

Influence of Problem-Based Learning Model, Discovery Learning, and Intellectual Intelligence on Creative Thinking

Maria Andriani Berek Ladjar, Tite Juliantine and Mulyana Mulyana
Universitas Pendidikan Indonesia, Jln. Dr. Setiabudhi No. 229 Bandung, Indonesia
marialadjar1990@gmail.com

Keywords: Problem-Based Learning Model, Discovery Learning, Intellectual Intelligence, and Creative Thinking.

Abstract: Teachers become facilitators in realizing creative thinking skills. Not apart from physical education teachers of sports and health, they also have a role and contribution to inculcate, foster and develop creative thinking skills of learners. The current reality of teacher-centered thinking and teaching styles, not students, closes the space for students to develop their creative thinking skills. Most of the learning models used by physical and health education subject teachers still use the direct learning model. Where teachers transfer knowledge directly to students. The teacher's mindset that by giving a live demonstration to the pupils, the learning materials will be effectively channeled and the pupils will more quickly understand the material. The purpose of this research is to know the effect of Problem-Based Learning Model and Discovery Learning and Intellectual Intelligence toward creative thinking. Experimental methods and 2x2 factorial design design were given to a predetermined class using the Problem Based Learning model and one class with the Discovery Learning model in delivering the material like the Volleyball game. Treatment was given for 14 x meetings with pretest and post-test. Parametric statistical test data processing using Independent Sample T-Test. If the data is not homogeneous, then a non-parametric statistical test is used using Mann-Whitney. Researchers are in the process of research so that has not obtained results from this study. Conclusion is Problem Based Learning model and Discovery Learning model is suitable with creative thinking characteristic, and can improve creative thinking student.

1 INTRODUCTION

Life skills of the 21st century are the targets of educational attainment as prescribed in the development of the 2013 curriculum. Three basic contexts of life skills of the 21st century are, first, learning and innovation skills composed of critical thinking, creativity, communication and collaboration. Both life and work skills consist of flexibility, initiative, leadership, social skills, cross-cultural, productivity, accountability and lifelong learning. Third digital literasi consisting of information media and ICT Literasi (ability to use information technology device).

Supporting students to master life skills of the 21st century. Education in schools is encouraged to cultivate and develop creative thinking skills that become one of 21 life skills aspects of the 21st century from early childhood and adolescence. Teachers become facilitators in realizing creative thinking skills. Not apart from physical education teachers of sports and health, they also have a role and

contribution to inculcate, foster and develop creative thinking skills of learners. The current reality of teacher-centered thinking and teaching styles, not students, closes the space for students to develop their creative thinking skills. Most of the learning models used by physical and health education subject teachers still use the direct learning model. Where teachers transfer knowledge directly to students. The teacher's mindset that by giving a live demonstration to the pupils, the learning materials will be effectively channeled and the pupils will more quickly understand the material.

Solutions for developing and fostering creative thinking skills in students. One of them is by using student-centered learning model. According to Guilford (Haefele, 1962, Bacanli, H, et al., 2011, p.540) suggests that creative thinking has eight essential elements, four cognitive, four affective: 1) Thinking smoothly: Creating as many solutions as possible; 2) Flexibility (think flexibility): Think in different ways; 3) Originality: Creating solutions that are different from others; 4) Elaboration: Detailing;

5) Curiosity: Creative people are curious people; 6) Complexity: They are intellectually complex. They deal with problems in different and complex ways of money; 7) Risk taking: They seek unusual (conventional) solutions and take risks. They take risks by looking for the unknown; 8) Imagination: They have a strong imagination.

Guilford's thinking can be simplified into the following four cognitive elements (Haeefele, 1962, Bacanli H, et al., 2011, pp. 540): 1) Thinking smoothly: Creating as many solutions as possible; 2) Flexibility (think flexibility): Think in different ways; 3) Originality: Creating solutions that are different from others; 4) Elaboration: Detailing.

