A Meta-Analysis of Cognitive and Affective Outcomes of *Havruta* Learning

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Abstract

The purpose of this study was to investigate effects of *havruta* learning through meta-analysis. Eighteen eligible experimental studies were obtained through a systematic literature review and then coded. An overall effect size was computed while moderator analyses were also conducted. This meta-analysis indicated that the overall effect size for all studies was 0.824. Moderator analysis showed statistically significant differences by moderating variables in study characteristics, methodological characteristics, design characteristics, and outcome characteristics. Results included that the effect size of the cognitive domain was larger than that of the affective domain. Regarding school levels, elementary school, secondary school, college, and kindergarten were in descending order of effect sizes. These findings could present a basis for developing effective programs grounded in empirical evidence.

Keywords: havruta learning, learner-centered instruction, meta-analysis, students learning outcomes

1. Introduction

The Organization for Economic Co-operation and Development (OECD) has set a new vision in the OECD Future of Education and Skills 2030 project, where students grow as a whole person, fulfill their potential, and build a shared future based on personal and social well-being (Taguma et al., 2018). Researchers in this project discussed the knowledge, skills, attitudes, and values necessary for the society of the future and explored various ways to innovate school education. In addition, they argue that educators can effectively prepare students for the future by cultivating convergence thinking based on creativity and problem-solving skills. Therefore, it is important for educators to understand the core concepts and principles of subject areas and develop core competences through learner-centered education (Tomlinson, 2021).

However, despite the rapid social change, teacher-centered education remains the dominant learning approach. In East Asia, teacher-centered instruction still emphasizes activities in which students in elementary and secondary schools reproduce the information in textbooks (Matsuyama et al., 2018). Although lectures are effective for the transfer of knowledge, there is criticism that they are inappropriate for improving high levels of student abilities such as critical thinking and analytical reasoning (Burden, 2020). The level of students' motivation and satisfaction is also likely to be low because the lecture cannot reflect all the characteristics of each participant. Ultimately, lectures are not effective in developing the knowledge, skills, and attitudes needed in the future society, nor are they very helpful in strengthening core competences. Therefore, prior studies emphasize the necessity of expanding learner-centered classes that can foster core competences through student interaction (Bhide et al., 2022; Huang et al., 2022). In student-centered classrooms, students can act as decision-makers and become agents of their thinking. In this context, researchers have shown interest in *havruta* learning and reported results on its effectiveness in educational settings with in-depth discussion (Gold et al., 2021; Menachem & Livnat, 2021).

Havruta is derived from the Hebrew word Haber, meaning friend (Segal, 2003). It is the method used in yeshivas and kollels to study the Bible, meaning that a small number of students work together to understand the meaning of holy texts (Kent, 2010). For example, when two people get together, they learn new knowledge through the activity of asking and listening to each other about the Bible. Thus, both participants can naturally alternate between the roles of teacher and student. In particular, since individuals have an educational obligation to their peers, it is necessary to

learn with high motivation and to understand and explain holy texts accurately (Gold et al., 2021). Students deeply understand what they learn in the process and internalize new knowledge.

Analyzing previous studies, the author confirmed that research on *havruta* learning still continues. However, no study has been systematically reviewed effects from prior research and suggested the direction for future studies. Therefore, this study tried to summarize the quantitative effects of *havruta* learning through meta-analysis. This study can provide a meaningful basis for knowledge accumulation in *havruta* learning.

Research questions are as follows. First, what is the overall effect size of *havruta* learning on student learning outcomes? Learning outcomes in this study include both cognitive and affective domains. Second, what is the effect size of *havruta* learning according to categorical variables of study characteristics, methodological characteristics, design characteristics, and outcome characteristics?

2. Literature Review

2.1 Havruta Learning

Havruta learning refers to the process of asking, speaking, and discussing texts in pairs. This usually means two people learning together, but sometimes up to five students participate in a small group activity at the same time. In *havruta* learning, teachers do not directly intervene or assist. Students take an active role in learning and seek teacher intervention only when they need help. *Havruta* was originally a term used to refer to partners discussing together, but the concept has been expanded as an instructional method for integrating questions and discussions.

Although *havruta* learning differs from the various teaching methods reported so far, it is not an entirely new approach. A similar method to *havruta* learning is the Socratic dialogue. While the Socratic dialogue involves interactions between teachers and students, *havruta* learning involves communication between fellow students. *Havruta* learning is similar to the discussion, but different. Students in the discussion review the pros and cons of a topic and debate a proposed solution to a problem. This process sometimes negatively affects students' emotional stability and puts pressure on them to stick to the position they initially chose. In contrast, *havruta* learning aims to collaborate, propose solutions, develop thinking skills, and allow students to listen to each other through questions and conversations.

The research of *havruta* learning began with Mathieson (1990). *Havruta* learning was introduced as an Israeli method for peer teaching and became known to international readers while Mathieson introduced teaching and learning models used in many countries around the world. In addition, Segal (2003) analyzed the history, advantages, and methods of developing *havruta* learning. In this report, Segal evaluated cooperative learning and the cognitive approach to improve *havruta* learning.

