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Synthesis and Detection of Publication Bias in Relationship between Motivation and Teacher Performance: A Meta-analysis Review

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Abstract The relationship between motivation and teacher performance has been extensively investigated by using various models of relationship analysis. As a result, the relationship between the two variables is relatively poorly understood and requires separate analysis to ascertain the extent of the relationship between the two variables. In addition, a number of studies have reported that motivation has a significant relationship with teacher performance. However, the accuracy of the information reported by these studies is an important aspect to explore to ensure that there is no publication bias. This research aims to analyze the relationship between motivation and teacher performance based on a meta-analysis review of a number of published studies. The research data used were 30 correlational research results from journal articles published from 2010 to 2019. The random effects model was used as an effect size in this meta-analysis study. The effect summary results show that there is a significant relationship between motivation and teacher performance with an r coefficient of 0.446 and the confidence interval is moderate category with a value range between 0.371 - 0.515. By using the Trim and Fill method in this meta-analysis procedure, it was found that this research did not indicate publication bias. The results of this research can be an important reference for education providers, especially school administrators, to plan strategies for increasing school productivity. Motivation can be a potential trigger factor for improving teacher performance.

Thus, school administrators can design appropriate motivational strategies to improve their teacher performance.

Keywords Meta-analysis, Motivation, Teacher Performance

1. Introduction

Motivation theory existed almost eight decades ago and has undergone many developments over time. The development of motivation theory can be traced from a number of motivational theories which include: the hierarchy of needs theory [1], X and Y theories [2], expectancy theory [3], the theory of the need for achievement [4], two-factor theory [5], task motivation and incentive theory [6], ERG theory [7], and Self-Determination Theory [8]. Until now, motivation was seen as an interesting classic issue and was widely discussed in a number of studies in psychology, management, and even education ([9]; [10]; [11]).

The issue of motivation has been widely studied, especially in relation to human resource management and organizational development. Motivation has been shown to have an important role in increasing individual performance and organizational productivity [12]. In the field of

education, the research of motivation is often associated with improving educational performance, both individually and institutionally. In smaller areas of education such as at the school level, research of motivation is often directed at the issue of improving teacher performance. However, on the other hand, teacher work motivation is also an important issue that can be improved through proper organizational management at the school level [13].

Motivation is an important factor that determines the achievement of one's work. [14] suggests that motivation becomes a force that energizes, navigates, and maintains individual actions. A similar view was expressed by [15] that motivation is a psychological process that determines the direction, intensity, and persistence of one's actions in relation to their work. Individual actions that are driven by certain motivations have the potential to produce better performance. In the organizational context, individuals who have strong work motivation will be more effective in doing their work compared to individuals who lack motivation. This is in line with the views of [16] which state that motivational control over behavior is achieved largely through the allocation of resources across all actions. Thus it can be concluded that behavior can result from actions that are navigated by motivation.

Motivation is a psychological process that encourages individuals to act towards certain goals that can affect the behavior produced by the individual. [17] suggested that motivation has an important effect on the quality of one's work and behavior. In the context of education in the scope of schools, teacher behavior that is relevant to the needs and achievement of school goals can be assessed as teacher performance.

Teacher performance is an interesting problem to learn even though it is not new in the scope of educational research [18]. Many educational researchers have explored the problem of teacher performance in the past ([19]; [20]; [21]; [22]; [23]; [24]). Contributions made by teacher performance are important for improving the quality of education. Therefore, the problem of teacher performance has always been an important research material among educational academics to date ([25]; [26]). In addition, today's rapidly developing information systems have made it possible for information transparency in the implementation of educational practices in schools [27]. With the transparency of this information, the process of monitoring teacher performance is easier to do. This situation requires every school leader to work hard in overcoming teacher performance problems [28].