"Characteristics of Problem-Based Learning is a student-centered learning approach (and curriculum) that empowers students to research, integrate theory and practice, and apply science and skills to develop sensible solutions in interpreting problems".

Vereijken and Whiting (in Raab, M., Masters, RSW, and Maxwell, J., 2011, 414) suggested that "Discovery learning refers to the process of making repeated attempts to perform a specific movement skill often based on a" working hypothesis "and making modifications based on outcome feedback". "Discovery Learning refers to the process of making a return effort to perform certain movement skills that are often based on" working hypotheses "and modify based on feedback results".

Based on the above opinion it can be concluded that the characteristics of Discovery Learning are learners independently (actively) seeking information and conceptual understanding, and find the basic principles of the material provided based on the hypothesis and modification of feedback results.

Problem-Based Learning and Discovery Learning models have appropriate characteristics and are suitable for improving students' creative thinking skills so they can serve as a solution in changing teacher's mind set as a learning center to become a student as a learning center.

2 METHOD

The research was conducted in the category of experimental study using Factorial Design 2 x 2.

Table 1: 2x2 factorial design for problem based learning model and discovery learning with intellectual intelligence towards creative thinking.

		Learning Models (X)	
		<i>Problem Based Learning</i> (X ₁)	<i>Discovery Learning</i> (X ₂)
Intellectual Intelligence (Y)	(Y ₁)	X ₁ Y ₁	X ₂ Y ₁
	(Y ₂)	X ₁ Y ₂	X ₂ Y ₂
Creative Thinking (C)			

2.1 Participant

A total of 32 students were divided into 2 groups, 16 students for the Problem-Based Learning Model group, and 16 students for the Discovery Learning Model group. Each group consists of 8 students with high intellectual intelligence and 8 students with low intellectual intelligence.

2.2 Data Collection Technique

Torrance Test of Creative Thinking (TTCT) that has been adapted to measure creative thinking in terms of cognitive. Creativity Behavior Assessment in Team Sports (CBATS) to measure creative thinking in psychomotor terms. Intellectual Intelligence derived from the results of student psychotes with the help of teachers Counseling Guidance.

3 RESULTS AND DISCUSSION

The research is still ongoing so that there are no significant findings. Broadly speaking, based on the theory of experts and previous research found the findings as follows:

3.1 Influence of Problem Based Learning Model with High Intellectual Intelligence on Creative Thinking

Arifah Purnamaningrum et al. doing research using Problem Based Learning Model showed that the application of Problem Based Learning model able to improve creative thinking ability of X-10 students of

SMA Negeri 3 Surakarta. This is evidenced by the increase in the ability of students in conveying many ideas, the ability of students in asking many questions the ability of students in designing steps in detail increased from before the implementation of Problem-Based Learning model. The results of the first cycle test showed that fluency ability increased by 13.38%, flexibility ability increased by 11.74%, the aspect of original thinking ability increased by 8.33% and the elaboration aspect increased by 13.26%.

Tomi Utomo et al. doing research using Problem Based Learning model got result that applying of model of Problem Based Learning able to improve ability of creative thinking of class VIII SMPN 1 Sumbermalang of Situbondo Regency. The ability to think creatively includes fluency, flexibility, and authenticity of student answers in answering the LKS. The result of analysis of students' creative thinking ability showed that the experimental class did not have 0 (0%) students in the criterion not creative (TK), while in the control class there were 2 (5.4%) students. In the less creative criteria (KK) there are 7 (18%) of the students in the experimental class that entered therein, while in the control class there are 16 (43.2%) students. In the next criteria, there are 20 (53.7%) of the students in the experimental class, while the control class is 14 (37.8%) students. On the Creative criterion (K), there are 10 (27%) of the students in the experimental class entering in it, while in the control class 5 (13.5%) students, the last criterion is the criterion of kreatif (SK), on this criterion both class experiment or control class there are no students who enter in it.

Based on all the above research, it can be concluded that the model of Problem Based Learning can improve creative thinking.

