Journal of Primary Education
11 (1) (2022) : 1–13

https://journal.unnes.ac.id/sju/index.php/jpe

The Effects of a Problem-Based Learning Model Aided by Mind Mapping on Self-directed Learning in Elementary School Students

Agus Ridwanulloh [1]✉, Suyahmo Suyahmo [2], Cahyo Budi Utomo [2]

[1.] Randegan Kulon I cv Primary School, Majalengka, Indonesia
[2.] Pascasarjana, Universitas Negeri Semarang, Indonesia

Article Info

History Articles
Received:
19 December 2021
Accepted:
20 January 2022
Published:
30 March 2022

Keywords:
Self-directed Learning, Mind mapping, Problem based learning

Abstract

Self-directed learning in schools has not shown positive results, especially in fifth grade students. Several surveys show that they still do not have an attitude toward self-directed learning. The problem-based learning model and mind mapping respectively has characteristics that can train this attitude. So, this study aims to analyze the effectiveness of the problem-based learning model with the aid of mind mapping in increasing self-directed learning in fifth-grade elementary school students. This research design used an experimental method with a pretest-posttest control group design by analyzing quantitative data on the effectiveness of the Problem-based learning model with the aid of mind mapping on the self-directed learning of elementary school students. The research sample was the fifth-grade students of Randegan Kulon I Primary Schools in Majalengka Regency as the experimental class and class V of Randegan Kulon II Primary School in Majalengka Regency as the control class. Data collection was obtained through a self-directed learning questionnaire sheet. The data obtained were analyzed using the classical completeness test, independent T-test, and N-gain test. The results showed that the Problem-based learning model assisted by mind mapping was effective in increasing the self-directed learning of students by showing: (a) the classical mastery score reached 93.75%, (b) the average score reached 81, (c) and the N-gain value reached 0 .50 in the medium category. Based on the analysis results, it was concluded that the problem-based learning model assisted by mind mapping was effective in increasing the self-directed learning of students.

✉ Correspondence address:
Jl. Malangsari no 1 Randegan Kulon Kecamatan Jatitujuh
Majalengka Jawa Barat
E-mail: agusridwanulloh11@gmail.com

p-ISSN 2252-6404
e-ISSN 2502-4515

INTRODUCTION

Education has the main purpose of potential development and intelligence in improve people's lives. Education in the modern era is not limited to the intellectual factors that a person possesses while receiving an education but must also contribute to other factors such as attitudes, behaviour, and character (Siswati, Utomo, & Muntholib, 2018). Character education is a country's hope for its citizens. It develops students with high expectations, a healthy balance of cognitive, emotional, and psychomotor attitudes and prepares them to compete as adults. Character education is one of the priority programs outlined in the Republic of Indonesia's Presidential Regulation No. 87 of 2017 on Strengthening Character Education. Suriadi, Firman, & Ahmad (2021) explained that the government's program to strengthen character education includes 18 characters, one of which is independence. However, the reality is that self-directed learning in schools has not yielded positive results. Several surveys indicate that many students lack an attitude toward self-directed learning.

The results of pre-research conducted by Saefullah, Siahaan & Sari (2013) indicate that students lack a self-directed learning attitude, as evidenced by low levels of student initiative in learning, discipline, self-confidence, and responsibility for learning. According to Aulia, Susilo, & Subali (2019) students' lack of independence is due to information discussion learning methods. The teacher acts more as a source of knowledge and students as recipients of the information. Jumaisyaroh, Napitupulu, & Hasratuddin (2015) students believe that teachers are the only source of knowledge, which keeps them dependent and prevents them from socializing and developing independence. These findings suggest that one of the factors contributing to students' low self-directed learning is teacher-directed learning.

Self-directed learning places a high premium on student accountability, as students strive to maximize their abilities to accomplish learning objectives. As cited by Wardana, Hartono, & Sumarti (2021) Cho explains that self-directed learning is critical for enhancing the character of people who seek (investigation). According to Tahar & Enceng (2006) individuals who engage in self-directed learning will see changes in their study habits due to organizing and organizing themselves. They can identify learning goals, learning needs, and strategies for learning that lead to the achievement of the formulated goals. According to Seker (2016) self-directed learning is critical in the learning process because it allows for children's exploration. Thus, self-directed learning must be implemented at the fundamental level for students to develop study habits consistent with the 2013 curriculum. Students' independence can be developed during the learning process by incorporating attractive learning designs that serve as a forum for developing self-directed learning. Kim & Holloway (2018) investigate self-directed learning in Korea, demonstrating that a supportive learning environment fosters self-directed learning.

