Effect of Science Teaching Materials Integrated Blended-PBL Models on Students' 21st Century Skills: A Meta-Analysis

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Abstract: The objective of the study was to analyze the effect size of a number of similar studies on students' 21st century skills. The research method can be classified into meta-analysis. In this meta-analysis method, the effect size of each similar study was determined and the hypotheses were tested from a number of similar studies. In this study, 26 similar articles were analyzed from national journals and international journals. As independent variables are science teaching materials, as moderator variables are types of teaching materials, learning models, and level of education. From the results of the analysis, it can be stated that science teaching materials have a positive effect on 21st century skills based on the type of teaching materials, learning models, and educational level. Therefore, the use of science teaching materials is effective for improving students' 21st century skills both in terms of various types of teaching materials, learning models, and educational levels.

Keywords: Blended learning; PBL; Teaching materials; The 21st century skills

Introduction

Twenty first century skills are needed by students to achieve success both in learning and in everyday life. The 21st century skills that need to be developed are critical thinking, creative, collaboration and communication skills (Mardhiyah, 2021; Andayani, 2018). Students achieve success by applying those skills. Critical thinking skills are able to apply scientific assessments of something new to student personalities (Astiwi, 2020). Creative thinking skills appear in solving problems with high creativity (Qomariyah, 2021). Collaboration skills are shown in working together in groups being able to accept other people's opinions in order to achieve the same goal (Sufajar, 2022). Communication skills see the relationship between learning material, reflect on learning material and construct it in simple delivery (Noviyana, 2019). By using 21st century skills students encourage student

learning abilities in dealing with the times. Therefore, it is necessary to implement appropriate learning to promote 21st century skills.

Implementation of learning should be based on the essential principles of 21st century learning. One of the essentials of 21st century learning is meaningful learning (Srihandayani, 2023). Learning is said to be meaningful learning if students like the learning process and leave meaningful experiences for these students (Krismanto, 2023). During the learning process students can solve and solve problems with pleasure and interest in learning (Lestari, 2020; Widodo, 2017). One way to make learning more meaningful is to apply problem-based learning. The problem-based learning process is learning using the problem-based learning model (Saputra, 2021). Problem Based Learning (PBL), namely student-centered learning, students learn actively in solving problems with a happy and calm heart. Problem based learning encourages students to be active and

learn to develop themselves into lifelong learning according to the independent curriculum.

Learning in the independent curriculum is relevant to 21st century learning. An independent curriculum demands learning to grow the character, potential and quality of students (Lutfiana, 2022; Wiryanto, 2022). Learning that fosters character by applying the Pancasila profile in project-based learning (Dewi, 2022; Kefi, 2022). Students' potential is explored by concentrating on important things and exploring basic skills such as 21st century skills (Lestari, 2021). The quality of students is seen from the understanding of content and learning situations during learning (Nofiana, 2017). The content presented is developed by educators in such a way that learning has high quality. Content in learning can also be developed using technology so that learning is not monotonous.

The application of information technology is needed to support student-centered learning and learning that takes into account the needs of students. The use of technology in learning is a novelty. Updates adapted to technological developments (Asrizal, 2023). Learning that can be done online and offline without reducing the meaning of the learning process itself (Yusri, 2021; Asrizal, 2022). The learning in question is Blended Learning (BL). In learning with blended learning, students can freely use technology in learning to make it more meaningful (Perdan, 2020). Blended Learning is able to develop students' skills by combining learning in offline classes and online classes. Thus, appropriate learning resources are needed to carry out this BL learning.

The learning process that is fun and attracts students' attention to learning cannot be separated from the learning resources used. Learning resources used by students can be in the form of teaching materials such as E-Modulees, e-books and worksheets (Malina, 2021; Vitrianingsih, 2021). These teaching materials can be integrated with learning models so that they are neatly arranged and easily understood by students. Teaching materials can be developed by educators according to student characteristics and combining them with technology (Yani, 2021). By using teaching materials students are able to find learning resources easily, solve problems and evaluate independently (Aisyah, 2020). Thus, teaching materials are urgently needed in BL learning in the independent curriculum and support the attainment of 21st century skills.