Performance is defined as the results of work done by a person or organization within a certain period ([29]; [30]). This definition of performance is only limited to the context of the results and does not represent overall aspects of performance. [31] offers a more comprehensive definition of performance. Performance can be understood in the context of behavior and also results [32]. According to [33], a person's behavior can be considered as an outcome because it results from a person's mental and

physical processes when applied to a task. With this rationale, [28] assume that to measure one's performance can refer to the behavior and results of one's thoughts. A similar opinion was expressed by [32] that performance is the result and behavior of a person that is relevant to organizational goals. By understanding these concepts, teacher performance can be understood as any behavior or teacher work that is relevant to the goals of the school organization.

Themes on teacher performance have resulted in research that has explored many processes and outcomes from various theoretical perspectives. The relationship between motivation and teacher performance has been extensively investigated by various relationship analysis models, both in the position as exogenous and endogenous variables, and its position as an intermediate variable that bridges the relationship between variables. As a result, the relationship between these two variables is relatively poorly understood and requires a separate analysis to ascertain the extent of the relationship between these two variables. In addition, a number of studies have reported that motivation has a significant relationship with teacher performance. However, the accuracy of the information reported by this research is an important aspect to explore in ensuring that publication bias does not occur in it. Therefore, this research aims to reveal two things:

- 1) How is the relationship between motivation and teacher performance based on the synthesis of a number of published research?
- 2) Is there a publication bias about the relationship between motivation and teacher performance?

2. Materials and Methods

This research is a synthesis of a number of correlation studies with the use of meta-analysis. The data collected in this research were obtained from a number of research articles in scientific journals that had been published from 2010 to 2019. These articles were written in Indonesian and English. For the procedure of finding articles in this research generally the researcher uses the Google Search Engine and searches on the Open Journal System from various universities. A total of 107 research articles that examined the relationship between motivation and teacher performance were collected by the researcher. However, after verifying only 30 articles were eligible for research and the remaining 77 articles were not used because the required data such as r , F , t , or even N values were not presented in these articles. In addition, there are also research articles that use a qualitative approach so that they do not meet the requirements to be analyzed by this research method. The sample of this research was teachers at the kindergarten, primary school, junior high school, senior high school / vocational school level in public and private schools. The type of meta-analysis used in this research is correlation meta-analysis.

The researcher calculates the effect size and standard error of each research article that has been verified and meets the requirements for further analysis. Before calculating the effect size, the F value or even the t value is converted to the r-value with the consideration that sometimes found in research data that does not provide or display the data needed comprehensively, such as there is an F value but does not provide information about the r-value.

r-values for 30 correlation research results in this research are presented in full in Table 1. For articles that do not include r values in their research results, r-values can be calculated based on the following equation:

$$t = \sqrt{F} \quad (1)$$

$$r = t / (\sqrt{t^2 + N-2}) \quad (2)$$

After calculating the effect size, the next step is the analysis procedure to determine the summary effect. The summary effect in this research uses a random-effect model. The random-effect model was used in this research by considering the assumption that the studies analyzed had different true-effect [33]. The intended true-effect here is the actual effect size at the population level.

Data processing and forest-plot making in this research uses the JASP 0.9.0.1 application.

Table 1. Transform F values into t and r values and Effect Size and Standard Error

