Implementation of the Project Based Learning (PJBL) Atmospheric Material Learning Model to Improve Students' Cognitive Abilities in the Era of Independent Learning

Nur Lailiiya[1], Ita Mardiani Zain[2]
Teacher Professional Program (PPG), LPSP, Surabaya State University
E-mail:nurlailiiyah12@gmail.com

Abstract

The aim of this study determines the effectiveness of the Project Based Learning (PJBL) learning model in the form of an Integrated Website Mock-up Project output via Barcode to improve students' cognitive abilities with atmospheric material in the independent era of learning which is closely related to nature and the nature of the students' era in the independent curriculum. This research uses the Classroom Action Research or PTK method. Data was obtained through pretest and post-test before and after PTK was carried out, then data analysis was carried out using Wilcoxon Signed Ranks. Based on data processing, Sig. (2-tailed) or the P value is 0.000 or the value is <5%. In accordance with the decision rules that have been made that Sig. (2-tailed) or P value < 5% then it is decided to accept Hi, so Ho is rejected. It can be stated that there is a difference in the average pretest and post-test scores, this difference is in the form of an increase in students' cognitive scores in learning using the PJBL learning model or Project Based Learning in the form of an Integrated Website Mock-up Project via Barcodes of atmospheric material in the era of independent learning.

Keywords: *Project Based Learning (PJBL), cognitive abilities, and independent learning era*

INTRODUCTION

The 21st century marks an era of rapid progress in science and technology, opening up new opportunities to solve various world problems. Based on this, humans as actors of the times are required to be more adaptive in developing competencies that are in line with the progress of this century. Lukum deepIndarta et al., (2022)states that there are three major competencies needed in the 21st century, namely the competencies to think, act and live in the world. Thinking competencies include critical thinking, creative thinking, and problem solving. Acting competencies include communication,

collaboration, digital literacy, and technological literacy. Meanwhile, competencies for living in the world include initiative, self-direction, global understanding, and social responsibility.

Education is considered as one of the institutions responsible for preparing the 21st century generation. The government through the Ministry of Education, Culture, Research and Technology of the Republic of Indonesia (Kemendikbud Ristek RI) has taken various steps, one of which is through implementing curriculum changes from the 2013 curriculum

to the independent curriculum. The independent curriculum is closely related to independent learning."Freedom of Learning" is based on the concept of Ki Hajar Dewantara's thoughts which is known as the among system, namely Ing ngarso sung tulodo, Ing madyo mangun karso, Tut wuri handayani (Directorate General of secondary and special education teachers, 2024). This thinking means that educators can actually play a role in providing examples, guiding and providing support or motivation to students. According to Ki Hajar Dewantara, the among system means that learning activities must pay attention to the concept of the nature of nature and the nature of the times. The nature of nature in question is the characteristics inherent in students, for example character, origins of students, talents, interests, knowledge abilities and so on, while the nature of the times is related to developments in the times which are closely related to technological developments, so the implementation of education must pay attention to the concept This is a form of

responsibility for creating independent education.

According to the Minister of Education, Culture, Research and Technology of the Republic of Indonesia (Kemendikbud Ristek RI), Nadiem Makarim, the main concept of freedom to learn is freedom to think.Indarta et al., (2022)stated that freedom to learn also involves conditions of freedom in fulfilling the objectives, methods, materials and evaluation of learning for both teachers and students. Based on this, in designing learning activities, a teacher must consider the objectives, methods, models and learning approaches that are adapted to the natural and contemporary nature of students.

Freedom to learn can be implemented starting from creating a strategy for designing learning activities. Teachers need to choose a learning approach that is pro-student, one of which is the student-centered learning approach or student-centered learning, then the selection of learning models and objectives must also be in accordance with the characteristics of the students. According to Barus inIndarta et al., (2022)that the learning models that teachers can choose for 21st century learning are Discovery Learning, Inquiry Learning, Problem Based Learning, Project Basic Learning, Production Based Training, Teaching Factory, and the Blended Learning Model. In this research it is also explained that Project Based Learning is a learning method that uses projects.