According to Masrukhi, Rachman, & Suyahmo (2018) quality teaching requires knowledge, understanding, ability, skills, and perseverance. Innovating learning models requires teacher skills. Using a good model can greatly improve students' skills, attitudes, and knowledge. The 2013 curriculum recommends the Problem-based Learning (PBL) model. The problem-based learning model optimizes students' thinking through structured collaboration (Kadir et al., 2020). PBL is said to increase student knowledge and is student-center. According to Atikasari, Isnaeni, & Prasetyo (2012) problem-based learning is a popular contextual learning approach. The problem-based learning model helps students who struggle with learning. This model starts with a real problem or questions that students must solve through investigation and application.

The problem-based learning model is a constructivism-based educational approach linked to real-world problems and can be implemented cooperatively (Herdini et al., 2018). The problem-based learning model

emphasizes problem-solving that can be accomplished collaboratively through students' active participation in their groups. At the first step of the learning process, students are assigned problems that train various aspects of their abilities (Alamiah & Afriansyah, 2018; Dunlap, 2005; Eglitis, Buntman, & Alexander, 2016). According to Fauzia, (2018) the problem-based learning model can achieve a maximum increase of 40%, a minimum of 5%, and 22.9%. Bahri, Mastur & Sukestiyarno (2018) ndicate that 1) can enhance problem-solving abilities as measured by meeting the minimum classical completeness criteria, the classical completeness average, and exceeding classical completeness average and 2) can enhance the character of cultural love. It is believed that the innovation and development of learning models can help students develop their characteristics. Models for problem-based learning can be developed with the assistance of mind mapping.

Mind mapping is a creative way of taking notes to help understand a concept. Mind mapping is the simplest way to express ideas and information (Nurroeni, 2013; Ristiasari et al., 2012; Paxman, 2011). Mind mapping is seen to help students learn to organize and store as much information as they want and how to group it. Mind mapping is useful for tracking changes in the learning process and distinguishing meaningful from insignificant changes (Al-jarf, 2011). According to Samseno, Purwanto, & Sutarno (2017) teaching mind maps will help students learn new skills. According to Astuti (2019) mind maps use both sides of the brain to receive information in symbols, images, emotional meanings, and colours. Mind maps help students understand difficult information and develop ideas.

Using a problem-based learning model in conjunction with mind mapping is one of the strategies for increasing students' self-directed learning. Mento, Martinelli, & Jones (1999); Nurroeni (2013); Liu et al. (2014) demonstrated that using mind mapping to achieve learning outcomes increased student activity by motivating students to master the material and exerting a positive influence on learning. In light of the previous, this study will examine the effectiveness of the problem-based learning model in conjunction with mind mapping on students' self-directed learning. In light of the previous, this study will examine the effectiveness of the problem-based learning model in conjunction with mind mapping in increasing students' self-directed learning.

The benefits of this research include serving as a reference for determining how to implement problem-based learning with the aid of mind mapping to increase students' self-directed learning and serve as a solution or alternative model for developing self-directed learning in the classroom.

METHODS

This study used a pretest-posttest control group design. This study uses non-probability sampling with saturated sampling, which means that all population members are sampled. Class V Elementary School Randegan Kulon I, Sub-district Jatiujuh, Regency Majalengka, will be given a problem-based learning model with mind mapping. In contrast, Elementary School Randegan Kulon II, Sub-district Jatitujuh, Regency Majalengka, will be given direct instruction. The experimental class consisted of 32 third graders from Randegan Kulon I Elementary School, while the control class consisted of 33 third-graders from Randegan Kulon II Elementary School.

Data collection methods include questionnaires, observation, and documentation. Observations were made to observe students engaged in learning activities. The normality test and homogeneity test are used to determine whether the data are normally distributed and homogeneous or not. The independent sample t-test is used to determine the effectiveness of the problem-based learning model assisted by mind mapping. The N-gain <g> test determines the categories before and after applying the mind mapping-assisted problem-based learning model. The effectiveness of problem-based learning with mind mapping and the criteria for the gain factor g. Table 1 shows the criteria for the gain factor g.

Table 1. N-Gain Criteria

N-gain	Criteria
0 <g> < 0.30	Low
0.30 ≤ <g> < 0.70	Moderate
0.70 ≤ <g> < 1.00	High

Self-directed learning is said to improve if the gain is normalized to 0.30 g> 0.70.

RESULTS AND DISCUSSION

Students took a pretest in the experimental and control classes before beginning their research activities. Table 2 shows the results of the pretest.

Table 2. The Results of Pretest

Number	Aspect	Self-directed Learning	
		Experiment	Control
1	Total Students	32	33
2	Average	61.1	62.4
3	The highest score	81.3	81.3
4	The lowest score	43.8	45.8

The data is then examined for similarity and homogeneity between the two classes using normality and homogeneity tests. The experimental class's initial normality test resulted in a significance value of 0.137 from (> 0.05). And the results of the initial normality test with a significance level of 0.200 for the control class. The homogeneity test resulted in a value of 0.511 from (> 0.05), indicating that the two samples are homogeneous. The calculated results suggest that the pretests for the experimental and control types are normally distributed.

