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Linguistic Intelligence: Improving Writing Ability through Mind Mapping of Project Based Learning

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Abstract
The survey results show that students have low writing skills. One of the contributing factors is that students have difficulty developing ideas from writing, which causes the writing process to be slow. Apart from that, passive learning activities also have an impact on students' writing abilities. Based on this, the aim of this research is to analyze the influence of the Mind Mapping-based Project Based Learning (PjBL) Model on students' writing abilities. This type of research is quasi-experimental research (quasi-experimental) using a 2 x 2 factorial design. The population in this research is grade IV elementary school students, totaling 9 schools. The total sample size was 160 students. The sampling technique uses a simple random sample. The data collection method in research uses test and non-test methods. The technique used to analyze data is inferential statistics. The results of the research are that the writing ability of the group of students who were given the Mind Mapping -based Project Based Learning Model was greater than the group of students with low linguistic intelligence, the writing ability of the group of students who were given the Conventional Learning Model, after controlling for language knowledge. It was concluded that the Project Based Learning (PjBL) Model based on Mind Mapping can improve students' writing skills. The implication of this research is that the application of the Project Based Learning (PjBL) Model based on Mind Mapping can stimulate students' learning and stimulate students' thinking skills so that it has an impact on improving students' writing skills.

Keywords: PjBL; mind mapping; writing ability; linguistic intelligence

Introduction

Linguistic intelligence is a student's ability to use words well, both orally and in writing. Linguistic intelligence includes the ability to think abstractly and unstructuredly, as well as the ability to grasp relationships or meaning, as well as the ability to easily adapt and adjust to new environments (Del Moral Pérez et al., 2018; Silwana et al., 2020). Linguistic intelligence includes a person's ability to understand, use and process language effectively, including the ability to speak, listen carefully, read with understanding and write clearly (Del Moral Pérez et al., 2018; Marhamah & Mulyadi, 2013; Silwana et al., 2020). Students who have linguistic intelligence usually read aloud and well, showing the ability to understand the meaning of words and sentence structure (Aminatun et al., 2018; Bertram et al., 2021; Kristiantari et al., 2023). Apart from that, students also have the ability to understand the meaning of words and sentence structures, as well as the ability to think abstractly and unstructuredly (Kurniaman et al., 2020; Suartama et al., 2024). In improving and developing students' writing skills, it is necessary to consider students' linguistic intelligence. Linguistic intelligence has an important role in improving students' writing abilities.

Linguistic intelligence has a significant relationship with students' writing abilities. Research has shown that linguistic intelligence influences the skills of writing summaries, writing poetry and writing short stories. Writing ability is considered the most complex skill. Writing involves the process of expressing thoughts and ideas in a structured manner, ensuring the message can be clearly understood by the reader. Mastering writing skills is more difficult than three other language skills, namely listening, speaking and reading (Bakarbessy et al., 2020; Wargadinata et al., 2021). This is caused by mastery of various language elements and other aspects contained in writing (Septhin et al., 2018; Yundayani & Ardiasih, 2021). When writing, one must have a deep understanding of grammar, sentence structure, spelling, and the rules of correct writing. Creativity and carefulness in choosing the right words are also important elements in writing ability (Herman et al., 2020; Puger et al., 2024; R. Winarni et al., 2021). By mastering writing skills well, students will be able to easily convey their thoughts and ideas to other people, so that the message they want to convey can be well understood by readers.

However, the current problem is that there are still many students who have difficulty writing. Findings from research also state that several factors that cause students' low skills in writing are due to students' lack of interest (Dwiyanti et al., 2018; Nuroh & Frestiya Adiyawati, 2023). Other research findings also confirm that the lack of interest in learning to write is also influenced by the lack of innovative learning stimulation from teachers (Ari Cahyani et al., 2019; Juariah et al., 2020; K. N. Maksum et al., 2020; Purwati, 2020). Lack of understanding and practice in writing has a low impact on the quality of the language used to convey ideas (Isman et al., 2022; Suandewi et al., 2019). The results of observations carried out in class IV in elementary schools in the core cluster of Buleleng sub-district also found that on average students still lacked writing skills. Based on the results of observations, it shows that class IV students in elementary schools in the Core Cluster of Buleleng District have low writing skills. This is shown by some students not being able to carry out and carry out the writing exercises that are often given by the teacher. Students experience delays when carrying out writing activities and it takes almost 2 class hours to write 5 lines of sentences. Students are not yet able to write words perfectly and there are still letters left behind. Apart from that, students are not yet able to use uppercase (capital) and lowercase letters correctly.