SMA Kemala Bhayangkari 1 Surabaya as one of the private educational institutions in the city of Surabaya also participates in implementing the independent curriculum. For 1.5 years, this school has implemented this curriculum, starting from FY 2022/2023 to FY 2023/2024. The independent curriculum is applied to class XI and class still involves the nature of nature and the nature of the times in it. To answer this, Classroom Action Research or PTK was carried out in class This project cannot be separated from considerations for integrating technological advances in it, namely the Project for Creating Integrated Website Mockups via Barcodes, while the natural nature of students is related to the learning styles of students in class X-7 which are very varied. Based on data, 44% of class X-7 students have a visual learning style, 23% have an auditory learning style, 20% have a kinesthetic learning style, and 13% have a mixed learning style of visual, auditory and kinesthetic. Where, problems were found in class X-7namely a total of 27 students, the pretest score on atmospheric material was in the poor category, meaning they got a score <35 out of 100. Meanwhile, the remaining 3 students, the pretest score was in the medium category, meaning they got a score of 36-70 out of 100. These data are based on the results of pretest activities on atmospheric material knowledge and learning style questionnaires for class X-7 students.

The aim of this research is to see the effectiveness of the Project Based Learning or PjBL learning model in the form of the output of the Website Integrated Mockup Project via Barcodes in improving students' cognitive abilities on atmospheric material in the era of independent learning which is closely related to nature and the nature of students' times.

RESEARCH METHOD

This research uses the Classroom Action Research or PTK method. Classroom action research or PTK is a controlled investigation process to find and solve learning problems in the classroom(Pantiwati & Permana, 2020). The ultimate goal of PTK itself is to change the academic community and the situation where research takes place towards improvement(Prihantoro & Hidayat, 2019). The classroom action research method used in this research is the PTK model proposed by Kurt Lewin, where according to Lewin there are three stages for conducting research using the PTK method, namely: input or planning, transformation or action, and output or results stages.(Prihantoro & Hidayat, 2019). The input stage contains preliminary diagnosis steps, data gathering feedback of results, and action planning. The transformation stage contains learning processes, action planning, and action steps. The output stage is changes in behavior, data gathering, and measurement.

Input or Planning Stage

Class X-7 consists of 34 regular students, with quite varied learning styles. A diagnostic assessment was carried out regarding atmospheric materials in class X-7. Because 4 students did not attend class, the research will only be carried out on 30 students who took part in this atmospheric material diagnostic assessment. Diagnostic assessments are carried out by students filling in questions on their respective LKPD (Learner Worksheets).

Based on the initial data obtained, the researcher planned an action in cycle I, namely implementing learning using the PJBL (Project Based Learning) model in the form of an Integrated Website Mock-up via Barcode. Determining and formulating an action plan includes:

1. Develop teaching modules for learning activities on atmospheric material, including learning objectives, learning activities, assessments, and learning reflection activities.
2. The formulation of learning objectives in the teaching module is:
   By carrying out learning activities using project-based learning, making integrated website mock-ups with group discussion techniques, it is hoped that students will be able to discover new knowledge about atmospheric material, think critically, collaboratively, creatively and be confident in every situation.
3. Formulation evidence or indicators of competency achievement, including:
   - Students can explain the characteristics of atmospheric layers through the integrated website mock-up project they create
   - Students can describe measurements of weather elements through the integrated website mock-up project they create
   - Students can interpret the weather through the website integrated mock-up project they create
   - Students can explain the classification of climate types through the integrated website mock-up project they create
   - Students can explain the characteristics of the climate in Indonesia through the integrated website mock-up project they create
   - Students can explain the influence of global climate change on life through the integrated website mock-up project they create
4. Based on indicators of competency achievement has determined, then prepare the materials, namely:
   a) Definition, constituent components, and characteristics of the atmospheric layers
   b) Definition and components of weather starting from cloud type, wind type, air pressure, temperature, humidity, temperature and sunlight
   c) Climate classification includes solar climate classification to climate classification according to figures, namely Koppen, Oldeman, Junghuhn, and Schmidt & Ferguson.
   d) Climate characteristics in Indonesia
   e) The impact of climate change on life in the world
5. Determine the learning method, namely the group learning method, where each group has a different project theme. Consisting of 5 groups of them group 1 on the topic of atmospheric layer characteristics, group 2 on the topic of measuring weather elements and weather interpretation, group 3 on the topic of climate type classification, group 4 on the topic of climate characteristics in Indonesia, and group 5 on the topic of the influence of global climate change on life.
6. Prepare assessment instruments including pretest and post-test
7. Coordinate the work program for implementing actions

Transformation stage

Learning processes,action planning, and action steps, at this stage occurs during four meetings in learning activities including,

1st Meeting:starting with greetings, conveying learning objectives, delivering learning models and learning assessments,

forming groups, creating product concepts for integrated website mockups via barcodes for each group

2nd and 3rd meetings: build a construction of understanding about each atmospheric material for each group, of course this construction of understanding will be used as a basis for making mock-up designs and website content based on the discussions of each group. Preparation of mock-up tools and materials, preparation of laptop and cellphone devices for designing websites, creating mock-up projects and websites according to the division of roles in each group.

