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Correlational of Collaborative Learning on Students' Social Interaction: A Meta-Analysis Study

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Abstract

Collaborative learning allows student' interaction to the cognitive construction system. Social interaction in the learning system includes elements of the environment, technology, and learning methods that are implemented in the learning process. The aims of this study are: 1) to analyze correlation of collaborative learning and students' social interactions in teaching learning process and 2) to analyze whether there was bias publication or not in the meta-analysis of relevant research publications. The method used in this research is meta-analysis. The research was conducted by browsing the Scopus database on relevant research with the limitation of the keywords "collaborative learning" "social interaction" "correlation studies" for publication results between 2015-2022. The data collected were 89 articles but the relevant ones were 12 articles with correlational studies. Data analysis used Effect Size test by JASP to answer the hypothesis about the relationship between collaborative learning and social interaction to determine whether there is bias publication. The results of analysis that used Random Effect model showed that there was a significant positive correlation between collaborative social learning and students' social interaction ($z=3.379$; $p<0.005$). The results of calculations regard to Rank Correlation showed that Kendall's value is 0.061 which showed the large correlation coefficient between effect size and variance where p-value of 0.841 is greater than the value of 0.05 which indicated that the publication sample data does not indicate bias publication. The results of this study indicate that collaborative learning in the direct social activities in the learning community. Meanwhile, indirect learning expands access to do discussion, publication capabilities, and reflection on various discoveries.

Keywords: Collaborative, Social, Interaction, Learning

INTRODUCTION

The learning environment offers a range of possibilities for collaborative processes in which students have knowledge, and ideas from responses and reactions to others. Collaborative learning is characterized by teachers' activeness to stimulate teaching learning process based on students' experiences and responsibility for learning to improve cognitive abilities and social skills in learning community. Collaborative learning becomes a trend in the 21st century towards the importance of critical education, independence and cooperation (Laal *et al..,* 2012; Ponce Gea & Gómez, 2022).

The purpose of collaborative learning focuses on the level of deep understanding and systematic thinking to develop aspects of communication, appreciation and social interaction to the material being studied. The existence an active role of students in collaborative learning means understanding for various abilities to explain, to define, and to evaluate the concept of reality (Gu *et al..,* 2015). Collaborative learning is based on the principle that students can enrich the learning experience by interacting with others and make useful each other's strengths. In a collaborative learning situation, students are responsible for each other's actions and tasks that encourage collaboration.

Learning in the 21st century also demands adaptations that allow learning to be done with technological collaboration. The provision of internet networks and information access facilities allows collaboration of distance learning with dynamic patterns of social interaction with various learning resources. The role of teachers, students, and a supportive environment gives varied learning experiences to enrich the cognitive formulations and students' communicative behavior. Collaboration through technology, teachers and the environment community learn from each other, fill and complete meaningful learning will create positive synergy in education. This concept of collaboration is still interpreted by students as cooperative learning that emphasizes learning in small groups where there is a division of tasks between group members to solve problems. The context of collaborative learning requires the involvement of various parties to be part of problem solving (Bosch *et al..,* 2019; F.-S. Chen *et al..,* 2020). Collaboration is a component that involves students, teachers' competencies, and the role of environment and technology to improve learning quality.

Collaborative learning involves cognitive processes, involves shared thinking and socio-emotional processes, recognizes the formation of social groups towards learning goal. The process becomes an internal part, operate students' minds and emotions. Thus, collaborative learning causes social interactions that manifest individual potential in the learning process. The social environment and teacher-student interactions have a positive influence on students' active learning that involves emotional abilities. Productive interactions in collaborative learning require balance and involvement of the system to shape the socio-emotional climate in critical discussions (Hiele *et al..,* 2019; Isohätälä, 2017). Interaction among students has a smaller relationship in the process to find students' knowledge (Molinillo *et al..,* 2018). A conducive collaborative learning can be based on social interaction, learning management and learning outcomes factors. Students' social interaction in completing group assignments is more prominent in the collaborative process than aspects of learning management and learning output (Nguyen *et al..,* 2021).

