The Effect of SETS Based Problem Based Learning on Student's Creative Thinking Ability

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Abstract: This study aims to determine the effect of the size of the influence of the SETS-based Problem Based Learning (PBL) model on students' creative thinking ability. This research is Quantitative research with meta-analysis method. Data sources come from national and international journals. The inclusion criteria in the research are research obtained through the google Scholar, IEEE, ERIC, ScienceDirect and ProQuest databases, research published in 2019-2023, research indexed by SINTA, Web of Science (WOS), and Scopus, Research related to Sports and Health Physical Education subjects, Research must have experimental classes with SETS-based Problem Based Learning models and conventional control model classes, and the study must have a sample size(N), Mean, and Standard deviation (SD). Data analysis in this study with the JSAP application. The results of the analysis of 18 studies concluded that there was a positive influence of the SETS-based Problem Based Learning model on students' creative thinking ability (rE = 0.848; Z = 5.109; p < 0.001). This finding explains that the SETS-based Problem Based Learning model has a high influence on students' creative thinking skills in learning Physical Education, Sports and Health.

Keywords: Creative thinking; Effect size; Problem based learning; SETS

Introduction

Creative thinking is an ability that students must have in facing the 21st century (Mursid et al., 2022; Ammaralikit & Chattiwat, 2020; Goddess, 2019; Artayasa, 2020). According to Khuana et al. (2017) that creative thinking is an ability to generate new ideas or ideas in solving a problem. The ability to think creatively involves four aspects of thinking in students, namely fluency, flexibility, originality and elaboration (Wulandari & Wardani, 2019; Lee et al., 2021; Nufus et al., 2018). The ability to think creatively helps students learn actively and innovatively in the learning process (Hayati et al., 2022; Atthachakara, 2021).

But in fact, students' creative thinking ability in learning Physical Education Sports and Health is still relatively low (Martiani, 2021). The low ability to think creatively of students is caused by the learning process that is centered on the teacher and the teacher does not lead to the learning process of students to think creatively (Wahyudi et al., 2018; Saregar et al., 2021; Nurtamam et al., 2023). In addition, students have not been able to provide solutions in solving a problem (Zulkifli et al., 2022; Razak et al., 2021; Elfira et al., 2023). According to Yustina et al. (2022) the learning model applied by teachers has not been able to stimulate students to think creatively. Therefore, there is a need for an effective learning model to encourage students to think creatively.
**Problem-based learning** is a learning model that effectively improves students' creative thinking skills in learning (Dwi et al., 2022; Maskur et al., 2013; Mursid et al., 2022; Amin et al., 2020). Problem-based learning is a learning model that provides a problem to students and students can provide solutions to the problem (Setyawanto & Koeswanti, 2021; Jumadi et al., 2021; Mustofa & Hidayah, 2020). The problem-based learning model can stimulate students to think higher order in learning (Nurkhairil et al., 2022; Munawaroh, 2020).

Problem-based learning models can be based on SETS. SETS is a learning that combines Science Environment Technology and Society in learning activities (Hairida, 2017; Sutipnyo & Mosik, 2018). SETS learning can encourage students to be more active and creative in learning (Widiantini et al., 2017; Savitri, 2020). In addition, the application of SETS can help students learn to implement the subject matter directly with the environment.

Research from Permatasari et al. (2019) and Duman (2023), the problem-based learning model can encourage critical thinking and problem-solving skills in students. Research from Kardoyo et al. (2020), Ulger (2018), Saptendro et al. (2019), Birgili (2015), Anazifa (2017) the application of problem-based learning models can help foster students’ motivation and creative thinking ability in learning. Therefore, the gap in this study is that problem-based learning models are generally used to learn science. In addition, there has not been found the effect of the size of the SETS-based problem-based learning model on students' creative thinking ability in physical education, sports and health learning. Based on these problems, this study aims to determine the effect of the size of the SETS-based Problem Based Learning (PBL) model on students' creative thinking skills.

