

The effects of multiple intelligences theory on learning success: A meta-analysis in social science

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ABSTRACT

Scholars have widely discussed meta-analysis studies on the theory of multiple intelligences. However, no research explicitly discusses the theory of multiple intelligences in the development of social science. This study determined the effectiveness of multiple intelligences on learning achievement in social studies. For this reason, researchers compiled a study that has been carried out to determine the effectiveness of multiple intelligences in meta-analysis. This study used a meta-analysis method. There are six articles used in the study based on the inclusion-exclusion criteria. The meta-analysis findings revealed that multiple learning intelligence had a modest and optimistic impact on students' social science performance. This study also revealed the magnitude of the effect of multiple intelligence-based learning based on moderator variables at the level of education, treatment implementation time, and type of subject. The research findings provide suggestions for the development of research on multiple intelligence studies in the future.

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1. INTRODUCTION

Multiple intelligence explains that intelligence cannot be measured only from one dimension and is expressed using a single measure (IQ) [1]. Intelligence is a phenomenon that consists of many elements and is plural [2]. A few definitions of insights have been created. One definition of insights clarifies that those insights cannot be straightforwardly watched, concrete, and satisfied. It can be watched through the behaviors and may be a complex structure that influences typical behavior and the future [3].

Another definition of intelligence is defined as something that can be found, adapted, shaped, and can choose context [4]. For that, it must be underlined that intelligence is continuously interacting with real life [5]. Intelligence is characterized as a person's capacity to uncover items in one or more societies and to successfully and productively illuminate the problems encountered in everyday life. Correspondingly, intelligence is defined as making or breaking the shape of one or more social aids. Although there are various distinct concepts of intelligence, most theories of intelligence expose intelligence as an innate skill or ability

inherent in an entity, passed down through the ages. It may be a dynamic mix of natural learning and impact, calculating the influence of the core nervous system [6], [7].

The theory of multiple intelligences was established by Gardner in cognitive and social psychology, differential psychology, neuroscience, anthropology, cultural studies, and psychometrics, and experimental psychology [8]. Gardner describes the capacities that exist in each human as a field of intelligence or “modality.” The following modality areas included linguistic verbal intelligence, logical reasoning intelligence, spatial visual intelligence, musical intelligence, body-kinetics intelligence, cognitive intelligence, intrapersonal intelligence, and naturalistic intelligence [9]. Then, theological wisdom and existential intelligence were applied to its growth. Several methods can be used to measure the level of multiple intelligence, such as the multi-attribute decision making (MADM) method using the weighted product (WP) method [10], analytic hierarchy process (AHP), simple additive weighting (SAW) method, and technique for order preference by similarity to ideal solution (TOPSIS) [11].

Previous scholars have undertaken many meta-analysis articles on the creation of multiple intelligence concepts. Previous studies showed in the analysis that the multiple intelligence concept has a profound and optimistic effect on academic pursuits [9], [12]. This increase is in line with the increasing application period. This effect is no different at the level of education. Although there will be differences in the results effect size from different lessons, geographic areas, and observed school years [13]. Besides, other research has revealed that men can have higher estimates of women in general, mathematical or logical and spatial intelligence. In contrast, women excel in the field of verbal skills [14]. This research line results show that women devote more time to improving interpersonal communication skills [15]. It will indirectly increase women’s opportunities to interact and communicate with other people, which will develop the advantages of interpersonal intelligence.

Technological developments in education also affect multiple intelligences. Technology-based interventions have the most significant effect on intelligence body-kinesthetic. While compelling visual image to improve linguistic intelligence and intelligence-kinesthetic body [16], [17]. Meta-analysis studies of multiple intelligences specific to the field of science have also been carried out. The multiple intelligence concept has a positive impact on academic performance in mathematics [18].

Most meta-analytical research on multiple intelligences has been done in the natural sciences [19]–[21]. There are no meta-analytical studies that address multiple intelligences in the social science. It is in line with other studies, which revealed that studies in social science tend to be slower than studies in natural sciences [22]. The researcher’s development is mainly related to scientific-based learning methods. For example: i) Scholars reveal the application of a comic-based scientific approach; ii) Improve student learning outcomes and scientific literacy [23]; iii) Student team achievement division [24]; iv) Media rotating wheel [25]; v) A problem learning model based learning [26]; vi) Contextual teaching and learning [27] provide a significant effect on learning outcomes. Previous study revealed that multiple intelligences can be measured using the SensiStrength application, which classifies multiple intelligences based on Twitter posts [28].

