

## Does The SETS Model Improve Problem Solving Thinking Ability? Meta-Analysis

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**Abstract** This study aims to determine the effect of the SETS learning model to improve students' problem-solving abilities. This type of research is a meta-analysis. This study analyzed 9 national and international journals published from 2020-2023. Data search through google scholar; IEEE; Frontier Journal; ERIC and Taylor of Francis. Selection of data sources through PRISMA method consisting of Identification, Screening, Eligibility and Included. Data analysis with the help of JSAP software. The results of the analysis of 9 effect sizes concluded that the SETS learning mode had a positive effect on students' problem-solving abilities with ( $z = 6.187$ ;  $p < 0.001$ ). This finding explains that the SETS learning model has a significant effect on problem-solving ability with high categories ( $rE = 0.876$ ). The SETS learning model is effective for teachers to develop in encouraging students' solving skills in learning.

**Keywords:** Model SETS; Education; Effect Size; Troubleshooting; Meta-analysis

### INTRODUCTION

Problem-solving ability is an ability that students must have in facing the 21st century (Sari et al., 2021; Khoiriyah & Husamah, 2018). Solving skills help students provide a solution in solving a problem (Hestiana & Rosana, 2020; Lin et al., 2021; Chamidy et al., 2020; Park & Choi, 2015). Problem-solving skills play an important role in encouraging student learning outcomes and interests (Syafii & Yasin, 2013; Yusri et al., 2018). According to Karantzas et al., (2013) students who have problem-solving abilities can think creatively to solve problems in life. Therefore, problem-solving skills are very important in supporting the learning process of students.

But in reality, the problem-solving ability in student learning in Indonesia is still relatively low (Simanjuntak, 2021; Elita et al., 2019; Hidaayatullaah et al., 2020). This can be seen in the learning process of students who are less actively involved (Hindriyanto et al., 2019), so that the learning process is too teacher-centered (Elfira et al., 2023; Nurtamam et al., 2023; Sofianora et al., 2023; Rahman et al., 2023; Rahman et al., 2023). In addition, in learning activities students have not been directed to use knowledge in analyzing a problem (Nurfitriyanti, 2016; Hendriana et al., 2018; Yuberti et al., 2019).

The low problem-solving ability can also be seen from the 2018 PISA research conducted by the OECD students' ability in science literacy only obtained a score of 396

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ranking 71 out of 78 countries (Supriyadi et al., 2023; Zulkifli Zulkifli et al., 2022; Zulyusri et al., 2023; Putra et al., 2023; Oktarina et al., 2021; Ichsan et al., 2022). In addition, in the learning process the teacher applies models that do not encourage students to stimulate students' problem-solving abilities in learning .

The SETS learning model is a learning model that is able to encourage problem-solving skills (Khoirunnisaa' et al., 2022). The SETS learning model is a learning model that combines science, environment, technology, and society that can support learning (Yuniastuti, 2015; Zahra et al., 2019). The *Science EnvironmentTechnology anad Society* (SETS) model can train students to solve a problem in their environment (Dewi et al., 2020). The SETS learning model can grow students' science literacy (Trihastuti et al., 2017).

Research (Aprianingtyas et al., 2016; Van Gobel et al., 2019) The SETS model has a positive influence on improving students' achievement and ability in learning. Research Indrawati et al., (2019) the SETS model can improve students' analytical thinking skills in solving a problem. However, many studies on the SETSA model in learning have not found meta-analysis of the SETS learning model to improve problem-solving skills. Based on this, this study aims to determine the effectiveness of the SETS learning model to improve students' problem-solving abilities.

