Comparison TTW Model with POE in Creative and Critical Thinking Skills in Physics lesson: Meta-Analysis Study

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Abstract

The research conducted by the researcher is a Meta-Analysis study from the results of research that has been carried out by previous researchers to compare the TTW model with the POE model on creative thinking skills and critical thinking in Physics lessons. Researchers studied several journals related to the problems faced, namely as many as 30 National articles indexed by Google Scholar. articles that are the research objectives with the theme of creative thinking models and critical thinking models TTW or POE. Based on this, there are 3 variables, namely (1) the TTW model, (2) the POE model, and (3) the ability to think creatively and critically. From the data analysis using the ANCOVA technique that has been carried out, both models provide an effect size with a large criterion of 0.652. While the influence of the two models can be said to be almost the same, namely the TTW model of 76.58 and the POE model of 74.00 so it can be concluded that the TTW and POE models have a major effect on creative and critical thinking skills. thinking in Physics lessons.

Keywords: TTW, POE, creative thinking, and critical thinking Skills

INTRODUCTION

The progress of a nation is determined by the quality of the education provided by that country. Advances in quality education will certainly produce superior Human Resources (HR) who are ready to accept the challenges of globalization. Educational activities are mandatory activities that must be passed by all children, this is stated in the 2003 National Education System Law which states that education is an activity that is carried out consciously, carefully planned for the development of children. Learning planning that is directed and carefully structured will certainly improve the quality of the education that is being carried out.

Directed learning in this case is learning that has been set by the teacher by applying various methods and approaches used to make it easier for teachers to explain the material and make it easier for students to understand the material. However, with the development of this modern era, some special skills must also be possessed by students. Some of these skills are critical thinking, creativity, collaboration, and communication, or what is often called the 21st-century 4C skills.

Creative thinking and critical thinking skills are skills with an emphasis on critical thinking aspects where these skills are used as skills that train students to be able to have a critical view of problems and be able to solve problems which will later be used to decide a decision that must be taken, collaboration and communication with the habit of collaborating. and accustomed to communicating, it will produce creativity. Creativity does not appear if you are not used to collaborating with others (Erdoğan, 2019); (Hidayatullah et al., 2021); (Kurniawan, 2021)

Based on the problems described above related to creative thinking and critical thinking skills in improving the quality of education, it is necessary to apply the right learning model so that students become more active so that it creates an impressive learning experience and can improve the quality of learning as evidenced by increased student understanding. Artayasa, I et al., (2021) applying the TTW (Think Talk Write) model, can arouse students to be more active in learning so that the expected creative thinking and critical thinking skills can emerge and be honed. Rustiana et al., (2021) explain using the TTW model with a learning syntax starting from planning, thinking, considering, testing, and finally pouring ideas that can be used to solve problems faced by students so that students are accustomed to practicing critical thinking skills. In line with this Wahyuni & Efuansyah., (2018); Supandi et al., (2018); Listiana et al., (2020) by applying the TTW learning model students can construct conceptual understanding to train critical thinking by carrying out a reasoning approach which later on understanding the results of the reasoning will be poured into the form of ideas which will then be communicated to others and collaborated on the results of these ideas.

Another learning model that can generate or train other critical thinking skills that are often used as research material is POE (Predict Observe Explain). Sarah et al., (2021); Maulida et al., (2018) explained that using the POE model with an initial syntax starting from predicting the problems encountered and determining solutions to these problems, then making

observations related to the problems encountered and finally clarifying the findings from observations able to train students in critical thinking. The same thing was also stated explained that using the POE model with an initial syntax starting from predicting the problems encountered and determining solutions to these problems, then making observations related to the problems encountered and finally clarifying the findings from observations able to train students in critical thinking. The same thing was also stated by Zulaikha et al., (2021) that by applying POE students are allowed to explore themselves in finding a truth that will build skills that are expected in the 21st century.

By looking at the phenomena described above, the TTW and POE models both have a positive effect on creative thinking and critical thinking skills capabilities. but based on this review, it has not explained which model is better. Therefore, from these problems, researchers are interested in examining the two models through a meta-analysis study of the TTW and POE models in creative thinking and critical thinking skills in physics lessons

METHOD

The method used by researchers in this study is Meta-analysis, where researchers examine several journals related to the problems faced, namely as many as 30 National Journals indexed by Google Scholar. The journal that is the goal is a journal that discusses the TTW or POE model on creative thinking and critical thinking skills. Based on this, there are 3 variables, namely (1) TTW model, (2) POE model, and (3) creative thinking and critical thinking skills. The collected articles were coded based on the model used, for the TTW model a T code was assigned, while for the POE model it was assigned a P-code. The data used to perform the analysis were pretest and posttest data for each article. Where these data are used to measure the prerequisite test consisting of normality, homogeneity, and linearity tests. After the prerequisite test is carried out, it is continued by doing the ANOVA test and calculating the effect size. The effect size calculation is carried out to see the magnitude of the influence on the TTW and POE models in creative thinking and critical thinking skills. the results of the effect size calculation are consulted with table 1 effect size to determine the size of the effect. The following Table 1 effect size is as follows.

