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Impact of Prezi Media-Assisted Problem-Based Learning on Scientific Literacy and Independence of Elementary School Students

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Abstract

The aim of this study was to analyze the impact of Problem Based Learning (PBL) with the support of Prezi media on scientific literacy and independence. The research design used was quasi-experimental in nature. The sample of this study consisted of 59 fourth grade students. Data were collected using a test and a questionnaire. The instruments used were a 20-item test to assess scientific literacy and a 30-item questionnaire to measure independence. The data were analyzed using descriptive analysis and statistical inference. Multivariate Analysis of Variance (MANOVA) was used in testing the hypotheses. The findings show that the PBL model supported by Prezi media has a simultaneous and partial effect on students' scientific literacy and independence. The findings also show that the Prezi media-enabled PBL model has a greater impact on scientific literacy than on students' independence.

Keywords: Elementary school, Independence, Literacy, Prezi media, Problem-based learning, Scientific literacy.

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Contents

Contribution of this paper to the literature

This study has advantages over previous research as this learning model focuses more on the influence of the PBL model assisted by Prezi media on scientific literacy and student independence. The research results show that this model has more impact on scientific literacy and helps develop the understanding of science concepts and applications in the learning process and in the process of scientific inquiry. So, this learning model can be used as a form of innovative learning to overcome literacy and independence problems among fourth grade elementary school students.

1. Introduction

Education in the 21st-century is important for everyone (Khoiriyah & Husamah, 2018). Education in the present context refers to activities carried out consciously or unconsciously to attain certain goals. The current educational learning processes are closely related to literacy skills. 21st-century literacy includes the acquisition of reading, speaking, listening and writing skills. Literacy can be a stepping stone to instilling noble values in students (Teguh, 2017). In addition, literacy also plays an important role in the acquisition of knowledge, orally and in written form, in problem solving and in being sensitive to the surrounding environment (Ke, Sadler, Zangori & Friedrichsen, 2021). One form of literacy is scientific literacy which is important in modern life as it is related to issues of science and technology (Semilarski & Laius, 2021;Valladares, 2021; Widodo, Sudibyo, Suryanti, Inzanah & Setiawan, 2020). Scientific literacy is very important since everyone needs aid in thinking, decision-making and problem-solving tasks (Chusni & Hasanah, 2018; Samsu, Mustika, Nafaida & Manurung, 2020; Wahyu, Suastra, Sadia & Suarni, 2020). Scientific literacy is important to support the attitudes in development, environmental awareness and responsibility, interests, motivation and student involvement (Oliver & Adkins, 2020). Literacy competency is the ability to use knowledge and scientific processes in problem solving (Fadila, Suliyanah & Deta, 2020; Rusilowati et al., 2018; Sudarsono, Abdurrahman & Rosidin, 2020; Widi, Setiya & Duden, 2016). Developing scientific knowledge, identifying problems and making conclusions based on real evidence by students in the learning process really need scientific literacy skills (Fauziyah, Prasetyaningsih & Biru, 2021). Therefore, scientific literacy can help develop students' knowledge, skills and attitudes toward learning science and technology, and strengthen environmental awareness so that the demands of the 21st century can be met.

In addition to scientific literacy, independent mind sets are needed for learning in this century. Students who are independent do not need encouragement from educators (Shepley, Spriggs, Samudre & Elliot, 2018). The independence of students is seen from their ability to motivate themselves to achieve their desired goals without outside help, in this instance from educators (Henri, Morrell & Scott, 2018; Nguyen & Habók, 2021; Ratminingsih, Marhaeni & Vigayanti, 2018). Independence is often associated with positive attitudes towards individual values and self-expression (Magnusson & Zackariasson, 2019). The independence of students can be seen through several indicators such as awareness of oneself and the situation at hand, and self-regulation. Independence of students can be developed through planning, organizing and evaluating learning (Tseng, Liou & Chu, 2020). Independence is gained through the experience of learning actively and effectively (Orakci & Gelisli, 2017; Orakci & Gelisli, 2019). Students' increasing independence has an impact on cognitive flexibility (Orakcı, 2021). To produce independent students, educators are required to have skills in developing active learning by managing the planning, learning, implementation and evaluation which are focused specifically on students' ability and development (Tseng et al., 2020). Thus, being independent is an important ability students must possess to face scientific and technological developments.