However, many studies indicate that students' 21st century skills are still low. The results of an initial study conducted by reviewing literature articles related to the influence of Problem Based Learning (PBL) and Blended Learning (BL) models on 21st century skills. Many publications discuss the influence of teaching materials on 21st century skills. Teaching materials are integrated with the PBL model able to form students' critical thinking skills (Endaryati, 2023; Hasanah, 2021; Islamiah, 2018). Some research results state that there is an influence of problem-based learning model teaching materials on students' creative skills (Hartini, 2014; Batlolona, 2019). Teaching materials that are integrated with the blended model have a positive influence on 21st century skills (Harahap, 2019). However, it is different from the results of the study which stated that there was no effect of using integrated PBL model teaching materials on increasing student skills (Tinedi, 2015). The difference in the results of this study became a reference for researchers to meta-analyze the effect of teaching materials integrated with PBL and BL models on 21st century skills.

Several researchers have offered solutions to problems in science teaching materials integrating PBL models, blended learning models, and PBL blended models. The learning process by combining the two PBL and BL models will create an update and solution to the above problems. One of the efforts to improve 21st century skills is by applying the PBL and BL models. The PBL-BL model has the potential to improve 21st century skills (Triyanto, 2016; Nismawati, 2019). PBL-BL learning helps solve problems with scientific literacy skills and 21st century skills (Amalia, 2017). PBL-BL learning is supported by technology and the internet in finding learning resources that help the student learning process.

Teaching materials assist the learning process in complementing student learning resources. Teaching materials contain subject matter that can help students in the learning process. The content of teaching materials is developed according to the material to be made interesting so that students are interested in learning and using it (Sriwahyuni, 2019). Teaching materials are developed to increase student knowledge, improve student attitudes and improve student skills (Susilowati, 2017). Teaching materials include subject matter, images, video, audio, animation and other interactive media (Rahim, 2019). Good teaching materials are teaching materials that can attract students' attention and increase students' knowledge. The presentation of the content of teaching materials is made simple, interesting, clear and easy for students to understand (Adawiyah, 2022). Students can learn actively in working on group assignments, discussions and other projects. Students can evaluate and reflect on learning and relate knowledge to their experiences (Indriati, 2017). The use of technology in teaching materials can increase the attractiveness and involvement of students in learning. Teaching materials developed in accordance with the objectives in solving problems can be integrated with problem-based learning models.

Problem based learning is learning in the process of solving real world problems using a scientific approach. The problem solving learning process can develop critical and creative thinking skills, problem solving, and collaboration (Azizah, 2022). Problem-based learning can increase students' knowledge in making the relevance of lessons so as to create solutions to problems (Ramdani, 2019). The role of students is active in solving problems, identifying relevant information, and proposing solutions (Jamaluddin, 2019). Students learn independently under the guidance of educators. Students can increase their sense of responsibility seen from making decisions in solving problems. Students are encouraged to apply concepts, theories and skills in solving problems (Masril, 2019). The skills created in problem-based learning are thinking skills at the level of analysis, synthesis, evaluation, reasoning and problem solving (Dewi, 2016). Problem-based learning can involve students actively in learning, encourage critical thinking, problem-solving skills and prepare students to face the real world.

Blended learning is learning that combines the use of digital technology with face-to-face learning in the classroom. In the learning process blended learning applies that students can access teaching materials online such as e-learning, online discussion forums, online presentations, as well as interactive modules (Rahmadi, 2021). The benefits of blended learning can make learning more flexible (Febriyana, 2022). Students can study anywhere according to their needs. Educators will be more creative in developing teaching materials by adjusting the level of difficulty, learning speed and student learning styles. The learning material presented is more interesting with videos, animations, simulations and other interactive media (Dwiqi, 2020). Interaction between educators and students through digital media, such as online discussions, project collaboration and providing online or offline responses (Hikmawati, 2021). Blended learning optimizes time and place so that learning can be done online or offline without missing evaluation and monitoring sessions. Evaluation and monitoring can also be carried out through an online platform (Fauziyah, 2022). Blended learning has proven to be effective in improving learning outcomes, developing 21st century skills and technological skills (Habibah, 2022; Handayani, 2020). Educators also consider the limited access to the internet in several places, and the uneven use of the internet for students.