The solution to overcome this problem is to apply an appropriate learning model that can stimulate students' writing skills. One of the solutions offered is by implementing Project Based

Learning Containing Mind Mapping. *The Project Based Learning (PJBL)* model is a learning model that involves a project in the learning process. PjBL is a teaching and learning strategy that involves students working on a project (Febriyanti et al., 2020; Endang & Koto, 2020) . The PjBL model has a positive impact on the learning process (Fitri et al., 2018; Rati & Rediani, 2021). Some of the impacts of PjBL are that it can improve learning outcomes, creativity, thinking skills and student activity (Faridah et al., 2022; Putu et al., 2021; Saenab et al., 2019; Surya et al., 2018). Implementing the PjBL model will have a positive impact on learning outcomes. Project Based Learning (PjBL) is a learning model that is oriented so that students can learn independently in solving the problems they are facing so that they can produce a real project or work (Kizkapan & Bektaş, 2017; I. W. Widiana et al., 2023; E W Winarni & Koto, 2021). The research results state that there is a significant influence on the application of Project Based Learning (PjBL) on the ability to write critical response texts (Irsyad & Anggraini, 2023; Isman et al., 2022). Implementing Mind Mapping-based Project Based Learning can help improve student skills.

Mind Mapping is a strategy that can be used in the learning process. Mind Mapping-based Project Based Learning (PjBL) can increase student involvement and make it easier for them to improve their writing skills. Mind Mapping is an effective strategy in increasing student engagement, increasing concept understanding, and improving memory (Masliani et al., 2019; Sartono et al., 2018; Sulfemi, 2019; I Wayan Widiana et al., 2022). Mind Mapping can help teachers present material more effectively and efficiently, as well as improve students' abilities in critical and analytical thinking (Dewi et al., 2017; Lubis et al., 2019; Sulistiyono et al., 2017). By using Mind Mapping, students can be more active and participate in the learning process, as well as understand complex concepts more clearly. In this approach, students are given assignments to develop projects related to course material, and they use Mind Mapping as a tool to organize and develop their ideas. Mind Mapping-based PjBL allows students to think critically and creatively in developing projects. Students can use Mind Mapping to identify problems, develop ideas, and organize information related to projects (Bystrova & Larionova, 2015; Puspitaningrum et al., 2018; I. Wayan Widiana et al., 2021). In this way, students can be more active and participate in the learning process, as well as understand complex concepts more clearly (Buran & Filyukov, 2015; Liu et al., 2018; Merchie & Keer, 2016).

Previous research results state that the PJBL model can improve high reasoning abilities (Y. Hilman, 2022; H. Maksum & Purwanto, 2022), student learning outcomes (Irsyad & Anggraini, 2023; Simbolon & Koeswanti, 2020), and creative thinking in students (Mamahit et al., 2020; Sari et al., 2019; Sinta et al., 2022; I. W. Widiana et al., 2024). The application of PjBL based on Mind Mapping can help students organize and connect their ideas better. Mind Mapping helps visualize information and allows students to organize essay frameworks in a more structured manner, making it easier for them to convey ideas and ideas in a coherent and coherent manner. By controlling students' linguistic intelligence and language knowledge, this model can further strengthen certain aspects that need to be developed in writing descriptive essays. However, there has been no study regarding the application of Mind Mapping-based PjBL to improve students' writing skills. Thus, adopting the PjBL model combined with Mind Mapping in improving descriptive essay writing skills by considering students' linguistic intelligence and language knowledge can have a strong positive impact in developing students' writing skills. Based on this, the aim of this research is to analyze the effect of implementing Mind Mapping-based PjBL on students' writing abilities. This helps overcome the difficulties and obstacles experienced by students with various levels of language ability, so that the learning process can be more effective and in accordance with the needs of each student. It is hoped that a learning process that is more

interactive, creative and tailored to students' needs will result in significant progress in their writing abilities.

