Development and Validation of RADEC Learning Model-Based Student Worksheets for Natural and Social Sciences (IPAS) Subjects

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Abstract. The RADEC learning model emerged as a revolutionary tool in Indonesian education, encouraging student engagement, self-discipline, and increased rigor. This approach enhances critical thinking skills, problem-solving abilities, communication, teamwork, and creativity in line with the needs of modern education. Study after study highlights the effectiveness of this approach in fostering active learning, understanding, and cooperation in the 21st century. However, using the RADEC model in sains education through the Lembar Kerja Peserta Didik (LKPD) creates challenges in terms of integration and growth. This study applies a systematic approach using the ADDIE model to measure and assess the validity of the LKPD based on RADEC for secondary education. The validation results confirm the validity of the LKPD and its compliance with the RADEC model, ensuring its quality and effectiveness in enhancing the learning process. Continuous teacher professional development and an adaptable learning model are crucial in meeting the needs of students' evolutionary progress. This study highlights the importance of implementing LKPD by the RADEC model to enhance learning outcomes in science classrooms and improve student performance.

Keywords: RADEC Model, LKPD, Science Learning, Independent Curriculum, Validation

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INTRODUCTION

The RADEC learning model, proposed by Sopandi in 2017, is a learning approach that emphasizes the active involvement of learners. This approach evokes learners' creativity, innovation, and responsibility within the range of learning activities. The main advantage of this learning model is its relation to the characteristics of students and the needs of the Indonesian curriculum, as highlighted in several studies (Handayani, Sopandi, Syaodih, Setiawan, et al., 2019; Primary et al., 2020; Sukardi et al., 2021). The steps in this model are presented clearly to facilitate understanding for educators. Thus, the RADEC learning model encourages students to hone responsibility both individually and in groups, increase personal interaction, sharpen critical thinking skills, solve problems, enrich communication skills, strengthen teamwork, and deepen understanding of concepts and creative thinking skills (Handayani, Sopandi, Syaodih, Suhendra, et al., 2019; Setiawan et al., 2020). More than just enabling learners to learn with an empowering approach (enriching character skills, citizenship, critical thinking, problem-solving, communication, collaboration, and creativity), the RADEC learning model also trains learners to use their existing knowledge to formulate and implement creative ideas.

Findings from previous studies show that RADEC can help teachers stimulate students to construct their knowledge in various subjects and education unit levels (Andini &; Fitria, 2021; Lestari &; Suhandi, 2020; Ritonga et al., 2021). This is supported by teacher pedagogic competence in compiling and implementing learning with the RADEC learning model based on mastery of fairly representative concepts (Sebbaq &(Sebbaq &; El Faddouli, 2022). In addition, students can also master concepts faster because students' reading interest is stimulated through the Read syntax in the RADEC model and focus more on understanding the material taught. Some researchers have also found that RADEC helps learners to be active and independent in mastering 21st century skills through the literacy (Anisa &; Hasanah, 2022, p. 21; Indarta et al., 2022, p. 21; Intiana et al., 2023).

According to Lee (2014), LKPD can help apply learning models. To integrate science and social studies into the curriculum, LKPD, whose stages of activities are by the RADEC learning model, must provide learning of science and social materials as well as scientific and social literacy, one of which is communication and collaboration (Chalkiadaki, 2018; Lee, 2014). LKPD, according to the needs of learners, can help learners understand lessons more easily and improve their understanding of the concepts learned (Fitriani et al., 2016; R. A. Pratama &; Saregar, 2019). LKPD also functions as practical teaching material to help students improve their knowledge of the concepts learned. Worksheet-based learning does not guarantee that teachers provide thorough instruction to students. According to Gunawan et al. (2023), worksheet-based learning differs from traditional learning because it does not involve instructional discussions between teachers and students (Z. Setiawan et al., 2023). On the contrary, teachers are very important for educational success because of their important role in the learning process (Agustina et al., 2022).

According to Gage and Berliner in (Kirom, 2017), the primary role of teachers is planner, organizer, and evaluator. The teacher must have the competence to complete the class. Instead, teacher professional development is called formal professional learning or continuous professional development, which refers to the various ways in which teachers can actively improve their skills throughout their careers (Kennedy, 2016). It is further explained that the abilities in question are pedagogic, social, professional, and personality abilities. The educational expertise also includes manufacturing teaching materials, one of which is LKPD. Scientific success is influenced by teaching models and teacher quality (Kurniasih et al., 2020). To accurately capture students' developmental levels, teachers need learning models to meet their needs. RADEC is considered a learning model that meets these needs. However, it was found that teachers still need help in developing RADEC-based LKPD for science subjects. Based on these findings, efforts are needed to develop LKPD to assist teachers in applying the RADEC learning model to science subjects.