Studies	Researcher	N	Sample	F	t	r	ES	SE
Studies 1	[34]	30	Senior High School Teacher	-	0.68	0.127	0.128	0.192
Studies 2	[35]	150	Senior High School Teacher	-	-	0.305	0.315	0.082
Studies 3	[36]	60	Junior High School Teacher	-	-	0.57	0.648	0.132
Studies 4	[37]	177	Senior High School Teacher	-	-	0.292	0.301	0.076
Studies 5	[38]	110	Certified Teacher	-	-	0.636	0.751	0.097
Studies 6	[39]	35	Junior High School Teacher	-	1.926	0.318	0.329	0.177
Studies 7	[40]	229	Senior High School Teacher	-	-	0.16	0.161	0.067
Studies 8	[41]	39	Junior High School Teacher	-	2.739	0.411	0.437	0.167
Studies 9	[42]	71	Junior High School Teacher	-	-	0.381	0.401	0.121
Studies 10	[43]	88	Kindergarten Teacher	-	-	0.565	0.640	0.108
Studies 11	[44]	82	Senior High School Teacher	-	-	0.408	0.433	0.113
Studies 12	[45]	46	Senior High School Teacher	-	-	-0.092	-0.092	0.152
Studies 13	[46]	60	Vocational Teacher	-	-	0.063	0.063	0.132
Studies 14	[47]	63	Primary School Teacher	-	-	0.58	0.662	0.129
Studies 15	[48]	110	Primary School Teacher	-	-	0.675	0.820	0.097
Studies 16	[49]	156	Senior High School Teacher	-	-	0.732	0.933	0.081
Studies 17	[50]	33	Vocational Teacher	-	-	0.634	0.748	0.183
Studies 18	[51]	202	Junior High School Teacher	-	6.29	0.406	0.431	0.071
Studies 19	[52]	110	Senior High School Teacher	-	-	0.296	0.305	0.097
Studies 20	[53]	170	Primary School Teacher	-	-	0.659	0.791	0.077
Studies 21	[54]	192	Senior High School Teacher	-	-	0.533	0.594	0.073
Studies 22	[55]	97	Vocational Teacher	7.51	3.677	0.353	0.369	0.103
Studies 23	[56]	87	Madrassa Teacher	4.906	2.215	0.234	0.238	0.109
Studies 24	[57]	57	Senior High School Teacher	-	7.377	0.705	0.877	0.136
Studies 25	[58]	400	Junior High School Teacher	-	-	0.306	0.316	0.050
Studies 26	[59]	33	Junior High School Teacher	-	2.234	0.372	0.391	0.183
Studies 27	[60]	54	Kindergarten Teacher	-	-	0.529	0.589	0.140
Studies 28	[61]	83	Primary School Teacher	-	-	0.493	0.540	0.112
Studies 29	[62]	63	Foundation Teacher	14.758	3.323	0.392	0.414	0.129
Studies 30	[63]	65	Junior High School Teacher	-	-	0.579	0.661	0.127

3. Results and Discussion

The results of the conversion of the values of F and t to r as well as the results of the calculation of the effect size and standard error of 30 correlation research for this research can be seen in Table 1.

The statistical values in table 1 become the main data in this meta-analysis process to obtain information about the summary of the effects of the research that have been collected. In addition, the statistical values in table 1 are also the main data used to detect publication bias in this research.

3.1. Summary Effect Using the Random Effect Model

Based on the results of calculations using a random effect model where the number k = 30, obtained p-value <0.001 for parameter Q = 171.2 with free degrees (df) = 29. With p-value <0.05 (for a significance level of 95%), then H0 is rejected so it can be concluded that θ is not equal to 0, which means there is a significant relationship between motivation and teacher performance. For the estimated standard error (SEM) value obtained 0.0457 and the Z value of 10.451 where the Z value is only to confirm the omnibus test (omnibus test of coefficient models) in Table 2. The results of these calculations are presented in Table 2 and Table 3 below.

To prove whether the effect size in this research is different, a heterogeneity test is performed. Based on the heterogeneity effect size test with several parameters, then obtained τ^2 and τ are greater than 0 (τ^2 and $\tau > 0$) with values

of both of them at 0.0486 for τ^2 and 0.2206 for τ . With this result, H0 is rejected, so it can be concluded that the effect size of each research used in this meta-analysis is heterogeneous. Whereas the parameter I^2 was 82.8419% which showed that the effect size between research was heterogeneous. The heterogeneity test results are presented in Table 4 below.

Table 2. Significance of Effect Size

Fixed and Random Effects			
	Q	df	p
Omnibus test of Model Coefficients	109.2	1	< .001
Test of Residual Heterogeneity	171.2	29	< .001

Note. p -values are approximate.

Table 3. Estimated Coefficient

	Estimate	Standard Error	z	p
intrept	0.4777	0.0457	10.451	< .001

Note. Wald test.