Kent (2010) analyzed videotapes and transcripts of real-life examples of interactions in *havruta* learning. As a result, *havruta* learning was divided into three pairs of core practices: listening and articulating, wondering and focusing, and supporting and challenging. The first pair of practices is listening and articulating. Listening means paying attention and articulating is expressing the student's thoughts. The pair keeps motivating students to continue *havruta* learning. *Havruta* partners recognize each other as teammates in learning and provide opportunities to understand new ideas from a different perspective. The second pair of practices is focusing and wondering. At this stage, participants concentrate their attention and explore various possibilities. They must concentrate on their work to deeply understand the meaning of texts and draw conclusions about their learning. Curiosity is also needed to come up with creative ideas. This pair sets the direction for the conversation. The third pair of practices is supporting and challenging. Supporting is the phase where students provide encouragement for partner's ideas and help strengthen them with more evidence. Challenging is to pay attention to whether there are conflicting or contradictory ideas among the ideas discussed. It also conducts reflective thinking on those ideas and the whole process of *havruta* learning. Both of these practices can help sharpen students' ideas.

2.2 Effects of Havruta Learning

As educators became increasingly interested in *havruta* learning, researchers analyzed its effectiveness. The author reviewed previous studies and found that intervention effects to date have all been reported in primary studies.

2.2.1 Cognitive Benefits

Segal (2003) explained that *havruta* learning greatly benefits the cognitive domain in three ways. First, the effect increased through interaction with peers in the learning. Students could learn better with the guidance and help of peers than they do on their own. Second, oral reading in *havruta* learning is an effective strategy for knowledge

retention. Third, the practice and application of textual skills in *havruta* learning are of great help not only in the acquisition of knowledge but also in learning how to learn. Creativity is another positive effect achieved in *havruta* learning (Segal, 2003). Students' independence, critical thinking, and creativity could be promoted because the learning process was more emphasized rather than knowledge acquisition.

In previous empirical studies, *havruta* learning has a positive effect on dependent variables such as creativity, communication skills, and self-regulation in the cognitive domain. Hur (2016) applied *havruta* learning in a film class for college students and analyzed the effect on students' creativity. The study found that the post-test score of the experimental group was higher than the pre-test score at the significance level. Cho and Lee (2019) implemented *havruta* learning in biotechnology targeting ten gifted secondary school students. They reported that *havruta* learning was particularly effective in the communication skills of gifted students who preferred abstract concepts and active experiments in their learning. You (2021) conducted *havruta* activities using picture books for twenty kindergarten students. The study found that the change in self-regulation in the experimental group was greater at the significance level than in the control group.

2.2.2 Affective Benefits

Havruta learning has a positive role in the affective domain (Segal, 2003). *Havruta* learning in the traditional way started in Yeshiva, a religious institution. Learning and discussion in the space surrounded by books provide spiritual stability and comfort to students.

Positive results have also been reported in studies discussing the effects of *havruta* learning on the affective domain. For example, Kang and Lee (2016) applied *havruta* learning to science class in the fourth grade. The improvement in learning attitude was statistically significant in the experimental group. Lim (2019) adopted *havruta* learning to nursing students in adult nursing for a semester. The study confirmed that learning satisfaction increased at the significance level in the experimental group.

3. Research Methods

Meta-analysis uses the systematic and quantitative approach that integrates the results of empirical studies to validate the effectiveness of a particular topic. It is a statistical method useful for converting results from primary studies into a common metric and for drawing conclusions when study results vary (Rosenthal & Schisterman, 2010).

Cooper (2015) introduced two advantages of meta-analysis. First, it can provide objective and accurate information and research trends to researchers by integrating results from a large number of studies. Second, the integration of results is not influenced by the reviewer's interpretation or use of the findings.

This study follows the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009) and the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2019).

3.1 Eligibility

The purpose of this study is to synthesize quantitative studies reporting the effects of *havruta* learning. The author investigated the effects of *havruta* learning adopting experimental or quasi-experimental designs, since interventional studies primarily aim to establish the effects of procedures (Meline, 2006).

The keywords and descriptors used in the data search include *havruta* or *havruta* learning OR effect or impact. The author searched international databases such as Scopus, Web of Science, Google Scholar, and ProQuest Dissertations & Theses (PQDT) and collected journal articles, book chapters, master's theses, and doctoral dissertations. Rosenthal (1979) argued that researchers should strive to include unpublished information in the data collection process for meta-analysis; an essential process for finding information in the "file drawer". Search results included English, Korean, and Chinese. In the first screening stage, the author checked the title, abstract, and keywords.

The following criteria were applied to find appropriate primary studies for meta-analysis: (1) investigated *havruta* learning in formal education and post-secondary education, (2) were implemented in school settings, (3) applied six *havruta* practices such as listening, articulating, wondering, focusing, supporting, and challenging, (4) reported educational outcomes as dependent variables such as cognitive and affective outcomes, and (5) provided quantitative or statistical data such as mean, standard deviation, and a number of participants. Primary studies not included in the meta-analysis had at least one of the following criteria: (1) provided only qualitative data, (2) included correlation or linear relationships between variables, and provided insufficient data required for calculating an effect size.

The number of records identified through database search was 429: 308 journal articles and 121 book chapters, conference papers, theses, and dissertations. Of these, 38 studies were eliminated based on title and abstract. At the second screening, 373 studies in full texts did not meet the inclusion criteria. Finally, 18 primary studies were selected for data analysis (Figure 1). All studies were taken from journal papers.

