EFFECTIVENESS OF AN INTEGRATED PJBL MODEL OF PROCESS AND PRODUCT DIFFERENTIATION ON STUDENTS' CREATIVE THINKING ABILITIES

Nur Atika[1], Bayu Widiyanto[2], Muriani Nur Hayati[3]

[123] Pancasakti University (TEGAL, INDONESIA)

[*] Corresponding author: atikanur110701@gmail.com

Abstract

The aim of this research is to compare the effectiveness of the integrated PJBL model of process and product differentiation with the PJBL model on students' creative thinking abilities. The type is a quasi-experiment (quasi-experiment), with a *pretest and posttest control group design.* The research population was class VIII students. *Purposive sampling* was used for sample selection. Learning style questionnaires, creative thinking ability tests, and observation sheets were used as research instruments. The data analysis approach includes tests: prerequisites (normality and homogeneity), and the effectiveness of the N-Gain Score. Based on the research findings, it can be concluded that the implementation of the PJBL model integrated with process and product differentiation has better effectiveness than the PJBL model on students' creative thinking abilities. Even though both are in the "quite effective" category, the average N-Gain percentage gain for the PJBL integrated learning process and product differentiation model is greater, namely 70%. while the PJBL model only obtained 57%. This is also supported by observation results which show that the application of the PPA model integrated with process and product differentiation in the experimental class reached an average of 85% in the **"very creative" category**, while the application of the PJBL model in the control class only achieved 75%, in the **"creative" category. "**The influence provided by the integrated PJBL model of process and product differentiation on students' creative thinking abilities is characterized bystudents' ability to work on creative thinking ability test questions better, fluency in finding ideas and making products, using various tools and materials to complete products, providing new ideas and modifying the products being made.

Keywords: PJBL, Differentiation, Creative Thinking

1 INTRODUCTION

Individuals in the 21st century must be able to obtain, sort, organize and process information to solve problems in a dynamic, challenging and competitive environment [1] . One of the abilities needed in this century is creative thinking [2]

Creative thinking is the process of identifying problems or knowledge gaps, developing ideas or hypotheses, testing and refining them, and conveying findings. Creative thinking has four main characteristics including thinking: fluency *, flexibility* , originality *and* elaboration .[3]

The education sector assesses that creative thinking skills are very important to have, because they give students lots of ideas that can be used to solve problems from new perspectives [4] . Not only that, creative thinking plays an important role in developing ideas that can be implemented in global problems [5]

Based on the importance of the ability to think creatively, the facts show that the ability to think creatively in Indonesia is relatively lacking. The results of the 2023 *Global Innovation Index show* that Indonesia is in 61st position out of 132 countries [6] . Research by [7] also showed that the creative thinking abilities of 70 students in science lessons were classified as less creative.

Actions that can be taken to optimize students' creative thinking abilities are implementing the PJBL model [8] and differentiated learning [9] . PJBL is an approach to learning where students participate actively (individually or in groups) in order to achieve learning goals through the creation of real work [10] . Meanwhile, differentiated learning is an effort to adapt educational experiences in the classroom to students' learning needs [11]

Previous research shows that the application of *project based learning* can foster student creativity, namely by obtaining an average number of four creativity indicators of 85.73% [12] . Furthermore, other research also states that project-based differentiated learning makes students more enthusiastic about providing ideas and opinions, collaborating and solving problems using creative methods [13] .

Based on the results of interviews with teachers at one of the Tegal City Middle Schools, information was obtained that in science learning the teacher had implemented differentiated learning even though according to the teacher it was not optimal. The type of differentiation usually applied by teachers is content and process differentiation. Teachers never apply product differentiation themselves. According to the teacher, he only gave an assignment in the form of a product once, namely when making a cell model. However, these products are generalized, not differentiated, and have been implemented for a long time. Then, in forming groups, teachers often group students randomly, for example by seating or presence. Teachers have never grouped students based on their learning styles.

Still related to the results of the interview, according to the teacher, teachers more often focus on two things in science learning. First, teachers pay more attention to students' understanding of the material. Second, teachers try to develop students' critical thinking abilities. However, teachers have never measured students' creative thinking abilities.