Table 4. Estimated Coefficient

Estimate	
τ^2	0.0486
τ	0.2206
I^2 (%)	82.8419
H^2	5.8281

For Forest Plot Summary results with random effects models can be seen in the following figure 1.

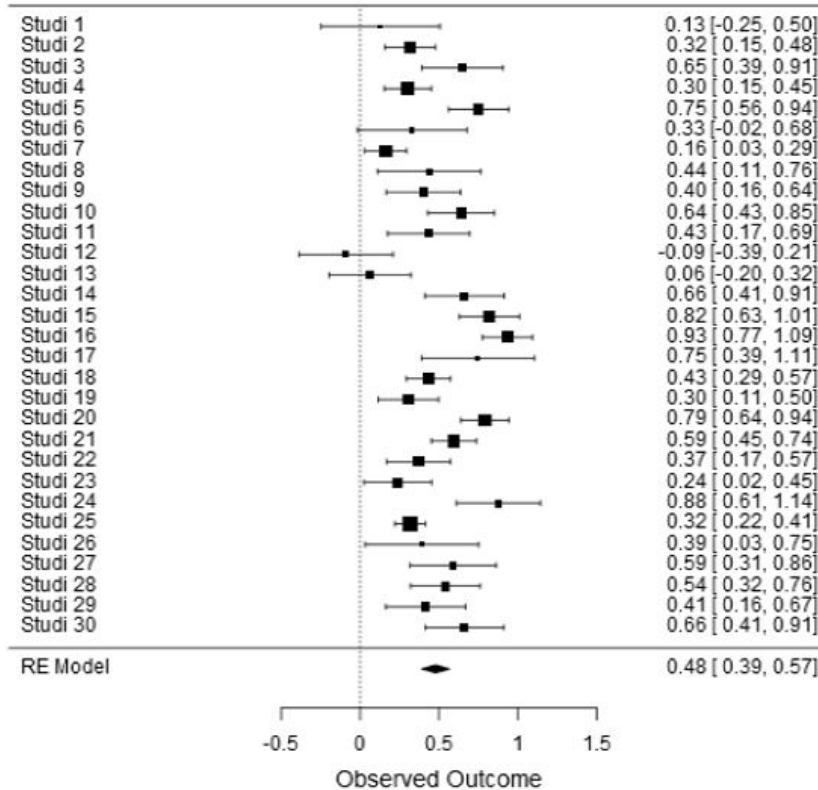


Figure 1. Forest Plot Summary for Random Effect

Based on the forest plot in Figure 1, the average weighted effect size (M) is 0.48 with a lower limit of confidence interval M (LLM) is 0.39, and the upper limit of confidence interval M (ULM) is 0.57. To obtain the correlation value from this meta-analysis research, the average weighted effect size (M) value is converted to the correlation coefficient r . The same treatment is also applied at the confidence interval, where LLM is converted to LLr, and ULM is converted to ULr. Each conversion equation for values of M to r and their confidence intervals is calculated by the following equation:

$$r = e^{(2 \times M - 1)} / e^{(2 \times M + 1)} \quad (3)$$

$$LLr = e^{(2 \times LLM - 1)} / e^{(2 \times LLM + 1)} \quad (4)$$

$$ULr = e^{(2 \times ULM - 1)} / e^{(2 \times ULM + 1)} \quad (5)$$

Based on the results of calculations using equations 3, 4, and 5, the correlation coefficient (r) is 0.446. This coefficient value indicates that the correlation between motivation and teacher performance is in the 'moderate' category [64]. Whereas the confidence interval is in the range between 0.371 - 0.515. This moderate category indicates that motivation has an important role in increasing teacher performance, but it is not entirely dominant affecting teacher performance because there are other variables that also influence teacher performance, such as the ability variable. This is supported by [65] who argues that ability is part of an individual aspect that influences a person's behavior in carrying out their duties or work.

3.2. Publication Bias

Publication bias occurs when the publication of research depends on the nature and direction of the results so the published research may be systematically different from unpublished research [66]. According to [67] that research with statistically significant or positive results are more likely to be published than non-significant or negative results.