4th meeting: Presentation of atmospheric material using integrated website mockup media that has been made according to each group, questions and answers, then at the end, strengthening the material together.

Output stage

Changes in behavior, data gathering, and measurement, in this section the desired changes can be seen. Of course, data collection is carried out regarding the changes themselves by carrying out summative assessments in the form of completing LKPD (Learner Worksheets) or posttests for 30 regular students in classes X-7.

DATA COLLECTION TECHNIQUE

The data in this research are the results of pretest and posttest assessments. The data source is the subject from which the data in this study was obtained. In this study, the data source was obtained from 30 regular students in class X-7 at SMA Kemala Bhayangkari 1 Surabaya. The data collection techniques used were written tests and documentation. Documentation is carried out at each stage of the Classroom Action Research (PTK) carried out. The test is used to measure the cognitive abilities of students before and after PTK. The PTK includes the input stage (preliminary diagnosis, data gathering feedback of results, and action planning). Transformation stage (learning processes, action planning, and action steps), and output stage (changes in behavior, data gathering, and measurement). As well as field notes which are used to collect data related to class situations or subjects during research activities.

RESEARCH INSTRUMENTS

The research instruments used in this research are LKPD (Learner Worksheets) for pre-test and post-test, field note instruments, and student project assessment rubrics.

ANALYSIS AND DATA PROCESSING TECHNIQUES

Data analysis was carried out using Wilcoxon Signed Ranks from the pretest and post-test results. The use of Wilcoxon Signed Ranks is because the data is not normally distributed so the t-test difference test is valid. Wilcoxon Signed Ranks is a non-parametric test to measure the significance of differences between 2 data sets that are paired on an ordinal or interval scale, but are not normally distributed or also known as the Wilcoxon matched pairs test (differencesantara.com, March 2022).

Table 1. Results of pretest and posttest scores for class X-7 students on atmospheric material using the PjBL learning model

No.	Nama Peserta Didik	Hasil Belajar Pengetahuan		No.	Nama Peserta Didik	Hasil Belajar Pengetahuan	
		Pretest	Postest			Pretest	Postest
1	A	11	80	16	Q	17	95
2	B	27	78	17	R	11	98
3	C	18	76	18	T	18	79
4	D	11	55	19	U	18	71
5	E	21	55	20	W	30	94
6	F	38	94	21	X	20	78
7	G	13	80	22	Y	20	78
8	H	27	90	23	Z	29	80
9	I	20	74	24	AA	9	34
10	J	38	74	25	AB	31	87
11	K	11	80	26	AC	18	79
12	L	11	78	27	AD	23	82
13	M	4	94	28	AE	29	77
14	N	18	71	29	AF	11	37
15	O	59	96	30	AH	14	49

Based on data processing in table 1, the probability value or P value from the pretest results is 0.041 and the P value from the post-test results is 0.002, meaning it is smaller than the significance level (0.05), so there is significant evidence to reject the P value using the t-test.

RESEARCH HYPOTHESIS

Ho: there is no difference in the average pretest and post-test scores

Hi: there is a difference in the average pretest and post-test scores

Aditya et al., (2021)states that the decision rule in determining whether Ho or Hi is considered correct or accepted is to use the following form:
When Sig. (2-tailed) or the P value (Probability) > 5% then it is decided to accept Ho, otherwise if the result that appears is Sig. (2-tailed) or P value < 5% then it is decided to accept Hi.

