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**[Research Article]**

# INTEGRATION OF THE RADEC MODEL IN ALTERNATIVE ENERGY TOPICS TO FOSTER CREATIVITY AS A TRAIT OF THE PANCASILA STUDENT PROFILE

***Herni Yuniarti Suhendi[1], Rifa'atul Maulidah[1], Vera Ariyanti[1]***

*[1]Universitas Siliwangi, Tasikmalaya, Indonesia*
*E-mail: herni.suhendi@unsil.ac.id*

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## ABSTRACT

This research was conducted to explore the effects of implementing the use of RADEC learning paradigm affects the Pancasila Student Profile's creative component, particularly in relation to alternative energy-related subjects. Using a matching-only posttest-only control group design, a quasi-experimental approach was used to select participants, with Class X.10 (36 students) serving as the control group and Class X.12 (36 students) as the experimental group. A posttest consisting of 10 essay questions that were all in line with the three creativity indicators listed in the Pancasila Student Profile was used to measure creativity. The research process included preliminary testing, expert validation, instrument trials, analysis of model implementation, the study also involved Hypothesis test through Test the significance level of $\alpha = 0.05$. The results showed that the computed t-value ($t = 8.4$) was above the significance level critical t-value ($t = 1.67$), prompting acceptance of the alternative hypothesis (Ha) and rejection of the null hypothesis (H0). These findings suggest that the RADEC model significantly enhances the creative dimension within the Pancasila Student Profile when applied to alternative energy material. The uniqueness of this study lies in its innovative application of the RADEC model in Physics instruction to foster student creativity and strengthen the creative competency within the Pancasila Student Profile framework.

Keywords: Creative Dimension, Alternative Energy, RADEC, Pancasila Stident Profile

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## 1. INTRODUCTION

The Merdeka Curriculum is designed to build 21st-century competencies, typified by the quick progress of information and communication technologies, which is why this era is generally known as the digital age. This transformation affects various aspects of life, including education, which plays a crucial role in shaping individuals to be democratic, productive, and capable of facing global challenges (Rahmawati et al., 2023). Within this curriculum, teachers are granted the autonomy to choose teaching materials that align with students' needs and learning interests. Furthermore, the Merdeka Curriculum policy initiated Ministry of Culture, Science and Technology Education highlights the importance of strengthening the Pancasila Student Profile as the main approach to to realize the objectives of national practice. This aligns with current and future challenges and demands, such as the Sustainable Development Goals (SDGs) and UNESCO's 21st Century Skills framework (Sutantri et al., 2023).

When creating educational regulations, he Pancasila Student Profile plays an essential role reference, including in guiding teachers to foster students' character and competencies. The goal is for learning to go beyond merely focusing on knowledge, by also comprehensively developing students' attitudes and skills, thereby shaping strong character (Juliani & Bastian, 2023). The implementation of this profile is one of the key approaches to nurturing character education, which encompasses six core dimensions: having faith in as well as a deep commitment to the Divine and the embodiment of virtuous conduct; being independent; working collaboratively; appreciating global pluralism, engaging in critical analysis, and fostering innovation (Kemendikbudristek, 2024).

The Pancasila Student Profile's creative component is crucial for developing students' capacity for original thought and enabling them to significantly impact society. In addition to fostering innovation, this dimension helps shape students into individuals who are solution-oriented and responsive to various challenges. Its implementation can be realized through collaborative projects and problem-based learning, which train students to think critically and creatively in solving real-world issues. Thus, the application of the creative dimension not only enhances academic intelligence but also cultivates character and skills that are relevant to the demands of the times.

The results of observations and interviews show that there is a critical need for instructional practices that promote creativity and inquiry in the classroom. This is in line with the requirements of education in the twenty-first century, which call for students to not only understand theoretical ideas but also use them creatively in practical settings. Rapid and complex developments must be addressed through creative thinking, as it is a highly valuable asset. Learners must be capable of thinking critically, generating new ideas, and finding innovative solutions to current problems (Lilihata et al., 2023). Student creativity is one of the key aspects that must be developed to help them become adaptive, innovative, and solution-oriented individuals in facing various challenges. The results of interviews and observations also support this finding, indicating the need for a more effective and participatory learning model—one that facilitates student-to-student discussions, encourages the exchange of ideas, It improves critical and creative thinking skills, particularly when it comes to problem-solving.