Research method

This research was experimental research. Considering that not all variables (symptoms that appear) and experimental conditions can be strictly regulated and controlled, this research is categorized as quasi- *experimental research* . A 2 x 2 factorial design is used to simultaneously investigate the effect of a treatment variable on the sample group being investigated. The use of a 2 x 2 factorial analysis design in this research is based on the assumption that the two independent variables have an influence on the other 2 variables and that there is an interaction of the two independent variables on the dependent variable. This design provides the opportunity to determine the main effect *,* interaction effect *and* simple effect *of* the independent variables on the dependent variable. Then, to determine the linguistic intelligence group, use the upper and lower groups (Guilford, 1942) . The comparison between the 2 independent variables is presented in Table 1.

Table 1. Comparison between 2 independent variables

		Learning Model (A)	
		Project Based Learning (A_1)	Conventional (A_2)
Linguistic Intelligence (B)	Height B_1	Y, X (A1B1)	Y, X (A2B1)
	Low B_2	Y, X (A1B2)	Y, X (A2B2)

The population in this study were fourth grade elementary school students in the core cluster of Buleleng sub-district, totaling 9 schools. The total sample size was 160 students. Each consisted of 90 students as the experimental group, namely the Mind Mapping-based PjBL model and 90 students as the control group, namely the conventional learning model. The results of data analysis show that the population is homogeneous, so the technique used for sampling is simple random sampling. The two groups above were divided into 45 students. Next, two groups consisting of 45 students who had linguistic intelligence at high language abilities and two groups consisting of 45 students with linguistic intelligence at low language abilities. The data collection method in research uses test and non-test methods. The non-test method is in the form of interviews conducted with teachers to obtain information regarding students' knowledge and writing skills.

The test method is an essay test. The essay test is used to determine students' knowledge of writing descriptive essays. The instruments used to collect data were questionnaire sheets and test questions.

The technique used to analyze data is inferential statistics. The prerequisite tests for ANAKOVA are the normality test, homogeneity test, regression linearity test, regression significance test, and regression line parallelism test. Inferential analysis takes the form of a two-way ANAKOVA to test the hypothesis followed by further testing. To test this, SPSS Statistics 25.0 is used. The analysis model used is two-way covariance analysis. This model is used to test differences in the average parameters of writing ability for all groups of students formed by the Learning Model and learning content, by controlling students' language knowledge.

Results

Based on the results of the tests that have been carried out, the first result is that there is a difference in students' ability to write descriptive essays between the group of students who study

using the Project Based Learning learning model and the group of students who study using the conventional learning model after controlling for the students' language knowledge. Differences in the ability to write descriptive essays between students who have high linguistic intelligence and students who have low linguistic intelligence after controlling for students' language knowledge. Second, there is an interaction effect between the learning model and linguistic intelligence on students' ability to write descriptive essays after controlling for students' language knowledge . For groups of students who studied following the *Project Based Learning learning model* , there were differences in the results of students' descriptive essay writing abilities between groups of students with high linguistic intelligence and low linguistic intelligence after controlling for students' language knowledge. For the group of students who studied following the conventional learning model, there were differences in the results of students' ability to write descriptive essays between groups of students with high linguistic intelligence and low linguistic intelligence after controlling for the students' language knowledge. The group of students with high linguistic intelligence, the writing ability of the group of students who were given the Project Based Learning Model, was higher than the group of students who were given the Conventional Learning Model, after controlling for language knowledge. The group of students with low linguistic intelligence, the writing ability of the group of students who were given the Project Based Learning Model, was lower than the group of students who were given the Conventional Learning Model, after controlling for language knowledge.

The testing stages carried out begin with a data normality test aimed at ensuring that the sample comes from a population with a normal distribution, enabling hypothesis testing to be carried out. In this study, a normality test was carried out to verify that the distribution of writing ability in each sub-population observed met the normal distribution criteria. The normality test uses the Kolmogorov-Smirnov test, and the results show that the significance value (sig) is 0.063, which exceeds the significance threshold of 0.05. Therefore, it can be concluded that the writing ability data comes from a normal distribution. The results of the normality test are presented in Table 2.

