities are listed completely and clearly	1.00	1.00	Valid
7.	The learning steps are by the lecture indicators	1.00	1.00	Valid
8.	The learning steps are clear, sequential, and systematic	1.00	1.00	Valid
9.	The description of the learning steps according to the learning model	1.00	1.00	Valid
10.	The suitability of learning steps with research variables	1.00	1.00	Valid
11.	The learning steps are by the topics discussed, the student environment, and student development	1.00	1.00	Valid
12.	Suitability of time allocation with learning	1.00	1.00	Valid
13.	Various learning activities	1.00	1.00	Valid
14.	Learning activities are constructivist	1.00	1.00	Valid
15.	Learning activities are following strategies, sources, tools, and learning media	1.00	1.00	Valid
16.	Learning activities encourage students to acquire life skills	1.00	1.00	Valid
17.	Learning activities instill noble character	1.00	1.00	Valid
18.	Student-centered learning activities	1.00	1.00	Valid
19.	The suitability of learning tools and media to support learning	1.00	1.00	Valid
20.	Learning resources relevant to the topic	1.00	1.00	Valid
21.	Learning resources are according to the student environment and student development and are contextual	1.00	1.00	Valid
22.	Sources, tools, and learning media using the student's closest environment	1.00	1.00	Valid
23.	Student competency assessment instruments are authentic and oriented to the cognitive domain	1.00	1.00	Valid
24.	The assessment instrument is by the lecture indicators	1.00	1.00	Valid

Based on the Aiken criteria, all aspects of the assessment performed by the three validators are shown to be valid in Table 2. The obtained validity indicates that the developed learning model is applicable in the classroom and provides lecturers with an option for implementing learning models in lecture activities to improve the quality of learning (Ramdhani et al., 2022). A weekly lesson plan that includes a valid learning model demonstrates that the Weekly Lesson Plan and the learning model are appropriate for use in physics learning (Doa et al., 2021; Fatiah et al., 2021; Mulya et al., 2022). In addition, this validity demonstrates that the developed learning model contains the four necessary components for a learning model: support systems, social systems, reaction principles, and syntax (Yao, 2021).

The validity of a valid Weekly Lesson Plan also means that Lesson plans and learning models are prepared by considering theory and related aspects. The development of the device is based on a strong and consistent theory (Hartianiet al., 2022). These results also indicate that the Weekly Lesson Plan, including the learning model, meets the criteria for content validity based on experts' assessments (Fatiah et al., 2021). In line with that, Anggreni et al. (2020) state that the results of this validity indicate that the learning model has good quality. Thus, the ECIRR learning model containing local wisdom of the archipelago can be applied in Fundamental Physics lectures on mechanics.

Implementation of the Learning Model

The implementation of the ECIRR learning model containing local wisdom of the archipelago was known from the implementation of lecturer activities and student activities when the learning model was applied in the classroom. Table 3 shows the implementation of lecturer activities at the implementation stage.

Table 3 Implementation of lecturer activities in class

Lecturer Activities	Means Score in Each Meeting					
	1	2	3	4	5	6
Introduction						
Elicit (Exploring Initial Knowledge)						
1. The lecturer starts the lecture by leading a prayer.	5.00	5.00	5.00	5.00	5.00	4.50
2. Lecturer submits Sub CP Subjects and indicators and titles of teaching materials.	5.00	4.50	4.50	4.00	5.00	4.50
3. The lecturer present contextual information related to the local wisdom of the archipelago.	5.00	4.50	5.00	4.50	5.00	4.50
4. The lecturer gives assignments to students to answer various questions related to the information that had been presented.	5.00	4.50	4.50	4.50	5.00	4.50
Main						
Confront (Confrontation with prior knowledge)						
1. The lecturer assigns students to answer various questions listed in the Student Worksheet.	5.00	4.50	5.00	4.50	5.00	4.50
Identify (Identify various conceptions)						
1. The lecturer asks the reasons for answering questions at the Elicit stage and their beliefs about these answers.	5.00	5.00	4.50	4.00	4.50	3.50
2. The lecturer asks students to write down their answers in the Student Worksheet.	5.00	5.00	4.00	4.50	5.00	5.00
Resolve (Discuss and decide scientific conception)						
1. The lecturer explains the scientific conception.	5.00	4.50	4.50	4.50	5.00	3.50
2. The lecturer assigns students to answer questions.	5.00	4.50	4.00	4.50	5.00	4.00
3. The lecturer and students discuss the correct answer.	5.00	4.00	4.00	5.00	5.00	3.50
Reinforce (Reinforce scientific conceptions and conclude)						
1. Lecturers give practice assignments to students.	4.00	4.00	4.00	5.00	5.00	4.50
2. The lecturer assigns students to make conclusions about the topics that have been studied.	4.50	4.00	5.00	4.50	4.50	4.50
3. Lecturers provide feedback on student assignments and conclusions.	4.50	4.00	3.00	4.00	5.00	3.50
Closing						
1. Lecturers reflect on learning.	4.50	4.00	4.50	4.50	5.00	3.50
2. The lecturer ends the lecture by reading a prayer.	5.00	5.00	4.50	5.00	5.00	5.00
Means	4.83	4.47	4.40	4.53	4.93	4.20
Total Means	4.56					
Category	Very Good					

