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PAPER

Integration of Mobile Learning in Rifdarmon Model to Improve Student Learning Outcomes

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ABSTRACT

Mobile learning utilizes mobile technology, such as smartphones, tablets, and other mobile devices, to facilitate a flexible and collaborative learning process. This research aims to implement the integration of mobile learning into the Rifdarmon model in the learning process and evaluate the effectiveness of mobile learning integration into the Rifdarmon model in improving student learning outcomes in the Sensors and Transducers course. This research uses a quantitative approach with an experimental method. The subjects in this study are active students in the Automotive Engineering Department of Padang State University taking the Sensors and Transducers course. The sampling technique used is cluster random sampling, where the researcher randomly selects two classes, the control and experimental classes. Then all students in the selected clusters become the sample. The data in this study were collected based on the pre-test and post-test scores obtained by students in the Sensors and Transducers course. Based on the results and discussion, the implementation of mobile learning integration into the Rifdarmon model in the learning process was successfully carried out in this research. There was a significant increase in learning outcomes for students after following the learning process, both with the conventional learning model (control class) and mobile learning integration into the Rifdarmon model (experimental class).

KEYWORDS

mobile learning, vocational education, Rifdarmon model, learning outcomes

1 INTRODUCTION

Vocational education focuses on developing the skills, knowledge, and attitudes needed to perform work effectively in a particular field [1]. The education system that implements vocational education is higher education, one of which is the State University of Padang (UNP). UNP has several Faculties implementing vocational education, including the Faculty of Engineering, particularly the Automotive Engineering Department. The Automotive Engineering Department aims to produce professional technicians/analysts in the automotive field according to the demands

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of the Indonesian National Qualifications Framework (KKNI) level (see Figure 1) with the ability of an associate's degree level (DIII) through a learning or lecture process.

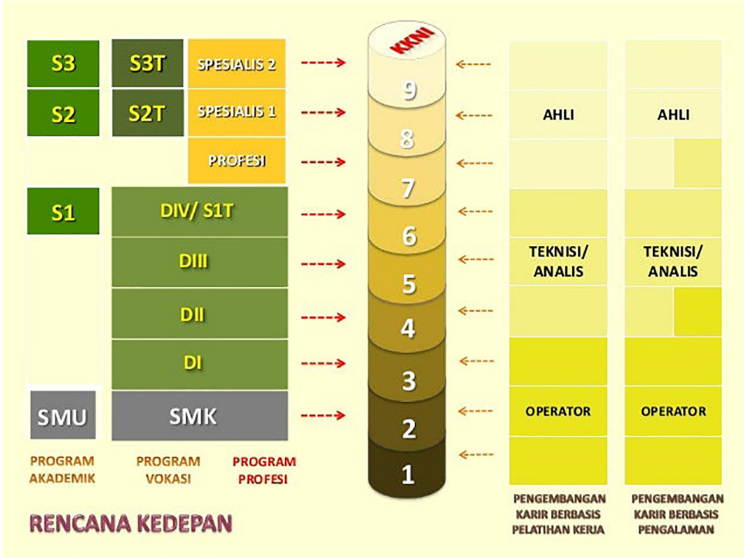

Fig. 1. KKNI level

The qualification of graduates of Diploma III (DIII) higher education in the K.K.N.I. is qualification level 5 with a description of learning achievements, namely: 1) Able to apply and utilize science and technology in their field of expertise in solving problems and able to adapt to the situations faced; 2) Mastering the concept of a particular field of knowledge as a whole and in-depth and being able to formulate procedural problem solving; and 3) Able to make the right decisions based on data information analysis and provide guidance in choosing solutions independently and in groups; and 4) can be responsible for their work and the work results of the organization. In line with the competency standards previously explained, Edgar Dale's cone of experience theory is also an essential part of determining an individual's competence based on concrete experiences in the form of direct experience (real-life experiences), interactive experiences, and dramatic participation to inform someone about how much that person remembers based on how they encountered the information [2].

