Utilization meta-analysis to identify the convenience of eBooks (visual and audio) for learning

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ABSTRACT

This research aims to conclude the influence of eBooks in the learning process throughout the world. The meta-analysis design taken was a group contrast between control and experimental groups with a random effect size model. The criteria used are time "data published 2018–2023," published in English, type of publication is a quantitative research article, the research design is a difference between control and experimental groups, containing complete data "mean, sample size, and standard deviation," and recorded in the Scopus database. Data collection was guided by the PRISMA method. The results of the analysis showed that the data were heterogeneous and free from publication bias. The results of the analysis showed that there was a large "positive" effect as indicated by a p-value <0.001<5% "95% confidence interval" and a total effect size=0.86 [0.61; 1.11]. It can be concluded based on the latest findings that eBooks have an equally good effect on all conditions which are influenced by the type of competency developed, the eBook information base, the type of eBook, and class size.

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1. INTRODUCTION

In the last few decades, technological developments have developed rapidly [1]. Among various technologies, the development of information technology has exerted extraordinary dominance on social life [2]. Things that were previously difficult to imagine can be realized by sophisticated information technology [3]. Until now, almost all people have been exposed to information technology through various derivatives, for example, the most familiar is the internet [4]. Based on a survey conducted by the Reuter Institute in collaboration with the University of Oxford, in 2023, many countries in the world will have internet penetration rates that have exceeded 90%, some of which even show very high figures, such as Norway and Denmark at 98%, South Korea and Sweden at 97%, and Switzerland at 95% [5]. If internet penetration is so large, there will be even more gadget and personal computer (PC) users in the world.

Such a situation shows a great opportunity to carry out digital transformation. Digital transformation can bring various things into efficient integration [6]. The process goes through digitization until digital transformation is realized [7]. This era brings various kinds of physical information transformed into digital information. In this way, various sources of information can spread more widely [8] and very quickly [1]. This era also marks the trend for printed books began to shift to electronic books. Apart from being

influenced by environmental issues, technological support is one of the main aspects that supports the continued development of the world of electronic book development.

Electronic books are defined as books in digital format that can be accessed through a screen [9]. The concept of electronic books emerged at the dawn of computers. However, at the beginning of the discovery of computers, they were not accessible to everyone, and the development of electronic books was slow [10]. However, in recent years, the spread of devices to access the internet and eBooks has reached various levels of society. The proof is the very high internet penetration in every country [5]. eBooks become common and more relevant in various countries, especially developed countries with higher device and internet usage. In some countries, eBooks are used to replace printed books [9].

According to research results, the use of eBooks in various countries shows a positive impact [9], [11]–[13]. eBooks "audio and visual" are a solution during the coronavirus disease 2019 (COVID-19) pandemic [14]. eBooks have the advantage of fast distribution and very efficient financing. In this way, it can reach a wider community [10]. Apart from that, the development of eBooks makes it easier for a particular person to find information and interact with various sciences [15].

However, not all research shows a positive response to eBooks. Some findings showed that 71.4% of students reported a low level of satisfaction with eBooks [4]. Several studies stated that students reported being more comfortable reading printed books [16]. There are at least two big problems that hinder the use of eBooks, namely the limited battery life of each device [17] and eye problems when reading for a long time [17]–[19]. Based on the two paragraphs above, there are advantages and disadvantages of using eBooks in the learning process. Thus, it is necessary to carry out a representative inference process to create a general overview of the trend in the influence of eBooks.

One of the methods that can be used to conclude is meta-analysis. To date, there have been several studies related to concluding the influence of eBooks in education using meta-analysis methods. The first research showed that the use of eBooks has a positive influence on mathematics learning with an effect size of 0.82. This research only specifically investigated the impact on mathematics learning [9]. The second research showed that there is no significant difference in the influence of eBooks in increasing students' literacy levels [20]. Third research showed that printed books are more recommended than eBooks for improving reading ability. However, the researcher added that the flow of digitalization is so fast that avoiding eBooks and sticking to printed books is not a good idea [21].

Thus, this research tries to provide a more comprehensive answer regarding the influence of eBooks in the learning process. Data collection will be carried out without focusing on one particular subject so it is expected that it will produce a more comprehensive general picture. Related to the influence on location, subject, grade, type, competency, information base, eBook implementation era, and class size will be specifically analyzed as moderator variables. In this way, it is hoped that the results of this research will produce more complete and comprehensive information so that it can be used as a basis for making various policies in various locations and school characteristics.

2. METHOD

A study related to the benefits of using electronic books in learning was carried out using the meta-analysis method. The meta-analysis method is a method that can be used to summarize various previous research results [22], [23]. In this way, meta-analysis will help researchers to conclude general conditions based on the results of research conducted by previous researchers [1]. The keyword in meta-analysis research is finding the total effect size [24] which in this research is a representation of the influence of the role of electronic books on the results of the learning process.

