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The influence of probing-prompting learning model toward students' mathematical reflective thinking skills

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Abstract

This research was conducted at SMP Negeri 32 Bandar Lampung to determine the influence of the Probing-Prompting learning model toward students' mathematical reflective thinking skills on the relations and functions learning materials. The researchers employed the quasi-experimental design. The research data was collected through a description test. This research was conducted on the eighth-grade students of SMP Negeri 32 Bandar Lampung. The samples consisted of sixty students determined using the cluster random sampling technique. Based on the Two-Way ANOVA test, the Probing-Prompting learning model significantly affected students' mathematical reflective thinking. Therefore, the learning model influenced the students' mathematical reflective thinking skills on the relations and functions learning materials.

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INTRODUCTION

Reflective thinking is used actively, persistently, and confidently to assist someone in finding a solution to a problem that arises from within by employing appropriate learning procedures (Dewey, 1910; Gürol, 2011; Suharna, 2012). One of the higher-order thinking skills is reflective thinking (Khusna, 2021). Reflective thinking is a method that uses arguments or evidence to support judgments and bridge gaps in learning circumstances (Choy and Oo, 2012). Reflective thinking tasks in mathematics can assist boost students' curiosity and understanding (Agustan et al., 2017; Hartati et al., 2020; Aldahmash et al., 2021). On the other hand, students are only concerned with remembering mathematical formulas (Ariestyan et al., 2016). Mathematical reflective thinking skills in mathematics learning continue to receive little attention (Ramadhani & Aini, 2019). Teachers still seldom introduce and cultivate mathematical reflective thinking in high school students. Nindiasari discovered in his research that 60 percent of pupils from one of Tangerang Regency's senior high schools were still inadequate in numerous measures of mathematics reflective thinking capacity (Nindiasari, 2011). According to Nur, students did not meet the indications of reflective thinking when addressing flat form issues. The kids' capacity to think mathematically reflectively is still lacking (Ramadhani & Aini, 2019).

Reflective thinking is a concern in SMP Negeri 32 Bandar Lampung as well. According to the pre-survey tests and teacher interviews, there were issues with students' reflective thinking abilities. The test findings revealed that the students had low mathematical reflective thinking skills when answering questions. The researchers thought that the source of the low mathematical reflective thinking ability was the expository learning approach typically used in the classroom. Students tended to just follow the teacher's example of problem resolution in the field. The students did not attempt to find ways to make learning more meaningful. The teacher supplied students with the material along with multiple sample questions. The students then worked on daily problems without active interaction between teachers and students.

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Responding to the aforementioned issues, the researchers required an appropriate learning model to enable students to explore their knowledge and communicate their thoughts in problem-solving. The Probing-Prompting learning model was considered relevant with mathematical reflective thinking skills. In its use, the teacher poses a sequence of questions designed to elicit students' knowledge and experiences (Dominikus et al., 2020; Kamilah et al., 2021; Utami, 2016). The question and response method is carried out by randomly assigning students to actively engage. Students cannot evade the learning process (Lutfia et al., 2020; Supriyadi & Sundara, 2018).

The Probing-Prompting learning model refers to students' ability to think more actively and their ability to voice their thoughts (Perrianty et al., 2019). This model is closely related to questions (Tuerah et al., 2020). Probing inquiries are those that probe for more information so that the following answer is clearer, more correct, and more reasonable (Nurhayati, 2019). On the other hand, prompting questions require pupils to find more accurate solutions (Danaryanti & Tanaffasa, 2016; Tuerah et al., 2020). Teachers provide an opportunity for students to investigate and enhance their responses to previous questions (Dominikus et al., 2020).

Several researchers have conducted a study on the Probing-Prompting model. This model improves problem-solving skills (Mustika and Buana, 2017), concept understanding (Oktaviana et al., 2013; Upita, 2018), and mathematical critical thinking skills (Susanti, 2017). However, no research has been conducted to investigate the impact of the Probing-Prompting learning model on reflective thinking skills. The purpose of this research was to determine which group (the Probing-Prompting model group or the conventional group) could deliver the best results in terms of reflective thinking skills.

METHOD

The researchers employed the quasi-experimental design to investigate the influence of certain treatments in the classroom. The researchers assigned two classes. The first class, which consisted of 30 students, was the experimental class where the researchers applied the Probing-Prompting model. The second class was the control class, which consisted of 30 students, where the researchers applied the expository model. There were four meetings in each class. The researchers administered post-tests in the last meeting to see the effectiveness of the learning models toward students' mathematical reflective thinking skills. The research design is displayed in the following figure:

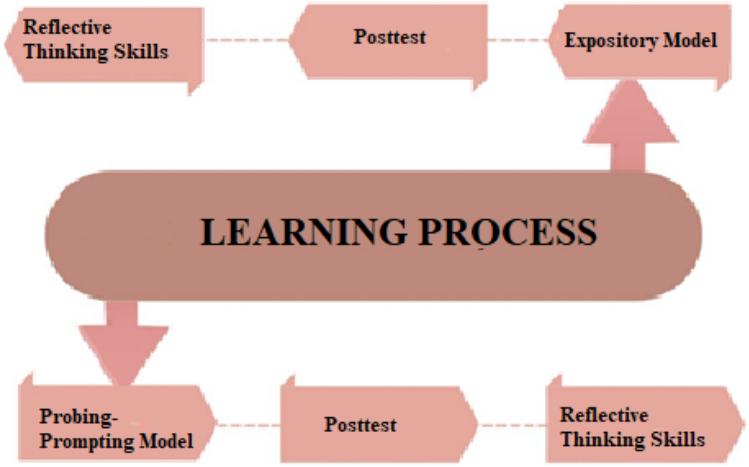

Figure 1. Research Procedure

The population of this research was all eighth-grade students of SMP Negeri 32 Bandar Lampung, which consisted of ten classes. The samples of the research were class VIII 9 and VIII 10. The researchers performed the cluster random sampling technique by randomly selecting one or several groups by drawing lots. The researcher performed the normality and homogeneity tests assisted by the SPSS 22 software with the provision that the sig. value should be higher than 0.05. Based on the normality test results, the significant value in the experimental class was 0.199, and the sig value in the control class was 0.200. It can be concluded that the two samples were normally distributed (reaching a significance

value > 0.05). The homogeneity test obtained a significance value of 0.092. It means that the research sample came from the same population.

The research instrument consisted of seven description questions tested for their feasibility. The instrument testing carried out were the validity test, reliability test, difficulty level test, and the discriminating index test. Based on the results of the tests, there were five questions declared valid and reliable. The hypothesis testing of this research was the two-way ANOVA test (Analysis of Variance) of unequal cells to see the effect of the Probing-Prompting learning model on students' mathematical reflective thinking abilities.

RESULTS and DISCUSSION

The results of this study are a description of the students' mathematical reflective thinking ability test data. The experimental class used the Probing-Prompting learning model, and the control class used the expository learning model. The Probing-Prompting learning model and the expository learning model showed different results on the reflective thinking ability. Posttest data analysis is presented in Table 1.

Table 1. The Description of Posttest Results

Group	X_{max}	X_{min}	$\bar{X}$	M_e	R	SD
Experimental	100	60	82,30	84,00	40	10,482
Control	87	60	73,40	73,00	27	7,050

Based on these data, the average value of the experimental class was 82.30, and the average value in the control class was 73.40. Therefore, the average value in the experimental class was greater than in the control class. Table 1 shows that the post-test results in the Probing-Prompting learning model were greater than the expository learning model on students' mathematical reflective thinking skills.

Table 2. The results of the Normality Tests

Group	p-value	Significance	Description
Experimental	0,199	0,05	Normal distribution
Control	0,200	0,05	Normal distribution

Based on table 2, the results of the normality calculation show that the p-value in the experimental class was 0.199, and the p-value in the control class was 0.200. Therefore, H_0 is accepted, and the population is normally distributed because the p-value is greater than α. Furthermore, the calculation of the homogeneity of variances test with the help of SPSS 22 is presented in Table 3.

Table 3. The Result of the Homogeneity Test

Group	Mathematical Reflective Thinking Skills
p − value	0,092
Significance	0,05
Conclusion	Homogenous

Table 3 shows that the mathematical reflective thinking skills came from a homogeneous population because they fit the criteria where the p-value was greater than α. After knowing that the research data was normally distributed and homogeneous, the next step was testing the hypothesis. The hypothesis test used in this research was the two-way ANOVA (Analysis of Variance) of unequal cells assisted by SPSS 22. The results of the ANOVA test are presented in Table 4.

Table 4. The Results of Two-Way ANOVA of Unequal Cell

ANOVA Hypothesis	Skill	p-value	Description
Model	Mathematical Reflective Thinking	0,001	H0A is rejected

Based on Table 4, the two-way ANOVA analysis stated that the hypothesis was rejected because the p-value was lower than α. Therefore, it can be concluded that there was an influence of the Probing-Prompting model on students' reflective thinking skills. These results are obtained because the steps in the Probing-Prompting learning model trigger students to be active through a series of questions posed by the teacher. Students think to find answers and conclusions during the learning process. Table 5 describes the steps of the Probing-Prompting learning model.

Table 5. The Steps of Probing-Prompting Learning Model

Model	Learning Activities	
	The teacher exposes students to new situations by paying attention to pictures, formulas, or other conditions that contain problems.	Students observe the situation presented by the teacher.
	The teacher waits for a few moments to allow students to formulate answers or have a small discussion in formulating them.	The students formulate the problem and hold a small discussion with their peers.
	The teacher appoints one student to answer the question.	The students prepare themselves and their answers.
	If the student has difficulty answering (inaccurate, inaccurate, or silent), then the teacher asks other questions whose answers are clues. Then the teacher continues with questions that lead students to think at a higher level until they can answer questions according to basic competencies or indicators.	The students perform the reflective thinking skills in answering teachers' questions.
	The teacher poses a final question to different students to emphasize that all students have understood the learning objectives/indicators and concluded.	The students conclude the answers to the teacher's series of questions.