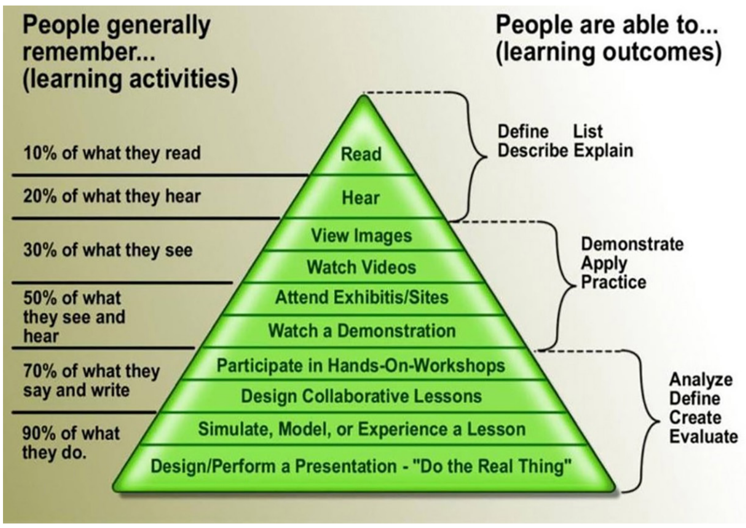

Fig. 2. Edgar Dale's cone of experience

Edgar Dale's cone of experience (see Figure 2) has relevance in determining competency standards based on the Indonesian National Qualifications Framework (KKNI) through the learning outcomes of specific knowledge and skills based on concrete experiences, including direct experience (real-life experiences), interactive experiences, and dramatic participation to inform someone about how much they remember based on how they find information. In this research, the Sensors and Transducers course's learning outcomes are the researcher's focus. Based on the researcher's observations in the Sensors and Transducers course, there is a problem of low achievement of learning outcomes according to the demands of Edgar Dale's cone of experience, resulting in the expected competencies not meeting the demands of the KKNI (Indonesian National Qualification Framework) level. This is evidenced by the learning outcomes (Table 1) obtained in the Sensors and Transducers course for the January–June 2023 semester.

Table 1. Learning outcomes of the sensors and transducers course

No.	Section Class	Number of Student	Average Score
1.	202220740013	11	52.52
2.	202220740015	12	65.34
3.	202220730025	13	51.87
4.	202220730026	20	62.25
5.	202220730031	15	52.02

Table 1 shows that the average student learning outcomes for the Sensors and Transducers course during the January–June 2023 semester were still low. Furthermore, field problems showed that students were only able to recall or understand 50% of what they read, heard, and saw from the learning activities, so these students were only able to achieve learning outcomes such as defining, describing, listing, and explaining what they learned. However, these students were not yet able to demonstrate, apply, and practice their knowledge. The factors that influence learning outcomes include the application of learning models [3–7], learning approaches [8], learning methods [9–11], learning media [12–16], assessment instruments [17–19], and curriculum [20–21], as well as intrinsic factors [22–24]. This study will focus on learning models and strategies.

The researcher also observed that in the Sensors and Transducers course, the learning model used is the problem-based learning (PBL) model. In learning using the PBL model, problems were identified that are the factors causing low student learning outcomes in the Sensors and Transducers course, including: 1) students who have difficulty in understanding key concepts or having a strong basic knowledge of the material due to the complexity of the material in the Sensors and Transducers course; 2) lack of student involvement in the learning process due to low motivation, lack of interest, or ineffective group dynamics, 3) when the lecturer does not provide adequate guidance or constructive feedback, so students may feel confused or lose direction in solving problems; 4) there is an ineffective problem design that causes students to lose interest or have difficulty developing the expected problem-solving skills; and 5) limited time to investigate problems in depth, conduct research, or engage in meaningful discussions.