"In the nineteenth century Galton saw creativity as a part of genius and said that it is a natural ability." (Hasan Bacanli et al., 2011). "In the nineteenth century Galton saw creativity as part of his intelligence and said it was a natural ability." (Hasan Bacanli et al., 2011). Individuals with high domain-general analytical thinking ability (intelligence) tend to be successful in school. Learning experiences in various domains in school raises domain-general intelligence test scores, and intelligence, in turn, contributes to better performance in school work (Ceci, 1991; Ceci and Williams, 1997 in Hong and Milgram, 2010). In other words, high intellectual intelligence will enhance the ability to think creatively.

So it can be concluded from all research that has been presented that Model Problem Based Learning

with high intellectual intelligence can increase creative thinking.

3.2 Influence of Problem Based Learning Model with Low Intellectual Intelligence to Creative Thinking

Dasa Ismamuza conducts research of class VIII students using Problem Based Learning on critical and creative thinking skills, the result is the students' creative thinking ability toward mathematics who receive Problem Based Learning with cognitive conflict strategy is significantly better than students receiving conventional learning.

Devi Diyas Sari conducted research found that critical thinking skills of students of grade VIII B SMP Negeri 5 Sleman increased through the application of Problem Based Learning model. The increase of each indicator of critical thinking include the definition of indicators and the clarification of the problem of good enough that is equal to 83%, then the indicator rate of information based on the problem criteria assessment increased from enough to be good by 85%, and indicators design solutions based on the problem criteria assessment increased from good enough to 83%.

Based on all the above research, it can be concluded that the model of Problem Based Learning can improve creative thinking.

According to the Welsh classification (1975 in Hasan Bacanli et al., 2011), "traditional thinking is a method of thinking in which intelligence (educated intelligence) and origin (originality) are absent. It means no intellect and origin. Cognitive thinking, the equivalent of creative thinking, is high on intelligence and originality."

"Traditional thinking is a method of thinking in which intelligence (intellectual education) and original (originality) are not present. That means without intelligence and originality. Cognitive thinking, equivalent to creative thinking, is superior to intelligence and originality. "In other words, low intellectual intelligence can not increase creative thinking because it has to have the intelligence to reach the level of creative thinking.

So it can be concluded from all research that has been explained that Model Problem Based Learning with low intellectual intelligence can not increase creative thinking.

3.3 Influence of Discovery Learning Model with High Intellectual Intelligence on Creative Thinking

Hendra Erik Rudiyanto conducts research using Discovery Learning model with scientifically charged character approach to improve creative thinking. The result of the research shows that mathematics learning is effective, with indicators: 1) the ability of creative thinking to achieve mastery with the value of 71,55 and reaching 90% classical completeness; 2) the average creative thinking ability of the Discovery Learning model class with a scientific approach is better than the expository class; 3) the character of curiosity and communicating skills positively influence the ability of creative thinking; and 4) the increase of creative thinking ability in Discovery Learning model class with scientific approach.

Contrary to Fitri Apriyani doing research using the Discovery Learning model of students' creative thinking on the material of light properties in grade V students significantly. From the result of calculation of two pretest and posttest mean test, the value of P-value Sig (2-tailed) is 0,000. Where 0.000 is smaller than $\alpha = 0.05$ so H_0 is rejected, so it can be concluded that the Discovery Learning model can improve students' creative thinking skill. The result of the research with significance level $\alpha = 0,05$ indicates that the use of discovery learning model can improve student's learning achievement and students' creative thinking skill on light matter properties significantly. Although the students' learning achievement and creative thinking skills are increasing, there is no impact of the Discovery Learning model on the significantly improved learning outcomes and creative thinking skills of students in the high, medium and low groups.

