The Interaction of Learning Model and Learning Style in Improving Students Learning Outcomes

Senny Widia Oktari[1]✉, Hamdan Tri Atmaja[2] & Achmad Rifai RC[2]

[1] Panggil GuruKu, Subang, Jawa Barat, Indonesia
[2] Universitas Negeri Semarang, Indonesia

Article Info	Abstract
	The purpose of this study was to determine the interaction between learning models (problem-based learning and inquiry-based learning) and learning styles in improving students learning outcomes (cognitive, affective, and psychomotor). The research method applied in this study was quantitative descriptive by using data analysis techniques of validity test, reliability test, difficulty level test, normality test, homogeneity test, and two-way ANOVA test. The data collection techniques used were tests in the form of descriptive questions, and non-tests in the form of cooperative attitude observation sheets, and student learning style questionnaire sheets. The subjects in this study were 48 students who were divided into two groups. The first group consisted of 24 students using the problem-based learning model, and the second group consisted of 24 students using the inquiry-based learning model. The results of the study showed that: There is an interaction between learning models and learning styles in improving the learning outcomes in the cognitive and affective domains. There is no interaction between learning models and learning styles in improving psychomotor domains. The learning model of inquiry-based learning was more effective to be used in the learning than the problem-based learning models in improving student learning outcomes (cognitive, affective, and psychomotor) in the class with heterogeneous student learning styles (visual, auditory, and kinesthetic).

✉ Correspondence address:
  Otista No. 19, Karanganyar, Subang, Jawa Barat, 41211
  E-mail: sennywidiaoktari@gmail.com

INTRODUCTION

Indonesia as a country with cosmopolitanism and the Asean Economic Community (MEA) is a form of globalization that is inevitable. Globalization that disguises the boundaries of a country is like having two sides of a coin. On the one hand, the positive impact in it is felt for our lives like the rapid technology that we feel today. On the other hand, it cannot be denied that there are also many negative impacts caused by globalization, such as the phenomenon of the generation of moral degradation that we have witnessed lately. In the era of globalization, we as citizens are required to compete not only with fellow Indonesians, but also citizens of other countries in any part of the world.

Nowadays, the development of science in Indonesia is increasingly rapid, and information is very easily accessible because of increasingly advanced technology (Amiluddin, and Sugiman, 2016). As the progress of science and technology is present because of the positive impact of globalization and the demands of the development of national education development is present as a form of planned business that aims to improve the quality of intelligent and competitive nation development in facing the challenges of globalization. Education is an important instrument in the preparation of quality human resources. This is in line with the opinion of Rufaida, and Sujiono (2013) as the progress of science and technology and the demands of development that require skilled and creative personnel in their scientific disciplines, with good quality, education through learning provided by teachers are expected to form quality human resources in order to achieve education goals.

Regardless of the above issue, therefore, education has a very important role in the formation of quality human resources. The formation of HR is, of course, starting from the learning process given by the teacher to students. Teachers are required to make students active, interactive, inspirational and competitive so that students have the ability as young people who have intelligence and creativity in the field of science and technology and can develop these skills according to their needs. This is in line with Government Regulation Number 32 of 2013 Article 19 which confirms that the learning process in educational units is held in an interactive, inspirational and competitive manner, so that students are motivated to actively participate in learning activities and get sufficient space for initiatives, creativity, and independence in accordance with talents, interests and physical and psychological development of students.

Setyorini, Sukiswo, and Subali (2011) suggested that the learning process had been dominated by teachers (teacher-centered) and had not provided opportunities for students to develop independently so that it caused a buildup of information or concepts that were not useful for students. In line with this, Sulistyani, and Retnawati (2015) stated that the lack of involvement of students in the learning or learning patterns which is in the teacher-centered class would cause less motivated students to participate in the learning activities. Consequently, creativity, independence, and intelligence of students may not develop. The learning pattern is inseparable from the teacher's role in the learning process. Faizah, Miswadi, and Haryani (2013) stated that one of the causes of learning patterns that are teacher-centered is that the learning model used by the teacher is less varied. Since the emergence of a global movement that called for the use of innovative learning models in the 21st century, the idea has developed that there must be a change in formal education. These changes are very important since they have a purpose of bringing out innovative forms of learning that are currently urgently needed in overcoming the complex global challenges. Conventional learning that emphasizes memorizing or applying simple procedures will not develop creativity, independence, and student learning outcomes both in cognitive, affective, and psychomotor. Currently, the curriculum used in education in Indonesia is from 2013. This curriculum requires students to play an active role in the learning process. Also, the learning process in Curriculum 2013 uses a scientific approach that is intended to

provide understanding to students in recognizing, understanding various learning materials using a scientific approach.