## RESEARCH METHODS

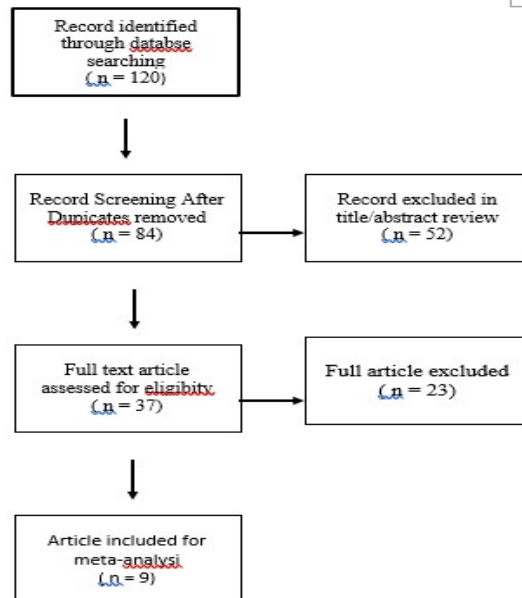
Larson This research is a type of meta-analysis research. Meta-analysis is a type of research that collects and analyzes primary data that can be analyzed quantitatively (Balemen, 2018); Dochy et al., 2003; Suharyat et al., 2022; Santosa et al., 2021; Razak et al., 2021). Meta-analysis research serves to determine the effectiveness of the SETS model on students' problem-solving abilities. According to Borenstein et al., (2009) the meta-analysis research procedure consists of determining inclusion criteria; collecting data; screening and coding data and data analysis.

The inclusion criteria in this study are data from reputable international journals or proceedings; publications published from 2020-2023; research must be experimental methods or Quasi-experiments; research on the SETS model on students' problem-solving abilities; And the study reported complete data to calculate the effect size. Data search through google scholar; IEEE; Frontier Journal; ERIC and Taylor of Francis. Selection of data sources through the PRISMA method consisting of Identification, Screening, Eligibility and Included can be seen (figure 1). Data analysis in the meta-analysis was carried out calculating the value of effect size (Badawi et a., 2023; Xu et al., 2022). According to Borenstein et al., (2009) statistical

analysis in meta-analysis research consists of: 1) calculating the effect of the primary study; 2) test heterogeneity and determine the estimation model; 3) check publication bias and 4) calculate p-value to test hypotheses. For data analysis in this study with JSAP. The inclusion criteria are guided by the effect size criteria (Cohen et al., 2007), can be seen Table 1.

**Table 1.** Cohen's Effect Size Criteria

Effect Size	Category
$0.00 \leq 0.20$	Low
$0.20 \leq 0.80$	Medium
$d \geq 0.80$	High



**Figure 1.** Meta-analysis Data Selection Method with PRISMA

## RESULT AND DISCUSSION

From the process of tracing data through a database, 120 studies related to the SETS learning model and problem-solving capabilities were obtained. Only 9 studies met the inclusion criteria. Research that has met the inclusion criteria is analyzed effect size which can be seen in Table 2.

**Table 1.** Effect Size Research Data

Publication Code	Year	Country	Effect Size
PE1	2022	Indonesian	1.19
PE2	2022	Indonesian	0.66
PE3	2021	Indonesian	0.90

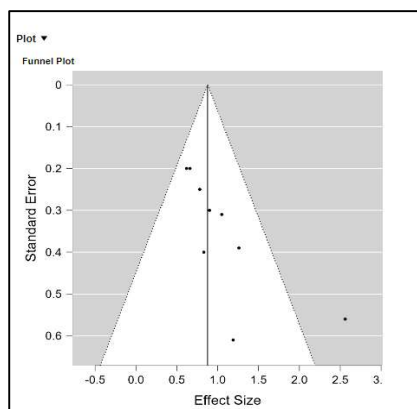
PE4	2021	United States	2.56
PE5	2020	Indonesian	1.26
PE6	2023	Indonesian	0.83
PE7	2022	Thailand	0.78
PE8	2022	Indonesian	1.05
PE9	2023	Indonesian	0.62

Based on Table 2, the results of data analysis explain the overall effect size ranging from 0.62 – 2.56. According to the effect size value criterion Cohen et al., (2007) from 9 effect sizes analyzed obtained two medium effect size criteria (22.2%) and seven high effect size criteria (77.8%). The next step tests heterogeneity and determines the estimation model from the 9 effect sizes analyzed. The results of heterogeneity tests with fixed and random effect models can be seen in Table 3.