"In the nineteenth century Galton saw creativity as a part of genius and said that it is a natural ability." (Hasan Bacanli et al., 2011). "In the nineteenth century Galton saw creativity as part of his intelligence and said it was a natural ability." (Hasan Bacanli et al., 2011). Individuals with high domain-general analytical thinking ability (intelligence) tend to be successful in school. Learning experiences in various domains in school raises domain-general intelligence test scores, and intelligence, in turn, contributes to better performance in school work (Ceci, 1991; Ceci and Williams, 1997 in Hong and Milgram, 2010). In other words, high intellectual intelligence will enhance the ability to think creatively.

So it can be concluded from all research that has been presented that Discovery Learning with high intellectual intelligence can increase creative thinking.

3.4 Influence of Discovery Learning Model with Low Intellectual Intelligence to Creative Thinking

Sri Rahayu doing research using Discovery Learning model shows that the increase of students' creativity in solving math problems can be seen from 1) the ability of students to explain the idea or idea in solving the problem both orally and in writing, from the initial condition of 12.50% to 79.17 %, 2) students' ability to respond to diversity of opinions about solving a problem in groups, from initial condition 20.83% to 87.50%; 3) students' ability to declare a problem into language or mathematical symbols, from initial condition 16.67 %, increased to 79.71%. So it can be concluded that the application of learning model of Discovery Learning in learning mathematics can improve the creativity of solving student problems.

Based on the results of the above research, it can be concluded that the Model Discovery Learning can improve students' creative thinking ability.

According to Welsh's classification (1975 in Hasan Bacanli et al., 2011), "traditional thinking is a method of thinking in which intelligence (educated intelligence) and origin (originality) are absent. It means no intellect and origin. Cognitive thinking, the equivalent of creative thinking, is high on intellectence and origence."

"Traditional thinking is a method of thinking in which intelligence (intellectual education) and original (originality) are not present. That means without intelligence and originality. Cognitive thinking, equivalent to creative thinking, is superior to intelligence and originality. "In other words, low intellectual intelligence can not increase creative thinking because it has to have the intelligence to reach the level of creative thinking.

So it can be concluded from all research that has been explained that Discovery Learning with low intellectual intelligence can not increase creative thinking.

3.5 Interaction Learning Model with Intellectual Intelligence to Creative Thinking

Based on all the opinions of experts above, both Model Problem Based Learning and Discovery Learning both can improve creative thinking.

4 CONCLUSIONS

The conclusion of the research is the research hypothesis because the research is still ongoing. Conclusion is Problem Based Learning model and Discovery Learning model is suitable with creative thinking characteristic, and can improve creative thinking student. Different intellectual intelligence between students make different improve creative thinking too.