2.1. Research procedures and data sources

The data source in this research is articles published in Scopus-indexed journals. To ensure the data source criteria, the data collection process was carried out in the Scopus portal, namely *https://www.scopus.com*. Scopus was determined as a database because it considered the quality of the research data to be analyzed. One of the shortcomings of meta-analysis is the researcher's inability to control the quality of each data. Thus, being selective in data selection is one of the most effective ways to ensure data quality. To accommodate these considerations, the Scopus database was chosen with the assumption that Scopus has a journal quality control mechanism that has a direct impact on the quality of published articles.

Data collection was carried out at *https://www.scopus.com* by rotating and combining keywords relevant to the selected theme, namely "impact," "effect," "eBook," "audiobook," "achievement," "outcome," and "learning." To obtain broad and exploratory search results, researchers used logic based on Boolean operators "AND, OR" as a link between various keywords. Search results on *https://www.scopus.com* are then selected based on the inclusion and exclusion criteria set by the researcher. The researcher will only take data

that meets all the specified inclusion criteria. Articles that do not meet the criteria "meet at least one of the exclusion criteria" will be excluded from the data to be analyzed. Table 1 is a profile of the inclusion and exclusion criteria in this study.

To control the Scopus database-based data search process, this research utilizes the PRISMA data search model. The PRISMA model helps researchers recapitulate data and helps readers trace the data collection process [25]. In this way, every data collection process can be accounted for. Figure 1 contains a PRISMA diagram showing the data collection process.

In the screening process, researchers obtained 15 articles that met all inclusion criteria. However, several articles contain more than 1 data, such as research conducted by Phadung and Dueramae [12] which found that the use of eBooks influences students' knowledge and skills. Another example is research conducted by Saputri *et al.* [13] which found that eBooks influence a student's knowledge and attitudes. Thus, the 15 articles collected produced 47 data which can be used as meta-analysis material to show the influence of eBooks on the learning process. The following is a summary of the research data analyzed in this meta-analysis in Table 2.

Table 1. Inclusion and exclusion criteria

Aspect	Inclusion criteria	Exclusion criteria	Aspect	Inclusion criteria	Exclusion criteria
Year	2018 - 2023	Else	Data component	Sampel size, mean, and standard deviation	Does not load one, two, or all three
Language	English	Else	Analysis data	Quantitative	Qualitative
Articles type	Research article	Else	Theme	The influence of eBooks on learning	Else
Data type	Quantitative	Qualitative	Data base	Scopus	Else
Research design	Group contrast	Else	Research model	Control and experiment	Does not load either or both
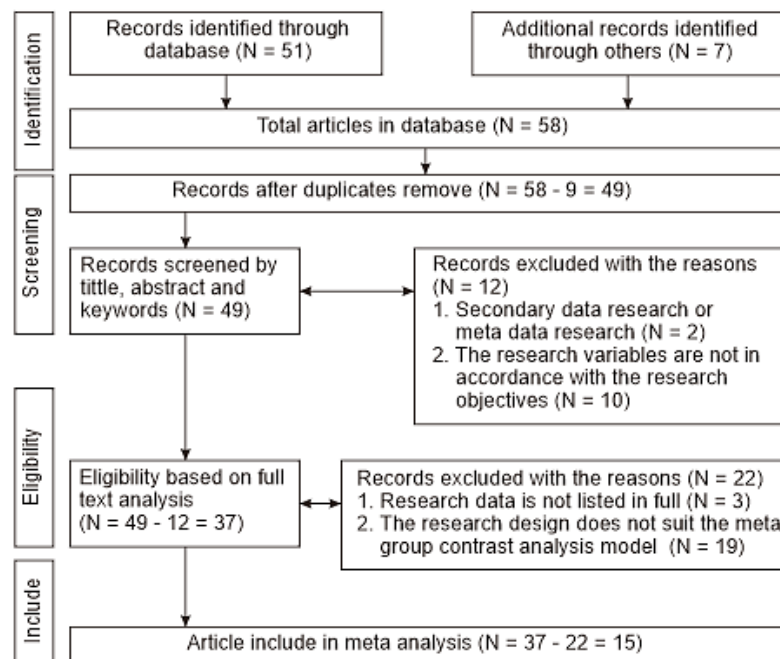
Figure 1. PRISMA data selection

2.2. Test prerequisites and publication bias

Based on the characteristics of the data collected, it can be concluded that the data varies. These conclusions are based on data from various countries, and various grades, and carried out at various times. Thus, the appropriate meta-analysis research model based on these characteristics is the random effect mode. However, to get a strong justification, statistical proof needs to be carried out [26]. The assumption test model used was the Q, T^2, and I^2 parameter method. Using three methods at once is expected to produce strong justification. The conclusion criteria used were heterogeneous data when p-val Q<0.05 "5% error," T^2 is more than 0 [27], and I^2 is 75%-100% substantial heterogeneity [28].