Based on the problems that have been described, this research offers a PJBL model that is integrated with process and product differentiation, which is adapted to student learning styles. Previous research revealed that differentiated learning that is adapted to learning styles can provide improved student learning outcomes [14] .

Based on the results of the positive influence of implementing differentiated learning that is adapted to learning styles from several studies, it is necessary to research the effectiveness of the integrated PJBL model of differentiated learning with processes and products on creative thinking abilities. The aim is to compare the effectiveness of the integrated PJBL model of process and product differentiation with the PJBL model on students' creative thinking abilities.

2 METHODOLOGY .

This research is a quasi-experimental type, with a *non-equivalent control group pretest and posttest design.*It will be implemented on 15-29 May 2024 at one of the Tegal City Middle Schools, involving class VIII students as the research population. Then from that population, samples were taken using *purposive sampling*. Based on considerations and recommendations from science subject teachers, the results were that classes 8A and 8B were selected as samples in this research. The number of samples in each class is the same, namely 31 students. Class 8A consists of 14 boys and 17 girls, while class 8B consists of 16 boys and 15 girls.

The procedure for this research was that classes 8A and 8B were given different treatment. Class 8A as an experimental class applies the integrated PJBL model of process and product differentiation, while class 8B as a control class applies the PJBL model only. However, both classes received the same learning material, namely mixed material, carried out full face-to-face meetings 4 times each, given *a pretest* before learning, and *a posttest* after completion of learning, and used the same PJBL syntax, including: 1) Determine basic questions, 2) Planning the project, 3) Developing a schedule, 4) Monitoring students and project progress, 5) Product assessment, and 6) Evaluation of experience. [15]

The variables of this research include the independent variable (integrated PJBL model of process and product differentiation, and PJBL model) as well as the dependent variable (students' creative thinking abilities). The instruments are learning style questionnaires, test instruments, along with observation sheets. The learning style questionnaire was used to determine the learning needs (learning styles) of experimental class (8A) students and as a basis for developing differentiated learning in that class. The test instrument is used to measure the dependent variable, namely students' creative thinking abilities. The test instrument is in the form of essay questions, totaling 5 *essay questions* and has been adapted to indicators of creative thinking abilities in the form of *fluency, flexibility*, *originality* and *elaboration*. Observation sheets are used to observe students' creative thinking abilities during learning. Observation activities were carried out by 2 observers.

Before being used for research, the instruments in this research were tested for expert validity on 3 validators (supervisors 1 and 2 and 1 science teacher). This validity includes content and construct validity to find out whether each item in the instrument that has been created is in accordance with the indicators or other aspects. The average results of content and construct validation from the three validators, both on the learning style questionnaire instrument, test instrument, and observation sheet, obtained an average that fell into the "can be used without revision" category.

For learning style questionnaires and test instruments, an empirical validity test is required after the instrument has been tested with a validator. Empirical validity is validity that originates or is obtained through observations in the field [16] . The results of the analysis of the learning style questionnaire trial showed that of the 18 learning style questionnaire items that were tested on 31 students, all were valid and had a reliability of 0.817 in the **"very high" category** . The results of the test instrument trial analysis were that of the 10 questions tested on 30 students, there were 8 valid questions and 2 invalid questions. The reliability value of 0.921 is in the **"very high" category** too. In the results of the trial of the test questions, the level of difficulty and the differentiating power of the questions were also tested. The results of the difficulty level test showed that of the 10 questions, there were 5 questions in the easy category, 4 medium, and 1 difficult, while in the discriminating power test, 2 questions had poor discriminating power, 2 fair, 4 good, and 2 very good. From these results, 5 questions were then taken which would be used as *pretest-posttest questions* for the research. SPSS version 22 and Microsoft Excel were used to analyze research data. The data analysis technique is testing: prerequisites (normality and homogeneity), as well as the effectiveness of the N-Gain Score.

3 RESULTS

3.1 Prerequisite Test Results

3.1.1 Normality Test

The results of the normality test show that the data is normally distributed with a significance value of >0.05. Where *the pretest and posttest* for the experimental class were 0.111 and 0.059, while *the pretest and posttest for* the control class were 0.087 and 0.091. The results are presented in table 1.