**Method**

This research is a type of meta-analysis research. Meta-analysis research is a type of research that collects and analyzes experimental research results that can be quantitatively calculated (Uluçına, 2022; Diah et al., 2022; Kaçar et al., 2021; Tamur et al., 2021; Oktarina et al., 2021). This meta-analysis aims to determine the SETS-based Problem Based Learning (PBL) model for students' creative thinking skills.

**Inclusion Criteria**

Researchers searched data from journals or proceedings related to problem-based learning models based on Science, Environment, Technology and Society (SETS) on students’ creative thinking skills. The data used as research sources have met predetermined inclusion criteria. The inclusion criteria are research obtained through the Google Scholar, IEEE, ERIC, ScienceDirect and ProQuest databases, research published in 2019-2023, research indexed by SINTA, Web of Science (WOS), and Scopus, Research related to Sports and Health Physical Education subjects, Research must have an experimental class with a SETS-based Problem Based Learning model and a conventional control model class, and research must have a sample size (N), Mean, and Standard deviation (SD).

**Data Collection**

The data collection process is through the journal databases google scholar, ERIC, IEEE, ScienceDirect and ProQuest. The data obtained according to the inclusion criteria were 27 articles. Furthermore, 5 studies were excluded because they had incomplete data and 4 studies that had value that could interfere with publication bias. Therefore, a total of 18 articles were analyzed. The results of selecting data sources are shown in figure 1. Keywords in searching data sources are problem-based learning models, SETS, creative thinking skills, SETS-based problem based learning and creative thinking skills.

**Data Analysis**

Meta-analysis research data analysis calculates the effect size value of a study (Aybirdi, 2023). Effect size can meta-analysis is an index that describes the effect of the SETS-based Problem Based Learning (PBL) model on students' creative thinking skills. Data analysis in the meta-analysis consists of calculating the effect size value of each study; conduct heterogeneity tests and determine estimation models; checking the bias of research publications; and calculate the p-value to test the hypothesis. Data analysis in this study with the help of JASP application. The criteria for effect values are guided by (Cohen et al., 2007), namely $d < 0.20$ insignificant effect criteria; $0.20 \leq d \leq 0.50$ low effect criteria; $0.50 \leq d \leq 0.80$ moderate effect criteria and $d \geq 0.80$ high criteria.

Furthermore, publication bias is one of the most important things in meta-analysis research (Cevik & Bakioglu, 2022; Aspiranti & Larwin, 2021; Joseph, 2023). Publication bias checking using funnel plots, Rosenthal Fail Safe N (FSN) Test and Egger’s Test. The comparison criterion in the Rosenthal Fail Safe N (FSN) test is $5K + 10$ (where $k =$ number of studies analyzed).
Furthermore, if the FSN value > 5k + 10 then there is no publication bias.

**Result and Discussion**

Results from research searches related to the SETS-based problem-based learning model on students' creative thinking skills, 18 articles were obtained that had met predetermined inclusion criteria. The data obtained are analyzed based on the characteristics of the article code, year of publication, country, sample size (N) and effect size which can be shown in Table 1.