To overcome the weaknesses in implementing the P.B.L. model in the Sensors and Transducers course, the researcher integrated a learning model with mobile learning. The integration results are expected to improve competency standards based on the K.K.N.I. through the achievement of knowledge and specific skills based on concrete experiences in direct (real-life) experiences, interactive, and dramatic participation to inform someone about how much they remember based on how they find information. The learning model integrated with mobile learning is the Rifdarmon model. The Rifdarmon model integrates problem-based learning (P.B.L.) and cooperative learning, such as jigsaw. Meanwhile, mobile learning is a learning approach that utilizes mobile technology, such as smartphones, tablets, and other mobile devices, to facilitate a flexible and collaborative learning process [25]. Mobile learning can also provide easy and interactive access for students [26]. With the advancement of mobile technology and the availability of widespread internet networks, mobile learning has become an increasingly popular alternative in the learning process at various levels of education, especially in higher education [27].

The importance of mobile learning in the learning process can be seen from several aspects, including: 1) Accessibility and flexibility: mobile learning allows students to access learning materials and engage in learning activities anywhere and anytime, not limited to classrooms or certain times [28]. 2) Engagement and motivation: interactive and attractive mobile devices can increase student engagement and motivation in the learning process [29]. 3) Collaboration and communication: mobile learning facilitates effective collaboration and communication between students, as well as between students and teachers [30]. 4) Contextual learning: through mobile technology, students can access information and learning resources relevant to specific contexts and environments, such as in field studies or location-based projects [31].

Integrating mobile learning in the Rifdarmon model has several advantages, including 1) Mobile learning can support more effective collaboration and communication in the Rifdarmon model, especially in group work and discussions [30]. 2) Mobile learning can expand students' access to resources relevant to the material or problems studied [31]. 3) Mobile learning can increase student engagement and motivation in the Rifdarmon model through attractive, interactive applications, games, videos, and multimedia [28].

This research aims to implement the integration of mobile learning in the Rifdarmon model in the learning process and evaluate the effectiveness of mobile learning integration in the Rifdarmon model in improving student learning outcomes in the Sensors and Transducers course. The novelty of the research "Integration of Mobile Learning in the Rifdarmon Model for Improving Student Learning Outcomes" can be emphasized in several aspects, including 1) This research proposes an innovative integration approach by incorporating mobile learning into the Rifdarmon learning model. 2) This research contributes to developing innovative and relevant learning models for the current digital era. Integrating mobile learning into the Rifdarmon model can enrich instructional design and learning strategies that can be applied in higher education environments, particularly in the vocational field. 3) This research explores the use of mobile technology in the context of vocational learning, which often requires a more practical and applied learning approach. Mobile learning can engage students in more authentic and contextual learning activities that support the achievement of vocational competencies. 4) This research also evaluates the effectiveness of this integration in improving student learning outcomes.

2 SYNTAX RIFDARMON MODEL

The syntax of the Rifdarmon learning model was developed based on the integration of the syntax from the Problem-Based Learning (PBL) model, the cooperative model of the Jigsaw type, and the peer tutoring model. As shown in Figure 3, the syntax of the Rifdarmon learning model is illustrated as a waterfall, where the learning steps are carried out sequentially. In other words, the next step cannot be performed unless the previous step has been completed. The syntax of the Rifdarmon learning model consists of nine stages, including: (1) Recognizing the Problem; (2) Information Gathering; (3) Forming Expert Groups; (4) Discussion; (5) Analyzing Solutions; (6) Reciprocal Teaching; (7) Mentoring Peers; (8) Organizing Findings; and (9) Narrating Outcomes.