Table 1. *Normality Test Results*

	Class	Shapiro-Wilk		
		Statistics	**df**	**Sig.**
Pretest	Experiment	,945	31	.111
	Control	,941	31	,087
Posttest	Experiment	,935	31	,059
	Control	,941	31	,091

3.1.2 Homogeneity Test Results

The homogeneity test results show that the data is homogeneous with a significance gain of >0.05, as shown in table 2.

Table 2*. Homogeneity Test Results*

	Levene Statistics	df1	df2	Sig.
Pretest	2,900	1	60	,094
Posttest	3,219	1	60	,078

3.1.3 Effectiveness Test

Testing the effectiveness of the N-Gain score to determine the effectiveness of the application of methods, models, strategies or treatmentsused [17] . In this research, we compare the effectiveness of the integrated PJBL model of process and product differentiation with the PJBL model on students' creative thinking abilities. The N-Gain Score test is carried out based on *the pretest-posttest* results. The results are presented in table 3.

Table 3. *N-Gain Score Effectiveness Test Results for Experimental-Control Class*

		Statistics		Std. Error	
		Experiment	**Control**	**Experiment**	**Control**
NGain_Percent	Mean	70.2906	57.1236	3.11060	3.19243
	Median	71.4286	55.5556		

Variance	299,950	315,940
Std. Deviation	17.31907	17.77471
Minimum	40.00	16.67
Maximum	100.00	85.71

Table 3 shows the average percentage of N-Gain for the experimental class where the integrated PJBL model of process and product differentiation is applied, namely 70%. Meanwhile, in the control class where the PJBL model was applied, only 57% was obtained. If categorized using the N-Gain effectiveness interpretation category according to Hake, then the application of the model from each class is included in the **"quite effective" category** because it is in the range of 56 - 75%. However, the average N-Gain percentage gain in the experimental class was greater. This means that the integrated PJBL model of process and product differentiation has **"better" effectiveness** than the PJBL model alone.

The observation results obtained increasingly support and strengthen that the effectiveness of the PJBL model integrated with process and product differentiation is better than the PJBL model alone. The results of observations of creative thinking abilities by 2 observers, in the experimental class where the integrated PJBL model of process and product differentiation was applied, obtained an average percentage of 85% in the **"very creative" category.** WhereThe percentages for each aspect are: 1) *fluency* = 90%, 2) *flexibility* = 86%, 3) *originality* = 81%, and 4) *elaboration* = 83%. Meanwhile, only 75% of the control class applied by the PJBL model is in the **"creative" category.** The percentage value obtained for each aspect is *fluency*81%, *flexibility* 82%, *originality* 68%, and *elaboration* 70%. The results of observations in both classes for each aspect are presented in Figure 1.