Low levels of scientific literacy are a hindrance to the development of science and technology; this can have a negative impact on the environment and expansion of innovations in science and technology (Zainuri & Huda, 2022). The average student's scientific literacy is not optimal when seen only in terms of content skills, especially when these skills cannot be communicated or associated with everyday problems (Wibowo & Ariyatun, 2020). Indonesian students' scientific literacy is still low and the books that have been used so far have not helped to train students to understand the nature of science (Chusni & Hasanah, 2018). A low understanding of science concepts is often associated with learning activities that are still oriented to memorization (retention), conventional learning methods and the difficulty levels of the material learned by students (Ariana, Situmorang & Krave, 2020). This notion is supported by the initial analysis results of studies which show that the learning activities introduced by the teachers lack innovativeness and creativity; the approaches applied are still conventional in nature and do not take into account students' active role in the learning process (Pujawan, Rediani, Antara, Putri & Bayu, 2022). The problem arising today as a result of online learning is that students begin to lose their independent attitude and need more support and encouragement in the learning process. The most worrying condition is that online learning makes students lazy to study, with more parents completing the school learning tasks given to their children. If this condition is left unchecked, it will have an impact on the success of the learning process, which will certainly hinder learning outcomes and learning objectives. To reduce or overcome this problem, an appropriate solution is needed. The development of scientific literacy and independence can be improved with innovative learning and help of the media (Cahyana, Supatmi & Rahmawati, 2019). One of the innovative learning models that can be used to solve the above problems is PBL.

PBL is a learner-centered model which impacts the learning process. PBL helps students get information that already exists to construct their own basic and complex knowledge bases (Malmia et al., 2019). PBL impacts the spiritual and social attitudes of students (Bachtiar, Zubaidah, Corebima & Indriwati, 2018) by increasing students' creative thinking skills (Maskur et al., 2020), improving math problem-solving skills (Aslan, 2021; Hendriana, Johanto & Sumarmo, 2018), developing students' critical thinking skills (Aini et al., 2019; Narmaditya, Wulandari & Sakarji, 2018; Saputra, Joyoatmojo, Wardani & Sangka, 2019), improving ability to identify problems and investigating and applying scientific facts and scientific literacy skills (Nurtanto, Nurhaji, Widjanarko, Wijaya & Sofyan, 2018). Thus, the application of the PBL model in learning activities provide opportunities for students to develop their intellect so that they have critical thinking skills which actively raise scientific literacy, which in turn impacts learning outcomes. A study related to PBL and scientific literacy states that PBL is effective in

increasing scientific literacy (Amaringga, Amin & Irawati, 2021). Research states that Socio Scientific Issues-based PBL affects Science Literacy and problem-solving skills positively (Hestiana & Rosana, 2020). Studies show that PBL has a significant impact on students' critical thinking and literacy skills (Suhirman & Khotimah, 2020). Therefore, PBL has a significant effect on scientific literacy. To make PBL effective in the learning process, it is combined with Prezi media.

Prezi is a web-based software that is used as a tool to present subject matter on a virtual canvas (Fahrizal, 2021; Huda, Hidayati & Syamsiah, 2021; Muharni, Alpusari & Putra, 2021; Nasution & Siregar, 2019a). Prezi is an application that can combine one's creativity with technological sophistication to design online-based digital presentations (Nasution. & Siregar, 2019b). Prezi-based media is one of the media devices chosen by educators to increase the attractiveness of lessons prepared for students (Rohman, Na'im & Sumardi, 2021). Prezi changes the learning paradigm from teacher-centric to student-centric, and teachers only act as facilitators, so students become active learners and no longer have to rely on teachers as the only source of information (Ayu, Ningsih & Komikesari, 2019). Prezi attracts students' learning interests and attention (Ikram, Elvia & Handayani, 2021; Rohiman & Anggoro, 2019) and improves student cognitive learning outcomes (Zoebaidha, 2020). Therefore, Prezi raises students' interest in the learning process.