Solutions from several previous researchers have some limitations. The limitations of previous researchers only discussed one teaching material (Nyeneng, 2021). Research on the influence of teaching materials is fixated on one teaching material only (Tinedi, 2015). There is no apparent measure of the relationship between teaching materials and students' 21st century skills. Only discusses one learning model such as problem-based learning or blended learning, also only focuses on one skill. Based on the problems, a meta-analysis of the influence of the PBL and BL models was carried out on students' 21st century skills. This study with effect size analysis aims to: analyze the effect of the use of integrated teaching materials in the PBL-BL model in terms of the types of teaching materials, analyze the effect of the use of integrated teaching materials in learning models on 21st century skills in terms of variations in the PBL model and BL models. analyze the effect of the PBL-BL model in terms of educational level, analyze the effect of using integrated teaching materials the PBL model and the BL model on 21st century skills.

A comprehensive study of the effects of integrated science teaching materials in the blended-PBL model needs to be carried out. The PBL model applies active students in learning, students are able to solve problems with real experience in the learning process. Blended learning can be chosen because learning will be more flexible because it is done offline and online. With the rapid development of technology, it will be a loss if it is not utilized in learning. The use of technology in learning is in accordance with the blended model that utilizes digital technology. Problem solving skills can be developed in learning using problem based learning models. Thus, it is necessary to conduct a meta-analysis of the effect of integrated science teaching materials on the blended-PBL model on improving 21st century skills.

Method

The research method can be classified into meta analysis. Meta-analysis is a type of systematic review research (Ridwan, 2021). Systematic review is a research method by analyzing findings from previous studies. Meta-analytic research was carried out by analyzing data on articles to produce effect sizes. Research data that can be analyzed is quantitative data in the findings of the article. Meta-analysis research on the effect of integrated teaching materials on the blended-problem based learning model on improving 21st century skills.

At the data collection stage from the Google Scholar database, 2301 search results were obtained and then 26 articles were selected that matched the criteria. Article selection was carried out according to inclusion and exclusion criteria. The criteria used in selecting articles for this meta-analysis were taken from national and international journals. Inclusion criteria in this study included: search keywords namely "teaching materials" "Problem Based Learning", "blended learning" and "critical thinking skills" "creative thinking skills" and articles published between 2013-2023 as well as articles in Indonesian or English. Selection of articles according

to the exclusion criteria, namely: there is data on the number of students there are the average values of the experimental class and the control class, or the pretest posttest scores of the control class and the experimental class, there are Science subjects.

Meta-analysis of the effects of integrated science teaching materials blended-PBL model on 21st century skills. The results of this meta-analysis are influenced by research variables. The meta-analysis research variable uses a moderator variable. The moderator variables used were the type of teaching materials, the type of learning model, the level of education, and the type of skills. To

see the effect of each moderator variable, a meta-analysis was carried out on the articles which obtained 26 articles.

This study obtained data by meta-analyzing articles from journals. Meta analysis is research by conducting a literature review (literature research). The nature of meta-analytic research is descriptive comparative analysis, which states explanations, explanations, analysis and comparisons between studies by reviewing and analyzing research data from previous research results (Amin, 2022). The meta-analytic research steps can be stated as Figure 1.
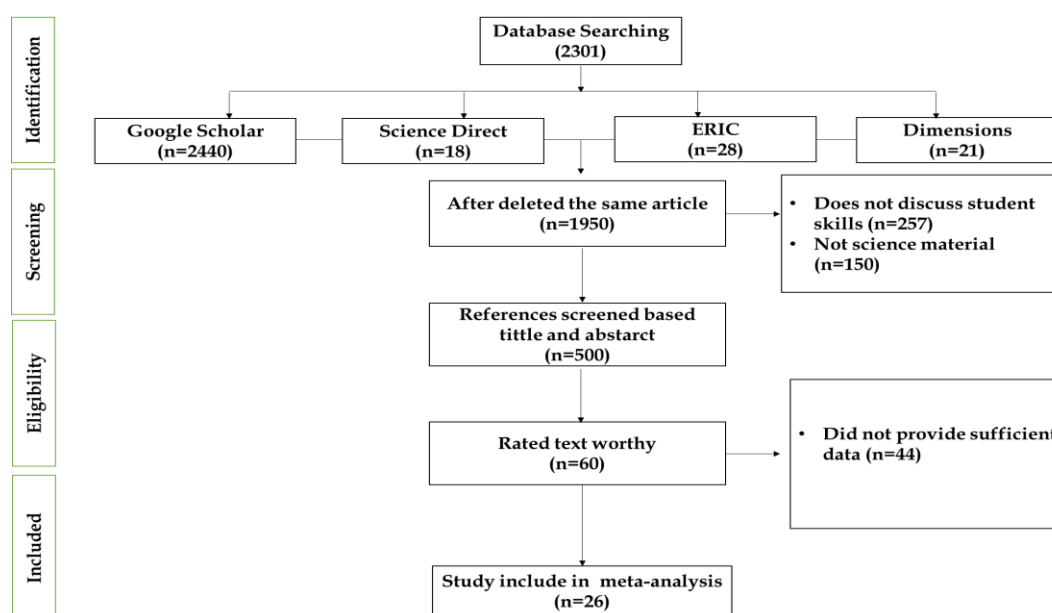