The learning in Elementary Schools is done by integrative thematic learning, the expected goal of which is the creation of meaningful learning (Rini, Atmaja, and Setyowati, 2019). The implications of the teacher in this regard are the use of resources around, both objects and classmates as the learning resources. This gives a positive influence on students, where they can obtain meaningful learning experiences (Amanaturrakhmah, Kardoyo, and Rifai, 2017). One of the problems that occur in the application of Curriculum 2013 in schools is the making of a lesson plan (Budiani, Sudarmin, and Syamwil, 2017).

The lack of understanding of the teachers in designing a lesson plan makes learning activities less following the scientific approach of observing, asking, reasoning, and communicating. Entering 2017, the dynamics of curriculum development were increasingly fast and significant, not only in content but in the implementation of learning processes and scoring systems. Revision of the implementation of Curriculum 2013 learning focuses on student learning outcomes that are not only seen from one domain, but from three domains, namely cognitive, affective, and psychomotor. To support these characteristics, an innovative learning model is needed and of course, adapted to the scientific approach.

Learning models that are relevant to the scientific approach are problem-based and inquiry-based learning models. This learning model applies cognitive theory to build students' knowledge and skills constructively. Park, and Choi (2015) model of problem-based learning can improve learning outcomes, problem-solving, critical thinking dispositions, decision making, and develop thinking skills in solving problems.

Problem-based learning provides opportunities for students to work in groups or individually to identify what is known and learn to solve problems (Fatchurrohmah, Sarwi, and Utsman, 2017). The steps of the PBL learning model in Hosnan (2016) are (1) orienting students to problems, (2) organizing students to learn, (3) guiding individual and group investigations, (4) developing and presenting work, and (5) analyze and evaluate the problem-solving process.

The learning model implemented was inquiry-based learning. Maretasari, Subali, and Hartono (2012) stated that the inquiry-based learning model focuses on finding concepts through scientific activities carried out by students during the learning process. Scientific activities carried out aim to provide students with direct experiences related to the topic being studied so that students can learn about environmental phenomena based on the experiences that they obtain during the learning process (Hartini, and Ferawati, 2016). Meanwhile, the results of a study conducted by Asriningsih, Supardi, and Wardani (2015) showed that inquiry learning models were able to improve students' understanding of concepts and characters through orientation activities, formulating problems, formulating hypotheses, collecting data, testing hypotheses, and then drawing conclusions. This is in line with Moore (Zahro, Ellianawati, and Wahyuni, 2019) who argued that in inquiry learning students are involved in the process of finding concepts, discussing ideas, developing facts based on explanations, and communicating ideas. This learning provides an opportunity for students to understand the meaning of a concept better and invite students to think scientifically in the process of discovering knowledge.

Based on the results of the observation, it can be seen that the inappropriate learning model used by the teacher is the main cause of students' learning outcomes that are less than optimal. In this case, the right and appropriate model which can involve students actively in learning will certainly improve the learning outcomes of students (cognitive, affective, and psychomotor).

Altun (2018) suggested that individuals can learn in different ways due to the differences in thinking skills and learning styles. Therefore, the teacher is expected to be able to provide equal treatment to students in the classroom to overcome differences in the learning styles of

students. Also, to facilitate the provision of the same treatment, the application of innovative learning models for all students with different learning styles is one of the possible solutions that can be used to overcome problems related to the lack of student learning outcomes.

Hamzah (2008) stated that learning style is the ability of a person to understand and absorb lessons, of course, different levels, some are fast, medium, and some are very slow. Barry, and Egan (2017) stated that students must take different ways to understand the same lesson. Some students like to write things that are delivered by the teacher; some students prefer to listen to the material delivered by the teacher and like to practice directly.