It is clear that PBL assisted by Prezi can have a positive impact on the learning process. This is supported by multiple studies showing that PBL using Prezi is superior to discovery-based learning models using Prezi to improve student learning outcomes (Ardiansyah, Shodiqin & Muhtarom, 2020). Research shows that students' learning outcomes when using the PBL learning model through the RME approach assisted by Prezi are better than learning through the scientific approach (Astuti & Widianawati, 2016). Further research has shown that, students' learning outcomes when using the Prezi-assisted PBL learning model show significant positive outcomes when compared with the Prezi-assisted Pair Check learning model used with conventional learning models (Hartina, Permata & Fatkhurrokhman, 2020). Studies have also found that Prezi-supported PBL models help achieve proficiency while Prezi-supported learning discovery models do not achieve this proficiency (Ardiansyah et al., 2020). Based on the findings so far, we can conclude that PBL and Media Prezi can together improve learning outcomes. This is one of the reasons why this study focuses on analyzing the impact of Prezi Media-powered PBL on 4th grade scientific literacy and independence. The novelty of the present research is found specifically in its variables which are scientific literacy and student independence. The Prezi media-assisted PBL model was implemented in studies related to materials in the water cycle. This research focused on scientific literacy variables where the indicators were scientific concepts and applications in everyday life, the process of scientific inquiry, understanding the nature of science and understanding the relationship between science, technology and society. Meanwhile, the study of students' independence was focused more on self-awareness and related situations and self-regulation. The results of this study were expected to improve scientific literacy and students' independence in the water cycle learning process.

2. Methodology

The study design used was quasi-experimental; this study was carried out using a non-equivalent post-test-only control group design. The experimental group was treated with the PBL model supported by Prezi Media while the control group was treated with the non-PBL model supported by Prezi Media. Both groups underwent a post-test to determine the difference in scientific literacy and independence. Data were obtained on (1) scientific literacy students (Y1) who were taught using the PBL model with the support of Prezi media; (2) Science literacy students (Y1) who were taught using a non-PBL learning model supported by Prezi Media; (3) Students with independent skills (Y2) who were taught using the PBL model with the support of Prezi media and (4) Self-employed students (Y2) who were taught using a non-PBL learning model supported by Prezi media. The research phase consisted of three stages, namely the research preparation stage, the research implementation stage and the final stage of experimentation or research completion. The survey procedure is shown in Table 1.

Table 1. Research procedure

No	Research Procedure	Research Activity
1	Research preparation stage	Pre-observation of learning activities before treatment
		Discussions with fifth-grade teachers on students' scientific literacy and independence, minimum scores and number of fifth-grade students
		Determining research sample based on the *Gugus* IV population, *Kecamatan* Pupuan, *Kabupaten* Tabanan
		Lesson Plan Preparation (RPP)
		Preparing the experimental group to learn using the Problem Based Learning model assisted by Prezi media
		Modeling for teachers who had not been able to understand the learning course using the Problem Based Learning model assisted by Prezi media
		Designing research instruments, namely arranging the post-test, designing learning outcomes assessment instruments and consulting supervisors
		Instrument tested for validity and improved according to expert advice. Results of the validity test discussed with lecturers to ensure it was feasible and the instrument was ready to be used
2	Research implementation stage	Treatment given to the experimental group in the form of learning using Problem Based Learning assisted by the Prezi model
		Treatment was given 8 times to the experimental group
3	Final stage of experiment	Post-test conducted for experimental and control groups to obtain data using Problem Based Learning method assisted by Prezi media
		Analysis carried out to process data on students' learning outcomes and hypotheses

The research population comprised all the fourth-grade elementary school students in *Gugus* IV, *Kecamatan* Pupuan, *Kabupaten* Tabanan, a total of 6 groups from 6 schools. The total number of fourth-grade students was 180. . The equivalence test with One Way-Analysis of Variance using the SPSS 25.0 for Windows application was used in the study conducted on the 6 groups at 6 elementary schools in *Gugus* IV, *Kecamatan* Pupuan, *Kabupaten* Tabanan and a simple random sampling technique was carried out using a lottery method to identify two schools to be used as the research sample. The sample was then divided into the experimental and control groups; the experimental group would be given treatment based on the Problem Based Learning model assisted by Prezi while the control group would not use the Problem Based Learning model assisted by Prezi. The experimental group comprised 30 students and the control group consisted of 29 students.