After familiarizing themselves with both normal and homogeneous data, the two classes received various treatments: the experimental class used a problem-based learning model aided by mind mapping. In contrast, the control class used a direct instruction model.

Before testing the effectiveness hypothesis, it is necessary to conduct prerequisite tests, specifically the normality and homogeneity tests, to ascertain the distribution of research data. The following step is to collect research data via a posttest to determine the difference in the two classes' results. Table 3 and Table 4 contain the results of the normality and homogeneity tests.

Table 3. Posttest Normality Test

Class	Sig		α =0,05	Criteria	Interpretation
Experiment	0.153	>	0.05	$\mathbf{H_0}$ accepted	Normal
Control	0.096	>	0.05	$\mathbf{H_0}$ accepted	Normal

Table 3 displays the normality test results for the experimental and control groups with a significance value greater than (> 0.05). It is possible to conclude that the data is normally distributed.

Table 4. Posttest Homogeneity Test

Class	Sig		α =0,05	Criteria	Interpretation
Experiment Control	0.967	>	0.05	$\mathbf{H_0}$ accepted	homogeneous

The results of the homogeneity test of self-directed learning for the experimental and control classes with a significance value greater than (> 0.05) are shown in Table 4. Thus, the data have the same or homogeneous variance. A classical completeness test is performed after determining that the data is normally distributed and has the same variance.

The final experimental class data revealed that 30 students met the minimum completeness criteria of KKM (x) out of 32 students. Calculation results with Z count = 2.45 based on the data obtained. Z count Z ((0,5-a)) is the rejection region of H 0. The standard normal distribution table list has a z value of Z ((0.45))= 0,3264. Because 2.45 > 0.3264, H 1 is accepted, students who use a problem-based learning model in conjunction with mind mapping achieve 75% classical completeness.

It can be calculated by multiplying the completeness score of at least 70 experimental and control classes by the number of subjects in that class. Table 5 summarizes the findings.

Table 5. The Results of Experimental and Control Class Classical Completeness

Class	N	The lowest Score	The highest score	Mean	Complete	incomplete	Percentage
Experiment	32	67	90	81	30	2	93.75%
Control	33	54	85	69	17	16	51.52%

Table 5 demonstrates that the experimental class achieved a higher mastery value than the control class when using a mind mapping-assisted problem-based learning model.

These findings demonstrate that the success of the problem-based learning model with the aid of mind mapping is superior to the direct instruction model in terms of self-concept improvement. It occurs because the problem-based learning model develops various students' abilities and skills. By posing meaningful questions and stimulating students with real-world problems, the model encourages students to explore information, find and present viable solutions, and practice group collaboration.

From elementary school, self-directed learning must be developed through meaningful learning that results in the development of self-directed learning. Supiandi & Julung (2016) asserted that the problem-based learning model benefits students by acclimating them to confronting problems and being challenged to solve them, increasing collaboration with peers and teachers, and adjusting them to conduct experiments. Students' self-directed learning abilities are gradually developed through this method of instruction.

The next step follows the average difference test and the N gain score test. The average difference test was used to determine the difference between the experimental and control groups in terms of their average difference. The independent sample t-test was used for statistical analysis. Table 6 contains the results.

Table 6. Independent Sample T-Test Self-directed Learning

Independent Sample T-Test	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Self-directed Learning	7.464	63	.000	11.418	1.530

As shown in Table 6, the results obtained with a significance level of less than 0.0 indicate an average difference between the control and experimental classes. And because the average difference test revealed that T-count > T Table shows that Self-directed learning is greater in the experimental class than in the control class, it can be concluded that using a problem-based learning model aided by mind mapping is effective at increasing students' learning independence. The effectiveness of the problem-based learning model is due to its singular focus on training students' high-level abilities (HOTS) for them to develop into quality human beings. It is supported by numerous studies that demonstrate that problem solving is a focused thought directed specifically toward finding a solution/workaround for a particular issue, that assigning matters at the start of learning forces students to consider how to solve a problem they encounter, and that the problem can be solved through group discussion. (Saputri & Febriani, 2017; Setiawan et al., 2012).

Mind mapping is viewed as a tool that can assist students in comprehending and receiving information, with the hope that students will learn to organize and store as much information as they want and how to group it. Mind mapping is extremely useful for tracking changes during the learning process because it can distinguish between significant and insignificant changes (Al-jarf, 2011). Samseno, Purwanto, & Sutarno (2017) explain that using mind maps as a learning strategy will open new avenues for skill acquisition. According to Buzan, as cited by Astuti (2019) mind maps involve both sides of the brain receiving information in symbols, images, emotional meanings, and colours to help them remember it more easily. Students will be able to more easily digest difficult-to-digest information and develop their ideas using mind maps.