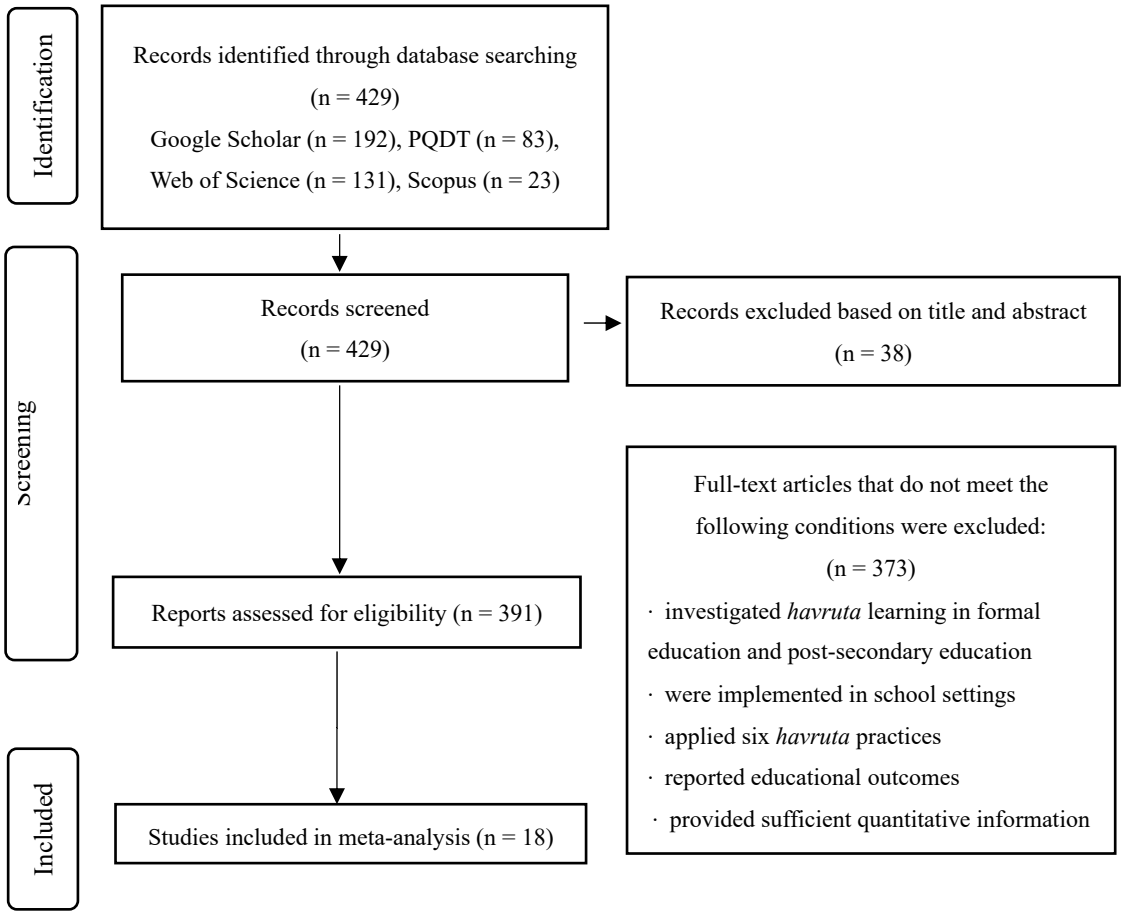

Figure 1. PRISMA Flowchart

A summary of the included 18 studies containing specified characteristics is reported in Table 1.

Table 1. Main Characteristics of Primary Studies Included in This Meta-analysis

Study	Research Design	School Level	Duration (weeks)	Frequency of Session	Orientation Training	Subject Areas	Educational Outcomes
Joung and Choi (2015)	Non-equivalent Control Group	College	12	6	No	Education	C
Hur (2016)	Non-equivalent Control Group	College	12	12	Yes	Education	C
Kang and Lee (2016)	Non-equivalent Control Group	Elementary	12	12	No	Science	C, A
Go et al. (2017)	Non-equivalent Control Group	College	13	26	No	Education	C, A
Kang and Cho (2017)	One Group	Secondary	-	5	Yes	Social sciences	C
Lim and Ahn (2017)	Non-equivalent Control Group	Kindergarten	8	8	No	Mathematics	C, A
Kim (2018)	Non-equivalent Control Group	College	5	5	Yes	Computer science	C, A

Study	Research Design	School Level	Duration (weeks)	Frequency of Session	Orientation Training	Subject Areas	Educational Outcomes
Yoo et al. (2018)	Non-equivalent Control Group	Kindergarten	12	24	No	Engineering	C
Cho and Lee (2019)	One Group	Secondary	15	15	Yes	Engineering	C
Kim (2019)	One Group	College	-	5	Yes	Computer science	C
Lim (2019)	Non-equivalent Control Group	College	12	12	Yes	Health science	C, A
Eom and Lee (2020)	One Group	College	-	4	Yes	Science	C, A
Ha and Lee (2020)	Non-equivalent Control Group	College	6	6	No	Health science	C
Jang (2020)	One Group	College	4	4	Yes	Health science	C, A
Lee (2020)	Non-equivalent Control Group	College	15	15	Yes	Health science	C, A
Chung (2021)	One Group	College	7	7	No	Health science	A
You (2021)	Non-equivalent Control Group	Kindergarten	10	10	No	Liberal arts	C, A
Joung and Kim (2022)	One Group	College	12	12	No	Liberal arts	C

Discription: C = cognitive domain; A = affective domain

3.2 Coding Reliability

The author independently coded 18 primary studies that met the inclusion criteria with two professors majoring in curriculum and instruction. Before coding, all coders developed a coding manual. It includes author, publication year, quantitative information for effect size calculation, study characteristics, methodological characteristics, design characteristics, and outcome characteristics. Coders extracted data, coded, and verified results together to maintain the reliability of the coding process. The results of the inter-rater reliability analysis showed a high level of 0.87. Discrepancies were resolved through discussion.