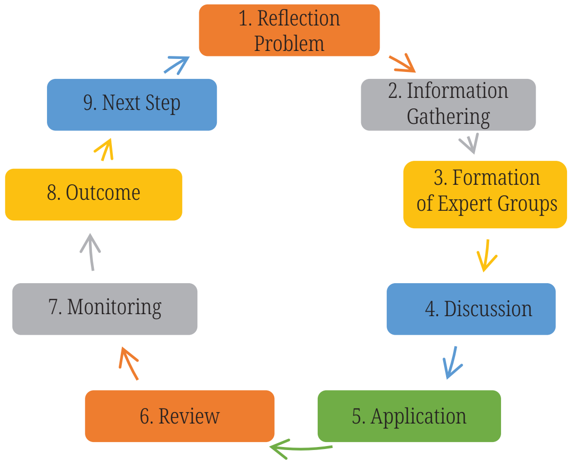

Fig. 3. Syntax Rifdarmon model

Based on Figure 3, it can be explained that the syntax of the Rifdarmon learning model integrates the principles of the Problem-Based Learning (PBL) model, the cooperative Jigsaw model, and the peer tutoring model harmoniously, creating a comprehensive approach that promotes collaborative problem-solving, deep mastery of material, and the development of communication and leadership skills. Through PBL, the Rifdarmon learning model adopts a focus on solving complex problems and independent research. Through the cooperative Jigsaw model, it incorporates the structure of expert groups and knowledge-sharing processes. Additionally, through the peer tutoring model, it includes elements of peer teaching and mentoring. The stages or syntax of the Rifdarmon learning model are explained in detail as follows.

2.1 Recognizing the problem

In this stage, the lecturer presents a problem related to oxygen sensors in vehicles, which is one of the topics in the Sensors and Transducers course. Students observe and analyze the problem, identifying key aspects that require further investigation concerning the oxygen sensor. They begin to develop an initial understanding of the complexity of the problem and pinpoint the key aspects that need deeper exploration. This stage stimulates students' curiosity and motivates them to engage in problem-based learning.

2.2 Information gathering

After recognizing and understanding the problem, students begin to gather relevant information from various sources. They collect information about oxygen sensors from multiple references, including textbooks, scientific articles, and vehicle manuals. This stage develops students' information literacy and critical thinking skills. Additionally, students start identifying knowledge gaps that need to be addressed to solve the problem.

2.3 Forming expert groups

At this stage, students are divided into expert groups of 1 to 2 individuals according to the specific aspects of the problem that have been identified, with each student responsible for one or two subtopics from the 14 learning objectives outlined in the study of oxygen sensors. This division allows students to focus on specific areas and develop in-depth expertise. This stage also promotes positive interdependence, where the success of the group relies on the contributions of each member.

2.4 Discussion

At this stage, students engage in in-depth discussions within their expert groups on the assigned subtopics. For example, they may discuss one of the subtopics related to oxygen sensors, such as the basic concept of the heated oxygen sensor or how to perform a diagnostic trouble code (DTC) analysis. Students share the information they have gathered, clarify their understanding, and build collective knowledge. This discussion facilitates collaborative learning and helps students construct a more complex understanding of the problem. Additionally, students develop communication, argumentation, and meaning-negotiation skills.

2.5 Analyzing solution

At this stage, the expert groups analyze potential solutions to the problem related to their subtopics, such as how to measure the sensor's output voltage or interpret a wiring diagram by evaluating the advantages and disadvantages of each solution and considering their impacts and consequences. This stage hones students' critical and analytical thinking skills. They learn to consider various perspectives and make decisions based on evidence and logical reasoning. Once this stage is completed, the expert groups will undergo a feasibility test to validate their expertise.

2.6 Reciprocal teaching

After being validated as experts, students return to their original groups and teach the knowledge they have acquired about their subtopics to the other group members. Before engaging in reciprocal teaching, students will take a pre-test to assess their prior knowledge, abilities, or skills related to oxygen sensors. Each group member, serving as an "expert" in a specific aspect, is responsible for sharing the insights and knowledge they have gained with the other members in a reciprocal manner. This stage reinforces students' understanding, as they must clearly articulate their knowledge. Additionally, reciprocal teaching develops students' communication and leadership skills.