In the process of research dissemination, bias can be included intentionally or unintentionally, knowingly, or unknowingly [67]. Researchers, research sponsors, peer reviewers, and journal editors can influence the research dissemination process. While the consequences of publication bias are the results of misleading estimates for treatment effects and relationships between research variables. This publication bias also impacts on the inaccuracy of information produced so that the published literature may not represent the research that has been done [33].

To detect whether publication bias occurs in this meta-analysis research, the Funnel Plot method and Trim-Fill analysis are used. The results of the analysis of these two methods as shown in Figures 2 and 3.

The visualization resulting from the Funnel Plot method in Figure 2 shows the shape of the Funnel Plot which is relatively symmetrical with the distribution of points that tends to be evenly distributed at the top, middle, and bottom.

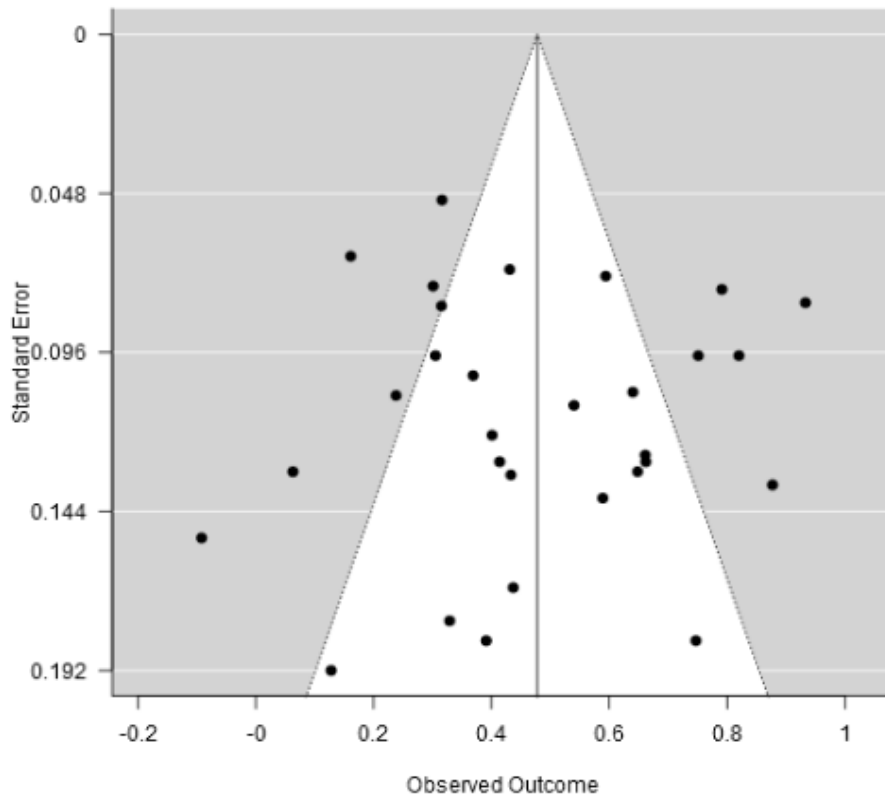


Figure 2. Funnel Plot Method for Detection of Publication Bias

The Trim and Fill method as shown in Figure 3 shows the comparison between the summary effect before being analyzed and the summary effect after being analyzed with Trim and Fill. Based on the results of the analysis using this method shows that there is no shift in the value of the results of the analysis, or it can be said that the two results of the summary effect are the same. In addition, based on this method it appears that there was no increase in the number of analysis samples. Thus it can be concluded that in this research publication bias is not indicated.