3.3 Data Analysis

Comprehensive Meta-Analysis (CMA) Version 2 was used to calculate effect size and 95% confidence intervals. The author adopted the formula below to calculate the pre-post effect sizes of the experiment and control groups. Formulas are as follows (Higgins et al., 2019).

$$g^{trt} = \frac{Y_{trt} - X_{trt}}{S_x}, \qquad g^{crt} = \frac{Y_{crt} - X_{crt}}{S_x} \tag{1}$$

Y_{trt} is the mean of the post-test of the experiment group. X_{trt} refers to the mean of the pre-test of the experiment group. Y_{crt} is the mean of the post-test of the control group. X_{crt} indicates the mean of the pre-test of the control group. S_x indicates the standard deviation of the pre-test mean between the experiment and the control group.

The following formula $\Delta = g^{trt} - g^{crt}$ is used to measure the effect size. The variance of the measured effect size is calculated by the formula below.

$$Var(g^{trt}) = \frac{4(1 - r^{trt}) + (g^{trt})^2}{2n^{trt}}, \qquad Var(g^{crt}) = \frac{4(1 - r^{crt}) + (g^{crt})^2}{2n^{crt}} \tag{2}$$

R is the correlation coefficient between the pre-post test scores in the experiment and the control group. The standard error of the measured effect size can be obtained as the square root of the variance.

Overall effects were weighted by the inverse of the variance. The author adopted a random-effects model for the main effect and moderator analyses since heterogeneity was found by visual inspection of forest plots and by calculating Q statistic and I^2 statistic (Cooper, 2015). A study was used as a unit to calculate overall effect size while the effect size was used as a unit to conduct moderator analyses according to shifting unit of analysis (Cooper, 2015).

The author referred to two studies to interpret the effect size. Cohen (2013) recommended 0.2 as small, 0.5 as moderate, and 0.8 as large. Wolf (1986) explained that an effect size of 0.25 or more was educationally significant, and an effect size of 0.50 or more was clinically significant.

4. Results

4.1 Description of Effects

The 18 studies with 1,214 subjects were reported between 2015 and 2022. The statistical method provided 181 effect sizes. Since multiple outcomes exist within a study, reviewers should be careful about the dependence of any study outcomes.

4.2 Overall Analysis

Figure 2 shows the descriptive statistics for all 18 studies and includes forest plots, variances, and standard errors. The forest plot identifies the precision of each study by the length of the confidence interval. The effect size of each sample was represented by each square dot. The horizontal line represents the confidence interval for each estimate. The diamond at the bottom right indicates the overall effect size of all studies. According to the forest plot, the standard error was 0.099, the variance was 0.01, and the 95% confidence interval ranged from 0.629 to 1.018.

The results of the homogeneity test are as follows. The effect sizes for the primary studies were heterogeneous (Q = 1217.029, df = 180, p <.001, I^2=85.21).

The effect of *havruta* learning was 0.824 standard deviations (Figure 2), which had a large effect size and was clinically significant.

Study name	Subgroup within study	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Cho & Lee, 2019	Combined	1.498	0.112	0.013	1.278	1.718	13.351	0.000
Chung, 2021	Combined	0.349	0.038	0.001	0.275	0.423	9.246	0.000
Eom& Lee, 2020	Combined	0.166	0.026	0.001	0.115	0.218	6.322	0.000
Go et al., 2017	Combined	0.499	0.069	0.005	0.364	0.633	7.253	0.000
Ha & Lee, 2020	Combined	0.360	0.099	0.010	0.166	0.555	3.635	0.000
Hur, 2016	Combined	0.840	0.063	0.004	0.717	0.963	13.357	0.000
Jang, 2020	Combined	0.131	0.028	0.001	0.076	0.186	4.694	0.000
Joung & Choi, 2015	Combined	0.600	0.121	0.015	0.363	0.837	4.959	0.000
Joung & Kim, 2022	Combined	0.566	0.088	0.008	0.395	0.738	6.468	0.000
Kang & Cho, 2017	Combined	0.942	0.080	0.006	0.784	1.099	11.732	0.000
Kang & Lee, 2016	Combined	0.382	0.061	0.004	0.264	0.501	6.307	0.000
Kim, 2018	Combined	2.041	0.259	0.067	1.534	2.547	7.890	0.000
Kim, 2019	Combined	0.752	0.076	0.006	0.603	0.901	9.918	0.000
Lee, 2020	Combined	0.640	0.114	0.013	0.416	0.863	5.613	0.000
Lim& Ahn, 2017	Combined	0.435	0.089	0.008	0.260	0.611	4.865	0.000
Lim, 2019	Combined	0.181	0.118	0.014	-0.050	0.413	1.535	0.125
Yoo et al., 2018	Combined	2.220	0.256	0.066	1.717	2.722	8.656	0.000
You, 2021	Combined	3.283	0.185	0.034	2.921	3.645	17.761	0.000
		0.824	0.099	0.010	0.629	1.018	8.291	0.000

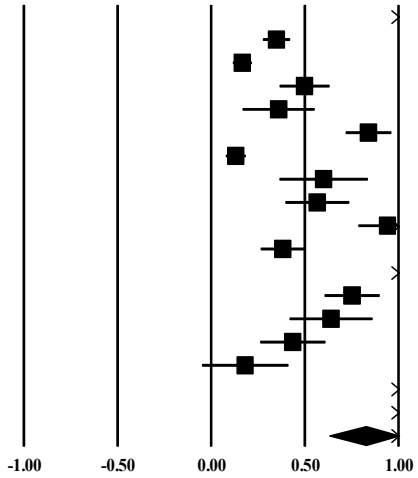

Figure 2. Forest Plots for 18 Studies

4.3 Moderator Analyses

The author performed the analyses to identify the source of variability and moderators, which affect the direction and difference among moderators (Cooper, 2015).