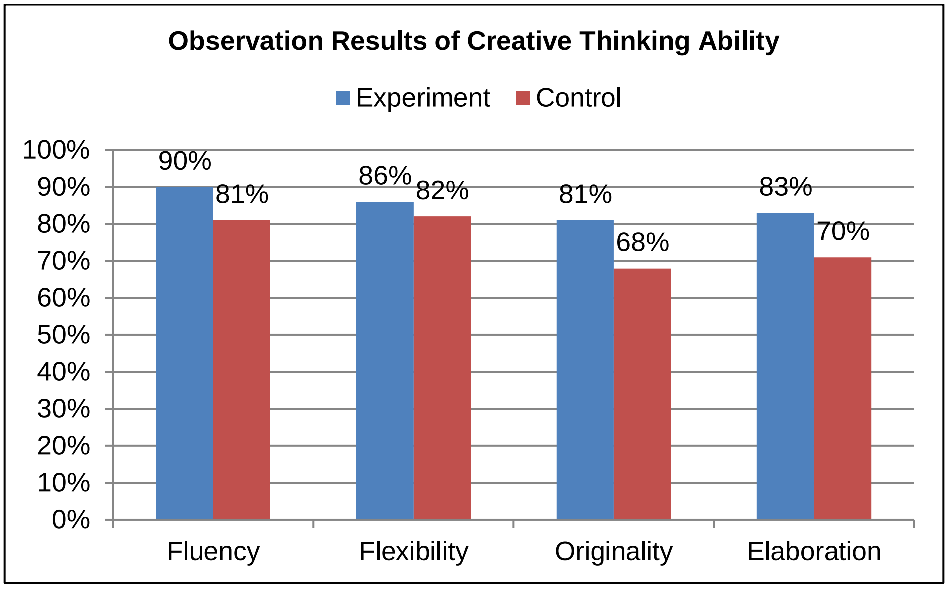

Figure 1. *Observation Results of Creative Thinking Ability for each Aspect*

The results of the N-Gain calculations that have been carried out are sufficient to explain the comparison of the effectiveness of the two models applied. Where is the effectiveness of the PJBL modelintegrated process and product differentiation is better than the PJBL model for students' creative thinking abilities. PJBL modelintegrated process and product differentiation applied in the experimental class, namely by paying attention to differences in student learning styles. This is what supports the success of learning in the experimental class so that it achieves better results than the control class. In line with previous research which suggests that success in integrated differentiated learning with the PJBL model in cycle II is obtained through teaching design that is aligned with student characteristics, abilities and needs [18]

Process differentiation in the experimental class is when the delivery of material is supported by various media such as PPT, animated videos and demonstrations. Apart from that, during group project activities, various LKPD are also used according to learning styles (visual, auditory, kinesthetic). In line with previous research which suggests that process differentiation is carried out through the provision of LKPD which includes challenging activities for each group, which are adapted to their learning styles [19]

Product differentiation in the experimental class is that the projects created by each group are different according to their learning style. Where the visual group made science comics about separating mixtures, the auditory group made songs, and the kinesthetic group made practical videos about separating mixtures. In line with theoretical studies which explain that product differentiation can be done by providing various product choices to students, such as reports , pamphlets, speeches, dramas, tests, writing, photos,stories or videos, and so on[20] . [21] in their research also applied product differentiation based on learning styles, namely kinesthetics made infographic projects about conservation methods, the auditory group made songs about conservation methods, and the visual group drew pictures related to conservation methods.

The implementation of the integrated PJBL model of differentiated learning between processes and products provides a new atmosphere in the science learning process, making students happier, enthusiastic and motivated to participate in learning. They can also express their creativity with their group. The LKPD for groups is made differently, which is adapted to their learning style, so that each group faces different challenges according to their learning style. So they can sharpen their creative thinking skills to solve the challenges they receive. In line with the findings of previous researchers, the PJBL model which combines differentiated learning strategies has a good effect on students' creative thinking abilities [22] . Other research also suggests that differentiated learning using the PJBL model can create an exciting, meaningful learning atmosphere and develop the creativity and innovation of junior high school students, as skills for the 21st century [23] .

Evidence that the integrated PJBL learning model of process and product differentiation has better effectiveness on creative thinking abilities can also be seen from the results of observations. Where the experimental class that applied the PJBL model integrated differentiated learning processes and products reached the "very creative" category with an average percentage gain of 85% (*fluency*90%, *flexibility* 86%, *originality* 81%, and *elaboration* 83%). Meanwhile, in the control class where the PJBL model was applied, it only reached the "creative" category with an average percentage gain of 70% (*fluency*81%, *flexibility* 82%, *originality* 68%, and *elaboration* 70%). These results show that experimental class students who received integrated PJBL learning model of process and product differentiation achieved a better level of creative thinking ability. This can be seen when their learning process is smooth and active in asking questions related to projects/LKPD and discussing creative ideas, using various creative materials and considering various ways to complete their products, providing new ideas for their products, and adding details to their products. to further clarify the product being made.

Based on the explanation above, the integrated PJBL model of differentiated learning between processes and products can be used as a learning option to improve students' creative thinking abilities. So it is recommended that future researchers conduct similar research either on the same or different aspects of differentiation as well as on the same or different material.

Despite the positive results obtained by this research, its implementation found obstacles in terms of class and time management, due to being faced with students who have varied learning styles. So, future researchers need to pay attention to good class and time management.