Based on these results, the researcher concludes that using RADEC Model: Answer, Talk, Read, Explain, and Create represents a structured approach that is essential to implementing a creative pedagogical strategy. Because it gives students plenty of chances to read, comment, through discussion, explanation, and creation, this approach is believed to be suitable. —thereby directly engaging them in an active and meaningful learning process (Maulana et al., 2022). The implementation of this model will focus on the topic of Alternative Energy, which

not only requires conceptual understanding but also demands a creative approach in identifying potential and solutions to energy-related issues. This approach is expected to encourage the growth of students' creativity, which is a key trait of the Pancasila student profile—specifically, learners who think critically, act independently, and reason creatively.

## 2. METHOD

The research method used must be written scientifically, namely rational, empirical and systematic. The time and place of the research should be stated clearly and the data and tools and materials used in the research.

### 2.1 Research Design

This study employed a quasi-experiment design, which includes a comparison group but does not fully account for all external factors that could affect how the experiment is carried out. (Sugiyono, 2022). The design applied in this research is the matching-only posttest-only control group design. This strategy involves pairing people in the experimental and control groups according to particular variables or criteria, without random assignment, in order to ensure that both groups are similar in characteristics that may influence the outcome (Frankel et al., 2015). Table 1 shows the research design.

**Table 1.** Table 1 shows the research design

| | | | |
|---|---|---|---|
| **Experimental The Class** | M | X | O |
| **Control Class** | M | C | O |

### 2.2 Instrument and Procedures

The data collection methods adopted In the present research comprise both assessed and non-assessed methodologies. The assessment delivered is an essay-based assessment targeted at evaluating the innovative component of the Pancasila Student Profile in pupils, consisting of 10 items, each representing one indicator of the creative dimension. The instrument, which has been validated by two validators, has an average validity score of 0.83. Validity was determined using Aiken's V formula (Retnawati, 2016), with the validity criteria based on Saifuddin (2020). Furthermore, the instrument validity was tested using the product-moment correlation with raw scores (Sugiyono, 2021) to assess the research instrument's validity. An instrument is considered valid if the calculated value fhitung > ftabel, and invalid if fhitung < ftabel. To assess the consistency of the instrument, its reliability was evaluated using the Cronbach's Alpha formula (Arikunto, 2014).

### 2.3 Data Analysis

Mustofa & Rusdiana (2016) provided the formula that served as the basis for the data analysis method utilized to assess the creative dimension in students' Pancasila student profiles. As shown in Equation (1) below, this formula determines the creativity dimension by taking into account the proportion of students' inventive replies to all of the creativity markers.

$$P_x = \frac{R_x}{nS_x} \times 100\%$$

Following that, the post-test results were examined using standards modified from Devi et al.'s (2019) framework for creative thinking skills, as shown in Table 2.

**Table 2.** Interpretation belonging to the Creativity Dimension assessment Levels in the Pancasila Student Profile

| Score Range | Creativity Dimension Level Categories |
|---|---|
| 80 < K < 100 | Highly innovative |
| 60 < K < 80 | innovative |
| 40 < K < 60 | Moderately innovative |
| 20 < K < 40 | more conventional |
| 0 < 20 | highly Low Creativity |

The prerequisite tests in this study included a normality test conducted using the Chi-Square and perform homogeneity testing conducted with

this method Fisher test. The normality test is undertaken to examine if the sample follows a normal distribution, whereas the homogeneity test is used to compare two or more groups with similar features to determine if the groups are homogeneous (Sugiyono, 2021).

The precondition tests revealed that the variances were homogeneous and the data followed a normal distribution. Consequently, a t-test was applied for hypothesis testing. Equation (2) below illustrates the test's purpose, which is to evaluate the variation between the experimental and control groups' post-treatment mean values.

$$t_{count} = \frac{x_1 - x_2}{SDG\sqrt{\frac{1}{n_1} - \frac{1}{n_2}}}$$

$$SDG = \sqrt{\frac{(n_1 - 1)V_1 + ((n_2 - 1)V_2}{n_1 + n_2}}$$

(Arikunto, 2012)

## 3. RESULT AND DISCUSSION

### 3.1 Results

The post-test results were gathered and are shown in Table 3 based on the study that used the DI instructional approach in the comparison group and the RADEC model within the experimental group.

**Table 3.** Post- Assessment Outcomes for the Pancasila Student Profile's Creativity Dimension

| Statistics | Eksperiment | Control |
|---|---|---|
| Lowest Score | 27 | 23 |
| Highest Score | 40 | 36 |
| Ideal Score | 40 | 40 |
| Average | 35,33 | 28,39 |
| Varians | 9,61 | 14,29 |
| Standard Deviation | 3,10 | 3,78 |

The experimental group's average post-test score (35.33) was greater than the control group's (28.39), indicating a greater improvement in the creativity dimension. The lower variance and standard deviation in the experimental class reflect more consistent and evenly distributed learning outcomes. This suggests that the implemented learning model was effective in enhancing creativity while also equalizing students' understanding. The researcher performed precondition tests, such as homogeneity and normality tests, before evaluating the hypothesis. With the use of Microsoft Excel, the a normality test was performed to ascertain whether the information had a normal distribution using the Chi-Square calculation. Table 4 displays the findings of the normalcy test.