Rovai, and Grooms (2004) stated that personality-based learning styles provide courses that are designed, including elements that appeal to students with different styles. Generally, students will find it difficult to process information in a way that they feel is uncomfortable. Students have their own learning needs, learn in different ways, and process information in different ways. Some students may have certain learning styles that are dominantly used in a variety of situations. Therefore, they do not use different styles for different situations.

Several previous studies that are relevant to the problem-based learning model, inquiry-based learning, and student learning outcomes are (Rachmadhan, Arifin, and Silvana, 2017; Hartini, and Ferawati, 2016). Based on several studies that have been described, this study found a gap in the form of limitations in the previous studies. It was found in some previous studies that no study integrates learning models and learning styles in improving student learning outcomes. Also, based on the background of the study presented, the problem that was examined in this study is how the interaction between learning models and learning styles in improving student learning outcomes is?

Considering the above explanations, this study is intended to analyze the interaction between learning models and learning styles in improving student learning outcomes.

METHODS

The method used in this study was a quantitative method with factorial experimental research design where the data that has been collected without the purpose of making conclusions, in general, were analyzed. This study connected learning models and learning styles in improving student learning outcomes by using data analysis techniques of validity test, reliability test, difficulty level test, normality test, homogeneity test, and two-way ANOVA test. The moderator variable in this study was student learning styles on the application of problem-based learning and inquiry-based learning models in improving student learning outcomes.

The population in this study were students of grade IV of Public Elementary School Sindangsari in the academic year of 2018/2019. The sampling technique used in this study was purposive sampling since the subjects of the study were selected based on several considerations. This research was divided into two experimental classes, and they were: experimental 1 and experimental 2 with 24 students in each group. The experimental class 1 was given treatment by applying the problem-based learning model in improving student learning outcomes, whereas, the experimental class 2 was given treatment by applying the inquiry-based learning model in improving student learning outcomes. After giving the treatment, the researcher identified the consequences of the application of the two treatments using descriptive analysis and tested the predetermined hypothesis.

The data collection techniques used in this study were tests and non-tests. The test was used to measure the cognitive learning outcomes of students following the learning objectives that have been set in the form of understanding of descriptive questions. The cognitive learning outcomes indicators used were: (1) showing, (2) classifying, (3) explaining; (4) finding, (5) comparing, (6) making conclusions or concluding. Meanwhile, the non-test technique used in this study was the observation sheet that was used to measure the effective learning outcomes of students. In this case, was the

attitude of student's cooperation during learning was recorded by the observer. The other non-test techniques used in this study were questionnaire sheets given to students to determine the classification of student learning styles.

RESULTS AND DISCUSSION

The results of this study were in the form of quantitative data which are analyzed by covering the initial and final stages.

The initial stage of analysis aims to test the normality and homogeneity of the research data and is called the prerequisite test. Based on the data analysis using IBM SPSS Statistics 22 with sig. 0.05 the prerequisite test results obtained can be seen in table 1.

Data of Prerequisite Test for the Research

Table 1 provides information on all data in this study, which was derived from the population that is normally distributed and derived from homogeneous variances.

Table 1. Results of the Prerequisite Test

Learning outcome	Prerequisite test	Sig	Interpretation
Cognitive aspect	Normality test	0.200	Data is normally distributed
	Homogeneity test	0.173	Data is homogeneous
Affective aspect	Normality test	0.200	Data is normally distributed
	Homogeneity test	0.064	Data is homogeneous
Psychomotor aspect	Normality test	0.200	Data is normally distributed
	Homogeneity test	0.480	Data is homogeneous

The Interaction of Learning models and Learning Styles

The testing of the interaction between learning models and learning styles in improving student learning outcomes from 3 domains using the learning models of problem-based learning and inquiry-based learning was examined. The data analysis was performed using two-way ANOVA test. The result of the ANOVA test can be seen in table 2.