Based on Table 3, on average, the activities of lecturers based on the ECIRR learning model that includes the local wisdom of the archipelago can be carried out very well. The category whose average score is determined by the criteria (Widoyoko, 2019).

The implementation of students' activities during learning with the developed model is shown in Table 4.

Table 4 shows that student activities in following each step of the ECIRR learning model using the local wisdom of the archipelago are also exemplary.

Table 4 Implementation of student activities

Student Activities	Means Score in Each Meeting					
	1	2	3	4	5	6
Introduction						
Elicit (Exploring Initial Knowledge)						
1. Students start the lecture with a prayer.	5.00	5.00	4.50	5.00	5.00	5.00
2. Students pay attention to the information presented by the lecturer.	4.00	4.50	4.00	5.00	4.50	4.50
3. Students answer various questions on the Student Worksheet.	4.00	5.00	4.50	5.00	4.50	5.00
Main						
Confront (Confrontation with prior knowledge)						
1. Students answer various questions.	4.50	4.50	4.50	5.00	4.50	5.00
Identify (Identify various conceptions)						
1. Students express the reason for the answer and their belief in the answer at the Elicit stage.	3.00	4.00	3.50	4.00	4.50	4.00
2. Students write answers in the Student Worksheet.	4.50	4.50	4.50	5.00	4.00	5.00
Resolve (Discuss and decide scientific conception)						
1. Students listen to the lecturer's explanation.	4.00	4.50	3.50	4.00	4.00	5.00
2. Students answer questions.	4.00	5.00	3.50	4.50	3.00	4.50
3. Students and lecturers discuss the correct answers.	4.00	5.00	3.50	4.00	4.00	5.00
Reinforce (Reinforce scientific conceptions and conclude)						
1. Students do the exercises given by the lecturer.	3.50	4.00	4.00	4.00	4.00	4.50
2. Students make conclusions.	4.50	4.00	4.50	4.00	5.00	4.50
3. Students receive feedback on their work.	4.00	4.00	3.50	4.00	3.00	5.00
Closing						
1. Students listen to the lecturer's explanation	4.00	4.50	3.50	4.00	4.50	4.50
2. Students pray.	5.00	5.00	4.00	5.00	4.50	5.00
Means	4.14	4.54	3.96	4.46	4.21	4.75
Total Means	4.36					
Category	Very Good					

The results of data analysis in Tables 3 and 4 show that the ECIRR learning model, which contains the local wisdom of the archipelago, is well implemented. The ECIRR learning model has been successfully applied in the classroom (Ningrum & Suliyanah, 2021; Hamzah et al., 2022). In addition, this demonstrates that lecturers and students utilize practical learning models during lecture activities (Ramadhan et al., 2020; Rizki et al., 2022).