Tabel 1. *Effect Size*

Effect Size	Description
$0 < d \leq 0.2$	Small
$0,2 < d \leq 0.5$	Currently
$0,5 < d \leq 0.8$	Large
$d > 0.8$	Very Large

RESULTS AND DISCUSSION

RESULTS

The initial step taken by researchers in conducting this research was to collect several national journals with the theme of the TTW model or POE model in creative thinking and critical thinking skill. The results of the journal collection are the results of a search using Google Scholar with a range of 2015-2022 (last 7 years). The search results found 25 journals with a total of 13 journals themed TTW in creative thinking and critical thinking skills and 12

journals with POE themes in creative thinking and critical thinking skills. The following is the result data from the summary of the journal's search.

Table 2. TTW Model Pretest and Posttest scores

in creative thinking and critical thinking

No	Journal Code	Percentage (%)		
		Pretest	Posttest	Enhancement
1	T1	31.85	72.65	40.8
2	T2	61.62	75	13.38
3	T3	40.08	78.89	38.81
4	T4	36.2	74	37.8
5	T5	32.08	72.56	40.48
6	T6	23.72	61.32	37.6
7	T7	37.3	71.4	34.1
8	T8	23.68	76.32	52.64
9	T9	68.08	94	25.92
10	T10	58	63.03	5.03
11	T11	42.5	87.5	45
12	T12	35.17	63.52	28.35
13	T13	58	70.6	12.6
	Average	42.1754	73.9069	31.7315

Table 3. POE Model Pretest and Posttest scores

in creative thinking and critical thinking

No	Journal Code	Percentage (%)		
		Pretest	Posttest	Enhancement
1	P1	74.65	80.25	5.6
2	P2	41.17	83.33	42.16
3	P3	47.34	84.38	37.04
4	P4	28	79	51
5	P5	29.17	60	30.83
6	P6	34.31	62.05	27.74
7	P7	62.39	83.04	20.65
8	P8	60.89	78.28	17.39
9	P9	52.3	77.6	25.3
10	P10	50	86.02	36.02
11	P11	49.58	79.81	30.23
12	P12	30.56	75.93	45.37
	Average	46.69667	76.64083	29.94417

In Table 2 related to the TTW model in creative thinking and critical thinking skills, it is found that the average pretest obtained from the journal data collected is 42.1754, while the posttest average is 73.9069 and the increase is 31.7315. Furthermore, in table 3 of the POE model related to creative thinking and critical thinking skills, the average pretest from the journal data collection obtained is 46.69667. The posttest data for the POE model is 76.64083 with an increase in the posttest score minus the pretest score, the value is 29,94417.

The next step after sorting the data between pretest and posttest data on both the TTW and POE models is a normality test, the purpose of normality is to find out whether the data collected by the researcher is included in normal data or not. One of the requirements in conducting the ANOVA test is to prove that the data held must be normally distributed.

following table 4 normality test using Shapiro Wilk

Table 4. Shapiro-Wilk Normality Test

Section		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
in Creative Thinking and Critical Thinking Skills in Physics lesson	PRETES_POE	.133	12	.200*	.945	12	.568
	POSTTEST_POE	.259	12	.025	.801	12	.010
	PRETEST_TTW	.183	13	.200*	.907	13	.169
	POSTTEST_TTW	.166	13	.200*	.925	13	.294

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

 The results from table 4 prove that the significant value on the Shapiro-Wilk proves to be greater than the value of 0.05, which means that the data collected by the researcher is normally distributed. The pretest value of the POE model is $0.568 > 0.05$; The posttest value of the POE model is $0.10 > 0.05$; The pretest value of the TTW model was $0.169 > 0.05$ and the posttest value of the TTW model was $0.294 > 0.05$. After the normality test was carried out, the homogeneity test was carried out on the pretest and posttest data. The following are the results of the calculation of the homogeneity test of the pretest data in Table 5 and the homogeneity test of the posttest data in Table 6.

Table 5. Homogeneity Test of Pretest Data

		Levene Statistic	df1	df2	Sig.
PreTest	Based on Mean	.003	1	23	.954
	Based on Median	.012	1	23	.915
	Based on Median and with adjusted df	.012	1	22.367	.915
	Based on trimmed mean	.000	1	23	.999

Table 6. Homogeneity Test of Posttest Data

		Levene Statistic	df1	df2	Sig.
PostTest	Based on Mean	.032	1	23	.860
	Based on Median	.006	1	23	.937

Based on Median and with adjusted df	.006	1	21.360	.938
Based on trimmed mean	.000	1	23	.989

The results of the analysis of the homogeneity test in Tables 5 and 6 show that both the data, both the pretest and posttest data that have been collected, show homogeneous data. The data from the homogeneity test is said to be homogeneous if the significant value on the test results is > 0.05. In Table 5, it is known that the significant homogeneous value is 0.954 > 0.05, which means that the pretest data is homogeneous. While in Table 6 the significant value is homogeneous at 0.860 > 0.05, which means that the posttest is homogeneous.