**Table 3.** Fixed and Random Effect

	Q	Df	P
Omnibus test of Coefficients Model	47.14	1	< 0.001
Test of Residual heterogeneity	186.70	8	< 0.001

Table 3, the analysis results show the value of  $Q = 186.70$  ;  $p < 0.001$  then the effect size of the analyzed study is heterogeneously distributed. The model used a *random effect model* to analyze these 9 studies. Furthermore, checking publication bias from 9 studies analyzed. Checking publication bias to reduce bias from each analyzed study (Sun et al., 2021; Utomo et al., 2023; Bengesai et al., 2023). Publication bias may occur due to studies for which insignificant analyses are reported (Li & Wang, 2022; Najafi & Heidari, 2018). Publication bias checking for 9 studies was conducted with funnel plots and Egger tests; s (Balakrishnan et al., 2021; Diah et al., 2022; Chamdani et al., 2022). The results of checking publication bias with funnel plots can be seen in figure 2.



**Figure 2.** Funnel Plot Random Effect

Figure 2, showing the results of funnel plot analysis, it is difficult to know whether the funnel plot is symmetrical or asymmetric, so it is necessary to do the Egger's Test. Egger's test results can be shown in Table 4.

**Table 4.** Egger's Test Results

	Z	p
Sei	2.975	< 0.003

Based on Table 4, Egger's test results show the value of  $Z = 2.975$ ;  $P < 0.003$ . This finding shows that the funnel plot is symmetrical, so in research research it is resistant to publication bias. The next step is to calculate the summary effect size or mean effect size of the 9 studies analyzed. The summary effect size test results can be seen in Table 5.

**Table 5.** Summary Effect Size

	Estimates	ONE	z	p	Lower bound	Upper bound
Intercept	0.876	0.318	6.187	< 0.001	0.419	0.980

Table 5, the results of the summary effect size with the random effect model obtained a value of 95% confidence interval lower of 4.19 and upper of 0.980 and all values of effect size analyzed of 0.876. Next, the value of  $Z = 6.187$ ;  $p < 0.001$ . then this SETS learning model has a positive effect on students' problem-solving abilities.

This research is in line with Tessarani et al., (2016) the SETS learning model has a positive influence on students' problem-solving abilities. The SETS learning model helps students more easily implement material with their environment to solve a problem. Research Lestari & Mulyani, (2022) the *Science Engineering Technology and Society* (SEST) model trains innovative and creative work teachers in learning. The SETS mode helps students develop their knowledge in learning so that students can think critically (Rasyidi, 2020). The SETS model students get combines *Science Eenvironment Technology* and *Society* that supports the learning process (Riwu et al., 2018).

This SETS learning model helps students learn directly with the environment. The SETS model of students implements the material learned with the environment so that they can develop problem-solving skills. Not only that, the SETS model is effective in shaping students in improving critical thinking skills (Destini et al., 2021), so that students can learn independently in finding concepts and theories (Permatasari et al., 2019) and improving student learning outcomes (Sedyawat, 2013; Made et al., 2018). Therefore, the application of the SETS model is very effective for teachers to encourage students' problem-solving abilities in schools.

## CONCLUSION

In this study it can be concluded that the SETS learning mode has a positive effect on students' problem-solving ability with ( $z = 6.187$ ;  $p < 0.001$ ). This finding explains that the SETS learning model has a significant effect on problem-solving ability with high categories ( $r_E = 0.876$ ). The SETS learning model is effective for teachers to develop in encouraging students' solving skills in learning. The SETS model of students in self-learning in applying the subject matter directly with the environment by utilizing science and technology.

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