**Table 4**. Data Normality Test Results

| Data | $X_{calculate}$ | $X_{table}$ | Conclusion | Analysis Conclusion |
|---|---|---|---|---|
| Post-Test Scores of DKKP (Experimental Class) | 5,85 | 9,49 | $H_0$ accepted | The sample was drawn from a normally distributed population. |
| Post-Test Scores of DKKP (Control Class) | 7,28 | | $H_0$ accepted | |

All calculated Chi-Square values Xcalculated were smaller than the critical Chi-Square values Xtable. Based on the decision-making criterion, where Xcalculated < Xtable, it can be concluded that all data groups follow a normal distribution. The findings of a further precondition assessment, the

homogeneity test, which is intended to ascertain whether the data originate from groups with identical variances (homogeneous). To perform this analysis, the Fisher test was used as the tool for assessing homogeneity, are displayed as can be seen in Table 5.

**Table 5.** Outcomes of the Homogeneity Test

| Class | N | Varians ($s^2$) | Fcalculate | $\alpha$ | Ftable | Conclusion |
|---|---|---|---|---|---|---|
| Experiment | 36 | 9,61 | 1,49 | 0,05 | 1,78 | $H_0$ accepted |
| Control | 36 | 14,29 | | | | |

The two variances are considered homogeneous if the Fcalculated is smaller than the critical Ftable. Since in this case Fcalculated < Ftable, Testing hypotheses was the next step after confirming that the data were homogeneous and regularly distributed. As indicated in Table 6, the t-test was employed for hypothesis testing.

**Table 6.** t-Test Results

| Data | $\alpha$ | $t_{calculate}$ | $t_{table}$ | Conclusion |
|---|---|---|---|---|
| Poattest scores (Experiment and Control) | 0,05 | 8,4 | 1,67 | $H_0$ rejected $H_a$ accepted |

At which has a significance level of α = 0.05, the outcomes of the theory test using a t-test showed that tcalculated > ttable, precisely 8.4 > 1.67. Consequently, $H_a$ was approved and $H_0$ was denied. This shows that, with a 95% confidence level, the RADEC (Read, Answer, Discuss, Explain, Create) instructional framework has a major effect on the Pancasila student profile's creativity component when it comes to alternative energy content. The data analysis results also indicate a difference in the average scores belonging to the creativity aspect of the Pancasila Student Profile. The average post-test score of the class that received the treatment was notably higher than that of the class that did not receive the treatment. More detailed information is presented according to Figure 1.

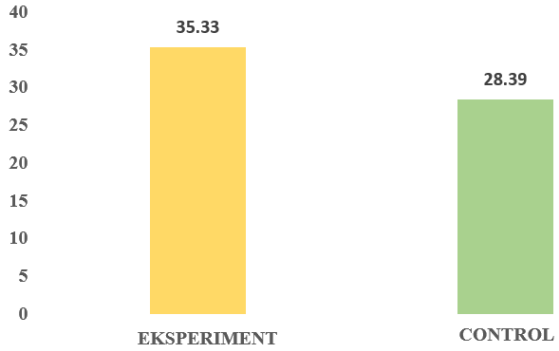


**Figure 1.** Average Posttest Score of the Creative Dimension in the Sample Class

The assessment of students' creativity dimension was based on the average percentage of post-test scores from 10 essay questions designed to measure the indicators of the creativity dimension in The student profile on Pancasila. Following the treatment, Table 7 displays the findings of the computation of students' creativity levels for each indicator in the two experimenting and control groups.

**Table 7.** Analysis of the Percentage Distribution into the Pancasila Student Profile's Creative Aspect Using Post-Test Results

| Indicators Creative Factors in Pancasila Student Profile | Experimental Class | | Control Class | |
|---|---|---|---|---|
| Demonstrates mental flexibility by investigating several strategies to get over obstacles. | 89% | Highly Creative | 68% | Creative |
| Generates original ideas. | 86% | Highly Creative | 67% | Creative |
| produces creative projects and endeavors | 89% | Highly Creative | 84% | Highly Creative |
| **Rata-rata** | **88%** | **Highly Creative** | **73%** | **Creative** |