A test and a questionnaire were used in the data collection procedures. Tests are used to determine an individual's level of competency by having the individual respond to multiple given stimuli or questions. In this study the test method was used to determine the effectiveness of the PBL model with the support of Prezi Media for scientific literacy. The test used the essay question format to measure the increase in students' scientific literacy. The test instrument was completed in several stages; they were 1) drafting the test instrument, 2) drafting the essay questions and 3) referencing the draft. The test given to the students comprised 20 items. The test items are shown in Table 2.

Table 2. Test items on scientific literacy indicators

No	Scientific Literacy Indicator	Indicators
1	science concepts and applications in daily life	1. Defining the meaning of the water cycle
		2. Analyzing the process of the water cycle
		3. Analyzing the types of water cycle
		4. Describing the benefits of the water cycle for life
2	Scientific inquiry process	1) Providing arguments on the factors affecting the water cycle
		2) Analyzing ways to prevent the impact of a damaged water cycle
3	Understanding the nature of science	1. Describing the steps for conducting a simple practicum on the process of the water cycle
4	Understanding the relationship between science, technology and society	1. Analyzing the relationship between the sustainability of the water cycle and advances in science and technology

A questionnaire-based data collection method was used to measure independence. The questionnaire was based on a 5-point Likert scale. There were 30 items based on 2 dimensions which were developed from 11 indicators. The two dimensions included 1) awareness of oneself and the situation and 2) self-regulation; the details and indicators are presented in Table 3. The instrument was tested for validity and reliability. The validity of the contents of the questionnaire was checked using the Content Validity Ratio (CVR) / Content Validity Index (CVI) formula. The CVR for each item was 1 and the CVI value was 1.00. This indicates that all items had been validated according to the validation rules. The questionnaire reliability was based on Cronbach's alpha and had a value of 0.81. Therefore, the questionnaire was deemed reliable.

Table 3. Students' independence indicators.

No	Dimension	Indicators
1	Self-awareness and Situation-awareness	1) Exploring one's feelings and behavior 2) Exploring strengths and weaknesses 3) Believing in oneself 4) Making the right decisions 5) Skillful at expressing thoughts, feelings, opinions and beliefs 6) Able to evaluate oneself
2	Self-regulation	1) Setting standards and goals 2) Managing emotions 3) Self-instruction 4) Self-monitoring 5) Self-evaluation creates self-defined contingencies

The data collected in this study were analyzed descriptively and inferentially. All data analysis processes in this study used the Statistical Program for Social Sciences 26.0 for Windows. The descriptive analysis carried out in this study included the mean, minimum and maximum values and standard deviation. Multivariate analysis of variance was used to analyze the data inferentially.

3. Results and Discussion

3.1. Results

The results of the analysis are shown in Table 4. The results show that there are differences in students' scientific literacy abilities and autonomy. This is indicated by the difference in average scores. The difference in scientific literacy scores between students who were taught using the PBL model with Prezi Media and those who were not taught using the PBL model with Prezi Media is 5.14. The average scores in scientific literacy acquired by students taught using the PBL model assisted by Prezi are high.. On the other hand, the difference in independence between students taught using the PBL model with Prezi Media and students taught using non-PBL models with Prezi Media is 3.32. The average scores in independence acquired by students taught using the PBL learning model are high. The results also show that scientific literacy is more affected than independence, as evidenced by the big difference in average literacy scores.

Table 4. Results of scientific literacy and Independence analyses

Treatment	Dependent Variable	Mean	Standard deviation	Maximum	Minimum
PBL model assisted by Prezi	Scientific Literacy	76.89	3.348	81	71
	Independence	64.47	3.49	70.00	60.00
Non PBL model assisted by Prezi	Scientific Literacy	61.75	2.826	66	55
	Independence	61.15	5.09	69.00	54.00

The assumption tests performed in this study include the normality test, homogeneity test of variance, multivariate and linearity test of the dependent variable. Kolmogorov-Smirnov was used in testing the normality of data distribution. The test results show that the data is normally distributed, with a significance value> 0.05. Details of the test results are shown in Table 5. After the normal data distribution conditions were met, the uniformity test was conducted. In this study, two analytical methods were used, Levene's homoscedasticity test to test the uniformity of variance and Box's test of homoscedasticity of the covariance matrix to test the uniformity of the multivariate.