The factors that influence the development of each intelligence are the focus of multiple intelligence studies. Except in mathematical intelligence, social studies teachers in Jordan had varying multiple intelligence levels [29]. In addition, there was no correlation between the levels of social intelligence and academic adjustment for sociology students [30]. Besides that, there are also differences in multiple intelligence between male and female students in the social field [31]. In addition to the curriculum in schools [32], [33] and learning style [34], the education level of parents also affects the differences in students’ multiple intelligences [35].

Based on previous literature, no study was conducted regarding the effect of multiple intelligence theory on learning success in non-science (social science). For this reason, this analysis is fundamental. This article aims to determine the effectiveness of multiple intelligences on learning achievement in social studies. The concept of multiple intelligences in non-science should be known to take advantage of debate possibilities to have educational advancement.

2. RESEARCH METHOD

This research employed the form of a meta-analysis. Meta-analysis analyzes empiric research on a subject or related area, including grouping studies according to specific parameters. This meta-analysis combines quantitative findings related to a specific study [36]. In simple terms, Cohen *et al.* [37] define meta-analysis as “analysis from the analysis.” A meta-analysis increases the validity of a specific research field by comparing study results with related findings. In this report, the meta-analysis process measures the effect size from multiple intelligence concepts to non-scientific successes. The database in this meta-analysis is the Google Scholar, Academic Microsoft, DOAJ, Emerald, Garuda Ristekdikti, Jstor, OATD, Sage, Science Direct, Springer, Taylor and Francis, and Wiley.

The steps taken by the researcher are first to make relevant keywords for this study. Researchers use the following keywords: "multiple intelligence *" OR "multiple intelligences" OR "multiple intelligences" OR "multiple intelligences". The search results obtained 1,189 journal article titles and theses. The search results were then selected using inclusion and exclusion criteria. The inclusion and exclusion parameters are: i) Criterion 1 (research method): the research uses quantitative research; ii) Criterion 2 (time interval): the study was conducted between 2016 and 2020; iii) Criterion 3 (published or unpublished study): thesis or dissertation, articles published in scientific journals; iv) Criterion 4: (numerical data): The study carried out contains the number of populations, the mean, and the standard deviations of the experimental and control groups. The coding format used in Microsoft Excel requires name, material, and analysis data to ensure the research's authenticity as presented in Figure 1.

Figure 1 shows that there are six articles match the criteria [38]–[43]. There were three tests carried out at the primary school level and three at the secondary school level as shown in Table 1. The treatment implementation period in the studied studies varied. There are two studies with treatment for 12 weeks, while two studies with treatment for two weeks. Hence, one study with treatment for five weeks and one study with treatment for seven weeks. Research subgroups were divided into three groups. Measuring the success rates of these trials by the period of application: "three weeks or less," "4 to 7 weeks," and "eight weeks or more." All of the research in this meta-analysis were published in the form of a journal paper. In this meta-analysis report, subgroups were also mapped based on subjects taught (drama, English, religion, and general social).

In this study, the application was a comprehensive meta-analysis (CMA 2.0) to compare effect size, variance, and subgroups. In this study, the group undergoing numerous intelligence-based therapies was coded as an experimental group, and the other group not receiving therapy (carried out by conventional learning practices) was coded as a control group.

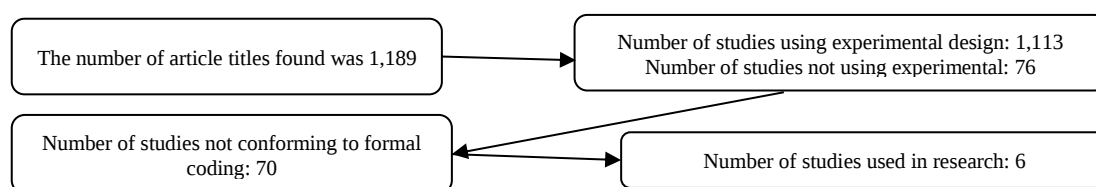


Figure 1. Selection process of studies included in the research

Table 1. Frequency and percentage of studies by level, type, period, and subjects

Moderator		Frequency (f)	Percentage (%)
Level	Primary school	3	50
Duration of treatment	Three weeks or less	2	33.3
	4-7 weeks	2	33.3
	Eight weeks or more	2	33.3
Types of lessons	Drama	2	33.3
	English	1	16.66
	Religious education	1	16.66
	General social science	2	33.3

3. RESULTS AND DISCUSSION

The comprehensive meta-analysis 2.0 (CMA) statistical package was used to compare effect sizes, variations, and groups. Multiple intelligence intervention research classes were coded with the experimental name category in this meta-analysis. Another group that obtained conventional learning treatment was coded as a control group. For this reason, the size of the positive effect is interpreted in the practice of multiple intelligence, while the size of the negative effect is interpreted in traditional learning practices.