Table 2. Normality test

	Kolmogorov-Smirnov [a]			*Shapiro-Wilk*		
	Statistics	*df*	*Sig.*	*Statistics*	*df*	Sig.
Residual for Writing Ability	0.065	180	0.059	0.985	180	0.063

In the context of a homogeneity test for writing ability, it tests whether the variance of this variable is uniform among the subpopulations of interest, which implicitly ensures that communication between groups is reliable in statistical analysis. The results of the homogeneity analysis showed that the data came from homogeneous data. This can be seen from the analysis results of *Levene's Test of* Equality *of Error Variances,* where the Sig value is greater than 0.05, namely 0.539. The results of the linearity analysis show that there is a linear relationship, this can be seen from the calculation results where the sig value is > 0.05. This test was carried out by testing the significance of the regression coefficient using the F-test. The F-test calculation process uses the SPSS statistics 26.0 program, with hypothesis testing. The calculation results show that there is no significant effect of regression, this can be seen from the sig value >0.05, namely 0.112 with an F value of 2.566.

The regression line parallelism test aims to determine whether the direction coefficient or slope of the regression line influence of the linguistic intelligence covariate language knowledge

(X) on the dependent variable writing ability of each sample group is parallel (homogeneous) or not. ANAKOVA inferential statistical testing requires that the direction coefficient or regression slope of the influence of the linguistic intelligence covariate language knowledge (X) on writing ability (Y) for each sample group (cell) formed by the learning model factors (A) and linguistic intelligence **(** B) must be equal and homogeneous. The testing procedure uses univariate general linear model (GLM) statistics through the program. The calculation results show that the direction coefficient or regression slope of the influence of the linguistic intelligence covariate language knowledge (X) on writing ability (Y) for each sample group (cell) is formed by the learning model factors (A) and linguistic intelligence **(** B) must be parallel and homogeneous. This can be seen from the sig value > 0.05. The regression line parallelism test is presented in Table 3.

Table 3. Regression line parallel test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8215.752 [a]	7	1173.679	10,128	0,000	0.292
Intercept	22342.085	1	22342.085	192,789	0,000	0.528
Linguistic_intelligence * Learning_model	800,685	3	266,895	2,303	0.079	0.039
Lingustic_intelligence * Language_knowledge	51,413	1	51,413	0.444	0.506	0.003
Learning_model * Language_knowledge	8,380	1	8,380	0.072	0.788	0,000
Linguistic_intelligence * Learning_model * Language_knowledge	430,248	1	430,248	3,713	0.056	0.021
Error	19932,826	172	115,889			
Total	1049066,000	180				
Corrected Total	28148.578	179				

In hypothesis testing, the analysis model used is two-way covariance analysis. This model is used to test differences in the average parameters of writing ability for all groups of students formed by the Learning Model and learning content, by controlling students' language knowledge. A two-way analysis of covariance procedure was used to: (1) test differences in student writing abilities for all student groups formed by learning model factors; (2) testing differences in writing abilities for all groups of students formed by learning content (3) testing the interaction effect of learning model factors and linguistic intelligence on writing abilities; and (4) examine differences in writing abilities in groups of students which are formed by the main factors of learning models and linguistic intelligence. The four testing processes were carried out after controlling for language knowledge which functions as a covariate whose influence is controlled statistically. So the parameters tested in analysis of covariance (ANAKOVA) are differences in mean deviations (adjusted means) or differences in constants from homogeneous regression.

In the results of the analysis carried out: The writing ability (Y) of the group of students given the Project Based Learning Model (A_1) was higher than the group of students given the Conventional Learning Model (A_2), after controlling for the students' language knowledge (X). In other words, there is a significant difference in students' writing abilities between students taught the Project Based Learning Model (A_1) and students taught Conventional Learning (A_2) after controlling for students' language knowledge (X). This can be seen from the Sig value. 0.000 with an F value of 58.985. The writing ability (Y) in the group of students with high linguistic

intelligence (B_1) is higher than the group of students with low linguistic intelligence (B_2), after controlling for language ability (X). In other words, there is a difference in writing ability (Y) in the group of students with high linguistic intelligence (B_1) which is higher than in the group of students with low linguistic intelligence (B_2), after controlling for language ability (X) this can be seen from a sig value that is smaller than 0.05, namely 0.034 with an F value of 4.017. There is an interaction effect of Learning Model and linguistic intelligence and (A*B), after controlling for language knowledge (X). From the results of the analysis, it was found that there was an interaction between the Learning Model and linguistic intelligence and (A*B). This can be seen from the calculation results of the sig value, which is greater than 0.05, namely 0.0 with an F value of 0.017.