<table>
<thead>
<tr>
<th>Journal Code</th>
<th>Year of Publication</th>
<th>Country</th>
<th>N</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>2020</td>
<td>Indonesian</td>
<td>40</td>
<td>-0.72</td>
</tr>
<tr>
<td>V2</td>
<td>2020</td>
<td>Indonesian</td>
<td>26</td>
<td>0.09</td>
</tr>
<tr>
<td>V3</td>
<td>2021</td>
<td>Indonesian</td>
<td>60</td>
<td>1.13</td>
</tr>
<tr>
<td>V4</td>
<td>2022</td>
<td>India</td>
<td>80</td>
<td>2.07</td>
</tr>
<tr>
<td>V5</td>
<td>2020</td>
<td>India</td>
<td>50</td>
<td>0.81</td>
</tr>
<tr>
<td>V6</td>
<td>2023</td>
<td>China</td>
<td>48</td>
<td>0.52</td>
</tr>
<tr>
<td>V7</td>
<td>2023</td>
<td>Turkish</td>
<td>110</td>
<td>0.94</td>
</tr>
<tr>
<td>V8</td>
<td>2021</td>
<td>English</td>
<td>98</td>
<td>1.15</td>
</tr>
<tr>
<td>V9</td>
<td>2019</td>
<td>India</td>
<td>40</td>
<td>0.83</td>
</tr>
<tr>
<td>V10</td>
<td>2020</td>
<td>Thailand</td>
<td>64</td>
<td>0.77</td>
</tr>
<tr>
<td>V11</td>
<td>2023</td>
<td>Thailand</td>
<td>85</td>
<td>0.86</td>
</tr>
<tr>
<td>V12</td>
<td>2023</td>
<td>Indonesian</td>
<td>112</td>
<td>1.57</td>
</tr>
<tr>
<td>V13</td>
<td>2023</td>
<td>Indonesia</td>
<td>90</td>
<td>2.33</td>
</tr>
<tr>
<td>V14</td>
<td>2023</td>
<td>Egypt</td>
<td>228</td>
<td>1.90</td>
</tr>
<tr>
<td>V15</td>
<td>2022</td>
<td>Malaysia</td>
<td>118</td>
<td>0.93</td>
</tr>
<tr>
<td>V16</td>
<td>2022</td>
<td>Indonesia</td>
<td>42</td>
<td>0.66</td>
</tr>
<tr>
<td>V17</td>
<td>2021</td>
<td>Malaysia</td>
<td>36</td>
<td>0.81</td>
</tr>
<tr>
<td>V18</td>
<td>2019</td>
<td>Indonesia</td>
<td>40</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Based on Table 1, showing 18 articles analyzed based on the characteristics of articles published in 2019-2023, seven studies were obtained from Indonesia, two studies came from Malaysia, two studies from Thailand, three studies came from India, one study came from Turkey, Egypt, and England. Furthermore, the overall value of the effect size ranges from 0.66 – 2.35. According to the effect size criteria (Cohen et al., 2007) of the 18 studies analyzed, 1 study had an effect size value (5.55%) insignificant effect size criteria, four studies had an effect size (11.12%) moderate criteria and thirteen studies had an effect size value (72.23%) high criteria.

Next, carried out heterogeneity tests from 18 studies analyzed. The results of the heterogeneity test can be seen in Table 2 and Table 3.

**Table 2. Heterogeneity Test Results**

<table>
<thead>
<tr>
<th></th>
<th>Q</th>
<th>Df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omnibus test of Model Coefficients</td>
<td>97.880</td>
<td>1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Test of Residual Heterogeneity</td>
<td>610.769</td>
<td>9</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Note. p value are approximate

Based on Tables 2 and 3 show heterogeneity test results from 18 heterogeneously distributed studies. This can be seen from the p value < 0.001; Q = 97.880; τ² or τ > 0 and I²(%) = 87.250 is close to 100%. The next step is to check publication bias. Publication bias checking is essential to avoid bias in meta-analysis research (Chamdani et al., 2022; Tamur & Wijaya, 2021; Chen et al., 2022; Diah et al., 2022). In this meta-analysis research, publication bias can be identified using funnel plots. The overall funnel plot effect size of the study can be seen in Figure 2.

**Figure 2.** Funnel plot standard error

Figure 2 showing publication bias analysis with funnel plots, the overall effect size is not in a vertical curve, making it difficult to know whether the curve is symmetrical or not. Furthermore, Egger’s test was carried out to determine the shape of the curve from 18 studies analyzed. Egger’s test results are shown in Table 4.