Table 2. Result of ANOVA Test

Learning outcome	Source	Sig	Interpretation
Cognitive aspect	Learning model	0.000	Have interaction
	Learning style	0.000	
	Learning model * Learning style	0.029	
Affective aspect	Learning model	0.000	Have interaction
	Learning style	0.000	
	Learning model * Learning style	0.042	
Psychomotor aspect	Learning model	0.000	No interaction
	Learning style	0.000	
	Learning model * Learning style	0.829	

Based on table 2, ANOVA test results on the interaction between learning models and learning styles in improving cognitive and affective learning outcomes show sig. < 0.05, then H_1 is accepted. Therefore, it can be concluded that there is an interaction between the application of learning models and learning styles in improving the learning outcomes of cognitive and affective domains of students. However, there is no interaction between learning models and learning styles in improving psychomotor domain learning outcomes. This happens since the average value of cognitive and affective learning outcomes of students who learn using the inquiry-based learning model is higher than the average value of cognitive learning outcomes of students who learn using the problem-based learning model.

Also, heterogeneous student learning styles are very influential in cognitive learning outcomes. Students with visual, auditory, and kinesthetic learning styles in the class who learn using the inquiry-based learning model have significant differences in the average of cognitive domain learning outcomes than the class that learns by using a problem-based learning model.

Therefore, it can be concluded that the inquiry-based learning model is more effective in improving the students learning outcomes with heterogeneous learning styles compared to the problem-based learning models. This is caused by several things that might happen, including There are differences in student characteristics and the characteristics of students in the class using inquiry-based learning models that have both visual, auditory and kinesthetic learning styles tend to be more active and were very enthusiastic in finding a new information and group discussions. The learning model used, based on the results of observations of the learning model that is tailored to the student's learning style, will certainly increase students' interest and enthusiasm for learning.

The influence of learning by using the model on student learning outcomes is due to the characteristics of learning syntax which requires interdependence of responsibilities between individuals, face to face, and communication in the process of finding problem-solving (Kono, 2016). Also, if it is reviewed based on student learning styles, the learning model of inquiry-based learning tends to emphasize more on giving space to students to learn according to their learning styles so that the development of cognitive, affective, and psychomotor aspects of students can be fulfilled in balance.

Data of Learning Outcomes using the Learning Model of Problem Based Learning and Inquiry-Based Learning

Data of student learning outcomes in this study consisted of three domains: the cognitive domain learning outcomes obtained from the test questions of students' understanding of the material that has been delivered, the test questions were in the form of an essay with ten questions. The affective domain learning outcomes were obtained through observations made by the observer on students' cooperation attitudes during the learning by using the problem-based and inquiry-based learning model. Meanwhile, the psychomotor domain learning outcomes were obtained through the assessment of students' skills in making and telling stories of

experiences. The student learning outcomes can be seen in table 3.

Table 3. Result of Learning Outcomes

Learning model	Learning outcome	Mean
PBL	Cognitive aspect	75.313
	Affective aspect	2.967
	Psychomotor aspect	73.375
IBL	Cognitive aspect	85.938
	Affective aspect	3.421
	Psychomotor aspect	82.458

Based on table 3, the average value of learning outcomes of the cognitive domain of students who learn using problem-based learning is 75.313. Meanwhile, the acquisition of the average value of learning outcomes of the cognitive domain of students who learn using the inquiry-based learning model is 85.938. Based on these results, it can be seen that the average value of cognitive learning outcomes of students who learn using the inquiry-based learning model is higher than the average value of learning outcomes of students who learn using the problem-based learning model. The average value of affective of student learning outcomes also showed a significant difference. Students who learn using the problem-based learning model obtain an average value of affective domain learning outcomes of 3.0, meanwhile students who learn using the inquiry-based learning model obtained outcomes equal to 3.4. The difference in the average value of learning outcomes between the two models also occurs in the psychomotor domain learning outcomes. Students who learn using the inquiry-based learning model have higher psychomotor domain learning outcomes than students who learn using the problem based learning models. The learning outcomes obtain equal to 85.938. Meanwhile, students who learn using the problem-based learning model have an average psychomotor domain learning outcome of 73.375.