Table 2. Summary of data

Study	ID	Nc	Mc	SDc	Ne	Me	SDe	Study	ID	Nc	Mc	SDc	Ne	Me	SDe
[29]_1	S001	30	18.53	2.78	30	21.2	2.66	[30]_5	S025	25	91.41	32.93	48	107.63	18.03
[29]_2	S002	30	18.33	2.91	30	21.2	2.66	[31]_1	S026	95	20.67	6.79	108	20.64	7.32
[29]_3	S003	30	16.83	1.3	30	18.97	2.33	[31]_2	S027	124	16.23	8.42	141	18.57	9.96
[29]_4	S004	30	17.63	1.38	30	18.97	2.33	[31]_3	S028	137	88.71	13.5	121	86.85	11.46
[29]_5	S005	30	18.2	1.38	30	19.93	1.44	[32]_1	S029	26	3.77	1.9	25	5.56	2.69
[29]_6	S006	30	17.43	1.04	30	19.93	1.44	[32]_2	S030	28	4.68	2.96	28	9.04	1.8
[12]_1	S007	26	6.54	2.77	28	7.29	2.12	[32]_3	S031	26	6.12	1.88	25	7.84	1.38
[12]_2	S008	26	6	2.59	28	6.5	2.02	[32]_4	S032	28	6.77	1.49	28	8.76	0.95
[12]_3	S009	26	5.08	2.54	28	7.5	1.03	[33]_1	S033	30	14.2	4.02	31	19.29	3.01
[13]_1	S010	30	13.7	2.09	30	15.97	2.13	[33]_2	S034	18	11.72	2.29	14	17.57	2.62
[13]_2	S011	30	60.13	8.89	30	69.07	8.87	[34]_1	S035	48	38.48	19.08	42	67.38	18.39
[35]	S012	59	64.75	8.8	59	81.69	10.19	[34]_2	S036	40	62.63	20.88	42	67.38	18.39
[36]_1	S013	12	3.88	0.48	15	4.46	0.36	[34]_3	S037	48	4.07	0.69	42	4.16	0.6
[36]_2	S014	7	3.14	0.64	15	4.46	0.36	[34]_4	S038	40	4.08	0.66	42	4.16	0.6
[36]_3	S015	12	3.39	0.3	15	3.91	0.57	[34]_5	S039	48	3.78	0.9	42	3.96	0.66
[36]_4	S016	7	3.33	0.63	15	3.91	0.57	[34]_6	S040	40	4	0.72	42	3.96	0.66
[36]_5	S017	12	3.82	0.61	15	3.61	0.56	[37]	S041	34	4.94	2.13	32	6.53	2.37
[36]_6	S018	7	2.81	0.62	15	3.61	0.67	[38]_1	S042	14	135.29	25.39	14	162.92	25.57
[11]_1	S019	25	25.39	5.9	25	36.25	3.45	[38]_2	S043	14	8	1.36	14	8.64	0.93
[11]_2	S020	36	23.61	3.45	36	36.25	2.32	[38]_3	S044	14	2.92	0.35	14	2.94	0.43
[30]_1	S021	25	64.6	19.41	48	65.49	16.43	[39]	S045	30	68	14.86	30	48.8	16.52
[30]_2	S022	25	73.64	18.95	48	77.32	16.39	[40]_1	S046	30	75.27	8.89	30	83.73	6.91
[30]_3	S023	25	66.64	23.51	48	72.08	17.59	[40]_2	S047	30	68.7	6.17	30	75.9	4.54
[30]_4	S024	25	81.45	30.03	48	92.77	15.63								

Then, in addition to assuming heterogeneity to support the choice of a random or fixed model, researchers need to guarantee that the data is free from publication bias. Proving freedom from bias uses identification based on funnel plots and the Fail-Safe N formula. Identification of freedom of publication bias in funnel plots is based on the symmetry of the point distribution. Meanwhile, determining freedom of publication bias can be based on the Fail-Safe N formula, namely the file-safe value N>5K+10 where K is the amount of data [41].

2.3. Determine the effect of size

This research model is a group contrast model of standardized experimental and control design. The standardization process is needed to produce proportional aggregates because the scale of the data collected varies [22]. After the standardization process is carried out, the data can be calculated to find the effect size d. However, to minimize bias, the effect size and standardized error were transformed using the recommended formula [42]. The analysis process was assisted by R software with the meta and metaphor packages. Then the total effect size findings can be classified as in Table 3 [43].

Table 3. Effect size categories results of meta-analysis of contrast group mode

Effect Size	Category
0–0.19	No effect
0.20–0.49	Small
0.50–0.79	Medium
0.80–1.29	Large
Above 1.30	Very large

2.4. Moderator variable analysis

The moderator variable is another variable that can be used to provide a more in-depth explanation regarding the general description of the role of eBooks in the learning process. The moderator variable will be able to provide a deeper meaning related to the total effect size findings. In this study, 8 moderator variables were used as material for interpretation, namely subject, grade, type, competency, information base, eBook implementation era, and class size. The technique for inferring various moderator variables utilized analysis of variance (ANOVA)-like analysis techniques. The results of an ANOVA-like analysis provided detailed information on the position of each category of moderator variables. Interpretation criteria were based on the p-value. If the p-value <5% "95% confidence level" then it shows significant differences between categories in the moderator variable group. Table 4 is a description of each moderator variable.