The next step is a Gain test to determine the quality and magnitude of the increase in students' self-directed learning before and after treatment with a problem-based learning model that incorporates mind mapping. Calculations in the class using the problem-based learning model aided by mind mapping produced an average value of 0.50, indicating that students' self-directed learning is moderate. In contrast, in the class using the direct instruction model, the score is 0.17, indicating that students' self-directed learning is low, a difference of 0.33.

During the initial stages of learning activities, students are encouraged to collaborate in groups to solve problems presented by the teacher via student worksheets. The teacher guides students through group discussion activities to develop the ability to use mind mapping to solve the problems contained in the student worksheets. Students are expected to be able to develop ideas or solutions to problems through the use of mind mapping and to create summaries that are easily understood by themselves and others. Parikh (2016) demonstrated that mind mapping is a straightforward method of receiving information facilitates comprehension. Students can create a picture corresponding to their desired outcome in resolving a problem. At first, students struggled because mind mapping was unfamiliar to them. Still, it became easier for students to take notes or solve problems using mind mapping with the teacher's guidance and direction. Example of student problem solving results with mind mapping is presented in Figure 1.

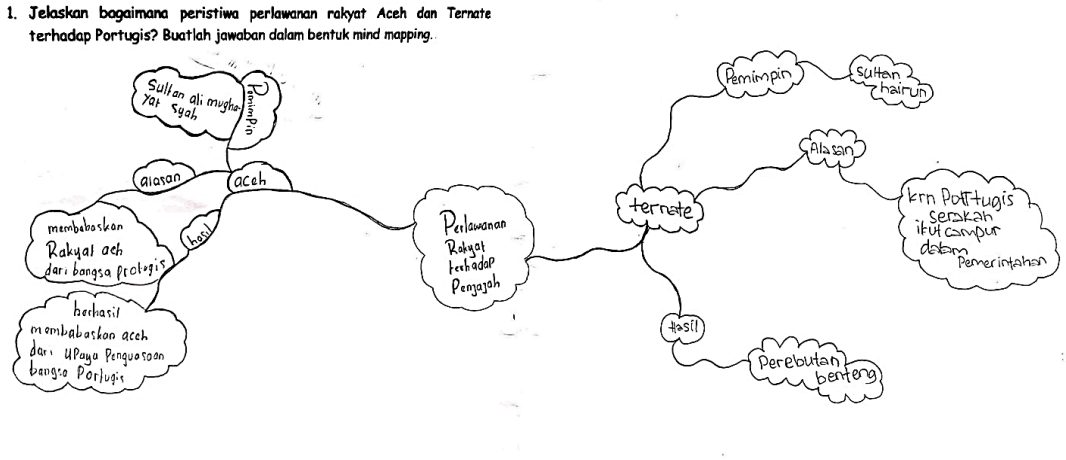

Figure 1. Results of Student Problem Solving with Mind Mapping (experimental class)

Based on Figure 1, it can be seen that students are able to answer questions, solve problems and write their ideas in the form of mind mapping both complexly and clearly, showed that students already have good initiative and confidence in learning.

In the control class, we used Direct Instruction, a direct learning model that involves students in both teaching and learning, to optimize students' teaching and learning abilities. According to Pritandhari (2017) the direct instruction model can help students develop their knowledge through learning activities. Direct instruction-based learning optimizes the cognitive side of learning and is more result-oriented and teacher-centered. Example of student problem solving results is presented in Figure 2.

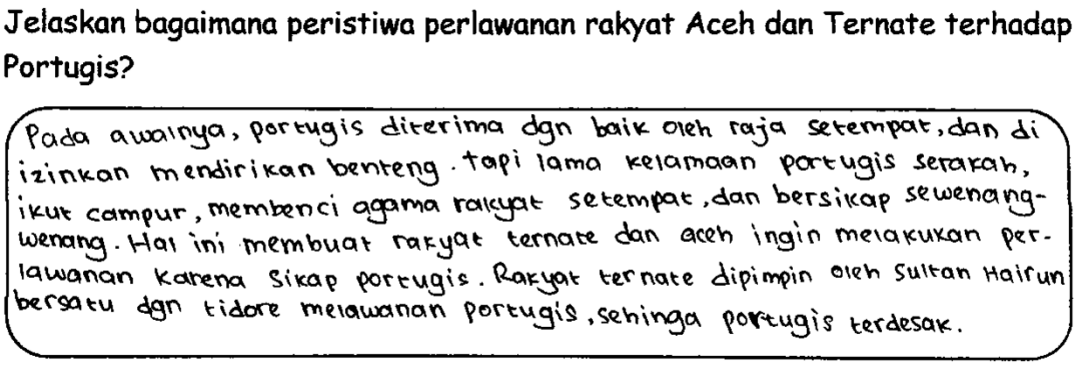

Figure 2. Results of Student Problem Solving (control class)

Based on Figure 2, it can be seen that students are able to answer questions dan solve problems, but it has not been seen to have the initiative in developing more complex and varied answers.