REFERENCES

- Alfieri, L., Brooks, P., Aldrich, N. J., Tenenbaum, H. R. 2011. Does discovery-based instruction enhance learning? A meta-analysis. *Journal of Educational Psychology*, 103(1), 1–18.
- Apriyani, F. 2013. *Pengaruh Model Pembelajaran Penemuan (Discovery Learning) terhadap Keterampilan Berpikir Kreatif Siswa pada Materi Sifat-Sifat Cahaya*. S1 Skripsi, Universitas Pendidikan Indonesia.
- Azwar, S. 2011. *Pengantar Psikologi Inteligensia*. Yogyakarta: Pustaka Belajar.
- Bacanli, H., Dombayci, M. A., Demir, M., Tarhan, S. 2011. Quadruple thinking: Creative thinking. *Procedia - Social and Behavioral Sciences*, 12, 536–544.
- Baehaqie, A. N. A. 2015. Peningkatan Ketrampilan Passing Bawah Bolavoli dengan menggunakan Metode Bermain Bola Pantul peserta ekstrakurikuler Bolavoli di SMA Negeri 1 Sirampong Brebes. (Skripsi). UNY: Yogyakarta.
- Carriger, M. S. 2015. Problem-based learning and management development – Empirical and theoretical considerations. *The International Journal of Management Education*, 13(3), 249–259.
- Fraenkel et all. 2012. *How design and Evaluate Research in Education*. New York, N.Y. McGraw-Hill Higher Education.
- Ge, X., Planas, L. G., Er, N. 2010. A cognitive support system to scaffold students' problem-based learning in a web-based learning environment. *Interdisciplinary Journal of Problem-Based Learning*, 4(1), 30–56.
- Henley Business School. 2008. Creative Thinking. *Learning Assets*, 49(October), 455–463.
- Hilman, A. S. 2014. Pengaruh Model Pembelajaran *Problem Based Learning* terhadap Keterampilan Bermain Bola Basket. (Tesis). UPI: Bandung.
- Hong, E., Milgram, R. M. 2010. Creative Thinking Ability: Domain Generality and Specificity. *Creativity Research Journal*, 22(792081565), 272–287.
- Im, H., Hokanson, B., Johnson, K. K. P. 2015. Teaching Creative Thinking Skills: A Longitudinal Study. *Clothing and Textiles Research Journal*, 33(2), 129–142.
- Ismaimuza, D. 2013. Kemampuan Berpikir Kritis dan Kreatif Matematis Siswa SMP melalui Pembelajaran berbasis Masalah dengan Strategi Konflik Kognitif. *Jurnal Teknologi (Sciences and Engineering)* 63:2 (2013), hal. 33-37.
- Jonassen, D. H., Hung, W. 2008. All Problems are Not Equal: Implications for Problem-Based Learning. *Interdisciplinary Journal of Problem-Based Learning*, 2(2), 10–13.
- Juliantine, T. 2010. *Penembangan Kreativitas Siswa Melalui Implementasi Model Pembelajaran Inkuiri Dalam Pendidikan Jasmani*. Disertasi UPI.
- Kim, K. H. 2011. The Creativity Crisis: The Decrease in Creative Thinking Scores on the Torrance Tests of Creative Thinking. *Creativity Research Journal*, 23(4), 37–41.
- Leary, H., Walker, A., Shelton, B. E., Fitt, M. H. 2013. Interdisciplinary Journal of Problem-Based Learning Exploring the Relationships Between Tutor Background, Tutor Training, and Student Learning: A Problem-based Learning Meta-Analysis. *Interdisciplinary Journal of Problem-Based Learning*, 7(1), 3–15.
- Machin, A. 2014. Implementasi Pendekatan Saintifik, Penanaman Karakter Dan Konservasi Pada Pembelajaran Materi Pertumbuhan. *Jurnal Pendidikan Ilmiah Indonesia (JPII)* 3(1) 2014 hal 28-35.
- Mukholid, A. 2007. *Pendidikan Jasmani Olahraga dan Kesehatan*. Jakarta: Yudistira.
- Mumford, M. D., Medeiros, K. E., Partlow, P. J. 2012. Creative thinking: Processes, strategies, and knowledge. *Journal of Creative Behavior*, 46(1), 30–47.
- Munandar, U. 2002. *Kreativitas dan Keberbakatan*. Jakarta : Rineka Cipta.
- Munandar, U. 2012. *Pengembangan Kreativitas Anak Berbakat*. Jakarta : Rineka Cipta.
- Pbl, A. P., For, M., Courses, E. 2011. Cooperative Problem-Based Learning (CPBL), 366–373.
- Pratiwi, F. A., et al., 2014. Pengaruh Penggunaan Model Discovery Learning dengan Pendekatan Saintifik terhadap Keterampilan Berpikir Kritis Siswa SMA. *Jurnal Pendidikan dan Pembelajaran* volume 3 No. 7.
- Purnamaningrum, A., et al. 2012. Peningkatan Kemampuan Berpikir Kreatif melalui Problem Based Learning (PBL) pada pembelajaran Biologi siswa kelas X-10 SMA Negeri 3 Surakarta Tahun Pelajaran 2011/2012. *Jurnal Pendidikan Biologi* vol. 4, No.3, hal. 39-51
- Raab, M., Masters, R. S. W., Maxwell, J. 2011. Learning in sports : Implicit or explicit processes ?, *International*