2.7 Mentoring peers

At this stage, students mentor each other within their original groups, ensuring a thorough understanding of all aspects of oxygen sensors, from basic concepts to the measurement of related components. After completing this stage, a post-test will be administered to assess the extent of their improvement in knowledge, abilities, or skills related to oxygen sensors. Students clarify challenging concepts, answer questions, and assist peers facing difficulties. This mentoring stage strengthens social bonds, fosters empathy, and develops students' interpersonal skills. It also helps identify and address any remaining gaps in understanding. Upon completing this stage, students will take a post-test to measure their progress in knowledge and skills related to oxygen sensors.

2.8 Organizing findings

At this stage, the group organizes their findings on oxygen sensors, synthesizes information from various subtopics, and develops a comprehensive understanding. This phase hones each student's ability to organize information, think systematically, and grasp the bigger picture. Students also learn to prioritize information and establish connections between concepts.

2.9 Narrating outcomes

At this stage, each group prepares a presentation that explains their understanding of oxygen sensors, covering all subtopics from basic concepts to measurement and diagnosis. This phase not only develops presentation skills but also enables deep reflection on the learning process. Students learn to communicate complex ideas clearly and convincingly, as well as respond to questions and critiques from their peers.

3 RESEARCH METHODS

This research uses a quantitative approach with an experimental method. This method was chosen because this research aims to analyze the effectiveness of improving learning outcomes using the Rifdarmon learning model integrated with mobile learning. The subjects in this study are active students in the Automotive Engineering Department of Padang State University taking the Sensors and Transducers course. The Population in this study consists of 66 students from 4 clusters. The sampling technique used is cluster random sampling, where the researcher randomly selects two classes as the control and experimental classes. Then all students in the selected clusters become the sample. The data in this research were collected based on the pre-test and post-test learning outcomes obtained by students in the Sensors and Transducers course. Pre-test data were obtained before the learning began, and post-test data were obtained after the learning process. The collected data will be analyzed using inferential statistical techniques with the help of S.P.S.S. version 25 software. The data analysis consists of a homogeneity test, normality test, and paired sample t-test to examine integrating mobile learning in the Rifdarmon model on improving student learning outcomes.

4 RESULT AND DISCUSSION

4.1 Result

The data in this study were collected based on the pre-test and post-test learning outcomes obtained by students in the Sensors and Transducers course. The pre-test data were obtained before the learning began, and the post-test data was obtained after the learning was conducted. The pre-test and post-test result data from the control class and the experimental class were obtained, as presented in Table 2.

Table 2. Pre-test and post-test result data

Pre-Test					Post-Test			
	Control Class		Experimental Class		Control Class		Experimental Class	
No.	Name	Grade	Name	Grade	Name	Grade	Name	Grade
1.	YAY	35.55	AAR	62.96	YAY	89.70	AAR	99.40
2.	MSA	16.66	MDK	98.81	MSA	79.88	MDK	95.25
3.	MRAAs	23.70	Legi	45.18	MRAAs	68.92	Legi	98.66
4.	MRus	23.33	CF	36.88	MRus	80.40	CF	99.70
5.	RTN	30	MAG	57.62	RTN	92.44	MAG	99.85
6.	RifPra	7.25	Mde	43.11	RifPra	87.70	Mde	99.40
7.	WaNA	33.33	RAS	46.07	WaNA	83.11	RAS	100
8.	Alim	16.66	Ario	28.88	Alim	88.70	Ario	94.81
9.	JS	65.77	RAP	67.40	JS	87.25	RAP	99.70
10.	RRP	69.18	AFA	62.81	RRP	86.91	AFA	99.70
11.	AgSa	2.81	AlA	14.33	AgSa	90.22	AlA	93.92
12.	ASDz	13.33	RAW	56.66	ASDz	80.66	RAW	96
13.	FH	2.51	SASC	25.62	FH	86.66	SASC	95.70
14.	RF	20	AAM	30.37	RF	84.81	AAM	99.11
15.	RAF	56.88	MIK	23.25	RAF	91.74	MIK	95.25
16.	MAIL	3.70	ASy	50.37	MAZL	92.55	ASy	96.96

4.2 Data analysis

Homogenitas Test. Based on the data obtained and the homogeneity test performed on S.P.S.S 25, it was found that for the pre-test, the F value (1.08) < F-table (2.40), so the pre-test data is homogeneous. Then, for the post-test, the F value (2.08) < F-table (2.40), so the post-test data is homogeneous. Therefore, based on the homogeneity test, both classes' pre-test and post-test data are homogeneous.