Meanwhile, students can develop various skills, knowledge, and attitudes through the problem-based learning model, which is designed in a complex manner to develop students' abilities. Students are more active in finding new concepts in learning through direct involvement of students in analyzing problems given at the beginning of learning so that learning is more meaningful. The teacher's role is limited to a facilitator and motivator during learning. Individuals acquire additional

knowledge on their own. According to constructivist learning theory, students are expected to discover new knowledge through their learning experiences. According to Hoover as cited by Amineh & Asl, (2015) teacher constructivism acts as a facilitator by allowing students to seek their knowledge through experience; then, the teacher uses students' prior knowledge and the learning environment as a reference point for acquiring new knowledge and experiences.

Additionally, this study demonstrates that the problem-based learning model, when aided by mind mapping, fosters a positive learning environment, as evidenced by the students' learning activities in Table 7.

Table 7. Recapitulation of Student Activities in Class

	Meeting			
	M1	M2	M3	Average
Total	218	234	253	235
Percentage	75.69%	81.25%	87.85%	81.60%
Category	High	Very high	Very high	Very high

Table 7 shows that student activity has increased at each meeting. Student participation in learning, motivation to learn, and group cooperation are assessed in class. According to research, one of the advantages of the problem-based learning model is that it can increase student motivation and activities, making them more active and enthusiastic in the learning process (Azizah et al., 2020; Syaparuddin et al., 2020; Wasonowati et al., 2014)

Mind mapping can enhance student learning activities by making it easier to locate and master the material. According to Mento, Martinelli, & Jones (1999) mind mapping instills new enthusiasm in the classroom by increasing one's motivation to master the material. Additionally, it is supported by Nurroeni (2013) which concluded that learning through mind mapping enhances students' activities. Additionally, effective activities enable students to investigate, discover, apply, and develop knowledge and attitudes of independence in learning.

The problem-based learning model places a premium on the students' learning experiences throughout the learning process, ensuring that learning is outcome-oriented and process-oriented. The problem-based learning model places a premium on the students' learning experiences; students take an active role in their education, with the teacher as a facilitator and motivator. According to Hoover, as quoted by Amineh & Asl, (2015) teacher constructivism acts as a facilitator by allowing students to seek their knowledge through experience. The teacher then uses students' prior knowledge and the learning environment as a reference to gain knowledge and new experiences. The steps in this study's problem-based learning model are as follows:

To begin, the teacher poses problems via questions. According to Afrizon, Ratnawulan, & Fauzi (2012) he problems presented are authentic real-life scenarios that avoid simplistic solutions and offer a range of possible solutions. Questions begin with what, then why and how, necessitating more complex and analytical responses. The issues to be discussed are presented in student worksheets, which students then observe and analyze. The teacher encourages students to be enthusiastic about problem-solving, reinforcing that every problem must have a solution. According to Sugianto, Suryandari, & Age (2020) indicate that students' motivation will always develop pre-existing interests and talents.

Second: students are divided into small groups of three to four individuals; groups are formed randomly to form heterogeneous groups; each group has a group leader and members. Each group elects its leader. The goal of group problem solving is for students to be able to

communicate and collaborate so that they can exchange ideas and work together to solve problems. According to Vygotsky, as Yohanes (2010) quoted, students, learn best through interaction with adults and peers who are more capable; through social interaction, students can form new ideas and advance their intellectual development; this is referred to as a cognitive apprenticeship.

Thirdly, the teacher's role as a facilitator is to guide students through the process of mind mapping analysis. According to Hikmayanti, Saehana, & Muslimin (2016) because problem-based learning requires students to seek solutions to given problems actively, the teacher's role is limited to a mediator and facilitator, assisting students in effectively constructing knowledge to facilitate learning. Meaning. Students actively record the significant points they discover while mind mapping in their groups. According to Piaget's theory, discovering the concept itself will make learning more meaningful and help students develop their understanding. Sulistiyoningsih, Kartono, & Mulyono (2015) assert that Piaget's learning theory holds that children actively construct systems and comprehend reality through their experiences and interactions. After identifying a solution through mind mapping analysis, students are guided through the process of creating their mind maps.

Fourthly, students present the results of their discussions in class. Other groups respond; this makes learning more active in the classroom, as each group exchanges ideas in response to the results of the other groups' presentations. It demonstrates that the problem-based learning model does not require the teacher to be the sole source of knowledge development; students can actively develop their knowledge through their own experiences. According to Eglitis, Buntman, & Alexander. (2016) through concise, interesting, and challenging questions and problems, problem-based learning (PBL) transforms students from passive listeners and learners to knowledge builders and active communicators. The teacher's role is to correct erroneous statements without blaming the students who respond and reinforce and affirm already-good responses. Additionally, students add additional unanswered questions to provide fodder for the next discussion.