Collaborative learning emphasizes the formation of relationships between teachers and students in an intense interaction process and fosters the productivity of the process and learning outcomes. Social interactions hone students' skills to work together, solve problems that involves the learning community. A learning process provides comprehensive problem solving freely through learning experiences in social activities (Shvarts & Abrahamson, 2019; Teo, 2019; Vuopala *et al..,* 2019). The habituation of reciprocal relationships between teachers and students in learning community through stimulation and environmental responses, cultural and technology to strengthens the students' socio-emotional intelligence. The impact of collaborative learning on students' social interaction is investigated in real and virtual learning spaces (Hu & Zhao, 2016; Liu & Shi, 2018). Social interaction in cyberspace through discussion is related to students' confidence in writing ideas and publishing findings, reflecting differences of opinion as a process of obtaining scientific truth.

Collaborative learning through digital learning platforms is more effective to give interaction access in understanding students' learning process, improving learning outcomes, providing learning support through extensive resources (B. Chen *et al..,* 2021; Fakomogbon & Bolaji, 2020; Zabidi & Wang, 2021). The use of social media and mobile devices through collaborative learning makes interactivity

with peers, teachers and technology academics and has a significant impact on students' academic performance. Collaborative learning facilitates students to be more creative and dynamic to find knowledge (Ansari & Khan, 2020). Collaborative learning using technology has a positive relationship to students' performance in reducing cyberstalking and cyberbullying so that it can improve students' performance (Alenazy *et al..,* 2019; Zabidi & Wang, 2021).

Based on these problems, this research focuses on analyzing the relationship between collaborative learning and social interaction from various correlational studies to determine the pattern of the relationship between the two variables. Data from articles about relationship between collaborative learning and social interaction were also identified to determine the bias publication of each published research result.

METHODS

This study uses a type of meta-analysis research. Meta-analysis was done by summarizing research data on collaborative learning and social interaction, reviewing, and analyzing research data from several publications that have similar methodologies. Data collection used Scopus indexed article. Limitation of searching article used keywords "collaborative learning" "social interaction" "correlation studies" with an interval of publication between 2015-2022. The results of searching articles obtained 89 articles that have been published by various online journals and they are relevant to the needs of data analysis. The basis for taking articles is quantitative research articles with correlational data between correlational learning and social interaction as many as 12 articles. Data analysis was done through several stages, they are: (1) labeling the selected articles, (2) writing the correlation test value (r) and the number of research subjects (N), (3) calculating the effect size (Z) and standard error effect size (SEz), (4) performing data analysis with the help of JASP software, (5) analyzing the results of finding from the articles that become data references, (7) making conclusion the research results (Crompton *et al..,* 2022; Franco-Trigo *et al..,* 2020). The stage of meta-analysis research is: correlational study of collaborative learning on students' social interactions, according to Figure 1.

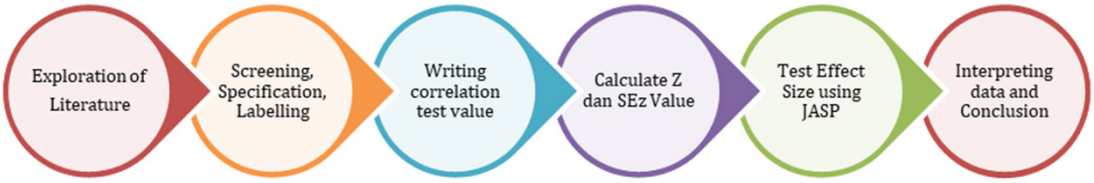


Figure 1. Research Stages

Calculate the value of Effect Size dan Standar Error Effect Size use this pattern:

$$z = 0.5xIn\frac{1+r}{1-r}$$

Equation 1. Calculate the value of Effect Size

Formula description
z: effect size
r: correlation coefficient

$$SE_z = \sqrt{V_z} \qquad V_z = \frac{1}{n-3}$$

Equation 2. Calculate Standar Error Effect Size

Formula description

V_z: Varians Effect Size

SE_z: Standar Error Effect Size

Data interpretation of Effect Size test results using JASP was analyzed to obtain data about there is bias publication or not toward used publication data to determine the relationship between collaborative social learning and social interaction, including the categories d = 0.1 (low), d = 0.3 (medium), d = 0.5 (height) (Baron-Cohen, 1989) about how data is collected, data sources and method of data analysis.