4 CONCLUSION

The conclusion of this research is that there is a difference in effectiveness between the integrated PJBL model of differentiated learning with processes and products and the PJBL model alone on students' creative thinking abilities. Even though the two treatments both have an interpretation of the effectiveness of the N-Gain Score which is in the **"Fairly Effective" category,** the integrated model of differentiated learning between processes and products obtains a greater average percentage of the N-Gain Score, namely 70%. Meanwhile, the PJBL model alone without integrated differentiated learning is 57%. The observation results also showed that in the experimental class where the PJBL model was applied, integrated differentiated learning processes and products obtained a percentage of 85% in the **"very creative" category**, while in the control class where the PJBL model was applied alone only got 75% in the **"creative" category.**

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REFERENCES

[1] S. Panjaitan, “Upaya Meningkatkan Kemampuan Berpikir Kreatif Peserta Didik Dengan Pembelajaran Kontekstual Humanistik,” *Sepren*, 2020, [Online]. Available: https://jurnal.uhn.ac.id/index.php/sepren/article/view/22

[2] R. Bancin, M. Sholeh, and F. Nasution, “Hubungan Strategi Pembelajaran Dengan Kemampuan Pelajar Luar Biasa,” *ALFIHRIS:Jurnal Inspirasi Pendidikan*, 2023, [Online]. Available: https://ejurnalqarnain.stisnq.ac.id/index.php/ALFIHRIS/article/view/133

[3] EP Torrance, *Creativity Research and Higher Education.* ERIC, 1969. [Online]. Available: https://eric.ed.gov/?id=ED037160

[4] H. Awang and I. Ramly, "Creative thinking skills approach through problem-based learning: Pedagogy and practice in the engineering classroom," *International Journal of Educational and Pedagogical* Citeseer, 2008. [Online]. Available: https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=c54c936436e2ee1f38b241181ed996f2a67e86f9

[5] GM Anwar, M. Nadeem, M. Aness, A. Khizar, and M. Naseer, “Relationship of Creative Thinking with the Academic Archives of Periódico Tchê Química. ISSN 2179-0302.(2020); vol. 17 (n 34) students and its …,” *Int. J. Teach. Learn. High…* . 2009.

[6] GII database, “Global Innovation Index Indonesia 2022,” *Glob. Econ.* , 2023.

[7] Purwanti, M. S. Hayat, E. Rita, and F. Roshayanti, “Analisis Keterampilan Berpikir Kreatif Siswa Kelas VIII SMPN 1 Jumo dalam Pembelajaran IPA,” *J. Ilm. Multi Sci.*, vol. 16, no. 1, pp. 17–24, 2024, [Online]. Available: https://doi.org/10.30599/jti.v16i1.3042

[8] M. Sinta, H. Sakdiah, N. Novita, F.W. Ginting, and F. Syafrizal“Penerapan Model Pembelajaran Project Based Learning (PjBL) untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa pada Materi Hukum Gravitasi Newton di MAS Jabal Nur,” *Phi: Jurnal Pendidikan Fisika dan Terapan*, 2022, [Online]. Available: https://jurnal.ar-raniry.ac.id/index.php/jurnalphi/article/view/14546

[9] S. Santos, D. Coutinho, B. Gonç alves, and W. Scholhorn, “Differential learning as a key training approach to improving creative and tactical behavior in soccer,” *Res Q. Exerc. Sport* , 2018, doi: 10.1080/02701367.2017.1412063.

[10] F. Febriani, *Project Based Learning Dalam Meningkatkan Kreativitas Siswa pada Sekolah Penggerak SMP Al Azhar Syifa Budi Cibinong-Bogor*. repository.ptiq.ac.id, 2023. [Online]. Available: https://repository.ptiq.ac.id/id/eprint/952/

[11] CA Tomlinson, *Differentiation of Instruction in the Elementary Grades. ERIC Digest.* ERIC, 2000. [Online]. Available: https://eric.ed.gov/?id=ED443572

[12] H. M. S. Wijayanti, M. N. Hayati, and B.Widiyanto, “Implementasi Lembar Kerja Peserta Didik berbantuan Kliping berbasis Project Based Learning terhadap Hasil Belajar dan Kreativitas Siswa,” *Prosiding Seminar Nasional*, 2022, [Online]. Available: https://semnas.upstegal.ac.id/index.php/senapipa/article/view/358