Table 4. Moderator variables

Mod Var	Category	f	%	Mod Var	Category	f	%	Mod Var	Category	f	%
Subject	Language	24	51.1%	Competence	Attitude	10	21.3%	Grade	Kindergarten	4	8.5%
	Social science	3	6.4%		Knowledge	24	51.1%		Elementary	26	55.3%
	Natural science	6	12.8%		Skill	13	27.7%		Junior high school (JHS)	4	8.5%
	Math	14	29.8%	Era	Pre covid	22	46.8%		Senior high school (SHS)	8	17.0%
Type	Interactive	16	34.0%		Covid	19	40.4%		University	5	10.6%
	Non-Interactive	31	66.0%		Post covid	6	12.8%	Based	Visual	40	85.1%
									Audio	7	14.9%

3. RESULTS AND DISCUSSION

By considering the character of the data, the data analyzed in this study was heterogeneous. However, statistical proof is needed to ensure the heterogeneity of the data. The first proof of heterogeneity was shown by the T^2 statistic. The analysis results showed $T^2 = 0.6458$ [0.4323; 1.1569] > 0 so the data was heterogeneous. The second proof was based on I^2 statistics. Based on the analysis, it was identified that $I^2 = 88.4\%$ [85.4%; 90.8%] so that the data was heterogeneous and fell into the substantially heterogeneous category. The third proof was based on the Q statistic. The p-value of Q was very small, it is close to 0, so the data was heterogeneous. Based on the three methods, it can be concluded that the data was heterogeneous so the characteristic assumptions were supported by statistical evidence. Thus, the selection of the random effect model was appropriate to use in data analysis in this research.

3.1. Publication bias

Another test that must be carried out is the freedom of data from publication bias. Proving the freedom of data from publication bias was carried out using two methods, namely funnel plot and Fail-Safe N. The results of the analysis produced a funnel plot image as in Figure 2.

In general, the point image on the funnel plot showed a symmetrical distribution. However, funnel plot-based visual identification has an element of subjectivity because the distribution of points was not symmetrical. Thus, the claim of a symmetric point distribution can be debated. Therefore, the claim of symmetrical distribution was proven using the Fail-Safe N calculation using the Rosenthal approach method. The analysis results showed that the Fail-Safe value was N=6171 "95% confidence level." The conclusion criterion for freedom from publication bias is if N>5K+1 "N is the Fail-Safe N value and K is the number of studies/data." With K=47 then 5K+1=236, which is far below N=6171. Based on these criteria, the assumption of a symmetric point distribution was supported by the Fail-Safe N value which showed that the data was free from publication bias. Freedom from publication bias indicates that the data from the analysis can be trusted in describing the influence of using eBooks in the learning process.
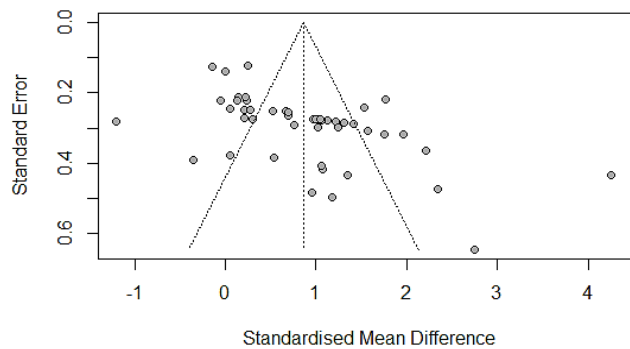
Figure 2. Funnel plot

3.2. Total effect size

After the assumptions were proven, the researcher carried out an analysis process to find the effect size for each study and the total effect size. The results of the effect size profiles and standard errors from each study were found and became the basis for determining the total effect size. The results of the analysis showed the total effect size with the random model was 0.86 [0.61; 1.11] with a p-value <5% "95% confidence interval." It indicated that there was a positive use of eBooks on learning outcomes. If put into categories, the total effect size showed that there was a large effect [43]. In more detail, the results of the analysis can be seen in the forest plot in Figure 3.