RESULTS AND DISCUSSION

There are 12 published articles on collaborative learning and students' social interaction used correlational studies. Data recording in this study was done by identifying the study, the title of study, correlation test (r) and the number of research subjects (N). Next, calculate the effect size value, effect size variance and standard error effect size. The calculation results can be described at Table 1, as follows:

Table 1. Result of calculation for effect size and standard error effect size

No	Name of Research	Title	r	N	Z	Vz	SEz
1	Sebastian Molinillo, *et al.* (2018)	Exploring the impacts of interactions, social presence and emotional engagement on active collaborative learning in a social web-based environment,	0.5412	416	0.471405	0.002421	0.049207
2	Mohammed Saqr, *et al.* (2020)	Capturing the participation and social dimensions of computer-supported collaborative learning through social network analysis: which method and measures matter?	0.77	548	1.24126	0.001835	0.042835
3	Jaana Isohatala (2017)	Striking a balance: Socio-emotional processes during argumentation in collaborative learning interaction	0.76	19	1.177737	0.0625	0.25
4	Ha Nguyen, *et al.* (2021)	"We're looking good": Social exchange and regulation temporality in collaborative design	-0.8	211	-0.44707	0.004808	0.069338
5	Michael Ayodele Fakomogbon dan Hameed Olalekan Bolaji (2017)	Effects of Collaborative Learning Styles on Performance of Students in a Ubiquitous Collaborative Mobile Learning Environment	0.579	39	0.542508	0.027778	0.166667
6	Waleed Mugahed Al-Rahmi, Akram M Zeki, (2016)	A model of using social media for collaborative learning to enhance learners' performance on learning	0.511	150	0.422057	0.006803	0.082479
7	Jaana Isohatala, *et al.* (2017)	Socially shared regulation of learning and participation in social interaction in collaborative learning	0.89	24	2.893531	0.047619	0.218218

8	Jamal Abdul Nasir Ansari and Nawab Ali Khan (2020)	Exploring the role of social media in collaborative learning the new domain of learning	0.487	360	0.386706	0.002801	0.052926
9	Waleed Mugahed Al Rahmi, *et al.* (2020)	Social media – based collaborative learning: the effect on learning success with the moderating role of cyberstalking and cyberbullying	0.78	667	1.310485	0.001506	0.038808
10	Nuria HernandezSelles, Pablo-Cesar Munoz-Carril, Mercedes Gonzalez-Sanmamed (2019)	Computer-supported collaborative learning: An analysis of the relationship between interaction, emotional support and online collaborative tools	0.219	106	0.12678	0.009709	0.098533
11	Horzum, Mehmet Barış,. (2015)	Interaction, structure, social presence, and satisfaction in online learning	0.6	205	0.587505	0.00495	0.07036
12	Lin, Wen-Shan; Wang, Yi-Ju; Chen, Hong-Ren (2018)	*A study of crowd-collaborative learning: an empirical study*	0.701	138	0.888322	0.007407	0.086066

Next, the researchers tested the hypothesis and bias publication on the data obtained. The meta-analysis was done with the help of a JASP application. The hypothesis in this study at Table 2, as follows:

Table 2. Hypothesis study

	Hypothesis Test	Bias Publication Test
H_0 : true effect size = 0	There is no relationship between collaborative learning and students' social interaction	Publication sample data indicated bias publication
H_1 : true effect size ≠ 0	There is relationship between collaborative learning and students' social interaction	Publication sample data did not indicate bias publication

After formulating the hypothesis the researcher carried out a heterogeneity test which was used to see the diversity of characteristics possessed by a group,

heterogeneity in the study resulted from the resulting score which had a large score variance. Based on the results of data testing using JASP output, the following values are obtained at Table 3:

Table 3. Fixed and Random Effects

	Q	Df	P
Omnibus test of Model Coefficients	11.415	1	< .001
Test of Residual Heterogeneity	880.609	11	< .001

Note. *p* -values are approximate.