**Table 4. Egger’s Test Results**

<table>
<thead>
<tr>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.843</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Based on Table 5 value (p-value > 0.05; z = 4.843) then the distribution of the funnel plot is symmetrical. The funnel plot showed no publication bias in this study. Furthermore, to increase the validity of publication bias,
it is necessary to conduct a Fasil Safe N (FSN) test. The results of the safe N file test can be seen in Table 5.

### Table 5. Safe N File Test Results

<table>
<thead>
<tr>
<th>Safe N File Test Results</th>
<th>z value</th>
<th>p-value</th>
<th>Alpha</th>
<th>Z for alpha</th>
<th>N</th>
<th>p &gt; number of missing studies</th>
</tr>
</thead>
</table>

Based on Table 5, the safe N (FSN) file value is 546. Next, the value of the safe N file is compared to the value of \( k = (5.18 + 10) = 90 \). Therefore, Rosenthal Fail Safe N > k values mean that in meta-analysis studies there is no publication bias, so there is no need for research to be added or eliminated. Next, calculate the summary effect value or mean effect size of the 18 studies to be analyzed. The results of the summary effect size test are shown in Table 6.

### Table 6. Summary Effect Size or Mean Effect Size Test Results

<table>
<thead>
<tr>
<th>Estimates</th>
<th>SE</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.848</td>
<td>0.210</td>
<td>5.109</td>
</tr>
</tbody>
</table>

Based on Table 4. Indicates that the p value < 0.001. These results conclude that the SETS-based problem-based learning model has a significant influence on students’ creative thinking skills. Furthermore, these results are categorized as high-effect based on the estimates standard error value, namely (0.848; Z = 8.109). The application of the SETS-based problem-based learning model is effective in improving students’ creative thinking skills in learning Physical Education, Sports and Health (PJOK) at school.

This research is in line with Kardoyo et al. (2019) the problem-based learning model has a positive effect on students’ creative thinking ability in learning. This finding is supported by Khairunnisa et al. (2022), Wenno et al. (2021), and Masek et al. (2011), said the problem-based learning model can develop students’ critical and creative thinking skills in the learning process. Learning with a student-based problem-based learning model can train students to be more active and creative in learning (Kurniahtunnisa et al., 2016; Aini et al., 2022; Nurkhasanah et al., 2019). The problem-based learning model based on Science Environment Technology and Society (SETS) makes it easier for students to implement learning materials with the surrounding environment (Hasanah et al., 2019; Rahman et al., 2023; Ummah & Yuliati, 2020; Suharyat et al., 2022).

Furthermore, the SETS-based problem-based learning model can foster student motivation and interest in learning (Munawarah, 2020; Mustofa & Hidayah, 2020; Suryawan et al., 2023) thus encouraging the ability to think creatively in learning Physical Education, Sports and Health (PJOK). The problem-based learning model allows students to think at a higher level in solving a problem in life (Hatipoğlu, 2023). Furthermore, Hairida (2017) students’ SETS-based learning is able to encourage students’ comprehension abilities in learning. Therefore, the SETS-based problem-based learning model contributes to teachers in improving students’ creative thinking skills at school.

### Conclusion

From this study, it can be concluded that there is a positive influence of the SETS-based Problem Based Learning model on students’ creative thinking ability (\( r_E = 0.848; Z = 5.109 ; p < 0.001 \)). This finding explains that the SETS-based Problem Based Learning model has a high influence on students’ creative thinking skills in learning Physical Education, Sports and Health. The SETS-based problem-based learning model of students can foster interest and higher-order thinking in solving a problem in life.

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### Author Contributions

In this research, all researchers consisting of Ahmad Adil, Syahirianti Syam, Muhammad Safar, Christianso Syam, Tri Satriawansyah and Rusmawan have contributed both directly and indirectly in carrying out the process of data collection, selection, interpretation and data analysis.

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### Conflicts of Interest

The authors declare no conflict of interest.

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