Table 2. Moderator Analyses by Study, Methodological, Design, and Outcome Characteristics

Moderator	Categories	k	ES	SE	-95% CI	+95% CI	QBetween
School Level	Kindergarten	22	0.147	0.054	0.041	0.253	109.811***
	Elementary	12	3.258	0.483	2.311	4.204	
	Secondary	52	0.876	0.090	0.699	1.053	
	College	95	0.738	0.057	0.626	0.851	
Student Ability	Full range	135	0.577	0.040	0.498	0.656	48.747***
	Gifted & Talented	46	2.061	0.209	1.652	2.469	
Instruction	Online	7	0.566	0.088	0.395	0.738	1.691
	Offline	174	0.693	0.043	0.609	0.777	

Moderator	Categories	k	ES	SE	-95% CI	+95% CI	QBetween
Professional Development	Yes	150	0.741	0.048	0.648	0.835	10.017**
	No	31	0.493	0.062	0.371	0.615	
Orientation Training	Yes	105	0.704	0.057	0.593	0.815	0.277
	No	76	0.661	0.060	0.543	0.778	
Publication Year	2015~2018	67	0.596	0.056	0.485	0.706	3.924*
	2019~2022	114	0.752	0.055	0.644	0.860	
Type of Research Design	One Group	104	0.564	0.049	0.468	0.661	6.472*
	Non-equivalent Control Group	77	0.786	0.072	0.645	0.926	
Sample Size	1-50	98	1.292	0.093	1.110	1.475	82.942***
	More than 50	83	0.378	0.037	0.305	0.452	
Duration of Treatment	Less than 5 weeks	15	0.133	0.081	-0.026	0.293	75.744***
	5-8 weeks	26	0.470	0.070	0.333	0.607	
	9-12 weeks	50	0.922	0.097	0.732	1.112	
	More than 12 weeks	62	1.241	0.121	1.004	1.477	
Frequency of Session	Less than 11	85	0.558	0.050	0.460	0.657	12.397***
	More than 10	96	0.858	0.069	0.723	0.992	
Domains of Learning	Cognitive domain	143	0.763	0.050	0.665	0.860	9.207**
	Affective domain	38	0.486	0.077	0.336	0.636	
Cognitive Domain	Achievement score	3	2.600	0.976	0.686	4.514	261.418***
	Communication skill	31	1.011	0.141	0.734	1.288	
	Computational thinking	5	0.987	0.102	0.788	1.186	
	Creativity	17	0.692	0.103	0.491	0.893	
	Critical thinking	37	0.470	0.084	0.305	0.636	
	Logical thinking	7	0.433	0.128	0.183	0.684	
	Problem-solving	19	0.702	0.092	0.522	0.882	
	Self-regulation	6	2.126	.551	1.046	3.207	
Affective Domain	Empathy	3	3.892	0.312	3.281	4.503	307.358***
	Learning attitude	12	0.285	0.042	0.202	0.367	
	Learning satisfaction	7	0.551	0.114	0.327	0.775	
	Self-efficacy	9	0.261	0.075	0.114	0.408	
	Self-esteem	6	0.203	0.130	-0.052	0.457	
Subject Areas	Education	32	0.659	0.072	0.519	0.800	169.686***
	Liberal arts	14	1.889	0.315	1.271	2.507	
	Social sciences	6	1.317	0.280	0.769	1.866	
	Computer science	10	0.989	0.158	0.679	1.298	
	Engineering	48	2.058	0.196	1.673	2.443	
	Health science	32	0.257	0.055	0.150	0.364	
	Mathematics	13	0.441	0.108	0.230	0.652	
	Science	26	0.214	0.031	0.274	0.529	

Discription: k = number of effect size, ES = effect size, SE = standard error, CI = confidence interval, *p<0.05, **p<0.01, ***<0.001

4.3.1 Effect Sizes in Study Characteristics

Variables related to study characteristics were school level, student ability, instruction, professional development, orientation training, and the publication year (Table 2). At the school level, the results ranked in the descending order of elementary school (3.258), secondary school (0.876), college (0.738), and kindergarten (0.147). For student ability, the effect size of gifted and talented students (2.061) was larger than that of the full range of students (0.577). Regarding instruction, the effect size of offline (0.693) was larger than that of online (0.566). In professional development, the effect size of educators having prior experience in professional development (0.741) was larger than that of teachers who had not participated in professional development (0.493). For orientation training, the effect size of yes (0.704) was larger than that of no (0.661). Yes means that at the beginning of the study, the teacher explained to students the meaning and process of *havruta* learning. Regarding publication year, the result for 2019~2022 (0.752) was larger than that of 2015~2018 (0.596).

4.3.2 Effect Sizes in Methodological Characteristics

The types of research design and sample size were variables related to methodological characteristics (Table 2). Regarding type of research design, the data in primary studies had two different formats. The effect size of non-equivalent control group (0.786) was larger than that of one group (0.564). For sample size, the effect sizes of 1-50 participants (1.292) and more than 50 participants (0.378) were in descending order.