[13] A. A. Rahma, B. Widiyanto, and Wakhmad, “Pemanfaatan Canva dalam Pembelajaran Berdiferensiasi untuk Meningkatkan Keterampilan Literasi Digital Peserta Didik,” *Prosiding Seminar Nasional Pendidikan Profesi Guru (PPG)*, 2024, [Online]. Available: https://semnas.upstegal.ac.id/index.php/semnasppg/article/view/887

[14] R. D. Puspita, H. P. Paksi, and S. Sutaji, “Penerapan Pembelajaran Berdiferensiasi (Gaya Belajar) untuk Meningkatkan Hasil Belajar Muatan IPAS Materi Sistem Pernapasan Manusia Kelas V SDN Sukowati Kapas Bojonegoro,” *J. Educ.*, vol. 6, no. 1, pp. 871–885, 2023, doi: 10.31004/joe.v6i1.3006.

[15] G. Lucas, “The George Lucas Educational Foundation: 2005,” *Instructional Module ProjectBased Learning* . 2005.

[16] S. Syaifudin, “vrba Validitas dan Reliabilitas Instrumen Penilaian Pada Mata Pelajaran Bahasa Arab,” *Cross-border*, 2020, [Online]. Available: http://www.journal.iaisambas.ac.id/index.php/Cross-Border/article/view/553

[17] S. Raharjo, “Cara Menghitung N-Gain Score Kelas Eksperimen dan Kontrol dengan SPSS,”

SPSS Indonesia. 2019.

[18] W. Angreini and T. Purnomo, “Integrasi Strategi Pembelajaran Berdiferensiasi dengan Project Based Learning untuk Meningkatkan Keterampilan Berpikir Kreatif Peserta Didik,” *Biosfer: Jurnal Biologi dan Pendidikan Biologi*, 2024, [Online]. Available: https://journal.unpas.ac.id/index.php/biosfer/article/view/13933

[19] A. N. Prafitasari, “Implementasi Pembelajaran Berdiferensiasi Proses dengan Problem Based Learning pada Pembelajaran Biologi,” *National Multidisciplinary Science*, 2023, [Online]. Available: http://proceeding.unmuhjember.ac.id/index.php/nms/article/view/489

[20] D. K. Fitra, “Pembelajaran Berdiferensiasi dalam Perspektif Progresivisme pada Mata Pelajaran Ipa,” *Jurnal Filsafat Indonesia*. ejournal.undiksha.ac.id, 2022. [Online]. Available: https://ejournal.undiksha.ac.id/index.php/JFI/article/download/41249/25699

[21] A. Y. Rachmawati, Y. Arfiani, I. Febriana, and S.Suyono, “Best Practices Pembelajaran Berdiferensiasi Berbasis Proyek untuk Meningkatkan Student Engagement pada Pembelajaran IPA,” *Jurnal Program Pendidikan Profesi Guru*, 2024, [Online]. Available: https://jproppg.upstegal.ac.id/index.php/JPRO/article/view/54

[22] A. A. Avivi, A. D. Pramadhitta, F.F. Rahayu, M. Saptriana and A. U. Salamah, “Implementasi Pembelajaran Berdiferensiasi dengan Model Project Based Learning pada Peserta Didik Sekolah Menengah Atas Kelas X pada Materi Bioteknologi,” *Jurnal Pendidikan Sejarah Dan Rises Sosial Humaniora*, 2023, [Online]. Available: https://ejournal.penerbitjurnal.com/index.php/humaniora/article/view/336

[23] Y. Lema, A. Nurwahyunani, M. S. Hayat, and F. Rachmawati, “Pembelajaran Berdiferensiasi Dengan Model PJBL Materi Bioteknologi Untuk Mengembangkan Ketrampilan Kreativitas Dan Inovasi Siswa SMP,” *Innovative: Journal Of Social Science Research,* 2023, [Online]. Available: http://j-innovative.org/index.php/Innovative/article/view/2798