Students actively build knowledge during learning because this model follows constructivist learning theory (Diani et al., 2020; Islamiyah et al., 2022; Sanjayanti et al., 2022). According to this learning theory, students build new knowledge based on old knowledge and change or develop it when an imbalance between new and old knowledge occurs (Hanfstingl et al., 2019; Pande & Bharathi, 2020). Sanjayanti et al. (2022) stated local wisdom-based learning, which is based on constructivist learning theory, provides students with opportunities to acquire real and contextual experiences

from the learning. This encourages students to learn. Student performance can also be enhanced by acquiring local wisdom, so naturally, student engagement is quite high (Fadli, 2020). Implementing this excellent learning model shows it is comprehensive, transparent, and consistent so that lecturers and students can easily implement it and learning occurs effectively and efficiently (Hamzah et al., 2022; Rizki et al., 2022). Moreover, the excellent practicability of the learning model indicates that the activity stages are organized systematically, each activity stage is carried out successfully during the lecture, and the learning is carried out completely (Ramadhanti & Mahardika, 2020). Thus, the learning model was effectively structured for application.

The implementation of effective learning cannot be separated from the role of the lecturer, who guides students through each stage of the learning process (Bangun et al., 2019). According to Hamzah et al. (2022), this practicality suggests that the lecturer understands the stages of learning readily, making it simple to implement. Bangun et al. (2019) added that this could not be isolated from the students' active participation in attaining the learning objectives. Likewise, Rahayu et al. (2019) state that this exemplary implementation pertains to a learning model that can be utilized to teach physics topics in learning environments. Thus, the devised learning model is applicable to the Fundamental Physics course.

Student Response to Learning Model

The responses of students to the ECIRR learning model, including the local wisdom of the archipelago, are displayed in Table 5 below. Students must respond to seven statements listed in the table. It appears that each statement was met with a positive response from all students. This indicates that each question was answered correctly by 100 percent of students.

Table 5 Student responses to the ECIRR learning model

No.	Statements	%
1.	Fun and interesting learning model	100%
2.	The learning model is new and very helpful for student learning	100%
3.	The learning model allows students to know the local wisdom of the archipelago	100%
4.	The learning model allows students to know the correct scientific concepts	100%
5.	The learning model makes students aware of the misunderstandings that they have been doing	100%
6.	The learning model allows students to develop knowledge through assignments given by the lecturer	100%
7.	Students are again interested in learning with the ECIRR learning model containing the local wisdom of the archipelago	100%

In addition to the data in Table 5, there are student comments on the learning model. The following are the comments given:

1. The learning model is very interesting and practical.
2. Learning ECIRR is highly intriguing.
3. The learning model utilizes a contextual approach closely related to everyday life, making the material simpler to comprehend.
4. The ECIRR learning model enables students to acquire physics while also making them aware of local wisdom in the discussed physics material.

5. Learning with this model can increase insight.
6. The learning model facilitates students' comprehension of commonplace physics concepts.

Based on these data, it can be seen that the student response to the learning model is very positive. This positive response is due to the learning model's incorporation of local wisdom, which makes it simpler for students to comprehend the material and motivates them to learn (Navisah et al., 2021; Lubis et al., 2022; Bulkani et al, 2022). Almuharomah et al. (2019) also stated that a very good response to learning shows that the learning model applied is attractive, encourages motivation, arouses interest in learning, the link between physics concepts and local wisdom can be understood, and the lecturer's explanations when teaching are easy to understand. Likewise, Ramdiah et al. (2020) revealed that a positive response means the learning model attracts students' attention. The excellent student response to the learning model also means that the learning applied is appropriate for students (Adhi et al., 2018).

According to Purwanti et al. (2019), students could follow the learning model that incorporated local wisdom since they studied material pertinent to the region's daily life. Students responded positively to learning that included local wisdom, as demonstrated by this study's findings, which are consistent with those of previous studies (Fitriah, 2020). Additionally, learners were able to internalize noble character due to learning containing local wisdom, so this type of learning must be applied immediately (Hidayati et al., 2020; Tohri et al., 2022). Thus, the learning model that has been developed can be applied in lectures because it gets a good response from students.

CONCLUSION

The conclusion that can be drawn from this research is that the ECIRR learning model, which contained the local wisdom of the archipelago, had validity. Besides that, this learning model was practically implemented and well received by students. So, the ECIRR learning model containing the local wisdom of the archipelago can be applied to learning Fundamental Physics on the topic of mechanics in Higher Education. Future research is expected to develop this learning model for other physics topics equipped with modules or textbooks based on the ECIRR learning model.

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