After knowing the homogeneity test, it was continued by doing the ANCOVA test to see the size effect given between the two models, namely TTW and POE. The results of the calculations using the ANCOVA test were then consulted with the effect size table in Table 1. The results of the calculations for the ANCOVA test are presented in Table 7.

Table 7 ANCOVA test results

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	497.921ª	3	165.974	1.977	.148
Intercept	8640.014	1	8640.014	102.901	.000
Model	8.688	1	8.688	.103	.751
Pretest	439.302	1	439.302	5.232	.033
Model * Pretest	17.586	1	17.586	.209	.652
Error	1763.252	21	83.964		
Total	143709.374	25			
Corrected Total	2261.173	24			

a. R Squared = .220 (Adjusted R Squared = .109)

Table 8. Descriptive Statistics

Model	Mean	Std. Deviation	N
TTW	76,58	10,352	12
POE	74,00	9,292	13
Total	75,24	9,697	25

The results obtained from the ANCOVA test shown in Table 7 state that these results have a significance value of 0.652 and if these results are consulted with Table 1 it states that the TTW and POE models have a great effect on creative thinking skills and critical thinking of students in physics. While in Table 8 it is known that the two models show that the TTW and POE models have almost the same average, which means that the two models have almost the same effect.

DISCUSSIONS

The purpose of this study is to prove whether the TTW and POE models have a significant effect on creative thinking and critical thinking. To be able to answer this question, the ANCOVA test is needed. Before the Ancova test, prerequisite tests or assumptions tests such as normality and homogeneity tests were carried out from the data obtained. Based on the assumption test that has been carried out, it is known that the normality test of the data carried out obtains a value greater than 0.05, which means that the pretest and posttest data in both the TTW and POE models are normally distributed.

After the first prerequisite test was carried out, namely the normality test with the results being normally distributed, it was continued by carrying out the homogeneity test which results can be shown in Tables 5 and 6. The data obtained is said to be homogeneous if the significance value obtained is greater than 0.05. Tables 5 and 6 in each model show that the significance value has exceeded 0.05 so that the assumption test of the two homogeneity tests is concluded that the data to be analyzed is homogeneous.

Finally, after the assumption test was carried out, the ANCOVA test was carried out to see how much influence the TTW and POE models had on the creative thinking and critical thinking of students in physics lessons. The results of the ANCOVA test can be seen in table 7 with a large significance of 0.652 and when compared with the effect size table the significance value is quite large and it can be concluded that the TTW and POE models affect creative thinking skills and critical thinking.

This is because the TTW model according to Wahyuni & Efuansyah, (2018) provides a different learning experience than usual, namely the occurrence of an understanding construction process built by students related to reasoning which is followed by demonstrating this understanding and practicing communicating with students. Others agree with this Rustiana et al., (2021); Artayasa, et al., (2021) explain that this model trains students to think creatively and critically to face challenges and to train in communication. with other students so that the results of the reasoning that is built can also be understood by other students. In addition to training the ability to think creatively and critically, the use of the TTW model can

increase students' confidence in learning so that creative and critical training can run smoothly (Supandi et al., 2018).

In addition to the TTW model, another model that is proven to have a great influence on creative thinking and critical thinking is the POE model. The POE model is a model with almost the same learning steps as the TTW model, in the POE model students know the construction of knowledge based on predictions that will be faced from the problems they face. Furthermore, after students predict the continuation of observations through activities or direct observations they face and explain the end of students obtained from activities (Maulida et al., 2018); (Sarah et al., 2021). It is similar in research Ryan & Bambang.,(2017) that applying the POE model can improve students' critical thinking skills by 86.4% or with very critical criteria.

The results and discussion contain scientific research findings and discussions. Write down scientific findings obtained from the results of research that has been done but must be supported by adequate data. The scientific findings referred to here are not the results of the research data obtained. The scientific findings must be explained scientifically including What scientific findings were obtained? Why did that happen? Why are trend variables like that? All these questions must be explained scientifically, not only descriptive if necessary supported by adequate scientific basis phenomena. In addition, it should also be explained in comparison with the results of other researchers who are almost the same topic. The results of the research and findings must be able to accommodate the research objectives in the introduction.

CONCLUSION

Based on the results and discussions that have been described, it is explained that the use of the TTW and POE models has almost the same effect. In the TTW model, it is known that the average is 76.58 while the POE is 74.00. Based on the ANCOVA test data, it is known that the two models TTW and POE have large criteria for creative thinking and critical thinking. These results are known by the significance value of the Ancova test of 0.652 in consultation with the effect size criteria table so that it can be concluded that the TTW and POE models provide a large effect size on creative thinking skills and critical thinking in a physics lesson.

RECOMMENDATION

Based on the meta-analysis on the application of the TTW and POE models both have a positive impact on creative thinking and critical thinking, the researcher suggests that further research should: 1) combine the two models into one renewable model; 2) developing learning media by applying the principles of the TTW and POE strategies, and 3) the need for research development by looking at other aspects such as literacy and collaboration skills

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