Figure 1. Research flow diagram

At the data collection stage from the Google Scholar database, 2301 search results were obtained, then 26 articles were selected that matched the criteria. Data analysis techniques (Moher et al., 2009) used in this study are identification, screening, eligibility, and inclusion. The research found is in the form of quantitative data so that the data in the article can be analyzed. Quantitative research states data analysis which states the relationship between variables in the article. Determining the relationship between variables can be known by using the effect size. The steps for tabulating the effect size data are: identifying the research variables, identifying the statistical data in the article and calculating the effect size using the effect size formula.

Meta-analysis of the effect of science teaching materials is intended to determine the effect size value of each article obtained. The effect size values of the 26 articles will be tested for heterogeneity to see the diversity of the effect size results. The meta-analysis heterogeneity test was carried out by determining the

statistical Q value and P value (Paloloang, 2020). If the p value is less than 0.05 then the null hypothesis which states the effect size of each study is homogeneous is rejected. Then the next choice is the estimation of random effects. If the p value is greater than 0.05 then the null hypothesis is accepted. Next, do an analysis of the moderator variable. Then the results will show whether or not there is an influence of blended-PBL integrated science teaching materials on improving 21st century skills.

Table 1. Effect size classification

Classification	Interval
Ignored	$0.00 < ES \leq 0.19$
Small effect	$0.19 < ES \leq 0.49$
Medium Effect	$0.49 < ES \leq 0.79$
Large Effect	$0.79 < ES \leq 1.29$
Very Large Effect	$ES > 1.2$

The results of the meta-analysis are expressed in terms of effect size values. The results of data analysis

using Ms.excel and JASP software in calculating effect size statistical data. The effect size value obtained will be categorized based on the Cohen standard (Cohen, 2018). Then the value of the parameter Q is obtained as a determinant that the data obtained is heterogeneous. If the value is heterogeneous, then it is continued with hypothesis testing using random effects and it is seen that the pvalue is small from the alpha value = 0.05. The classification of the effect size value category is shown in Table 1.

taken from national and international journals. Articles are collected through Google Scholar and Eric. The 25 articles obtained were articles related to the topic of problem based learning and blended learning models for 21st century skills. The 21st century skills in question are critical thinking, creative, communicative and collaborative skills. The articles will be grouped according to moderator variables, namely learning models, class levels and 21st century skills. The data to be analyzed is quantitative effect size data from 25 articles which can be shown in Table 2.

Result and Discussion

Characteristics of Meta-Analytic Study

The research results were obtained by collecting 26 articles from various journal sources. Journal sources