Note. The model was estimated using Restricted ML method.

The results of the heterogeneity test analysis showed that the 12 effect sizes of the analyzed studies were heterogeneous (Q=880.609, p<0.001). Thus, the Random Effects model is suitable for estimating the mean effect size of the 12 analyzed studies. The results of the analysis also indicate that there is potential to investigate moderating variables that influence the relationship between collaborative social learning and students' social interaction.

Hypothesis test to find out a significant positive correlation between collaborative social learning and students' social interaction in the data that has been obtained, the test is carried out at Tabel 4, as follows:

Table 4. Summary Effect/Mean Effect Size

Coefficients

					95% Confidence Interval	
	Estimate	Standard Error	Z	P	Lower	Upper
Intercept	0.788	0.233	3.379	< .001	0.331	1.245

Note. Wald test.

The results of analysis using Random Effect model show that there is a significant positive correlation between collaborative social learning and students' social interactions (z=3.379; p=0.005), with a lower limit of 0.331 and an upper limit of 1.245. This means that the Ho hypothesis is rejected, in this case *the true effect size* is not equal to 0, so in other words, there is a relationship between collaborative learning and students' social interactions. Then a publication bias test was carried out on the data at Table 5:

Table 5. Rank Correlation Test for Funnel plot Asymmetry

	Kendall's τ	**p**
Rank test	0.061	0.841

Based on Table 5. Regarding Rank Correlation, it can be seen that Kendall's value is 0.061 which shows the large correlation coefficient between effect size and variance where the p-value of 0.841 is greater than the value of 0.05 which indicates that the Ho hypothesis (Publication sample data indicate bias publication) is rejected, in other words, H_1 there is no indication of bias publication.