4.3.3 Effect Sizes in Design Characteristics

Variables related to design characteristics were duration of treatment and frequency of session (Table 2). For duration of treatment, the results ranked in the descending order of more than 12 weeks (1.241), 9-12 weeks (0.922), 5-8 weeks (0.47), and less than five weeks (0.133). For frequency of session, the effect size of more than 10 sessions (0.858) was larger than that of less than 11 sessions (0.558).

4.3.4 Effect Sizes in Outcome Characteristics

Variables related to outcome characteristics were domains of learning, cognitive domain, affective domain, and subject areas (Table 2). For domains of learning, the effect size of the cognitive domain (0.763) was larger than that of the affective domain (0.486). For the cognitive domain, the results ranked in the descending order of achievement score (2.6), self-regulation (2.126), communication skill (1.011), computational thinking (0.987), problem-solving (0.702), creativity (0.692), critical thinking (0.47), and logical thinking (0.433). In the affective domain, the effect sizes ranked in the descending order of empathy (3.892), learning satisfaction (0.551), learning attitude (0.285), self-efficacy (0.261), and self-esteem (0.203). For subject areas, the results ranked in the order of engineering (2.058), liberal arts (1.889), social sciences (1.317), computer science (0.989), education (0.659), mathematics (0.441), health science (0.257), and science (0.214).

4.4 Publication Bias

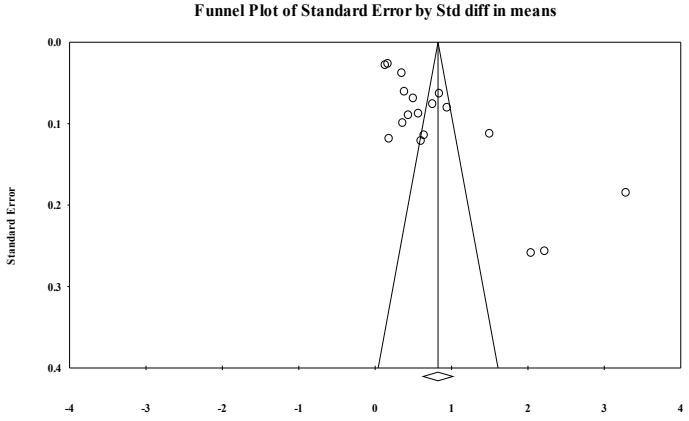

Figure 3. Funnel Plot

The author adopted three methods such as the funnel plot, the Trim and Fill test, and Orwin's fail-safe N test to investigate the publication bias. First, the funnel plot was asymmetrical in Figure 3. Second, the Trim and Fill test showed that the adjusted value was equivalent to the observed value, indicating the absence of publication bias

(Duval & Tweedie, 2000). Third, the author calculated Orwin (1983)'s fail-safe N. It means the number of missing studies needed to bring the estimated effect size value under 0.2, which is a criterion for a trivial effect. The total effect size for 18 papers is 0.824 in this study. According to Orwin's fail-safe N, 26 studies showing no effect at all are necessary for the effect size of this study to be 0.2. Therefore, there is no publication bias for the overall effect size. In summary, visual inspection of the funnel plot and outcomes of statistical analyses suggest that publication bias is unlikely in the current study.

5. Discussion and Conclusion

5.1 Discussion

This study implemented a meta-analysis to examine effects of *havruta* learning on students' cognitive and affective outcomes. Since no study has systematically reviewed the outcomes of *havruta* learning, this study is the first to attempt to summarize the quantitative effects of *havruta* learning through a meta-analysis. The author analyzed 18 primary studies taken from journal papers.

Responding to the first research question, what is the overall effect size of *havruta* learning? The author found the overall effect was 0.824 which was a large effect size. This result can be a basis for empirically supporting the opinion of Segal (2003), who theoretically discussed the effect of *havruta* learning. In addition, this finding can be recognized as important information confirming that *havruta* learning is effective for student development. Teomim-Ben Menachem and Livnat (2021) explained that this is because students learn better with the guidance and help of peers than when they study alone. Kang and Lee (2016) argued that because students perceive *havruta* learning as a new type of instruction, students are more interested and engaged, which contributes to improving student achievement. More teacher attention and effort are needed to ensure that students are actively engaged in *havruta* learning to increase their effectiveness (Holzer, 2015). The finding is noteworthy since systematic evidence for the effectiveness of *havruta* learning has not yet been thoroughly studied for international audiences.

As for the second research question, what are effect sizes of moderator analyses by study characteristics, methodological characteristics, design characteristics, and outcome characteristics? The findings from moderator analyses revealed that differences in effect size were statistically significant depending on categorical variables.

Discussions on study characteristics are as follows. First, the results ranked in the order of elementary school (3.258), secondary school (0.876), college (0.738), and kindergarten (0.147) at the school level. The result is similar to the research finding that the effect is higher than that of secondary schools because elementary school students actively participate in cooperative learning (Tomlinson, 2021). Some secondary school students who have accumulated learning failures from elementary school tend to have low learning motivation and attitude and can participate passively in class (Alegre Ansuategui & Moliner Miravet, 2017). Also, the older the students, the more they judge that competition is more advantageous than cooperation (Katz et al., 2021). Therefore, it is necessary to teach students the advantages of interaction through the history of *havruta* learning. Educators may also induce active participation of students by applying performance evaluation (Kim, 2019).