From the collected studies, the significance level used is 0.05. For this reason, in this meta-analysis study, the level of statistical significance used was also 0.05. In this meta-analysis study, the effect size value is interpreted based on the Cohen [37]. It is mentioned that 0.20-0.49 implies a minor impact in the Cohen value interval, 0.50-0.79 indicates a modest effect, and 0.80 and higher indicates a significant effect.

3.1. Publication bias

The likelihood of articles being either positive or statistically significant for publication was higher than articles showing negative results or did not significantly bias the published study. It will directly affect the meta-analysis research conducted based on the literature found [44]. To some degree, publication bias

may be demonstrated by a higher than actual computed value by influencing the calculated average effect size [45]. Thus, it is essential to conduct a publication bias test before the meta-analysis.

The publication bias evaluation may be conducted for many kinds of analysis in meta-review studies. The bias test used four tests in this research: the funnel scatter plot, clip and fill, Rosenthal, and Orwin's fail-safe N. 4 in the meta-analysis report, the bias test is very widely used [46]. Each of these tests will measure the likelihood of publication bias.

3.1.1. Funnel scatter plot and clip and fill methods

The x-axis indicates the value of the impact size in the funnel scatter plot. The y-axis goes to show the standard error. From the funnel scatter plot in Figure 2, it can be seen that the distribution is relatively symmetrical around the primary effect size. However, several experiments have gone out of the funnel line. Also, based on the trim and fill estimate, it was observed that three experiments had to be applied to the funnel scatter plot to remove the publishing bias. Including the three experiments reveals that the impact size can be raised from 0.52250 to 0.70129 in the random-effects model. When comparing the Cohen classification [37], both values suggest a moderate impact. As a result, the missed research would not substantially change the effect size measured to achieve learning success in this publishing bias.

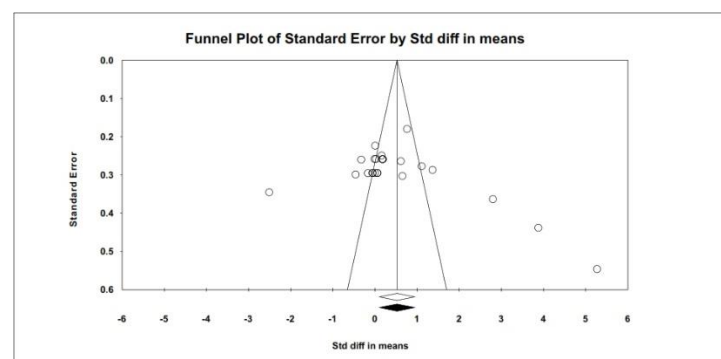


Figure 2. Funnel scatter plot

3.1.2. Fail-safe n method

The number of studies applied to the meta-analysis should be counted to reset the impact size to 0 [44]. If the fail-safe-N value is higher than the number of studies contained in the calculation findings, it may be concluded that the publication bias is oblivious to the results collected. Another approach proposed by Orwin is that it is possible to quantify the amount required to reset the effect size to negligible or negative in the meta-analysis [44]. In this analysis, the value of the Rosenthal fail-safe N was 309 as shown in Table 2. It suggests a need for 309 experiments with negligible effect sizes, which would result in this meta-analysis of scientific publishing bias. Based on these statistics, it can be inferred that the meta-analysis study is immune to publishing bias.

Table 2. Frequency and percentage of studies by level, type, period, and subjects

The Rosenthal Fail-Safe N Method		The Orwin Fail-Safe N method	
Z-value for observed studies	7.29359	Std diff in means in observed studies	0.34359
P-value for observed studies	0.00000	Criterion for a "trivial" std diff in means	0.00000
Alpha	0.05000	Mean std in-means in missing studies	0.00000
Tails	200.000	The criterion must fall between other values	
Z for alpha	195.996		
Number of observed studies	24		
Number of observed studies	24		
Number of missing studies that would bring p-value to > alpha	309		

3.2. Combined findings

It was found that the impact size value on student success with the multiple intelligence-dependent learning practice was 0.344 with the fixed-effect model and 0.523 with the random effect model based on meta-analysis test results, which were conducted using the Robust version 3 meta-analysis application. If we relate to the homogeneity test's effects by referring to the Q-value of 319.537 and the P-value of 0.000, the

current data may be inferred to be heterogeneous. With its homogeneous effects, the random effect paradigm is used [47]. The results of multiple intelligence-based learning on student progress in learning utilizing a random paradigm are also included in this analysis. The research estimates suggest that, in this meta-analysis, the random impact value seen is 0.523. These results indicate the results of the moderate effects on the classification by Cohen [37]. In more detail, Figure 3 shows the forest plot.