Study	Experimental Total	Mean	SD	Control Total	Mean	SD	Standardised Mean Difference	SMD	95%-CI	Weight (common)	Weight (random)
S045 2020	30	48.80	16.52	30	68.00	14.86		-1.21	[-1.76; -0.65]	1.7%	2.2%
S017 2018	15	3.61	0.56	12	3.82	0.61		-0.35	[-1.12; 0.42]	0.9%	2.0%
S028 2018	121	86.85	11.46	137	88.71	13.50		-0.15	[-0.39; 0.10]	8.9%	2.4%
S040 2021	42	3.96	0.66	40	4.00	0.72		-0.06	[-0.49; 0.38]	2.8%	2.3%
S026 2018	108	20.64	7.32	95	20.67	6.79		-0.00	[-0.28; 0.27]	7.0%	2.4%
S044 2020	14	2.94	0.43	14	2.92	0.35		0.05	[-0.69; 0.79]	1.0%	2.0%
S021 2020	48	65.49	16.43	25	64.60	19.41		0.05	[-0.43; 0.53]	2.3%	2.2%
S038 2021	42	4.16	0.60	40	4.08	0.66		0.13	[-0.31; 0.56]	2.8%	2.3%
S037 2021	42	4.16	0.60	48	4.07	0.69		0.14	[-0.28; 0.55]	3.1%	2.3%
S022 2020	48	77.32	16.39	25	73.64	18.95		0.21	[-0.27; 0.70]	2.3%	2.2%
S008 2018	28	6.50	2.02	26	6.00	2.59		0.21	[-0.32; 0.75]	1.9%	2.2%
S039 2021	42	3.96	0.66	48	3.78	0.90		0.22	[-0.19; 0.64]	3.1%	2.3%
S036 2021	42	67.38	18.39	40	62.63	20.88		0.24	[-0.20; 0.67]	2.8%	2.3%
S027 2018	141	18.57	9.96	124	16.23	8.42		0.25	[0.01; 0.49]	9.1%	2.4%
S023 2020	48	72.08	17.59	25	66.64	23.51		0.27	[-0.21; 0.76]	2.3%	2.2%
S007 2018	28	7.29	2.12	26	6.54	2.77		0.30	[-0.24; 0.84]	1.9%	2.2%
S024 2020	48	92.77	15.63	25	81.45	30.03		0.52	[0.03; 1.01]	2.2%	2.2%
S043 2020	14	8.64	0.93	14	8.00	1.36		0.53	[-0.22; 1.29]	0.9%	2.0%
S025 2020	48	107.63	18.03	25	91.41	32.93		0.67	[0.17; 1.16]	2.2%	2.2%
S004 2023	30	18.97	2.33	30	17.63	1.38		0.69	[0.17; 1.21]	2.0%	2.2%
S041 2017	32	6.53	2.37	34	4.94	2.13		0.70	[0.20; 1.20]	2.2%	2.2%
S029 2018	25	5.56	2.69	26	3.77	1.90		0.76	[0.19; 1.33]	1.6%	2.2%
S016 2018	15	3.91	0.57	7	3.33	0.63		0.95	[-0.00; 1.90]	0.6%	1.8%
S001 2023	30	21.20	2.66	30	18.53	2.78		0.97	[0.43; 1.51]	1.9%	2.2%
S011 2020	30	69.07	8.87	30	60.13	8.89		0.99	[0.46; 1.53]	1.8%	2.2%
S002 2023	30	21.20	2.66	30	18.33	2.91		1.02	[0.48; 1.56]	1.8%	2.2%
S031 2018	25	7.84	1.38	26	6.12	1.88		1.02	[0.44; 1.61]	1.6%	2.1%
S046 2021	30	83.73	6.91	30	75.27	8.89		1.05	[0.51; 1.59]	1.8%	2.2%
S042 2020	14	162.92	25.57	14	135.29	25.39		1.05	[0.25; 1.85]	0.8%	1.9%
S010 2020	30	15.97	2.13	30	13.70	2.09		1.06	[0.52; 1.60]	1.8%	2.2%
S015 2018	15	3.91	0.57	12	3.39	0.30		1.07	[0.25; 1.89]	0.8%	1.9%
S003 2023	30	18.97	2.33	30	16.83	1.30		1.12	[0.57; 1.67]	1.8%	2.2%
S018 2018	15	3.61	0.67	7	2.81	0.62		1.17	[0.20; 2.15]	0.6%	1.8%
S005 2023	30	19.93	1.44	30	18.20	1.38		1.21	[0.66; 1.76]	1.7%	2.2%
S009 2018	28	7.50	1.03	26	5.08	2.54		1.25	[0.66; 1.83]	1.6%	2.1%
S047 2021	30	75.90	4.54	30	68.70	6.17		1.31	[0.75; 1.87]	1.7%	2.2%
S013 2018	15	4.46	0.36	12	3.88	0.48		1.35	[0.50; 2.20]	0.7%	1.9%
S033 2017	31	19.29	3.01	30	14.20	4.02		1.42	[0.85; 1.98]	1.7%	2.2%
S035 2021	42	67.38	18.39	48	38.48	19.08		1.53	[1.05; 2.00]	2.4%	2.2%
S032 2018	28	8.76	0.95	28	6.77	1.49		1.57	[0.97; 2.17]	1.5%	2.1%
S030 2018	28	9.04	1.80	28	4.68	2.96		1.75	[1.13; 2.38]	1.4%	2.1%
S012 2019	59	81.69	10.19	59	64.75	8.80		1.77	[1.34; 2.20]	2.9%	2.3%
S006 2023	30	19.93	1.44	30	17.43	1.04		1.96	[1.34; 2.59]	1.4%	2.1%
S019 2018	25	36.25	3.45	25	25.39	5.90		2.21	[1.50; 2.93]	1.0%	2.0%
S034 2017	14	17.57	2.62	18	14.72	2.29		2.34	[1.41; 3.27]	0.6%	1.8%
S014 2018	15	4.46	0.36	7	3.14	0.64		2.75	[1.48; 4.01]	0.3%	1.5%
S020 2018	36	36.25	2.32	36	23.61	3.45		4.25	[3.40; 5.10]	0.7%	1.9%
Common effect model	**1711**			**1562**				**0.60**	**[0.52; 0.67]**	**100.0%**	**—**
Random effects model								**0.86**	**[0.62; 1.11]**	**—**	**100.0%**