Project Based Learning Model (A_1), writing ability (Y), the group of students who had high linguistic intelligence (B_1), was higher than the group of students who had low linguistic intelligence (B_2), after controlling for language knowledge (X). This can be seen from the mean value of *the Project Based Learning Model* (A_1), the writing ability (Y) of the group of students who have high linguistic intelligence (B_1) of 83.360 [a] which is greater than the group of students who have low linguistic intelligence (B_2) namely 79,689. There is a quite large difference, namely 3.671. For the group of students given the Conventional Learning Model (A_2), the writing ability (Y) of the group of students with high linguistic intelligence (B_1), was higher than the group of students with low linguistic intelligence (B_2), after controlling for language knowledge. This can be seen from the results of calculating the mean value where the mean value of the Conventional Learning Model (A_2), writing ability (Y) in the group of students with high linguistic intelligence (B_1) is 70.720 greater than the group of students with low linguistic intelligence (B_2) which is 67,474. For the group of students with high linguistic intelligence (B_1), the writing ability (Y) of the group of students given the Project Based Learning Model (A_1), was higher than the group of students given the Conventional Learning Model (A_2), after controlling for language knowledge (X). This can be seen from the mean value where the group of high linguistic intelligence (B_1), writing ability (Y) in the group of students given the Project Based Learning Model (A_1) is 83,360 [a] greater than high linguistic intelligence (B_1), ability writing (Y) in the group of students given the Conventional Learning Model (A_2), after controlling for language knowledge (X) of 70,720 [a.] For the group of students with low linguistic intelligence (B_2), the writing ability (Y) of the group of students given the Project Based Learning Model (A_1), was higher than the group of students given the Conventional Learning Model (A_2), after controlling for language knowledge (X). This can be seen from the mean score of the group of students with low linguistic intelligence (B_2), writing ability (Y) in the group of students given the Project Based Learning Model (A_1) of 79.689 [a] greater than the group of students with low linguistic intelligence (B_2), writing ability (Y) in the group of students given the Conventional Learning Model (A_2), after controlling for language knowledge (X) was 67,474.

Discussion

The results of the analysis show that there is a significant difference in students' writing abilities between students who were taught Project Based Learning based on Mind Mapping and the Conventional Learning Model. This is caused by the following factors. First, Project Based Learning based on Mind Mapping can improve students' writing skills. In learning activities, students are involved in working on a project that can help improve students' writing skills. The Project Based Learning (PJBL) model is a learning model that involves a project in the learning process (Ayish & Deveci, 2019; Fiana et al., 2019; Perayani & Rasna, 2022). The project given by the teacher to students is to create descriptive essays that can practice students' writing skills. Apart

from that, project learning can also improve students' critical thinking skills. Learning activities like this train independent learning in solving the problems being faced so that they can produce a project (Anazifa & Djukri, 2017; Ayish & Deveci, 2019; Fiana et al., 2019; Perayani & Rasna, 2022; I Wayan Widiana et al., 2022; E W Winarni & Koto, 2021). Previous research findings state that learning activities that train students to learn independently can improve students' understanding of learning material (Dwi Ardianti et al., 2017; Maharani Zan & Mardian, 2022; Wijaya et al., 2021). The PjBL model has a positive impact on the learning process (Rati & Rediani, 2021; Sharma et al., 2020; Tahmidaten, 2021). PjBL learning uses problems as a stimulus and focuses on student activities. This is what causes the PjBL model to have a positive impact on students' writing skills. Research results state that there is a significant influence of the Project Based Learning (PjBL) model on students' abilities, especially writing abilities (Anggraini et al., 2022; Y. Hilman, 2022; Irsyad & Anggraini, 2023; Isman et al., 2022; Triadi, 2020). So from the results of this research it can be said that the existence of the PjBL model has been proven to have an influence on students' writing abilities.