The results also revealed significant differences in student learning outcomes that were observed. Students who learn by using problem-based learning model tend to learn concepts based on problems, meanwhile, students who learn using the inquiry-based learning model answer questions and solve

problems based on the facts or information they obtain from the questions. This matter has a greater influence on the skills of students in processing information, gathering information, and resolving the problems under study.

The implementation of the inquiry-based learning model has stages which require students to collect data through sources or information before they can resolve the problem. These stages can be certainly very influential in student learning outcomes. It is supported by the results of the research conducted by Hartini, and Ferawati (2016) which stated that there were differences in the science learning outcomes between students who were given the inquiry-based learning with students who were given the problem-based learning model. The average science learning outcomes of students in the class using the inquiry learning model were higher than those in the class using the learning model of problem-based learning.

Data of Students' Learning Outcomes based on Learning Styles

The classification of student learning styles was obtained based on the learning style questionnaires that have been completed by students before giving treatment. Student learning styles were divided into three classifications, namely visual, auditory, and kinesthetic. The average of student learning outcomes based on the learning styles can be seen in figure 1, 2, and 3.
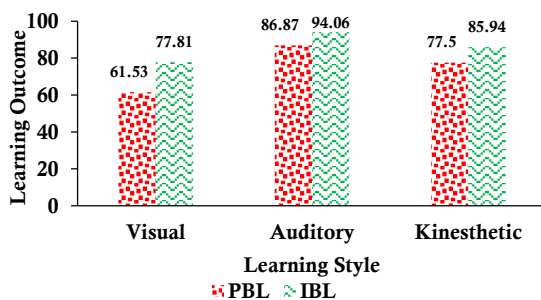

Figure 1. Students Learning Outcome (Cognitive Aspect) based on the Learning Style

Figure 1 shows that there is a difference in the increase of the average value of learning outcome in cognitive domain based on students'

learning styles from both classes after being treated by using problem-based learning and inquiry-based learning models. Students with visual learning styles who learn using problem-based learning models get the average value of 61.56, while students who learn using inquiry-based learning model get the average value of 77.81.

Then, students with auditory learning styles who learn using problem-based learning models get the average value of 86.87, while students who learn using the inquiry-based learning model get an average value of 94.06. Also, the average score in cognitive learning outcomes of students with kinesthetic learning styles in the class that used problem-based learning model gets the average value of 77.50, while students who learn using the inquiry-based learning model get the average value of 85.93.
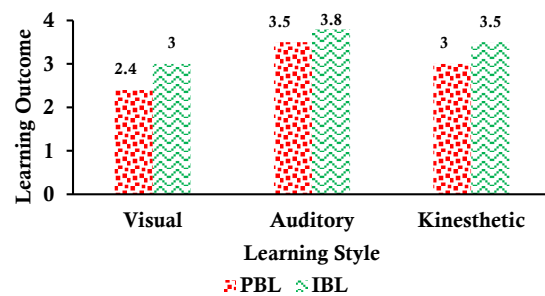

Figure 2. Students Learning Outcome (Affective Aspect) based on the Learning Style

Figure 2 shows that there is a difference in the increase of the average value of learning outcome in affective domain based on the learning styles of students from both classes after being treated by using problem-based learning and inquiry-based learning models. Students with visual learning styles who learn using problem-based learning model get the average value of 2.4, while students who learn using inquiry-based learning model get the average value of 3.0. Then, students with auditory learning styles who learn using problem-based learning model get the average value of 3.5, while students who learn using inquiry-based learning model get the average value of 3.8. Also, the average score in affective learning outcomes of students with kinesthetic learning styles in the class that used

problem-based learning model gets the average value of 3.0, while students who learn using the inquiry-based learning model get the average value of 3.5.
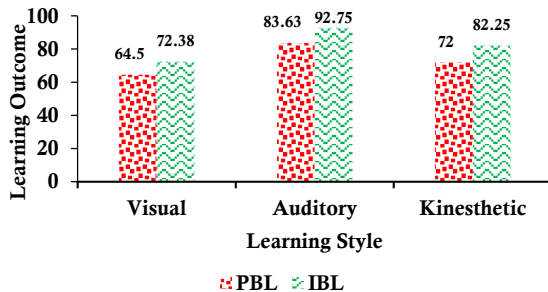