INDEPENDENT TEST RESULTS OF THE WILCOXON SIGNED RANKS SAMPLE

The results of the Independent Wilcoxon Signed Ranks Test on the data in table 1 above obtained the following results:

Table 2. Results of the Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
posttest - pretest	Negative Ranks	0a	.00	.00
	Positive Ranks	30b	15.50	465.00
	Ties	0c		
	Total	30		

a. posttest < pretest
b. posttest > pretest
c. posttest = pretest

Table 3. Results of the Wilcoxon Signed Ranks Statistics Test

Test Statistics

	posttest - pretest
Z	-4.783b
Asymp. Sig. (2-tailed)	,000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

DISCUSSION

Table 3 above obtained Sig. (2-tailed) or a P value of 0.000, it can be stated that the value is <5%. In accordance with the decision rules that have been made that Sig. (2-tailed) or P value < 5% then it is decided to accept Hi, so Ho is rejected. It can be stated that there is a difference in terms of increasing the average pretest and posttest scores using the PjBL learning model or Project Based Learning in the form of an Integrated Website Mockup Project via Barcodes of atmospheric material in the era of independent learning, because the PjBL model is one of the 21st century learning models with curriculum renewal, namely an independent curriculum which is closely related to the concept of "free learning" as a form of response to changing times. The results of this research are strengthened by research conducted by Wahyuni and Fitriana in 2021 regarding the Implementation of the Project Based Learning (PjBL) Learning Model in Improving Student Learning Outcomes in Islamic Religious Education Subjects at SMP Negeri 7 Tangerang City.Wahyuni & Fitriana (2021)in his research stated that the Project Based Learning (PjBL) learning model in Islamic religious education subjects can improve student learning outcomes. Before using the PjBL model, only 60% of students' learning outcomes succeeded in achieving Minimum Learning Completeness (KBM), but after using PjBL learning model student learning outcomes increased to 85% who succeeded in achieving Minimum Learning Completeness (KBM).

CONCLUSION

It can be concluded that there is effectiveness of the Project Based Learning or PJBL learning model in the form of the output of the Website Integrated Mock-up Project via Barcode in improving students' cognitive abilities on atmospheric material in the era of independent learning which is closely related to the nature of nature and the nature of the students' era.

ACKNOWLEDGEMENT

To all parties who have helped with the PTK process, collecting both student test result data and documentation data, we thank you. And don't forget to apologize whether intentionally or not during this research

process, may Allah SWT always give us His blessings and convenience.

BIBLIOGRAPHY

Aditya, F., Muchayan, A., Bahaswan, R., Lestari, S. E., & Bt Zulkifli, C. Z. (2021). Uji Beda Kinerja Keuangan Bank Menggunakan Independent Sample T-Test. *E-Jurnal SPIRIT PRO PATRIA*, *7*(1), 48–57. https://doi.org/10.29138/spirit.v7i1.1493

Indarta, Y., Jalinus, N., Waskito, W., Samala, A. D., Riyanda, A. R., & Adi, N. H. (2022). Relevansi Kurikulum Merdeka Belajar dengan Model Pembelajaran Abad 21 dalam Perkembangan Era Society 5.0. *Edukatif : Jurnal Ilmu Pendidikan*, *4*(2), 3011–3024. https://doi.org/10.31004/edukatif.v4i2.2589

Pantiwati, Y., & Permana, F. H. (2020). Penerapan Model Pembelajaran Berbasis Proyek untuk Meningkatkan Pemahaman dan Kualitas Media Pembelajaran Buatan Mahasiswa. *Bioedukasi: Jurnal Pendidikan Biologi*, *13*(1), 9–14. https://doi.org/10.20961/bioedukasi-uns.v13i1.39917

Prihantoro, A., & Hidayat, F. (2019). Ulumuddin: Jurnal Ilmu-ilmu Keislaman MELAKUKAN PENELITIAN TINDAKAN KELAS. *Ulumuddin: Jurnal Ilmu-Ilmu Keislaman*, *9*(1), 49–60. https://jurnal.ucy.ac.id/index.php/agama_islam/index

Wahyuni, E., & Fitriana, F. (2021). IMPLEMENTASI MODEL PEMBELAJARAN PROJECT BASED LEARNING (PjBL) DALAM MENINGKATKAN HASIL BELAJAR PESERTA DIDIK PADA MATA PELAJARAN PENDIDIKAN AGAMA ISLAM SMP NEGERI 7 KOTA TANGERANG. *Jurnal Kajian Islam Dan Pendidikan Tadarus Tarbawy*, *3*(1), 320–327. https://doi.org/10.31000/jkip.v3i1.4262

Perbedaanantara.com, Maret 2022. https://perbedaanantara.com/apa-perbedaan-uji-wilxocon-uji-mann-whitney-dan-uji-friedman/

Direktorat Sekolah Menengah Pertama, Mei 2022. https://ditsmp.kemdikbud.go.id/menilik-konsep-merdeka-belajar-menurut-ki-hajar-dewantara/