Table 2. Characteristics of meta-analytic study

Author	Code	Year	Teaching Material	Subject	Journal	Model Type	Skills	School Level	D
Sujanem, et al.	A1	2020	E-Module	Physics	International	PBL	Critical	SHS	1.56
Handayani, et al.	A2	2023	E-Module	Natural Science	National	PBL	Critical	ES	1.67
Zulaikha, et al.	A3	2022	E-Book	Physics	International	PBL	Creative	SHS	0.99
Anesa & Ahda.	A4	2021	E-Module	Biology	International	PBL	Critical	University	1.28
Endaryati et al.	A5	2022	E-Module	Natural Science	National	PBL	Critical	ES	1.27
Nyeneng	A6	2021	Worksheet	Physics	National	PBL	Creative	SHS	1.03
Rohmatin, et al.	A7	2022	E-Module	Physics	National	PBL	Critical	SHS	1.54
Susanto, et al.	A8	2022	E-Book	Natural Science	International	PBL	Critical	ES	-1.37
Hasanah et al.	A9	2021	Worksheet	Biology	National	PBL	Critical	SHS	1.10
Islamiah et al.	A10	2018	Worksheet	Physics	National	PBL	Critical	SHS	0.85
Amalia & Budhi.	A11	2014	Worksheet	Physics	National	PBL	Creative	SHS	0.70
Nurhaliza et al.	A12	2019	Worksheet	Physics	National	PBL	Creative	SHS	1.35
Fitriyani et al.	A13	2019	Worksheet	Physics	National	PBL	Creative	SHS	1.32
Tinedi, et al.	A14	2015	Worksheet	Physics	National	PBL	Creative	SHS	0.98
Hartini et al.	A15	2014	Worksheet	Natural Science	National	PBL	Creative	ES	0.64
Ariawan et al.	A16	2021	E-Module	Natural Science	National	BL	Creative	ES	1.73
Yustina, et al.	A17	2022	E-Module	Biology	International	PBL	Creative	SHS	0.41
Amalya et al.	A18	2021	Worksheet	Biology	National	PBL	Critical	SHS	1.09
Fitri et al.	A19	2017	Worksheet	Physics	National	PBL	Creative	SHS	0.32
Hasna et al.	A20	2021	Worksheet	Natural Science	National	PBL and BL	Critical	ES	1.96
Purwanti, et al	A21	2022	E-Model	Biology	National	PBL and BL	Critical	SHS	-104
Al-Madani	A22	2015	E-Book	Natural Science	International	BL	Creative	ES	0.30
Harahap. et al	A23	2019	E-Module	Biology	International	PBL and BL	Creative and Critical	SHS	0.72
Batlolona et al	A24	2019	E-Book	Physics	International	PBL	Creative	SHS	0.34
Putra, et al	A25	2021	E-Book	Physics	International	PBL and BL	creative and Critical	SHS	1.74
Wahyudi, et al	A26	2019	Worksheet	Natural Science	National	PBL and BL	Creative	University	-0.81

Based on the data in Table 2, science learning using the PBL and BL models was seen in the range from 2013 to 2023, the most common being found in 2021. The use of the PBL and BL models has increased from 2019 to the present. The use of PBL and BL models in learning can improve students' 21st century skills (Lolanessa, 2020; Suharyat, 2022). The lowest effect size value is -1.37 indicating that there is no effect of teaching materials on improving 21st century skills. The highest effect size value of 1.96 is in the very high category. The average value of the effect size obtained is 0.83 in the high category. The results of this study are relevant to previous research related to the use of the PBL model. The effect size obtained is 0.68 in the high category (Suharyat, 2022). Another study found an effect size related to the use of the PBL model of 0.691 in the high category (Olivia, 2022). The difference in effect size results is influenced by several other factors.

Results of Forest Plot Meta Analysis

The results of effect size data are used to see the effect of using learning models on improving 21st century skills. Furthermore, the effect size values of the 25 articles will be displayed in the form of a forest plot in Figure 2. The forest plot displays the range of effect sizes and confidence intervals from lowest to highest values. The position of the effect size value is found to be located on the right, so it is included in the high group and has a major influence on a study. The black dots on the forest plot vary in size. The average has a significant size, so that it is stated that the research analyzed has a significant influence on 21st century skills. The average effect size value is 0.83 in the high category with a confidence interval below 0.51 and a confidence interval above 1, 15.

The black dot on the plot indicates the significance level of an effect size. In Figure 2, the black dot varies in size. The smallest black point size in the forest plot is at A20 with an effect size of 1.96 with a confidence level of 1.31 to 2.61 indicating low significance. The largest black point size is at A5 with an effect size of 1.27 with a confidence level of 0.96 to 1.56 indicating high significance. The average effect size is 0.83 with a confidence level of 0.51 to 1.15 indicating high significance.