Fifth: students are invited to evaluate the work of each group, provide opportunities for students to seek out previously unanswered questions, and then confirm temporary answers to the teacher; the teacher then completes and corrects any errors made during group discussions and expresses gratitude to each group and individual who worked cooperatively to solve the problem. These stages prepare students to become more self-sufficient in their learning. Numerous studies demonstrate that the problem-based learning model is extremely effective when used in elementary schools because elementary school students exhibit a high level of curiosity and facilitate students' development of all aspects of knowledge, skills, and attitudes. Problem-based learning requires students to take ownership of their learning (Hmelo-Silver & Barrows, 2006). The learning model chosen by students will determine their level of independence in the classroom. Because the model trains students to think independently, the problem-based learning model with mind mapping is one of the best solutions for developing students' learning independence through learning experiences and student involvement in problem-solving.

CONCLUSION

This Study Concluded That Problem-Based Learning With Mind Mapping Increases Students' Self-Directed Learning. Because The Problem-Based Learning Model Encourages Students To Participate In Group Discussions And Problem-Solving, They Become More Active And Communicative Learners. The Teacher Is Merely A Facilitator. The Addition Of Mind Mapping Engages Students In Solving Problems Because It Is Simple And Easy To Understand.

ACKNOWLEDGMENT

Thank you to those who actively assisted this research activity, especially the principals of Randegan Kulon I and II Elementary Schools, Jatitujuh District, Majalengka Regency, who granted permission for research on the assisted problem-based model. Mind mapping can help elementary school students learn more independently.

REFERENCES

Afrizon, R., Ratnawulan, & Fauzi, A. (2012). Peningkatan Perilaku Berkarakter dan Keterampilan Berpikir Kritis Siswa Kelas IX MTsN Model Padang pada Mata Pelajaran IPA Fisika menggunakan Model Problem Based Instruction. *Jurnal Penelitian Pembelajaran Fisika 1*, *1*(22), 1–16. http://www.undana.ac.id/jsmallfib_top/jurnal/pendidikan/pendidikan_2012/peningkatan perilaku berkarakter dan keterampilan berpikir.pdf

Al-jarf, R. (2011). Teaching Spelling Skills with a Mind Mapping Software. *Asian EFL Journal*, *53*(July), 4–16.

Alamiah, U. S., & Afriansyah, E. A. (2018). Perbandingan Kemampuan Komunikasi Matematis Siswa antara yang mendapatkan Model Pembelajaran Problem Based Learning dengan Pendekatan Realistic Mathematics Education dan Open-Ended. *Mosharafa: Jurnal Pendidikan Matematika*, *6*(2), 207–216. https://doi.org/10.31980/mosharafa.v6i2.308

Amineh, R. J., & Asl, H. D. (2015). Review of Constructivism and Social Constructivism. *Journal of Social Sciences, Literature and Languages*, *1*(1), 9–16. http://blue-ap.org

Astuti, T. P. (2019). Model Problem Based Learning dengan Mind Mapping dalam Pembelajaran IPA Abad 21. *Proceeding of Biology Education*, *3*(1), 64–73.

Atikasari, S., Isnaeni, W., & Prasetyo, A. P. B. (2012). Pengaruh Pendekatan Problem-Based Learning dalam Materi Pencemaran Lingkungan terhadap Kemampuan Analisis. *Unnes Journal of Biology Education*, *1*(3), 279–286. http://journal.unnes.ac.id/sju/index.php/ujbe

Aulia, L. N., Susilo, S., & Subali, B. (2019). Upaya Peningkatan Kemandirian Belajar Siswa dengan Model Problem Based Learning berbantuan Media Edmodo. *Jurnal Inovasi Pendidikan IPA*, *5*(1), 69–78. https://journal.unnes.ac.id/sju/index.php/upej/article/view/27470

Azizah, W. A., Sarwi, S., & Ellianawati, E. (2020). The Implementation of Project-Based Learning Model (PjBL) Using Stream-Based Approach In Elementary Schools. *Journal of Primary Education*, *9*(3), 340–349. https://doi.org/https://doi.org/10.15294/jpe.v9i3.39950

Bahri, S. P., Mastur, Z., & Sukestiyarno, Y. (2018). Problem Solving Ability on Independent Learning and Problem Based Learning with Based Modules Ethnomatematics Nuance. *Unnes Journal of Mathematics Education Research*, *7*(2), 218–224. http://journal.unnes.ac.id/sju/index.php/ujmer

Dunlap, J. C. (2005). Problem Based Learning and Self Efficacy: How a Capstone Course Prepares Students for a Profession. *Educational Technology Research and Development*, *53*(1), 65–83. https://link.springer.com/article/10.1007/BF02504858