Figure 3. Students Learning Outcome (Psychomotor Aspect) based on the Learning Style

Figure 3 shows that there is a difference in the increase of the average value of learning outcome in psychomotor domain based on students' learning styles from both classes after being treated by using problem-based learning and inquiry-based learning models. Students with visual learning styles who learn using problem-based learning models get the average value of 64.50, while students who learn using inquiry-based learning model get the average value of 72.38. Then, students with auditory learning styles who learn using problem-based learning models get the average value of 83.63, while students who learn using the inquiry-based learning model get an average value of 92.75. Also, the average score in psychomotor learning outcomes of students with kinesthetic learning styles in the class that used problem-based learning model gets the average value of 72.00, while students who learn using the inquiry-based learning model get the average value of 82.25.

Based on figure 1, 2, and 3, there is a significant difference in the average value of student learning outcomes based on the learning style that is owned ($p < 0.05$). The differences in student learning outcomes with visual learning styles between classes that use the problem-based learning model and classes that use the inquiry-based learning model can also be seen. From the results of the second test, it can be concluded that in the groups of students with visual learning

styles who learn using the problem-based learning model have an average value of the cognitive learning outcomes which were lower than the average value of cognitive learning outcomes of students who study using inquiry-based learning. This is possible since the groups of students who have a visual learning style have individual goals and responsibilities so that they can have more ability to focus on working on the test than making noise or chatting with their friends.

The goals of individuals and responsibilities are one of the things needed for the successful and effective implementation of the inquiry-based learning model. Instead of using tests in measuring the cognitive learning outcomes, observations were also made to measure the student's effective learning outcomes. This observation was carried out by using six observers; each observer was given the responsibility to observe four students.

Five aspects became the focus of observation of the attitude of cooperation in this study, and they were: (1) doing all the tasks given by the teacher, completing all the tasks given by the teacher promptly, (2) helping friends to solve problems in group discussions by working together in answering group assignments, (3) giving opinions in group discussions, working on group assignments according to the responsibilities given and listening to opinions raised by friends during the group discussions, (4) giving responses on the opinion expressed by friends, playing active roles in the group discussions, (5) showing enthusiasm in the group discussions. The indicators in these aspects include: responding to teacher's instructions, helping friends, involving themselves in the discussion, respecting others, and achieving common goals. Aydin (2016) stated that learning styles which are following the teaching methods have a significant influence on the student learning outcomes. This study is in line with the research conducted by Silberman (2011) which explained that as a teacher, it is required to understand students who have various ways of learning. That is, if the teacher can understand the learning style of the student, it can help in determining the learning model that can be used

in learning, besides that it can also help teachers in designing interesting and enjoyable learning so that students can be active and enthusiastic in the learning process.

The average value obtained from the students learning outcomes with auditory learning styles between students who learn using problem-based learning and inquiry-based learning models. Based on the test results, it can be concluded that in the group of students with auditory learning style, the average value of learning outcomes of students who learn using the inquiry-based learning model is significantly higher than the learning outcomes of students who study using problem-based learning model. This is possible since one of the advantages of students with auditory learning styles is that it is easier to listen to others. Also, students with auditory learning styles can understand the problem in a very good manner since they can mention the information that is known and the things that are asked in the problem correctly.

The average value obtained from the students learning outcomes with kinesthetic learning styles between students who learn using the problem-based learning and inquiry-based learning models. Based on the test results, it can be concluded that in the group of students with kinesthetic learning styles, the average value of learning outcomes of students using the inquiry-based learning model is significantly higher than the learning outcomes of students who study using problem-based learning model.

The learning process using inquiry-based learning model in this study produces an average value of student learning outcomes with a visual, auditory, and kinesthetic learning style higher than students with the learning process using problem-based learning model. This happened since the inquiry-based model has the advantage of emphasizing the development of cognitive, affective, and psychomotor aspects in a balanced way; therefore, the learning by using inquiry-based learning is considered more meaningful. Also, the inquiry-based learning model can provide space for students to learn according to students learning styles. Regarding this matter, students are actively required to examine

problems that are relevant to their lives in the context of learning.