The results of the forest plot data state that the range of effect sizes is in the left and right positions of zero. The farther to the right the effect size is, the greater the influence of the Blended-PBL model of integrated Natural Sciences teaching materials on 21st century skills. The further to the left the effect size is, the smaller the effect of the Blended-PBL integrated Natural Sciences teaching materials on 21st century skills. In Figure 2, only a few findings suggest that effect sizes are to the left of zero. This states that the study did not provide sufficient influence on the use of science teaching materials. Other research states that the effect size results are next to zero. this stated that the research had an effect on the use of science teaching materials. The results of the forest patch meta-analysis article can be shown in Figure 2.

Based on Figure 2, the effect size results from the meta-analysis of article data obtained the highest and lowest range values. the effect size value of -1.37 article 8 does not have enough effect on the use of integrated teaching materials of the blended-PBL model on skills. The highest effect size is found in article 20 of 1.96 which states that the use of natural science teaching materials greatly influences skills.
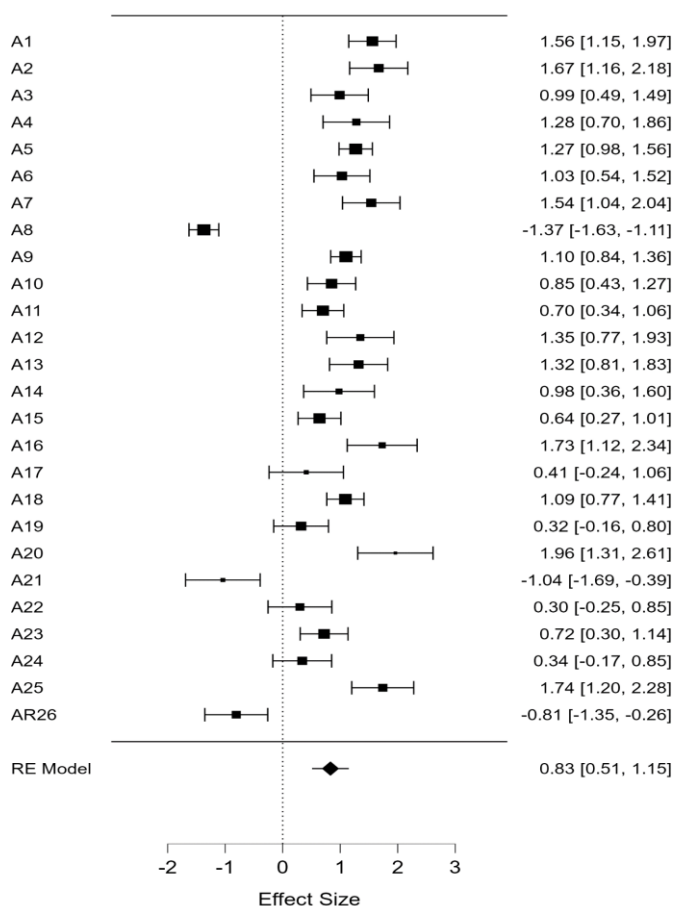

	Effect Size [95% CI]
A1	1.56 [1.15, 1.97]
A2	1.67 [1.16, 2.18]
A3	0.99 [0.49, 1.49]
A4	1.28 [0.70, 1.86]
A5	1.27 [0.98, 1.56]
A6	1.03 [0.54, 1.52]
A7	1.54 [1.04, 2.04]
A8	-1.37 [-1.63, -1.11]
A9	1.10 [0.84, 1.36]
A10	0.85 [0.43, 1.27]
A11	0.70 [0.34, 1.06]
A12	1.35 [0.77, 1.93]
A13	1.32 [0.81, 1.83]
A14	0.98 [0.36, 1.60]
A15	0.64 [0.27, 1.01]
A16	1.73 [1.12, 2.34]
A17	0.41 [-0.24, 1.06]
A18	1.09 [0.77, 1.41]
A19	0.32 [-0.16, 0.80]
A20	1.96 [1.31, 2.61]
A21	-1.04 [-1.69, -0.39]
A22	0.30 [-0.25, 0.85]
A23	0.72 [0.30, 1.14]
A24	0.34 [-0.17, 0.85]
A25	1.74 [1.20, 2.28]
AR26	-0.81 [-1.35, -0.26]
RE Model	0.83 [0.51, 1.15]

Figure 2. Forest plot

Heterogeneity Test Results

The results of the study obtained effect size data for each article and a heterogeneity test was carried out. The heterogeneity test will obtain data on the values of Q, P and I. The value of heterogeneity can be seen from the values of Q and I. For the P value, the hypothesis is accepted if the value of $p < 0.05$. Then it is stated that there is an effect of using integrated teaching materials PBL-BL models on 21st century skills. Heterogeneous data on

the effect of using integrated teaching materials learning models on 21st century skills is shown in Table 3.