Second, Project Based Learning based on Mind Mapping makes it easier for students to learn. Project Based Learning requires students to be fully involved in writing learning activities. Learning to write descriptive paragraphs using the Mind Mapping model *by the* teacher *is* in accordance with existing theory. Teachers need to provide sufficient mind mapping practice and train students to develop ideas into coherent writing. Several studies related to Mind *Mapping* include the influence of the implementation of the Mind Mapping method and students' writing abilities (Lestari, 2019; Suparmi et al., 2019). *Mind Mapping* is a strategy for making notes about a topic, before writing to show relationships or ideas (Andari & Al-Wahid, 2020; Munasti et al., 2021; Zahro et al., 2018). Basically, *Mind Mapping* departs from the results of research on how the brain processes information (Polat & Aydın, 2020; Puspitaningrum et al., 2018). In improving and developing writing skills, it is necessary to consider students' linguistic intelligence. Intelligence is something that a human has to understand various things, think rationally, and can be used to face life's challenges (I. Hilman & Mainaki, 2020; Silwana et al., 2020; Winarti et al., 2019). The potential that exists within oneself can be interpreted as a linguistic intelligence that students already possess which can be used and optimized in writing activities. Mind Mapping based learning provides a significant difference in effect on writing skills. Mind Mapping allows students to communicate more effectively with friends and teachers (Buran & Filyukov, 2015; Lestari, 2019; Sulfemi, 2019; Suparmi et al., 2019; Tri Pudji Astuti, 2019). With Project Based Learning based on Mind Mapping, it makes it easier for students to learn. Project Based Learning requires students to be fully involved, students can develop better communication skills and thinking abilities such as critical thinking, analytical thinking, and creative thinking.

Third, Project Based Learning based on Mind Mapping increases the active learning atmosphere. In learning activities, the Project Based Learning learning model based on Mind Mapping increases the learning atmosphere to become more active and independent. This has an impact on increasing students' interest in learning. Previous research findings also reveal that Project Based Learning can improve students' learning atmosphere (Pan et al., 2021; Sagala & Widyastuti, 2022; Ulya et al., 2020). A pleasant learning atmosphere makes students serious about learning to write. Writing activities are defined as activities to express in writing ideas, ideas, opinions, or thoughts and feelings (Aghajani & Adloo, 2018; Dollah et al., 2021; Ulya et al., 2020). *Mind Mapping* starts with a single concept or theme that has many thoughts which becomes bait for students to think and produce many ideas about that single concept or theme (Andari & Al-Wahid, 2020; Munasti et al., 2021; Zahro et al., 2018). Based on research conducted on aspects of

students' linguistic intelligence in writing descriptive essays through mind mapping, students collect, organize and connect ideas better, deepen their understanding of the material and develop the structure of their writing. Mind mapping also increases creativity, helps remember information, and makes it easier for students to plan and compose writing in a more structured and meaningful way (Ananda, 2019; Annisa et al., 2018; Hidayat et al., 2020). Mind mapping plays an important role in helping students master writing skills better and more enjoyable. The implication of this research is that the application of PjBL based on Mind Mapping helps students in the learning process by improving critical, analytical, creative, visual, systematic thinking skills so that it can improve students' writing skills.

Conclusion

The results of data analysis show that the writing ability of the group of students who were given the Project Based Learning Model was higher than the group of students who were given the Conventional Learning Model, after controlling for the students' language knowledge. In other words, there is a significant difference in students' writing abilities between students taught the Project Based Learning Model and students taught Conventional Learning after controlling for students' language knowledge. The writing ability of the group of students with high linguistic intelligence was higher than the group of students with low linguistic intelligence, after controlling for language ability. In other words, there is a difference in writing ability in the group of students with high linguistic intelligence, which is higher than in the group of students with low linguistic intelligence, after controlling for language ability. There is an interaction effect of Learning Model and linguistic intelligence, after controlling for language knowledge. From the results of the analysis, it was found that there was an interaction between the Learning Model and linguistic intelligence. It was concluded that the Project Based Learning Model based on Mind Mapping could improve students' writing skills.

Declaration of conflicting interest
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