METHOD

This research begins with a clear goal to develop and validate Student Worksheets (LKPD) based on the RADEC learning model for Natural Sciences (Science) subjects. This study adopts a methodological approach to Design and Development to achieve this goal. Richey and Klein describe that this approach aims to conduct systematic research in designing, developing, and evaluating a system or product with a specific goal in mind (Ellis & Levy, 2010).

In using this Design and Development method, this study implements the ADDIE Model as the main framework. The ADDIE model, which consists of five main stages, namely analysis, design, development, implementation, and evaluation, plays an important role in the development process of RADEC-based LKPD for science subjects. According to Januszewski and Molenda, cited by Suryani et al. (2018), the ADDIE Model is the main foundation of a systematic approach to learning development (Suryani, 2018).

The first stage of the ADDIE Model is analysis. At this stage, an in-depth study of the needs and characteristics of students, teaching materials, and learning environments is carried out. This analysis is an important foundation in designing LKPD that is by the context of RADEC model-based science learning. The design phase, which is the next step, involves planning the structure, format, and content of the LKPD to be developed. After the design stage, research proceeds to the development stage, where RADEC-based LKPD for science subjects begins to be realized. This process involves implementing the design plan into a tangible form of LKPD that can be used in the context of actual learning. Finally, the evaluation stage plays an important role in assessing the effectiveness, effectiveness, and suitability of the LKPD with the learning objectives that have been previously set.

The instruments to be used in this study consist of several types, one of which is a validation instrument by experts. The validation questionnaire that will be used focuses on assessing the feasibility of the content and suitability of the Student Worksheet (LKPD) that has been developed. The purpose of this instrument is to obtain valuable input and validation regarding the quality and usefulness of LKPD in the context of the RADEC learning approach. In addition, additional

instruments in the form of questionnaires will be used to explore further information related to the implementation of LKPD by students and teachers in the learning process.

In data collection, various instruments and techniques are used according to the research purpose. First, data are obtained through theoretical studies and documentation to formulate indicators in Natural and Social Sciences (IPAS) subjects in elementary schools. The source of academic information comes from achieving the minimum competence of elementary school students in science subjects from various regulations, guidelines, and existing curriculum guidelines. Then, for the development of pre-learning questions in science subjects, an observation approach is used to analyze the RPP (Learning Implementation Plan) and learning outcomes that the teachers have prepared. Observations were made to understand the learning design, which consisted of RPP, LKPD, and pre-learning questions that had been prepared by educators.

RESULTS

In developing draft feasibility assessment instruments and the practicality of student worksheets, the process involves making validation instrument sheets as formative evaluation tools by a team of experts. This stage focuses on several very important aspects, which include: 1) the feasibility and practicality of the content, which assesses the substance of the material presented; 2) the appropriateness and practicality of the language, to ensure the use of appropriate and clear language; 3) the feasibility and practicality of Presentation, which refers to the way the material is presented; 4) the feasibility and practicality of Graphics, assessing the layout, visualization, and graphic elements that support understanding; and 5) the feasibility and practicality of the RADEC Model-Based LKPD, which focuses on matching student worksheets with the learning model used, namely the RADEC model. A thorough evaluation of these aspects will result in more effective student worksheets and support quality learning.

The product developed in this study is RADEC-based LKPD on IPAS material. After being made based on the stages of the ADDIE model, an instrument validation process is carried out first, in this case it is the validation of instruments in aspects of content, language, presentation, graphics, and RADEC. The instrument validity test is carried out to minimize judgment errors both in terms of material or media concepts developed, so that after the completion of valid instrument validation, then the instrument can be used to assess the feasibility of RADEC-based LKPD on IPAS material.

Table 1. Recapitulation of Instrument Validation Results

No.	Aspects	Value Validity	Criterion
1	Others	0,94	Valid
2	Language	0,96	Valid
3	Penyajian	0,92	Valid
4	Graphics	0,96	Valid
5	RADEC	0,97	Valid
Average		0,95	Valid

The validation of this research instrument was tested on 5 validators who were professors and lecturers who were experts in their respective fields. On instrument validation shows that the results of Aikens analysis of the V value of the table are more than equal to 0.92 (Aiken et al., 1985). The validity value of each aspect of the instrument developed is the content validity aspect of 0.94, the language aspect of 0.96, the presentation aspect of 0.92, the graphic aspect of 0.96, and the RADEC aspect of 0.97. Therefore, the instrument is declared valid and feasible to be used to assess LKPD based on suggestions or comments provided by validators so that the quality of the LKPD instrument becomes better.

Improvements made during the instrument validation process, namely in the aspect of using and explaining sentences, especially the presentation component. Based on the validation results, the presentation component got the lowest value of 0.92, this is because the validator gave

suggestions to add LKPD assessment, sentence improvement, and instrument systematics improvement. In the language aspect, it is carried out to correct ambiguous sentences, typing errors, and appropriate word selection. Suggestions and input from the validator become a reference in improving the LKPD instrument until the instrument is declared valid and worthy of trial.