Second, the effect size of gifted and talented students (2.061) was larger than that of the full range of students (0.577) at student ability. Gifted and talented students can objectively and accurately understand their level of content knowledge and learning styles (Tibken et al., 2022). They recognize their strengths and weaknesses related to learning and listen to the explanations and opinions of their peers. Therefore, the effect of *havruta* learning would be relatively high because gifted and talented students instantly reflect the results of interaction in their study and improve their problem-solving ability. Also, even when a full range of students participated in *havruta* learning together, the effect size was still moderate. Based on this finding, it is possible to organize students at different levels into the same group so that underachieving students can learn problem-solving strategies from gifted and talented students.

Third, regarding instruction, the effect size of offline *havruta* learning (0.693) was larger than that of online *havruta* learning (0.566). Although the difference in effect size between the two instructional methods was not statistically significant, it is interesting that both methods had moderate effect sizes. Since online classes have expanded due to COVID-19, there are concerns that teachers cannot interact positively with students, and academic achievement has declined (Yoon, 2022). In general, this is because of the perception that offline education is more suitable for student development. However, the findings of this study show that the effect can increase depending on how online classes are operated. The author recommends researchers conduct qualitative research on students' perceptions and analyze the effects of *havruta* learning.

Fourth, in professional development, the effect size of educators (0.741) who had professional development experience for *havruta* learning was larger than that of teachers who did not participate in professional development (0.493). This finding means that teachers who have acquired various information on the definition, procedure, and operational strategies of *havruta* learning are more effective when planning and implementing instructions (Kent, 2010; Segal, 2003). To strengthen students' competences to prepare for the future, teachers strive to investigate various instructional methods and introduce effective teaching and learning practices. *Havruta* learning could be recognized and explored as a new pedagogical opportunity. School districts may provide teachers with information about *havruta* learning, offer educational programs and workshops, and encourage teachers to participate.

Fifth, the effect size between 2019 and 2022 (0.752) was higher than that between 2015 and 2018 (0.596) according to the year of publication. The finding means that recently reported studies are more effective. It may be due to a growing awareness of *havruta* learning and the sharing of relevant information and strategies. In terms of research, it is meaningful that recent studies showed relatively higher effects in empirical data exploring *havruta* learning. Continuous interest and efforts of researchers and practitioners are required to maintain this phenomenon.

Discussions on methodological characteristics are as follows. First, the effect size of the non-equivalent control group (0.786) was larger than that of one group (0.564) according to the type of research design. The finding suggests that researchers adopt a sound methodology when analyzing intervention effects. A more robust type, quasi-experimental research design, has seen a rapid proliferation in education since 2009 (Gopalan et al., 2020). Therefore, researchers are encouraged to adopt the quasi-experimental research design when exploring the effects of *havruta* learning in the future.

Second, the effect size between 1 and 50 participants (1.292) was larger than that of more than 50 participants (0.378) for sample size. The student interaction effect is relatively large in small groups. The more opportunities students have to discuss with classmates, the greater the effectiveness. Tombak and Altun (2016) argued that interaction with fewer students in a group showed high levels of satisfaction and effects.

Discussions on design characteristics are as follows. According to the duration of treatment, the effect size of 12 weeks or more (1.241) was the largest, followed by 9-12 weeks (0.922), 5-8 weeks (0.47), and less than five weeks (0.133). In addition, the effect size of 10 sessions or more (0.858) was larger than that of less than 11 sessions (0.558) for the frequency of sessions. Combining these results, the effect size of *havruta* learning was larger in the category with the highest duration and frequency. Reviewing all the primary studies included in this meta-analysis (Table 1), the author found that researchers previously applied *havruta* learning for a minimum of 4 weeks and a maximum of 15 weeks. When educators integrate *havruta* learning into their school curriculum, it is desirable to operate it throughout the semester. Lee (2020) recommends that educators apply for at least one semester or more so that students can recognize the characteristics of the new instructional method, adapt to the process, and understand content knowledge in depth.

Discussions on outcome characteristics are as follows. First, according to domains of learning, the effect size of the cognitive domain (0.763) was larger than that of the affective domain (0.486). In *havruta* learning, students simultaneously assume the roles of teacher and student, understand each other's perspectives, and experience mutually beneficial intellectual activities through empathy and collaboration. Segal (2003) explains that the benefit is not giving a person a fish, but teaching a person to fish. Meanwhile, peer support in a difficult and complex process of learning can help improve cognition, affection, and social relationship.

Second, according to the cognitive domain, achievement score (2.6) had the largest effect size, followed by self-regulation (2.126), communication skill (1.011), computational thinking (0.987), problem-solving (0.702), creativity (0.692), critical thinking (0.47), and logical thinking (0.433). The finding of the achievement score supports Kim (2018)’s discussion that academic achievement increases with the acquisition of knowledge and problem-solving ability through cooperative activities in *havruta* learning. Also, the large effect size for self-regulation is related to the preparation of students to enhance the effectiveness of *havruta* learning. Students prepare for class through self-regulation and judgment that their efforts will help their peers learn, although preparing for class is hard (Segal, 2003). In addition, the large effect size of the communication skill is due to continuing conversations and discussions with peers in class (Eom & Lee, 2020). An essential element of communication is to express one's ideas clearly through oral and written language and understand the other person's intention accurately. The good communication skill is necessary to figure out information more quickly and accurately. This competence is considered critical in real-life situations. Teachers may listen to how students communicate in *havruta* learning and, if necessary, provide additional guidance on how to improve it.