Therefore, students will be able to develop various attitudes and abilities to think about solving problems. These problems are presented as naturally as possible, and then students work with problems that require them to apply their knowledge and abilities according to their level of psychological maturity and learning ability which will influence the learning outcomes. In learning with the inquiry-based model, students are allowed to carry out activities to collect data by digging information through sources and experiences, and then students build an explanation or knowledge based on the data collection process. In this regard, students find it easier to understand learning material and have a greater willingness to learn even with different learning styles. Based on this, it can be understood that the application of inquiry-based learning model can provide a significant difference in the effect of student learning outcomes, making it possible to use the problem-based and inquiry-based learning models alternately as needed.

CONCLUSION

Based on the results and discussion, it can be concluded that there is a significant interaction between the application of learning models (problem-based and inquiry-based) and learning styles in improving student learning outcomes in cognitive and affective domains. The statistical analysis obtained Sig greater than 0.05 which means that the inquiry-based learning model is more effective to be used to improve students' learning outcomes (cognitive, affective, and psychomotor domains) than the problem-based learning model. Also, the implementation of the inquiry-based model is more effective to be used for classes with heterogeneous student learning styles (visual, auditory, and kinesthetic) than the problem-based learning model.

REFERENCES

Altun, H. (2019). Examining the problem solving skills of primary education mathematics teacher candidates according to their learning styles. *International Education Studies*, *12*(4), 60-73. Retrieved from
http://www.ccsenet.org/journal/index.php/ies/article/view/0/38873

Amanaturrakhmah, I., Kardoyo, K., & Rifai RC, A. (2017). Manajemen pembelajaran tematik di kelas tinggi sd percontohan kabupaten indramayu. *Journal of Primary Education*, *6*(2), 159-165. Retrieved from
https://journal.unnes.ac.id/sju/index.php/jpe/article/view/17570

Amiluddin, R., & Sugiman. (2016). Pengaruh problem posing dan pbl terhadap prestasi belajar, dan motivasi belajar mahasiswa pendidikan matematika. *Jurnal Riset Pendidikan Matematika*, *3*(1), 100-108. Retrieved from
https://journal.uny.ac.id/index.php/jrpm/article/view/7303

Asriningsih, K. K. A., Supardi, K. I., & Wardani, S. (2015). Pengaruh model pembelajaran inkuiri terbimbing berbasis lingkungan terhadap kemampuan pemahaman konsep dan karakter pada siswa kelas v sd. *Journal of Primary Education*, *4*(2), 132-138. Retrieved from
https://journal.unnes.ac.id/sju/index.php/jpe/article/view/10973

Aydin, B. (2016). Examination of the relationship between eighth grade students' learning styles and attitudes towards mathematics. *Journal of Education and Training Studies*, *4*(2), 124-130. Retrieved from
http://redfame.com/journal/index.php/jets/article/view/1162

Barry, M., & Egan, A. (2017). An adult learner's learning style should inform but not limit educational choices. *International Review of Education, 64*(3), 1-12. Retrieved from
https://link.springer.com/article/10.1007/s11159-017-9694-6

Budiani, S., Sudarmin, & Syamwil, R. (2017). Evaluasi implementasi kurikulum 2013 di sekolah pelaksana mandiri. *Innovative Journal of Curriculum and Educational Technology*, *6*(1), 45-57. Retrieved from
https://journal.unnes.ac.id/sju/index.php/ujet/article/view/15998

Faizah, Miswadi, S. S. & Haryani, S. (2013). Pengembangan perangkat pembelajaran berbasis masalah untuk meningkatkan soft skill dan pemahaman konsep. *Jurnal Pendidikan IPA Indonesia*, *2*(2), 120-128. Retrieved from
https://journal.unnes.ac.id/nju/index.php/jpii/article/view/2712

Fatchurrohmah, A., Sarwi, & Utsman. (2017). Pengaruh problem based learning melalui demonstrasi dan diskusi terhadap kemampuan verbal. *Journal of Primary Education*, *6*(2), 140-146. Retrieved from
https://journal.unnes.ac.id/sju/index.php/jpe/article/view/17567

Hamzah, B. U. (2008). *Teori Motivasi dan Pengukurannya.* Jakarta: Bumi. Aksara.