Normality Test. Based on the data obtained and the normality test performed on S.P.S.S. 25, it was found that the normality test for the average pre-test score of the control class ($\bar{x}$) = 30.89, standard deviation (s) = $\sqrt{351.32}$ = 18.75, Z value for the probability [P(Z ≤ Zi)] from the standard distribution table, and proportion [P(Z)] = cumulative frequency/n, the most significant difference between P(Z ≤ Zi) and P(Z) was D = 0.181. Then, for the pre-test score of the experimental class, the D value = 0.151 was obtained. For the normality test of the post-test score for the control class, the D value = 0.138 was obtained, and for the post-test score of the experimental class, the D value = 0.168 was obtained.

Furthermore, by comparing the D value with the critical Dtable value with n = 16 and a significance level of 0.05, then Dtable = 0.322, the results showed that for the Pre-test Control Class, D (0.181) < Dtable (0.322), so the data is normally distributed; for the Pre-test Experimental Class, D (0.151) < Dtable (0.322), so the data is usually distributed. Then, for the Post-test Control Class, D (0.138) < Dtable (0.322), the data is normally distributed; for the Post-test Experimental Class, D (0.168) < Dtable (0.322), the data is usually distributed. Based on the normality test using the Kolmogorov-Smirnov test, all pre-test and post-test data from both classes are typically distributed.

Paired sample T test. Based on the data obtained and the paired sample t-test performed on S.P.S.S. 25, it was found that for the control class, there was a significant difference between the pre-test and post-test scores (sig. 2-tailed = 0.000 < 0.05). In contrast, for the experimental class, there was a significant difference between the pre-test and post-test scores (sig. 2-tailed = 0.000 < 0.05). Thus, there is a significant difference between the pre-test and post-test scores in both the control and experimental classes.

4.3 Discussion

This study aimed to implement the integration of mobile learning into the Rifdarmon model in the learning process, evaluate the effectiveness of this integration in improving student learning outcomes, identify factors influencing the successful implementation, and analyze students' perceptions and responses toward the use of mobile learning integrated into the Rifdarmon model in the Sensors and Transducers course. Based on the homogeneity test, the pre-test and post-test data from both classes (control and experimental) were homogeneous.

This indicates that both classes had equivalent initial abilities before receiving different treatments. The normality test using the Kolmogorov-Smirnov test showed that all pre-test and post-test data from both classes were usually distributed. This is one requirement for performing parametric statistical tests such as the paired sample t-test. The results of the paired sample t-test showed a significant difference between the pre-test and post-test scores, both in the control and experimental classes. This indicates a significant improvement in learning outcomes after the learning process, both with the conventional learning model (control class) and mobile learning integration into the Rifdarmon model (experimental class).

5 CONCLUSION

Based on the data and discussion, this study successfully integrated mobile learning into the Rifdarmon model in the learning process. Student learning outcomes significantly improved after participating in the learning process, both with the conventional learning model (control class) and mobile learning integration into the Rifdarmon model (experimental class). Before receiving different treatments, the initial abilities of students in the control and experimental classes were equivalent, as shown through the homogeneity test of the pre-test data. The pre-test and post-test data from both classes were typically distributed, meeting the requirements for performing parametric statistical tests such as the paired sample t-test. This study successfully evaluated the effectiveness of integrating mobile learning into the Rifdarmon model in improving student learning outcomes. However, further analysis is needed to compare the improvement in learning outcomes between the control and experimental classes.

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