Third, according to the affective domain, the effect sizes ranked in the order of empathy (3.892), learning satisfaction

(0.551), learning attitude (0.285), self-efficacy (0.261), and self-esteem (0.203). In summary, empathy and learning satisfaction are relatively high. The largest effect size of empathy is because students' understanding of thoughts and feelings of others improves during *havruta* learning (Kent & Cook, 2014). In addition, learning satisfaction indicates the impact of processes students experience while participating in education. The result of satisfaction is usually pleasure or displeasure as comparative outcomes between students' expectations and recognized service. In *havruta* learning, students consider themselves leaders and strive to achieve learning outcomes, which improve their satisfaction with the process and results of learning. Understanding that learning satisfaction is an important variable in measuring school performance (Wu et al., 2015), teachers should pay attention to *havruta* learning. If researchers conduct an in-depth study of the mechanisms by which *havruta* learning improves learning satisfaction, the results will provide implications for the consumer-oriented model of teaching and learning.

Fourth, according to subject areas, the results ranked in the order of engineering (2.058), liberal arts (1.889), social sciences (1.317), computer science (0.989), education (0.659), mathematics (0.441), health science (0.257), and science (0.214). In summary, the effects of *havruta* learning are found in various subject areas regardless of the academic discipline. Interestingly, engineering has the largest effect size. This finding is contrary to Holzer and Kent (2013)'s opinion that a larger effect size could be observed in the humanities and social sciences, which emphasize cooperative interaction and discussion among students. Segal (2003) also discussed that *havruta* learning is more effective in the humanities and social sciences, given that the method is known as powerful in studying holy texts. However, this research demonstrates that *havruta* learning is critical in exploring the physical and natural world and applying scientific knowledge. Therefore, the author recommends practitioners recognize the potential of *havruta* learning and integrate it into various subject areas in curriculum.

5.2 Implications and Recommendations for Practice and Research

The results of this study have implications for practice. First, educators may integrate *havruta* learning into various subject areas. This integration would strongly support teachers in improving students' cognitive and affective development in the classroom. The second suggestion is for educators to participate in professional development before adopting *havruta* learning. As it is a unique instructional method, educators must understand the definition and three pairs of core practices. Third, the author also recommends that the teacher conducts orientation training for students. The effect increases when students recognize multiple phases of *havruta* learning and apply them accurately in class. School districts may offer educational workshops and training programs and encourage teacher engagement. Fourth, the teacher needs to keep the number of students in a group as low as possible. It is desirable to increase interaction between students. A more active learning environment can enhance student satisfaction and the effectiveness of instruction. Fifth, the duration and frequency should be as high as possible while educators design the instruction. The author recommends applying *havruta* learning for at least one semester. Students need to be exposed to more opportunities for peer interaction in the classroom.

Suggestions for future studies are as follows. First, the author recommends the synthesis of previously conducted qualitative studies. Meta-syntheses of qualitative research will provide a meaningful theoretical foundation for *havruta* learning and help researchers and educators understand it more deeply. Second, quantitative research in art, music, and physical education is needed. Researchers may apply sound research methods such as quasi-experimental research design. They need to report the mean, standard deviation, and the number of participants required to calculate the effect size. Third, researchers need to conduct additional research in an online learning environment. Even after COVID-19, educators will still find online classes important and useful (Yoon, 2022). Even if face-to-face classes are fully implemented, online education is highly likely to be used in schools due to its advantages. This circumstance explains why researchers should conduct research on how to improve the implementation and effectiveness of online *havruta* learning. Fourth, teacher educators may conduct research and practice in pre-service teacher education. *Havruta* learning is effective in elementary and secondary schools. Pre-service teachers should acquire relevant knowledge and hands-on experience in advance.

5.3 Limitations

The author believes that this study provides a comprehensive and reliable foundation for *havruta* learning. However, this study has limitations to be considered. First, 18 primary studies were reviewed for meta-analysis. I hope more primary studies will be conducted to analyze and discuss the various results. Second, this study reviewed primary studies adopting the experimental design. Quantitative studies also include studies that report correlational data. Future studies should attempt to analyze correlational data for additional understanding. Third, the results of multiple moderator analyses could be misleading. The moderator analysis is not based on randomized comparisons. Higgins et al. (2019) recommend researchers decrease the critical value to .01 to control the Type 1 error. Readers should

interpret the findings in this study with caution.

5.4 Conclusion

Although studies in *havruta* learning have been reported, rigorous evaluation of its effectiveness has not yet been conducted. This study synthesizes the effects of *havruta* learning through systematic review and meta-analysis. As a result of this study, *havruta* learning is effective at multiple school levels and subject areas and is a factor in improving students' abilities in cognitive and affective domains. In addition, the author analyzed the effect size according to the variables of methodological and design characteristics. Educators and school administrators may develop effective and efficient *havruta* learning programs based on the findings of this study. The author hopes that *havruta* learning allows students to experience successful learning in school and achieve their goals.

5.5 Recommendation

First, researchers need to consider conducting future studies in subject areas such as physical education to investigate the effect of *havruta* learning in the psychomotor domain. No study has been published on the effect of the psychomotor domain in *havruta* learning through statistical analysis. Kang (2017) reported findings from a qualitative study that students taking physical education classes experienced positive learning experiences, such as understanding content knowledge, class participation, and physical performance. Future studies will help to accumulate research in the psychomotor domain and provide more implications for researchers.

Second, future studies should include qualitative meta-syntheses on the effect of *havruta* learning. While selecting primary studies for data analysis, the researcher could find previous studies that analyzed the effect of *havruta* learning by applying qualitative research methods. Qualitative data can help researchers deeply understand the nature of interactions and feelings of participants in *havruta* learning. Therefore, future studies should synthesize qualitative findings.

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