Table 3. Results of the meta analysis

Variables	Overall	95% confidence	
		lower	upper
Number of samples (K)	26		
Heterogeneity test (Q)	439.07		
Probability value (P)	<0.001		
Standar score (z)	5.03	0.51	1.15
Efek size (g)	0.83		
Heterogeneity test (τ²)	0.65	0.37	1.292
Heterogeneity test (τ)	0.80	0.61	1.14
Heterogeneity test (I²%)	92.91	88.35	96.32
Heterogeneity test (H²)	14.11	8.58	27.20

The results of the heterogeneity test showed that the effect sizes of the 25 articles analyzed were heterogeneous. Q = 493.07; P <0.001, 95% confidence level. With the heterogeneity test results obtained, the random effect model is suitable for estimating the average effect size value (Zan, 2023). The random effect results show that there is a significant effect of using the PBL and BL models on 21st century skills. The positive effect of using the PBL and BL models on 21st century skills has a value of 0.83 in the very high category. The use of learning models can improve 2nd century skills in line with previous research, an effect size value of 1.71 is obtained in the very high category (Rohmawati, 2022). The effect size values obtained varied due to moderator variables in the study. The moderator variables in this study were variations in the types of teaching materials, learning models, educational levels, and skills. The number of moderator variations will affect the results of the study. To determine the effect of integrated teaching materials on learning models based on moderator variables seen from the combined heterogeneity (QW) and intermediate heterogeneity (QB) values.

Effects of Science Teaching Materials Based on Types of Teaching Materials

The first moderator variable is seen from the diversity of teaching materials found in the articles. Meta-analysis was carried out to see the effect of the type of teaching materials on 21st century skills. The results of the meta-analysis based on teaching materials can be seen in Table 4.

Table 4. Effects of science teaching materials by type of teaching materials

Moderator	K	Effect size	95% Confidence		Qb	p-Value
			Lower	Upper		
Teaching Materials					144.68	<0.001
E-Module	9	1.03	0.47	1.59		
E-Book	5	0.39	-0.64	1.41		
Worksheets	11	0.86	0.46	1.25		

Based on the results of the analysis in table 4, the results obtained were heterogeneity and p-value. The Q value of 144.68 states that the moderator variable has heterogeneous data because it is greater than the total value of df. The highest effect size value was obtained for teaching materials in the form of E-Modulees, namely 1.03, which was in the high category. There is a great influence in the use of E-Modulee teaching materials on increasing students' 21st century skills. The lowest effect size value is on teaching materials in the form of e-books, namely 0.39 which is in the low category. So that the influence of e-books on improving 21st century skills is only small and insignificant. The p-value of the moderator variable is less than 0.05, so the H0 value is rejected. The results of the study indicate that there is a significant influence on the use of integrated teaching materials PBL and BL models on 21st century skills. This is in line with previous research where the application of PBL and BL models can help improve 21st century skills (Alfi, 2016; Puspitarini, 2022).

Effects of Science Teaching Materials Based on Learning Models

The moderator variable for the second meta-analysis is viewed from the learning model used. The learning model obtained is the PBL model and the BL model. The results of this meta-analysis look at the effect size of the influence of the learning model on improving 21st century skills. The results of the meta-analysis based on the learning model are stated in Table 5.

Table 5. Effects of science teaching materials based on learning models

Moderator	k	Effect size	95% Confidence		Qb	p-Value
			Lower	Upper		
Model Variation					93.52	<0.001
Problem Based Learning	24	0.82	0.48	1.16		
Blended Learning	7	0.66	-0.25	1.57		

Based on the data from the meta-analysis in table 5, the heterogeneity and p-values were obtained. The Q value obtained is 93.52 which is greater than the value of the total df. The data obtained is heterogeneous, as seen from the Q value which is greater than the K-1 value or the df value. Then a random effects test was carried out and the pvalue was lower than 0.05. It can be stated that there is a significant difference between the use of the two models. The greatest influence was found in the use of the PBL model and the lowest was found in the BL model. The effect size value for the PBL model is 0.82, which is in the high category, while for the BL model, an effect size value of 0.66 is in the medium category. The difference in effect size values is not much different due

to the significant influence of the use of the PBL model and the BL model. In accordance with previous research that the use of the BL model is used to improve 21st century skills (Rahayu, 2022).