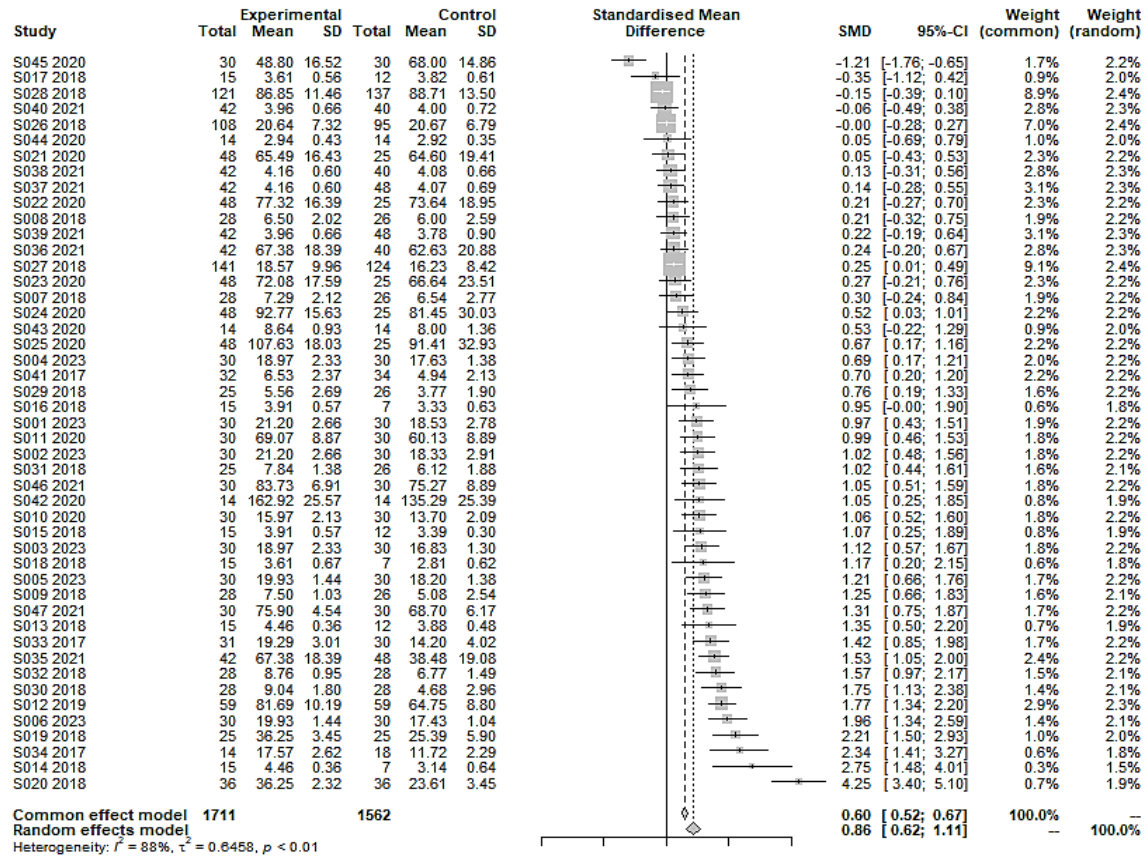Heterogeneity: $I^2 = 88\%$, $\tau^2 = 0.6458$, $p < 0.01$

Figure 3. Forest plot

The meta-analysis findings are in line with several previous studies [9], [44], [45] which stated that the use of eBooks makes a positive contribution to student performance in the learning process. This positive effect is related to the ease and flexibility of eBooks in presenting learning content to their users. Apart from that, eBooks that have interactive features can also make learning time more efficient as well as grow and strengthen the connection between users and the learning content in the eBook.

3.3 Moderator variables analysis

The general description of the positive influence of using eBooks on the learning process can be followed up with an analysis of other variables. In this study, other variables that were also analyzed were categorized into moderator variables, namely subject "language, social sciences, natural science, and mathematics," grade "kindergarten, elementary, junior high school, senior high school, university," type "interactive and not interactive," competencies developed "attitudes, knowledge, and skills," era "pre covid, covid and post covid," and class size "small and large." The results of the moderator variable analysis were summarized in the forest plot in Figure 4. The results of the moderator variable analysis in Figure 4 showed various conditions for each variable. Researchers found that from 2018 to 2023, research on the influence of the use of eBooks on the learning process was carried out on three continents, namely Asia, America, and Europe.