- Journal of Sport and Discovery* (May 2013), 37–41.
- Roji. 2006. *Pendidikan Jasamani Olahraga dan Kesehatan*. Jakarta: Erlangga.
- Rudyanto, H. E. 2014. Model Discovery Learning dengan Pendekatan Saintifik Bermuatan Karakter untuk Meningkatkan Kemampuan Berpikir Kreatif. *Jurnal Pendidikan Dasar dan Pembelajaran, Premiere Educandum*, Volume 4 Nomor 1, pp. 41-48.
- Runco, M. A., Acar, S. 2012. Divergent Thinking as an Indicator of Creative Potential. *Creativity Research Journal*, 24(1), 66–75.
- Santos, S. et al. 2017. *Effect of the Skills4Genius Sport-based Training Program in Creative Behavior*. <http://doi.org/10.1371/journal.pone.0172520>
- Sari, D. D. 2012. *Penerapan Model Problem Based Learning (PBL) untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik pada Pembelajaran IPA kelas VIII SMP Negeri 5 Sleman*. (Skripsi). Universitas Negeri Yogyakarta.
- Savery, J. R. 2006. Overview of Problem-based Learning : Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 9–20.
- Sugiyono. 2013. *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Bandung: Alfabeta.
- Tamim, S. R., Grant, M. M. 2013. Interdisciplinary Journal of Problem-Based Learning Definitions and Uses: Case Study of Teachers Implementing Project-based Learning Definitions and Uses: Case Study of Teachers Implementing Project-based Learning. *Interdisciplinary Journal of Problem-Based Learning*, 7(2), 5–16.
- Utami, P. T., Mashuri. 2013. Pengaruh Pendekatan Saintifik Model Pembelajaran Berbasis Masalah Terhadap Pemahaman Konsep Dan Prestasi Belajar Siswa Pada Materi Segiempat Kelas Vii Mts Negeri Jetis Ponorogo Tahun Pelajaran 2013/2014.
- Utomo, T., et al. 2014. Pengaruh Model Pembelajaran Berbasis Masalah (Problem Based Learning) Terhadap Pemahaman Konsep Dan Kemampuan Berpikir Kreatif Siswa (Siswa Kelas Viii Semester Gasal Smpn 1 Sumbermalang Kabupaten Situbondo Tahun Ajaran 2012/2013). *Jurnal Edukasi*, [S.L.], V. 1, N. 1, P. 5-9, Mar. 2014. ISSN 2442-353x.
- Veermans, K., van Joolingen, W. R., de Jong, T. 2006. Use of Heuristics to Facilitate Scientific Discovery Learning in a Simulation Learning Environment in a Physics Domain. *International Journal of Science Education*, 28(4), 341–361.
- Wartini, I. A. K., et al. 2014. Pengaruh Implementasi Pendekatan Saintifik terhadap Sikap Sosial Dan Hasil Belajar PKn Di Kelas VI SD Jembatan Budaya, Kuta.(Tesis).Undiksha: Singaraja
- Widya, B. P. 2014. Pengaruh Model *Problem-Based Learning* Dan *Problem-SolvingSkills* Terhadap Peningkatan *Self-Esteem* Siswa Kelas VIII. (Tesis). UPI: Bandung.
- Wirkala, C., Kuhn, D. 2011. Problem-based learning in k-12 education: Is it effective and how does it achieve its effects? *American Educational Research Journal* (Vol. 48).
- Zakiah, Z. 2015. Pendekatan Pembelajaran Saintifik Terhadap Hasil Belajar Ilmu Pengetahuan Alam (Ipa) Pada Anak Tunanetra Kelas I .(Tesis). Unesa: Surabaya.
- Zohrabi, M. 2013. Mixed Method Research: Instruments, Validity, reliability and Rporting Finding. *Theory and Practice in Language Studies*, Vol. 3, No. 2, pp. 254-262.