Eglitis, D. S., Buntman, F. L., & Alexander, D. V. (2016). Social Issues and Problem-based Learning in Sociology: Opportunities and Challenges in the Undergraduate Classroom. *Teaching Sociology*, *44*(3), 212–220. https://doi.org/10.1177/0092055X16643572

Fauzia, H. A. (2018). Penerapan Model Pembelajaran Problem Based Learning untuk meningkatkan Hasil Belajar Matematika di Sekolah Menengah Pertama. *Jurnal Primary*, *1*(2), 1–10. https://doi.org/10.33627/gg.v1i2.179

Herdini, R. A., Suyitno, H., & Marwoto, P. (2018). Mathematical Communication Skills Reviewed from Self-Efficacy by Using Problem Based Learning (PBL) Model Assisted with Manipulative Teaching Aids. *Journal of Primary Education*, *8*(1), 85–73.

Hikmayanti, I., Saehana, S., & Muslimin, M. (2016). Pengaruh Model Problem Based Learning menggunakan Simulasi terhadap Hasil Belajar Siswa pada Materi Gerak Lurus Kelas VII MTs Bou. *JPFT (Jurnal Pendidikan Fisika Tadulako Online)*, *3*(3), 58. https://doi.org/10.22487/j25805924.2015.v3.i3.5382

Hmelo-Silver, C. E., & Barrows, H. S. (2006). Goals and Strategies of a Problem-based Learning Facilitator. *Interdisciplinary Journal of Problem-Based Learning*, *1*(1). https://doi.org/10.7771/1541-5015.1004

Jumaisyaroh, T., Napitupulu, E. E., & Hasratuddin, H. (2015). Peningkatan Kemampuan Berpikir Kritis Matematis dan Kemandirian Belajar Siswa SMP melalui Pembelajaran Berbasis Masalah. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *5*(2), 157. https://doi.org/10.15294/kreano.v5i2.3325

Kadir, A., Rochmad, R., & Junaedi, I. (2020). Mathematical Connection Ability of Grade 8th Students in terms of Self-Concept in Problem Based Learning. *Journal of Primary Education*, *9*(3), 258–266. https://doi.org/10.15294/jpe.v9i3.37547

Kim, S., & Holloway, S. D. (2018). Parenting and Young Children's Emotional Self-Regulation in Urban Korean Families. *Journal of Early Childhood Research*, *16*(3), 305–318. https://journals.sagepub.com/doi/10.1177/1476718X18775759

Liu, Y., Zhao, G., Ma, G., & Bo, Y. (2014). The Effect of Mind Mapping on Teaching and Learning : A Meta-Analysis. *Standard Reseach Journals (SRJ)*, *2*(April), 17–31.

Masrukhi, Rachman, M., & Suyahmo. (2018). Pengembangan Kepribadian Guru Berwawasan Nasionalisme di SMAN Dempet dan SMKN 2 Demak. *Jurnal Penerapan Teknologi Dan Pembelajaran*, *16*(1), 95–104. https://doi.org/10.15294/rekayasa.v16i1.15094

Mento, A. J., Martinelli, P., & Jones, R. M. (1999). Mind mapping in executive education: Applications and outcomes. *Journal of Management Development*, *18*(4), 390–416. https://doi.org/10.1108/02621719910265577

Nurroeni, C. (2013). Keefektifan Penggunaan Model Mind Mapping terhadap Aktivitas dan Hasil Belajar IPA. *Journal of Elementary Education*, *2*(1), 54–60. http://journal.unnes.ac.id/sju/index.php/jee

Parikh, N. D. (2016). Effectiveness of Teaching through Mind Mapping Technique. *The International Journal of Indian Psychology*, *3*(3), 148–156.

Paxman, C. G. (2011). Map your way to speech success! Employing mind mapping as a speech preparation technique. *Communication Teacher*, *25*(1), 7–11. https://doi.org/10.1080/17404622.2010.513994

Pritandhari, M. P. (2017). Implementasi Model Pembelajaran Direct Instruction untuk meningkatkan Kemampuan Berpikir Kreatif Mahasiswa. *PROMOSI (Jurnal Pendidikan Ekonomi)*, *5*(1), 47–56. https://doi.org/10.24127/ja.v5i1.845

Ristiasari, T., Priyono, B., & Sukaesih, S. (2012). Model Pembelajaran Problem Solving dengan Mind Mapping terhadap Kemampuan Berpikir Kritis Siswa. *Journal of Biology Education*, *1*(3).

http://journal.unnes.ac.id/sju/index.php/ujeb

Saefullah, A., Siahaan, P., & Sari, I. M. (2013). HUBUNGAN ANTARA SIKAP KEMANDIRIAN BELAJAR DAN PRESTASI BELAJAR SISWA KELAS X PADA PEMBELAJARAN FISIKA BERBASIS PORTOFOLIO. *Jurnal Wahana Pendidikan Fisika*, *1*, 26–36.