DISCUSSION

Instrument The validation sheet is used to validate the eligibility of LKPD and LKPD is validated by 5 validators. The validation aspects of LKPD are aspects of content feasibility, language feasibility, presentation feasibility, graphic feasibility, and LKPD feasibility based on the RADE model. LKPD validation results in feasibility data calculated using the Guttman Scale formula.

After the instrument validation stage is completed and revised, a RADEC-based LKPD assessment is carried out to determine the feasibility of LKPD. In addition, this stage is to find out the practicality of LKPD developed during the lecture process. The feasibility of LKPD is assessed by 4 validators who are lecturers who are experts in their respective fields. The results of the feasibility of LKPD show that the results of the Guttman scale analysis of feasibility are divided into three intervals, namely feasible (percentage value ≥66.51%), quite feasible (percentage value 33.26-66.50%), and not feasible (percentage value ≤33.25%). The percentage value of LKPD feasibility test results from each aspect, namely the content feasibility aspect of 95%, the language aspect of 93.75%, the presentation aspect of 93.75%, the graphic aspect of 100%, and the RADEC aspect of 100%. Therefore, LKPD is declared suitable for use based on suggestions or comments provided by validators so that the quality of LKPD becomes better.

At this stage, LKPD is produced as a formative evaluation tool by a team of experts. The feasibility data of each aspect of the LKPD component or each statement item are shown in Table 2.

Table 2. LKPD Feasibility Results of Each Aspect

Aspects	Item	Validator					Total	Score Ideal	%	Category
		1 (F)	2 (I)	3 (R)	4 (S)	5(D)				
Others	1	4	4	4	4	4	4	4	100	Proper
	2	4	4	4	4	4	4	4	100	Proper
	3	4	4	4	4	4	4	4	100	Proper
	4	4	4	4	4	4	1	4	100	Proper
	5	4	3	4	4	4	3	4	75	Proper
		Average					3,5	4	95	Proper
Language	1	4	4	4	4	4	4	4	100	Proper
	2	4	4	4	4	4	4	4	100	Proper
	3	3	4	4	4	4	3	4	75	Proper
	4	4	4	4	4	4	4	4	100	Proper
		Average					3,75	4	93,75	Proper
Penyajian	1	4	4	4	4	4	4	4	100	Proper
	2	4	3	4	4	4	3	4	75	Proper
	3	4	4	4	4	4	4	4	100	Proper
	4	4	4	4	4	4	4	4	100	Proper
		Average					3,75	4	93,75	Proper
Graphics	1	4	4	4	4	4	4	4	100	Proper
	2	4	4	4	4	4	4	4	100	Proper
	3	4	4	4	4	4	4	4	100	Proper
	4	4	4	4	4	4	4	4	100	Proper
		Average					4	4	100	Proper
Radec 4C	1	4	4	4	4	4	4	4	100	Proper

Aspects	Item		Validator				Total	Score Ideal	%	Category
		1 (F)	2 (I)	3 (R)	4 (S)	5(D)				
	2a	4	4	4	4	4	4	4	100	Proper
	2b	4	4	4	4	4	4	4	100	Proper
	3a	4	4	4	4	4	4	4	100	Proper
	3b	4	4	4	4	4	4	4	100	Proper
	3c	4	4	4	4	4	4	4	100	Proper
	4a	4	4	4	4	4	4	4	100	Proper
	4b	4	4	4	4	4	4	4	100	Proper
	5a	4	4	4	4	4	4	4	100	Proper
	5b	4	4	4	4	4	4	4	100	Proper
	5c	4	4	4	4	4	4	4	100	Proper
	5d	4	4	4	4	4	4	4	100	Proper
		Average					4	4	100	Proper

Improvements made during the LKPD feasibility test process, namely in the aspects of content and sentences, especially the presentation component. Based on the validation results, the presentation and language components got the lowest score compared to other aspects, namely 93.75%, this is because validators provide suggestions for sentence improvement, and improvement of LKPD systematics.

CONCLUSION

Within the Indonesian curriculum, the RADEC learning model offers a viable framework for improving student participation, responsibility, and skill development. The model's easy-to-follow steps make it easier for educators to comprehend and put it into practise while fostering students' critical thinking, problem-solving, communication, collaboration, and creative abilities. Research indicates that it is effective in enhancing students' understanding, mastery of 21st-century abilities, and active learning. Nevertheless, there were difficulties in developing Student Worksheets (LKPD) that integrated the RADEC model into science courses. The study demonstrated a methodical process for developing and validating RADEC-based LKPD for science topics by employing the ADDIE Model. The LKPD's validity and fit for the RADEC model were validated by the validation results, assuring its high calibre and potency in assisting with learning processes. The study emphasises the value of ongoing professional development for teachers and customised lesson plans to accommodate students' changing requirements. The development and refinement of LKPD in accordance with the RADEC model is essential to promoting successful learning experiences and improving academic results in science courses.

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