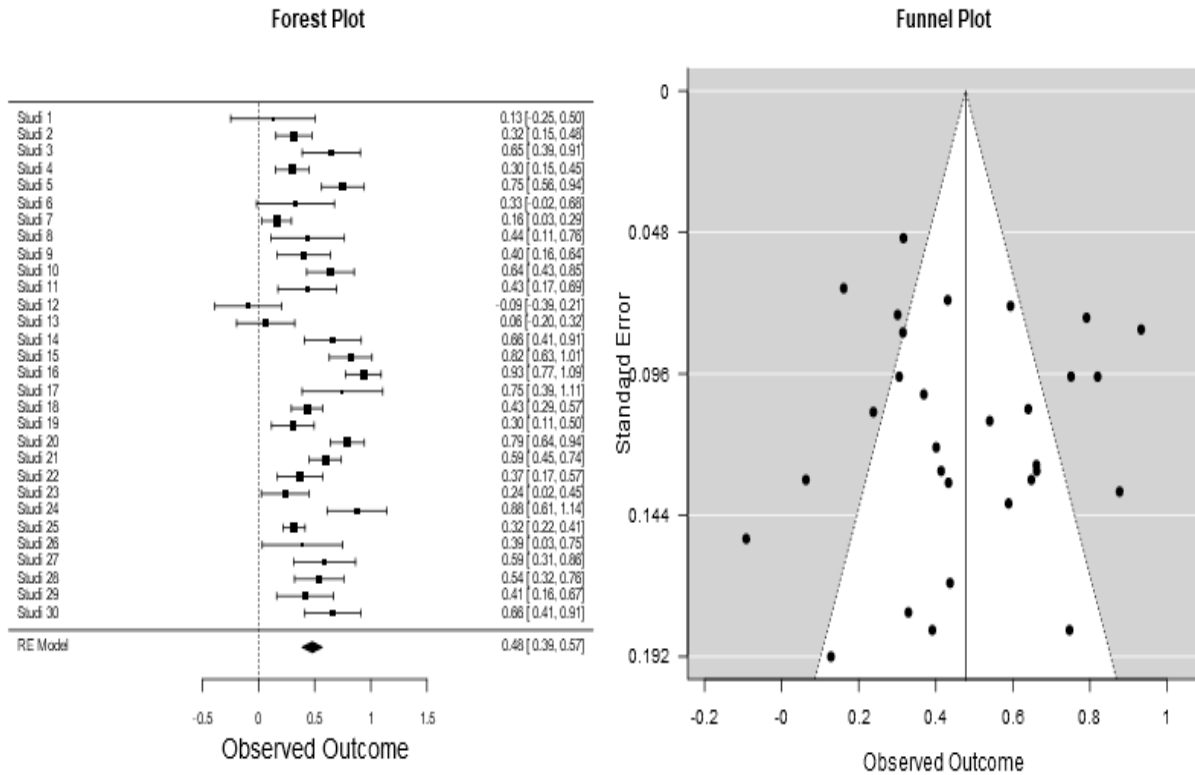


Figure 3. Trim-Fill Method for Detection of Publication Bias

4. Conclusions and Implication

A number of research results have reported that motivation has a significant relationship with teacher performance. Even so far, a lot of research in education has proven that motivation is a predictor of teacher performance. The significant relationship between these two variables can be an important reference for education administrators to plan strategies for increasing school productivity. Increasing school productivity can be done through motivating strategies specifically designed by management at the school level. Management interventions at the school level in motivating teachers are believed to improve teacher performance and school productivity. Although a number of research reports that intrinsic motivation is more effective in efforts to improve teacher performance than extrinsic motivation, administrators and managers of education at the school level need to examine and research in detail about aspects of the greatest needs of teachers as suggested by [68] namely a higher level of self-esteem, more autonomy, and a higher level of self-actualization. Various interventions in educational practice at the school level to improve teacher performance must be measurable and refer to supporting

data from research findings. The research findings will be effectively utilized if the information presented in these findings is accurate and reliable. The accuracy of the information provided by the research findings is that they are free from publication bias and thus have potent benefits when applied to specific practices. The results of educational research that are free from publication bias will be effectively utilized when applied to targeted educational practices. Therefore, the detection of research publication bias will support the effectiveness of using the results of this research. Future research can be directed to compare meta-analysis between the effect of intrinsic motivation on teacher performance, and the effect of extrinsic motivation on teacher performance.

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