Moreover, the value I^2 obtained is greater than 75% as shown in Table 3. It suggests that the effect size of studies conducted on learning success has a high heterogeneity [45]. Moderator variables are used to explain the distribution of this heterogeneity, namely the level of education, time of treatment implementation, and the types of subjects taught. Moderator variables shape the results in meta-analysis and are used to determine the degree of the meta-analysis consequence. For this purpose, a sub-group study was undertaken to test the moderator variables of the review.

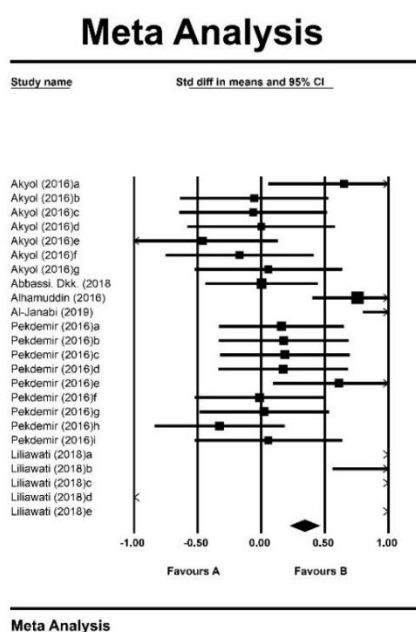


Figure 3. Forest plot

Table 3. The homogeneity distribution value, the average effect size, and the confidence interval are included in the studies' effect size model in the meta-analysis

in the studies Effect size model in the meta analysis											
Model	Number of studies	Effect size and 95% confidence interval				Absence hypothesis		Heterogeneity			
		Effect size	Standard error	Variance	Lower limit	Upper limit	Z-value	p-value	Q-value	Df (Q)	I 2
Fixed effects	24	0.344	0.057	0.003	0.233	0.455	0.067	0	319.537	23	0
Random effects	24	0.523	0.213	0.045	0.105	0.940	2.452	0.014			

3.3. Subgroup analysis

In this study, the study's sub-groups were divided into three parts: education, time of treatment implementation, and the types of subjects taught. Learning is split into two groups: primary and intermediate levels, which assess the effect of various intelligence-based learning activities on social learning. After being divided based on the two levels from the study's meta-analysis results, an effect size value of 0.312 for the primary education level and 0.713 for the secondary education level. It indicates a significant gap between primary and secondary education in the effects of multiple intelligence-based learning on learning performance in the social sector. It can be seen from the homogeneity test's effects where the Q-value is 0.928, and the P-value is 0.335. This result is the same as previous research, which explains differences in educational level [48]. However, several articles state no difference in educational level [49]–[51].

Second, from the research results on the compiled studies, the studies had a different time duration. The studies were classified into three groups to determine differences in multiple intelligence-based learning practices on social learning success based on the implementation time of the treatment given to students, namely “less than three weeks,” “4-7 weeks,” and “more than eight weeks.” Based on the meta-analysis findings performed using the Systematic Meta-Analysis V3 application, each category’s mean effect size was 0.155 for studies conducted fewer than three weeks, 1.729 for studies conducted from 4-7 weeks, and 0.214 for studies conducted more than eight weeks. It indicates a significant gap in incorporating treatment duration in various intelligence-based therapy and learning performance in social areas. It can be seen from the homogeneity test’s effects where the Q-value is 2.539, and the P-value is 0.281. This result is different from several other meta-analysis studies that reveal differences in treatment implementation time [50], [52]–[55].

Third, based on the collection of studies that have been carried out, mapping of the types of subjects taught. From the mapping results, it was found that for four different subjects. The four different subjects are drama, English, general education, and religious education. The meta-analysis calculation results found that each lesson’s average effect size was: 0.069 for drama lessons, 0.003 for English subjects, 1.960 for general subjects, and 0.759 for religion lessons. Referring to the effects of the homogeneity test, where the Q-value is 16, 723 and the P-value is 0.001, there are no significant differences in the effect of multiple intelligence-based directions on learning success in social areas between the types of lessons. This result is in line with previous research, which also supports no difference in the aspects of the subject [56], [57].

4. CONCLUSION

The study found a moderate effect of multiple intelligence-related learning on student performance in the social sector. These findings highlight the multiple intelligences theory’s relevance in social studies. Based on the discussion, this study paves the way for future research. Further research should examine the moderator or mediator variables that influence the theory of multiple intelligences on social studies success. To ensure that various intelligence-based learning continues to evolve and succeed in the future.

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