Hartini, I., & Ferawati. (2016). Effectiveness of inquiry learning and problem-based learning on students' achievement in science cource. *Jurnal Inovasi Pendidikan Dasar*, *2*(1), 27-34. Retrieved from
http://jipd.uhamka.ac.id/index.php/jipd/article/view/35

Hosnan, M. (2016). *Pendidikan saintifik dan kontekstual dalam pembelajaran abad 21.* Bogor: Penerbit Ghalia Indonesia.

Kono, R., Mamu, H. D., & Tangge. (2016). Pengaruh model problem based learning (pbl) terhadap pemahaman konsep biologi dan keterampilan berpikir kritis siswa tentang ekosistem dan lingkungan di kelas x sma negeri 1 sigi. *Jurnal Sains dan Teknologi Tadulako, 5*(1), 28-38. Retrieved from
http://jurnal.untad.ac.id/jurnal/index.php/JSTT/article/view/6958

Maretasari, E, Subali, B. & Hartono. (2012). Penerapan model pembelajaran inkuiri terbimbing berbasis laboratorium untuk meningkatkan hasil belajar dan sikap ilmiah siswa. *Unnes Physics Education Journal*, *1*(2), 27-31. Retrieved from
https://journal.unnes.ac.id/sju/index.php/upej/article/view/1375

Park, S., & Choi, S. (2015). Effects of problem-based learning on the learning atti-tudes, critical thinking disposition and problem-solving skills of nursing students: infant care. *Advanced Science and Technology Letters*, *103*, 192-196. Retrieved from
https://pdfs.semanticscholar.org/507b/9146c159de0082c701c8977d700d9be3dba5.pdf

Rachmadhan, O., Arifin, Z., & Silvana, H. (2017). Effectiveness of the use of inquiry learning approach towards students' improvement in process skills of iv graders in cikeas natural

school. *Educational Technologia*, *3*(1), 1-12. Retrieved from http://ejournal.upi.edu/index.php/edutechnologia/article/view/8900

Rini, B. S., Atmaja, H. T., & Setyowati, D. L. (2019). The effectiveness of the thematic instructional materials in improving social sciences basic competence by using a problem-based learning model in elementary school. *Journal of Primary Education*, *8*(1), 10-15. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpe/article/view/24624

Rovai, A. P., & Grooms, L.D. (2004). The relationship of personality-based learning style preferences and learning among online graduate students. *Journal of Computing in Higher Education*, *16*(1), 30-47. Retrieved from https://link.springer.com/article/10.1007/BF02960281

Rufaida, S., & Sujiono, E. H. (2013). Pengaruh model pembelajaran dan pengetahuan awal terhadap kemampuan memecahkan masalah fisikapeserta didik kelas xi ipa man 2 model makassar. *Jurnal Pendidikan IPA Indonesia*, *2*(2). Retrieved from https://journal.unnes.ac.id/nju/index.php/jpii/article/view/2718

Setyorini, U, Sukiswo, S. E., & Subali, B. (2011). Penerapan model problem based learning untuk meningkatkan kemampuan berpikir kritis siswa smp. *Jurnal Pendidikan Fisika Indonesia*, *7*(1), 52-56. Retrieved from https://journal.unnes.ac.id/nju/index.php/JPFI/article/view/1070

Silberman, M. L. (2011). *Active learning 101 cara belajar siswa aktif*. Bandung: Nusamedia.

Sulistyani, N., & Retnawati, H. (2015). Pengembangan perangkat pembelajaran bangun ruang di SMP dengan pendekatan problem based learning. *Jurnal Riset Pendidikan Matematika*, *2*(2), 197-210. Retrieved from https://journal.uny.ac.id/index.php/jrpm/article/view/7334

Zahro, U. S., Ellianawati, & Wahyuni, S. (2019). Pembelajaran inkuiri untuk melatih kreativitas dan keterampilan berpikir ilmiah siswa. *Unnes Physics Education Journal*, *8*(1), 1-7. Retrieved from https://journal.unnes.ac.id/sju/index.php/upej/article/view/29488