The second moderator variable, namely subjects, showed that there were differences in the positive effects of eBooks in terms of each subject because p-value=0.03<0.05 "95% confidence level." If we look at the effect size for each category, it shows that the positive effect of eBooks on the science, social studies, and mathematics subject groups is relatively same. Meanwhile, the positive effect of eBooks for the language learning subject was relatively lower than for the other three subjects. This happens because each subject has different characteristics, so the positive effect of eBooks on learning in each subject also varies. Language subjects have a more complex range of learning dimensions compared to science, social studies, and mathematics. The competencies and skills developed in language subject learning are more comprehensive, including reading, listening, writing, and speaking in a wider context [46]. Apart from that, the use of eBooks in language learning tends to be involved in developing basic literacy aspects, namely reading [20].
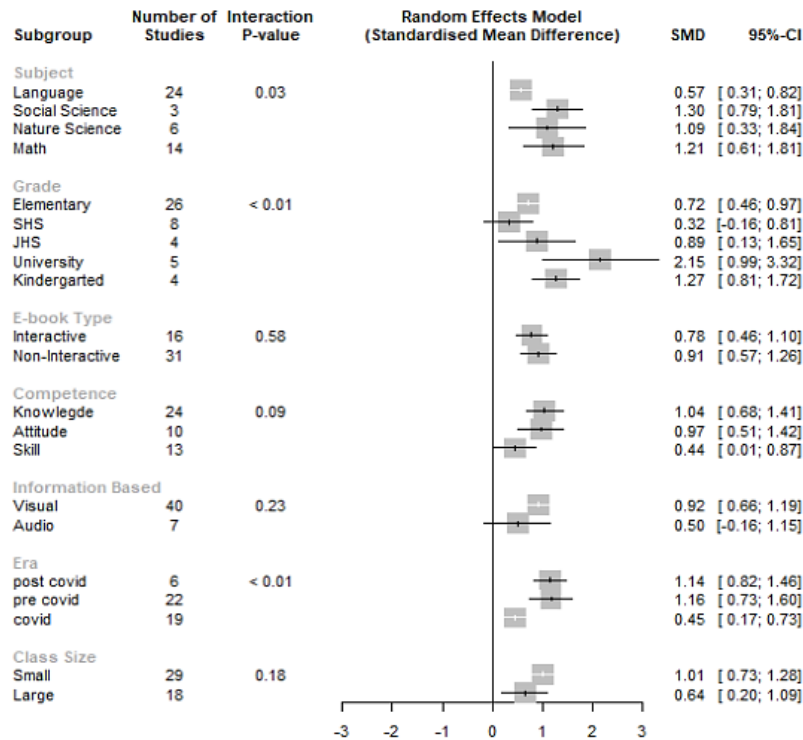
Subgroup	Number of Studies	Interaction P-value	Random Effects Model (Standardised Mean Difference)	SMD	95%-CI
Subject					
Language	24	0.03		0.57	[0.31; 0.82]
Social Science	3			1.30	[0.79; 1.81]
Nature Science	6			1.09	[0.33; 1.84]
Math	14			1.21	[0.61; 1.81]
Grade					
Elementary	26	< 0.01		0.72	[0.46; 0.97]
SHS	8			0.32	[-0.16; 0.81]
JHS	4			0.89	[0.13; 1.65]
University	5			2.15	[0.99; 3.32]
Kindergarted	4			1.27	[0.81; 1.72]
E-book Type					
Interactive	16	0.58		0.78	[0.46; 1.10]
Non-Interactive	31			0.91	[0.57; 1.26]
Competence					
Knowlegde	24	0.09		1.04	[0.68; 1.41]
Attitude	10			0.97	[0.51; 1.42]
Skill	13			0.44	[0.01; 0.87]
Information Based					
Visual	40	0.23		0.92	[0.66; 1.19]
Audio	7			0.50	[-0.16; 1.15]
Era					
post covid	6	< 0.01		1.14	[0.82; 1.46]
pre covid	22			1.16	[0.73; 1.60]
covid	19			0.45	[0.17; 0.73]
Class Size					
Small	29	0.18		1.01	[0.73; 1.28]
Large	18			0.64	[0.20; 1.09]

Figure 4. Interaction and forest plot of moderator variables

Educational level was also one of the moderator variables which showed a p-value <0.01<0.05 "95% confidence level." It means that there were differences between categories. The university category was the category with the highest eBook effect compared to other categories. The intensive use of technology, especially eBooks in learning requires users to be autonomous in learning. At the university level, students can use cognitive and metacognitive learning strategies according to preferences [47] to increase learning achievement, one of which is by using technology, namely eBooks.

The next moderator variable was interactive and non-interactive eBooks. The analysis results showed that p-value=0.58>0.05 "95% confidence level." The results of this analysis showed that there was no difference in the effects of interactive and non-interactive eBooks. Both types have almost the same effect. It is supported by previous research which states that interactive and non-interactive eBooks both have a positive impact on learning outcomes [48] regardless of whether there are interactive features in them or not.

The balance of competency development is one of the widely studied issues nowadays. Balanced development of attitudes, knowledge, and skills is a target set by many governments in the world. Data in the networking process also showed variations in the expected outcomes from using eBooks. The analysis results indicated that p-value=0.09>0.05 "95% confidence level." It means that there were no significant differences between categories. A more contextual conclusion showed that eBooks have the same influence when used to improve learning outcomes in the domains of attitudes, knowledge, and skills. This is because eBooks were developed to expand the reach of learning in the classroom into virtual form [49] so that they have a balanced focus on the domains of attitudes, knowledge, and skills.

Recently, books consisted of two information bases, namely visual and audio. Visual eBooks are a duplication of conventional "printed" books in virtual form. Meanwhile, audio eBooks are the conversion of visual books into audio-based or other formats with structured scientific content like books delivered by narrators. Current technological sophistication makes the opportunities for providing inclusive education even greater. The combination of visual and audio gives sensory disabilities options that suit their comfort in accessing information. The analysis results showed that p-value=0.23>0.05 "95% confidence level." It indicates that audio eBooks and visual eBooks provide the same positive impact on the learning process. Therefore, although audio and visual eBooks support the achievement of learning objectives in different ways and different aspects [50], in general, the learning objectives to be achieved are integral, complementary, and cannot be separated from each other.