Effects of Science Teaching Materials Based on Education Level

The third moderator variable meta-analysis of science teaching materials is the level of education. The use of integrated teaching materials with PBL and BL models for 21st century skills is also influenced by the level of education. The results of the meta-analysis based on the level of education can be stated in table 6.

Table 6. Effects of science teaching materials by education level

Moderator	k	Effect size	95% Confidence		Qb	p-Value
			Lower	Upper		
			Level of education		38.39	<0.001
Elementary Schools	7	0.87	-0.01	1.74		
Senior High School	17	0.89	0.60	1.18		
University	2	-0.12	-1.48	1.24		

The results of data analysis obtained a Q value of 38.39 which is greater than the df value. So it can be stated that the data used is heterogeneous. Then a random effect will be tested and a small pvalue of 0.05 will be obtained so that H0 is rejected. The results of the analysis show that there is a significant effect of the use of integrated PBL and BL model teaching materials on 21st century skills. The highest effect size value is located at the high school level with a value of 0.89 in the high category. The use of teaching materials integrated with PBL and BL models is suitable for use at the high school level in improving 21st century skills. The lowest effect size value is at the university level, which is -0.12. The use of integrated PBL and BI models of teaching materials has no effect on improving 21st century skills

at the university level. This is in line with research which states that the use of model-integrated teaching materials can improve students' 21st century skills (Gusti, 2021; Anggreni, 2022).

Effects of Science Teaching Materials Based on 21st Century Skills Components

The fourth moderator variable meta-analyzes the influence of the use of integrated teaching materials PBL and BL models seen from 21st century skills. 21st century skills namely critical thinking, creative, collaboration and communication skills (Fitriyah, 2021). Based on the 25 articles analyzed, only two skills were found, namely critical and creative thinking skills. The results of the skill-based meta-analysis can be stated in table 7.

Table 7. Effects of science teaching materials based on 21st century skills components

Moderator	k	Effect size	95% Confidence		Qb	p-Value
			Lower	Upper		
			21st Skills		21.29	<0.001
Critical thinking	13	0.95	0.39	1.50		
Creative thinking	15	0.78	0.46	1.10		

Based on the results of the analysis of table 6, it can be stated that the value of heterogeneity and the p-value. The Q value shows 21.29 which is greater than the df value. It appears that the Q value indicates that the data obtained is heterogeneous. Next, a random effect hypothesis test was carried out and a pvalue <0.05 was obtained. This shows that there is an effect of using the PBL and BL models on each 21st century skill. The highest effect size value is for critical skills, namely 0.95,

which is in the high category. The results of this meta-analysis research reveal the magnitude of the influence on increasing critical thinking skills (Iskandar, 2021; Agnezi, 2020). The smallest effect size value for creative skills is 0.78 in the medium category. The results of the study stated that there was an effect of using the model on collaboration skills. In line with the research results, PBL learning can improve creative thinking skills (Handayani, 2021; Suparman, 2021).

Conclusion

Based on the research results obtained four conclusions. First, the influence of the use of integrated PBL and BL model teaching materials on the variety of teaching materials, is greatest in E-Modulees and smallest in e-books. Second, the influence of the use of teaching materials on the variety of learning models is greatest in the PBL model and smallest in the BL model. Third, the effect of using teaching materials integrated with PBL and BL learning models is greatest in high schools and least in tertiary institutions. Fourth, the effect of the integrated learning model is greatest on communication skills and least on collaboration skills. Therefore, it is found that the PBL-BL integrated science learning model is able to improve 21st century skills.

Author Contributions
DF writes meta-analysis articles based on JPPIPA templates and revises it based on commends. AMZ helps collect similar articles and analyzes data. LF and AS provide ideas, guide and direct, and review this article.

Conflicts of Interest
The authors declare that there is no conflict of interest not only in conducting research but also in scientific publication.

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