### 3.2 Discussion

The learning model implemented in class X-12 as While class X-10, the control group, employs the Direct Instruction method, the experimental class follows the Read and Respond, Discuss, Explain, Create (RADEC) paradigm. The RADEC model plays a role in fostering the creative dimension of the profile of students who adhere to Pancasila, particularly in the subject of alternative energy. This is because of the that function involvement students involved in the learning process. This supports the results of. This aligns with the findings of (Sutantri et al., 2023), The findings indicate that the RADEC framework effectively supports the formation and enhancement belonging to the Pancasila Student Profile during learning mechanism. As reflected in the post-test results which is indicated in Table 7, students in the trial group demonstrate an elevated degree of creativity in contrast to those in the control group after being taught with the RADEC approach. Furthermore, each indicator of innovative aspect Profile of Pancasila Learners shows a consistently higher percentage in the experiments class than the control group. The most significant difference is seen in the indicator of flexible thinking in finding alternative solutions to problems, where the experimental class reached 89%, far higher than the control class, which only reached 68%. Although the differences in other indicators are smaller—such as in producing original works and actions (a 5% difference)—the experimental class still demonstrates dominance in every aspect. Overall, the experimental class's average student inventiveness was 88%, which puts it in the extremely creative category, whereas the control class's was just 73%, which puts it in the creative category.

Based on guidelines of the controlled group. Indonesian Ministry of Culture, Education, Technology and Science (Kemendikbudristek, 2024), the creative dimension of the Pancasila student profile examined in this study comprises three indicators: the ability to generate original ideas, the capacity to produce unique efforts and behaviors, along with the ability to think flexibly and explore alternative solutions. The experimental class scored 89% on the thinking flexibility indicator, which is considered extremely creative, compared to 68% for the control class, which is classed as creative, according to the post-test data. The variations in the applied learning models are the cause of this discrepancy. The RADEC model syntax used in the experimental class encouraged students to explore creative solutions from various perspectives. This aligns with the view of Nurhayati & Langlang Handayani (2020), who stated that active involvement in education enhances critical thinking and the exploration of solutions. In the "read" phase, students read learning materials guided by stimulus questions in the student worksheet (LKPD), which helped them build a foundation for creative solutions related to alternative energy. Next, in the "discuss" phase, they worked in groups to select an alternative energy theme, design a sketch of a power generation system, and identify its challenges and possible solutions. This process strengthened students' understanding, improved their critical thinking skills, and trained their

flexibility in thinking when addressing sustainable energy issues.

Furthermore, the experimental class's indicator for coming up with original ideas was 86%, which puts it in the extremely creative group, whereas the control class's was only 67%, which puts it in the creative category, a difference influenced by the variation in instructional approaches despite similar learning activities. Students in the experimental class independently explored reading materials, enabling them to express more diverse and creative ideas during discussions. This aligns with the results of (Susanti et al., 2023), who argued that the RADEC This model offers students with opportunities to enhance their potential and broaden their perspectives through various sources of information. This indicator was developed through the Answer, Discuss, and Explain phases, where students responded to questions based on reading materials, collaborated to synthesize ideas, and explained the concepts they had designed, such as power generation systems based on alternative energy themes. Discussions helped students expand their perspectives, while teacher feedback during the Explain phase refined their ideas. Through this approach, students not only gained a deeper understanding of the material but also developed creative and innovative thinking skills in generating solutions to energy-related problems.

While the comparison group received a score of 84%, the trial group's indicator for producing original works and behaviors reached 89%, with both falling under the highly creative category. The similarity in activities—designing a power generation system and creating an alternative energy workflow chart—contributed to the achievement of this indicator. This aligns with Nindhia (2017), who stated that similar activities tend to produce nearly similar outcomes. However, the distinction lies in the degree of creative freedom granted to the students. In the experimental class, students independently designed their systems using various alternative energy themes, whereas in the control class, both the design and the tools were predetermined by the teacher. This indicator was developed through the Create and Explain phases, where students explored innovative ideas and outlined the workflow of the power generation system in their student worksheets (LKPD). In the experimental class, students were given full freedom to determine the system design, allowing for broader creative exploration. In contrast, pupils in the control group were not allowed to select their own designs and instead followed preset rules.

The final projects produced by the experimental class's students showed greater variety in the workflow diagrams and power generation system designs, a unique model with a different approach, whereas in the control class, limited exploration and uniform themes led to more standardized projects that followed the teacher's guidelines. This demonstrates that creative freedom in project design has a major impact on enhancing the originality of students' work. During the second session, students finalized their designs and workflow charts on poster board, adding more detailed drawings, incorporating colors, and organizing the workflow neatly to make the flow of energy easier to understand.