The research results were classified into 3, namely the pre-covid period "before 2020," the COVID period "2020 – 2021," and the post-covid period "2022 and above." Education in the last 6 years has been very dynamic due to the 2019 Covid pandemic. The learning process has changed so quickly from offline,

online, blended, back to offline. These certainly have a lot of influence on students' and teachers' behavior. The results of the analysis showed a p-value <0.01<0.05 "95% confidence level," which means there was a difference in the influence of eBooks on the learning process before COVID-19, during COVID-19 and after COVID-19. The implementation of eBooks during the Covid period was a period when the positive influence of eBooks was relatively small compared to the period before and after Covid. During the COVID-19 pandemic, the emergence of various new digital communication tools occurred massively to deal with distance learning conditions. Digital technology used for learning is categorized into several groups such as social media, messengers, video conferences, letters, and connecting tools [51]. Thus, it makes teachers and students utilize various forms of digital communication tools as learning intermediaries that are selected and adapted to their needs, so they are not only focused on eBooks.

The last moderator variable was class size which was used to identify the suitability of the eBook based on the number of students in the class. The results of the analysis showed that the number of students in the class was not a variable that had a positive impact. This conclusion was based on the p-value =0.18>0.05 "95% confidence level." In using eBooks, digital tools tend to be used individually and personally [52]. Moreover, the use of eBooks is only related to the availability of facilities and infrastructure so the number of students in the class is not a determining variable.

4. DISCUSSION

This research shows that eBooks have a positive influence on student learning outcomes in general. For more in-depth information, it can be explored by paying attention to the results of the moderator variable analysis. The results of the moderator variable analysis show that eBooks have an equally good influence when viewed from the subject aspect "the lowest effect is in language lessons even though it is still in the positive category," school level "the greatest effect of eBooks used for studying at universities," and implementation time "the use of eBooks does not have much of an effect during the pandemic." Apart from that, the results of the analysis found that eBooks had an equally good effect when viewed from the type of eBook, the competencies developed, the information base, and the number of students in one class.

These findings complement various research conducted by several previous researchers. Wijaya et al. [9] in their meta-analysis study found that eBooks had a positive influence on mathematics and STEM learning outcomes. Egert et al. [53], with meta-analysis, found that the use of eBooks has a positive impact on the process of caring for pre-school children. More specifically, it was stated that the eBook activity was also superior to the activity of reading printed story books. Meta-analysis results that were similar to those of Egert et al. were also found by Savva et al. [54] with subjects of grade 2 students and Swanson with subjects of grade 12 students [20]. Thus, the general description of this research is accompanied by detailed findings based on moderator variables, providing enrichment to the results of previous research.

There is one finding that is beyond the expectations of the general mindset, namely that there is no difference between interactive and non-interactive books. Logically, interactive books can make students more active [55]. Apart from that, learning motivation and endurance also become more manageable [56]. However, the findings from the analysis show something different. This is part of the limitations of meta-analysis research which makes researchers unable to confirm findings that are considered unusual [23]. The rational search for findings can be traced through various literature or research results [57]. The rationale for why interactive and non-interactive eBooks do not provide significant differences is the situational conditions of the learning process and the quality of the interactive eBook. No matter how good the learning media is, if the learning situation does not support it then the results will not be optimal [58]. Apart from that, the quality of interactive eBooks can also be a cause. Creating media that can provide maximum positive effects is certainly not easy. If it is produced with poor quality, the effect on learning may not be optimal [59].

Based on the results of this meta-analysis research, there is a strengthening of the argument that eBooks have a positive influence on learning. The policy to develop various eBooks is one solution to strengthening the quality of the educational process. An in-depth study is needed regarding the production of quality eBooks so that the potential for student learning outcomes can be maximized. Every subject and every level of education definitely has unique characteristics that must be adapted [22].

5. CONCLUSION

Meta-analysis research to conclude the influence of eBooks on the learning process uses a random effect model due to the heterogeneous characteristics of the data which is confirmed by statistics T^2, I^2, and Q. The data collected and analyzed showed that it is free from publication bias with the safe N File. Thus, the data is feasible to proceed to meta-analysis. The results of the analysis showed that there is a large "positive"

effect as indicated by a p-value <0.001<5% "95% confidence interval" and a total effect size = 0.86 [0.61; 1.11]. In a more in-depth investigation through moderator variable analysis, the results were found that: i) in America, eBooks did not have greater influence as in Asia and Europe; ii) the language learning group did not have significant influence as in the science, social studies and mathematics groups; iii) universities are the best level for implementing eBooks; iv) during the COVID era eBooks did not have a big influence; and v) there were no differences for each category in the type of competency developed, eBook information base, eBook type, and class size. It can be stated from the latest findings that eBooks have an equally good effect on all conditions which are influenced by the type of competency developed, the eBook information base, the type of eBook, and class size.

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