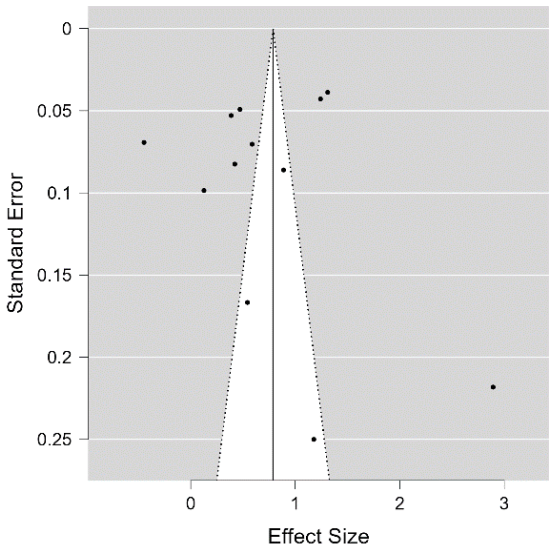


Figure 2. Funnel Plot

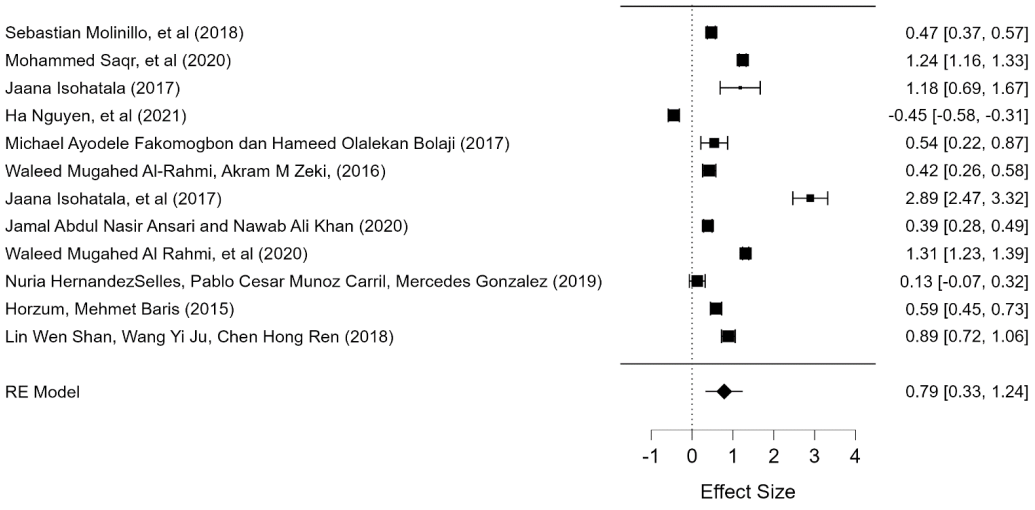
The results of funnel plot are difficult to conclude whether the bias publication is symmetrical or not, so an Egger test is needed to test the funnel plot is symmetrical or not, so that it can prove that there is no bias publication.

Table 6. Regression test for Funnel Plot Asymmetry ("Egger's test")

	z	p
sei	1.759	0.079

Table 6. shows that the z-value which is the magnitude of the regression coefficient is 1.759, while the p-value of 0.079 is greater than 0.05 which indicates that the Ho hypothesis (Publication sample data indicate bias publication) is rejected, in other words, H_1 there is no indication of bias publication.

Table 7. Forest Plot



Based on the forest plot, it can be observed that the analyzed studies vary in magnitude from -0.45 to 1.31. Furthermore, the summary effect value of 0.79 can

be obtained. This value explains that the average effect of collaborative learning on students' social interactions is 79% which is classified as high category. The effect of collaborative social learning and social interaction is included in the high category* (r=0.79) *d =0.1 (low), d=0.3 (medium), d= 0.5 (high) (Baron-Cohen, 1989).

The relationship between collaborative learning and students' social interaction in the study of several literatures shows a positive and significant relationship. The pattern of students' participation and communicative elements shows better learning performance in the process of finding knowledge. Knowledge construction can be developed through different perspectives and associations of various concepts (Rapchak, 2018; Viilo et al.., 2018. Collaborative learning in science learning by utilizing digital technology can reduce students' cognitive load and improve learning achievement (Queupil & Muñoz-García, 2019). Collaborative learning in social learning is used as authentic learning about dynamic social insights. Collaborative learning provides benefits on social, psychological, academic and learning values aspects (Jobe et al.., 2020).

Collaborative learning that encourages students' social interaction can be identified from the learning process that provides open communication space, diverse participation, free thinking, constructive conflict, democratic structure, exploration various sources of knowledge, wide involvement of various parties and fulfillment of learning facilities. In addition, the success of collaborative learning is also determined by the management by all elements of education and policies that support the implementation of collaborative learning (Smythe et al.., 2019).

School as social institutions in the demands of the globalized world prepares individuals for a very complex society. The process of social interaction can be formed through a collaborative pattern of students' knowledge and competence construction. Adaptive social interaction through technology is a challenge that can create discussion patterns in unlimited space and time (Angelstam et al.., 2017; Curth et al.., 2017; Horzum, 2015; Ouyang & Chang, 2019). Although communication in online interactions does not fully present a positive relationship with the need for social presence in education element.

The suitability of collaborative learning needs to the demands of the 21st century where education prepares students to face the challenges of global world.

Ease of access information, computing capabilities, automation and communication are implemented in students' activity, multi-interaction in the learning process, collaboration with various sources, mastery of technology, multidisciplinary analysis, creativity and democracy in learning. Superior resources in accordance with the needs of the 21st century society is a dynamic study in the development of education.

CONCLUSION

Collaborative learning has a positive and significant relationship on students' social interactions, either direct learning or using technology. Based on the meta-analysis of published collaborative learning articles, it shows the positive and negative implications that are revealed so that it does not indicate any bias publication. The implications of collaborative learning are social, psychological, academic and learning values.

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