Table 5. Normality test results

Variables	Learning Approach	Kolmogorov-Smirnov		
		Statistic	df	Sig.
Scientific Literacy	PBL Model assisted by Prezi	0.156	30	0.20
	Non PBL model assisted by Prezi	0.157	29	0.20
Independency	PBL Model assisted by Prezi	0.156	30	0.20
	Non PBL Model assisted by Prezi	0.155	29	0.20

The results show that the research data are homogeneous; the value of sig. is greater than 0.05. Levine's equivalence test value is 0.08 for scientific literacy, which is significant. The independence ability shows a value of 0.253. On the other hand, the uniformity test using Box's covariance matrix equivalence test is also significant. The F value of 0.942 is 0.822. The next prerequisite test is the multicollinearity test. The results of the analysis show that the Variance Inflation Factor (VIF) and tolerance scores are close to 1. This means that the scientific literacy of variables is not correlated with independence. Now that the test conditions for the MANOVA study are met, MANOVA was used to perform the hypothesis testing. The sequence of the study is shown in Tables 6 and 7.

Table 6. Manova analysis results

Impact		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai Trace	1.00	9613.16	2.00	57.00	0.000
	Wilks Lambda	0.00	9613.16	2.00	57.00	0.000
	Hotelling Trace	534.06	9613.16	2.00	57.00	0.000
	Roy Largest Root	534.06	9613.16	2.00	57.00	0.000
Group	Pillai Trace	0.89	145.44	2.00	57.00	0.000
	Wilks Lambda	0.11	145.44	2.00	57.00	0.000
	Hotelling Trace	8.08	145.44	2.00	57.00	0.000
	Roy Largest Root	8.08	145.44	2.00	57.00	0.000

The MANOVA results show that the intercept effect has an F coefficient of 9613.16 and a Sinicization score of 0.000 (<0.05). This means that there is a difference between scientific literacy and student independence among those exposed to the PBL model using Prezi media. After testing the effect between subjects, the F-score is 5.13 and Sig= 0.03, which is lower than 0.05. This shows that the PBL model supported by Prezi media has affected its logical ability Third, the results of the inter-subject effect test show an F value of 233.89 with a significance value of less than 0.05 (0.000). This shows that the PBL model assisted by Prezi Media affects students' independence.

Table 7. Between-subjects effects results

Source	Dependent Variable	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	Scientific Literacy	95.07	1	95.07	5.13	0.03
	Independence	2234.82	1	2234.82	233.89	0.00
Intercept	Scientific Literacy	154256.61	1	154256.61	8328.62	0.00
	Independence	187294.82	1	187294.82	19601.51	0.00
Group	Scientific Literacy	95.07	1	95.07	5.13	0.03
	Independence	2234.82	1	2234.82	233.89	0.00
Error	Scientific Literacy	685.29	57	18.52		
	Independence	353.54	57	9.56		
Total	Scientific Literacy	154942.00	59			
	Independence	188958.000	59			
Corrected Total	Scientific Literacy	780.36	58			
	Independence	2588.36	58			

4. Discussion

The research results show that the Prezi-assisted PBL model affects students' scientific literacy and independence. The results show improvements in students' scientific concepts. This is correlated with the learning process. Prezi media-assisted PBL was adopted based on the students' characteristics. Learning using this model makes learning more comfortable because students are supported by appropriate learning models and media. Students are given problems faced in their daily lives, which are introduced attractively with the help of

Prezi media. This form of learning makes students more interested in participating in the learning process. Students who have interest in learning become more interested in the learning process (Fajri et al., 2021; Yuliansih, Arafat & Wahidy, 2021). Interest in learning influences student activity in the learning process. Students actively collect information related to the materials provided. This leads to better understanding of science. Learning activities provide students with the opportunity to develop scientific process skills (Pujawan et al., 2022). With the development of the scientific process, students acquire knowledge in science. In other words, students' ability to solve problems using the scientific process has an impact on their scientific literacy skills.