Samseno, A. S., Purwanto, E., & Sutarno. (2017). Bimbingan Kelompok dengan Peta Pikiran dan Self-Reward untuk Meningkatkan Keterampilan Belajar Siswa SMPN 3 Karanganyar. *Jurnal Psikoedukasi Dan Konseling*, *1*(1), 1.

Saputri, D. A., & Febriani, S. (2017). Pengaruh Model Problem Based Learning (PBL) terhadap Kemampuan Pemecahan Masalah Peserta Didik pada Mata Pelajaran Biologi Materi Pencemaran Lingkungan Kelas X MIA SMA N 6 Bandar Lampung. *Biosfer: Jurnal Tadris Biologi*, *8*(1), 40–52. https://doi.org/10.24042/biosf.v8i1.1262

Seker, M. (2016). The Use of Self-regulation Strategies by Foreign Language Learners and its Role in Language Achievement. *Language Teaching Research*, *20*(5), 600–618. https://journals.sagepub.com/doi/abs/10.1177/1362168815578550?journalCode=ltra

Setiawan, T., Sugianto, & Junaedi, I. (2012). Pengembangan Perangkat Pembelajaran Matematika dengan Pendekatan Problem Based Learning untuk meningkatkan Keterampilan Higher Order Thinking. *Unnes Journal of Research Mathematics Education*, *2*(1), 76–83. http://journal.unnes.ac.id/sju/index.php/ujrme

Siswati, Utomo, C. B., & Muntholib, A. (2018). Implementasi Pendidikan Karakter dalam Membentuk Sikap dan Perilaku Sosial Peserta Didik Melalui Pembelajaran Sejarah di SMA PGRI 1 Pati Tahun Pelajaran 2017/2018. *Indonesian Journal of History Education*, *6*(1), 1–13.

Sugianto, I., Suryandari, S., & Age, L. D. (2020). Efektivitas Model Pembelajaran Inkuiri terhadap Kemandirian Belajar Siswa di Rumah. *JIP (Jurnal Inovasi Penelitian)*, *1*(3), 159–170.

Sulistiyoningsih, T., Kartono, & Mulyono. (2015). PBL bernuansa Adiwiyata dengan Blended Learning untuk Meningkatkan Kemampuan Pemecahan Masalah dan Karakter Peduli Lingkungan. *Unnes Journal of Mathematics Education Research*, *4*(2), 84–92. http://journal.unnes.ac.id/sju/index.php/ujmer

Supiandi, M. I., & Julung, H. (2016). Pengaruh Model Problem Based Learning (PBL) terhadap Kemampuan Memecahkan Masalah dan Hasil Belajar Kognitif Siswa Biologi SMA. *Jurnal Pendidikan Sains*, *4*(2), 60–64. http://journal.um.ac.id/index.php/jps/%0D

Suriadi, H. J., Firman, F., & Ahmad, R. (2021). Analisis Problema Pembelajaran Daring terhadap Pendidikan Karakter Peserta Didik. *Edukatif : Jurnal Ilmu Pendidikan*, *3*(1), 165–173. https://doi.org/10.31004/edukatif.v3i1.251

Syaparuddin, S., Meldianus, M., & Elihami, E. (2020). Strategi Pembelajaran Aktif dalam Meningkatkan Motivasi Belajar PKn Peserta Didik. *MAHAGURU: Jurnal Pendidikan Guru Sekolah Dasar*, *2*(1), 31–42.

Tahar, I., & Enceng. (2006). Hubungan Kemandirian Belajar dan Hasil Belajar pada Pendidikan Jarak Jauh. *Jurnal Pendidikan Terbuka Dan Jarak Jauh*, *7*(2), 91–101.

Wardana, H. A., Hartono, & Sumarti, S. S. (2021). Model of Problem Based Learning Assisted with Multimedia Flash in Improving the Concept Understanding of Elementary School Students. *Journal of Primary Education*, *10*(3), 296–303. https://journal.unnes.ac.id/sju/index.php/jpe/article/view/35099

Wasonowati, R. R. T., Redjeki, T., & Ariani, S. R. D. (2014). Penerapan Model Problem Based Learning (PBL) pada Pembelajaran Hukum-Hukum Dasar Kimia ditinjau dari Aktivitas dan Hasil Belajar Siswa Kelas X IPA SMA Negeri 2 Surakarta. *Jurnal Pendidikan Kimia (JPK)*, *3*(3), 67–75.

Yohanes, R. S. (2010). Teori Vygotsky dan Implikasinya terhadap Pembelajaran Matematika. *Jurnal Widya Warta*, *XXXIV*(2), 854–1981.