The completed power generation system designs are shown in the sample documentation below, emphasizing the differences among the trial and comparison groups:

**Figure 2.** Results of the Power Generation System Design in the Experimental Class

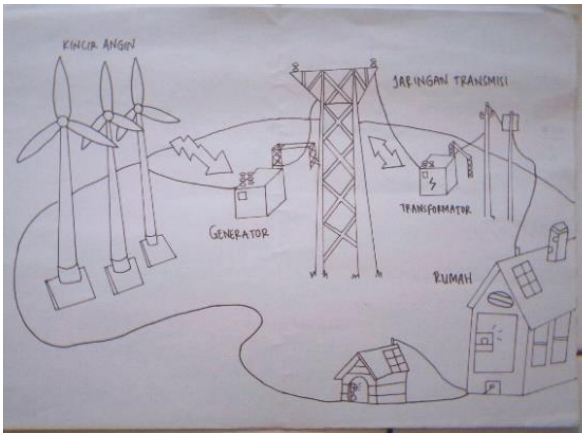


**Figure 3.** Results of the Control Class's Power Generation System Design.

In the context of alternative energy subjects, the RADEC instructional approach (Read, Answer, Discuss, Explain, Create) can be used to integrate the creative feature belonging to Pancasila Learner Profile. This is corroborated this is based on post-test outcomes, which show that the experimental class utilizing RADEC had a better average achievement of the creative component in the Pancasila student profile, classifying it as highly creative, compared to the control class using Direct Instruction (DI), which was categorized as creative. This difference highlights the advantage of the RADEC model, which promotes active student engagement in reading, answering questions, discussing, explaining concepts, and creating products—allowing them greater freedom to explore creative ideas. Students in the control group, on the other hand, seemed more submissive, which may hinder the development of creativity and alternative solutions. This finding is consistent with (Arnika, 2014), who stated that the Direct Instruction model emphasizes teacher-led instruction, thereby limiting learners' proactive participation in learning.

The indication of producing creative works and actions was successfully supported by both the Direct Instruction (DI) The model has been applied to the control group and the RADEC education model applied in the tested group. However, in the experimental group, the attainment of this indicator did not stand alone; it was also supported by the two preceding indicators—namely, flexibility in thinking to find alternative solutions and generating original ideas. This occurred because, within the Create phase of the RADEC model, students were not only tasked with producing a final product but were also encouraged to develop innovative ideas based on the solutions they had previously explored. As a result, the RADEC model's Create phase gave students the chance to apply their creativity and adaptability to the design of their power generation systems, resulting in more varied outcomes that reflected deeper levels of thought.

Students had the opportunity to study concepts at each stage of the RADEC model, discuss solutions, and express them in the form of tangible products. In the context of this learning activity, designing a power generation system along with an alternative energy workflow chart served as a

concrete form of the expected application of creativity. This process not only trained students in developing new ideas but also provided them with experience in organizing concepts and visually and systematically representing their thoughts. Therefore, the attainment of innovation dimension within Pancasila student profile using the RADEC model in this study can be considered sufficient at the stage of designing the power generation system, without requiring actual physical implementation. This is in line with the findings. of (Rezania et al., 2023), who showed that poster-making projects centered around the theme of Bhinneka Tunggal Ika can foster students' creative side without necessitating practical application.

During the implementation of the study, challenges were encountered due to differences in the class schedules between the control and experimental groups, which potentially affected students' learning conditions. The control class was scheduled during the first lesson every Monday, which often coincided with flag ceremonies. As a result, instructional time was reduced, and some students experienced fatigue, which negatively impacted their concentration and participation. To address this issue, lessons began immediately after the ceremony, and the delivery of material was adjusted to be more concise and focused on core concepts.

Meanwhile, the experimental class took place during the last lesson of the day, when students typically experienced higher levels of fatigue after attending several prior lessons. This condition occasionally affected the classroom atmosphere and decreased student engagement in learning activities. Nevertheless, this challenge was mitigated through effective communication between the researcher and the students, as well as the students' high enthusiasm for learning physics, which allowed the learning process to continue effectively.

## 4. CONCLUSION

Fundamental Finding: The RADEC model has a considerable effect on the creative dimension pertaining to Pancasila student profile in the midst of of alternative energy topics, according to the research findings, data analysis, and hypothesis testing. Implication: The application of the RADEC model has a beneficial influence on student growth creative dimension as a component within the Pancasila Student Profile. Limitation: Considering which the indicator for generating original ideas scored lower than the indicator for producing original works and actions, future research could focus on strengthening the early stages that support idea development. This could be achieved through creativity-stimulating learning strategies, more structured brainstorming sessions, or the use of concept mapping techniques.

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