Scientific literacy is important in modern life which is faced with issues related to science and technology (Semilarski & Laius, 2021; Valladares, 2021; Widodo et al., 2020). Preparing for scientific literacy is very important because everyone needs information in their daily lives as a reference for scientific thinking and in decision making and problem solving tasks (Chusni & Hasanah, 2018; Samsu et al., 2020; Wahyu et al., 2020). Scientific literacy is important to support the development of attitudes, environmental responsibility, interest, motivation and student involvement (Oliver & Adkins, 2020). Literacy competency itself refers to the use of knowledge and scientific processes in solving problems (Fadila et al., 2020; Rusilowati et al., 2018; Sudarsono et al., 2020; Widi et al., 2016). Scientific literacy is needed to develop scientific knowledge, identify problems and draw conclusions based on actual evidence from the process (Fauziyah et al., 2021). Scientific literacy has worked well in this study because students were directly involved in the learning process and the learning process was focused on how the students performed in the problem-solving process. Students never get tired of learning when the materials are introduced using interesting media.

The results of the study also show that the PBL model supported by Prezi Media has a significant impact on student autonomy in the learning process. . In this learning process, the PBL model supported by Prezi Media is focused on introducing technology- based problems that enable students to continue to develop. . Students are able to deepen awareness and face situations confronting them; the students become flexible in the process. This condition does have a positive impact on student independence during the learning process. Student independence is strongly shaped by student-oriented activities.. These activities make students more active. This independence comes from a positive and effective learning experience in the learning process (Orakci & Gelisli, 2017; Orakci & Gelisli, 2019), to address and organize management plans and evaluate learning that can develop students' independence (Tseng et al., 2020). In other words, learning that involves student activity in the learning process makes the students more self-reliant. Highly independent students no longer need encouragement from educators (Shepley et al., 2018). Independent learners are learners who direct learning to achieve their goals, are completely independent of educators, are motivated to learn and develop the ability to reflect on learning (Henri et al., 2018; Nguyen & Habók, 2021; Ratminingsih et al., 2018). Independency is associated with positive attitudes towards individual values and self-expression (Magnusson & Zackariasson, 2019). In this study, a more developed indicator is the students' self and situation awareness. This condition is supported by a learning process that focuses more on the problem-solving process. Through problem-solving learning, students are taught not to take other people's opinions for granted without any confirmation; rather, they are taught to focus on conveying problem-solving ideas obtained from the scientific process. In addition, students are also accustomed to self-evaluation in the learning process, which of course makes for better students.

The results of this study are consistent with the results of several previous studies which state that student learning outcomes are superior in Prezi-supported PBL models over Prezi-supported discovery learning models (Ardiansyah et al., 2020). Studies show that students learning with a PBL learning model through the Realistic Mathematics Education approach supported by Prezi presentations outperformed those learning through a scientific approach (Astuti & Widianawati, 2016). Studies have shown that there are differences in student learning outcomes when using Prezi-based PBL learning models and Prezi-based pair-check learning models in traditional learning environments (Hartina et al., 2020). Studies have also shown that students' learning outcomes with Prezi-supported problem-based learning models achieve Learning Mastery, while Prezi-supported Discovery Learning models do not achieve Learning Mastery (Ardiansyah et al., 2020).

This study has advantages over previous studies in that this learning model focuses on the impact of Prezi Media-based PBL models on student academic literacy and independence. Research results show that this model has a great impact on scientific literacy and the development and understanding of scientific concepts and applications in scientific research processes. However, due to the limitations of this study in the number of samples, more schools need to be studied to better understand the impact of implementing this model.

5. Conclusion

The results show that the PBL model assisted by Prezi media affects the scientific literacy and independence of students both simultaneously and partially. This is shown by the differences in the mean values, where the mean values of scientific literacy and independence among students who were taught using PBL assisted by Prezi media is greater. The results also show that the most affected variable is scientific literacy compared with the independent variable of students. Therefore, this method can be recommended as one of the learning approaches used to improve students' scientific literacy and student independence.

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