Reflective thinking is a systematic, rigorous, and disciplined method of thinking. It is based on experience and attempts to relate it to subsequent events (Rahmi et al., 2020). The two-way ANOVA test results in Table 4 indicate that the Probing-Prompting learning model effectively increases students' reflective thinking. This model necessitates students' active participation and critical thinking in responding to a series of questions from the teacher. During the learning process, students must also provide conclusions. According to Rany et al., the questions presented in the Probing-Prompting learning model are investigative, resulting in a thinking process that connects students knowledge and

experience with the knowledge learned (Widyastuti et al., 2020). Students receive more information from the teacher in expository learning, so they are less trained in mathematical reflective thinking. This study's findings are consistent with previous research indicating that reflective thinking is important in mathematics learning because it is one of the determinants of students' success in solving math problems (Supriyaningsih et al., 2018).

The Probing-Prompting learning model requires students to actively participate in thinking to find answers to a series of questions posed by the teacher to create an environment that can improve students' mathematical reflective thinking skills. According to previous research, this model can improve mathematical concept understanding (Upita, 2018), increase activeness and mathematical critical thinking skills (Susanti, 2017), and improve mathematical connection skills (Danaryanti & Tanaffasa, 2016). The students' post-test responses from the two sample classes are shown in Table 1. This table illustrates the difference in students' answers when treated with the Probing-Prompting learning model versus the expository learning model.

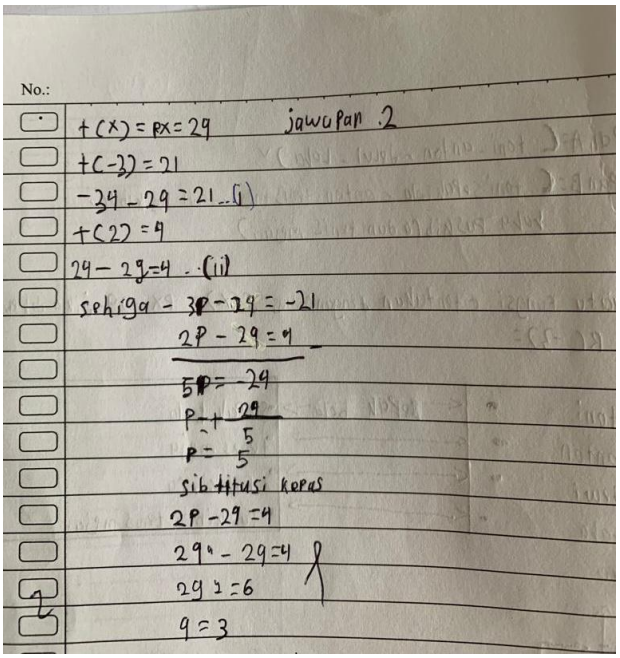

Figure 2. Control Class

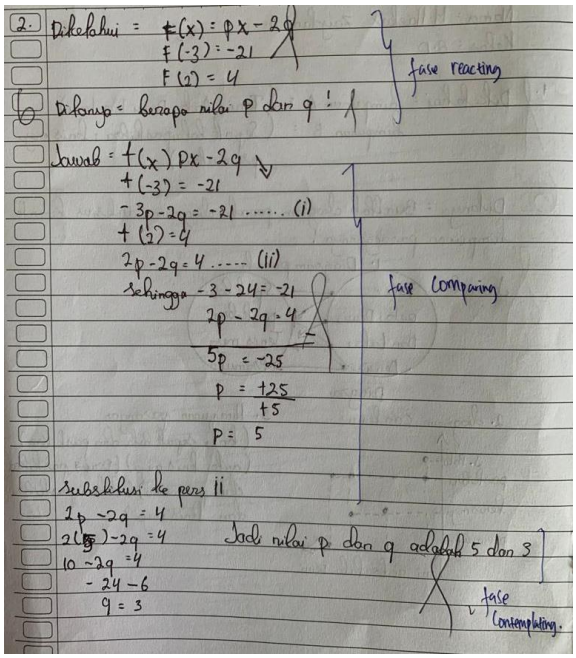

Figure 3. Experimental Class

Figure 2 and 3 shows the difference in the answers and the comparison of each student's answers in the control class and the experimental class. Before the learning model was applied, most students solved pre-research questions inappropriately. It was due to the students did not understand how to analyze questions. Thus, they gave incorrect answers. After being given treatment by applying two different learning models in the two sample classes, the students' mathematical reflective thinking had increased. However, there were differences in the experimental class students who met the mathematical reflective thinking indicators. The first indicator was reacting. The students state what is asked, what is known, the relationship between what is asked and what is known, and explain what is known to answer questions. The second indicator was elaborating. The students explain the problems that have been obtained and relate them to the problems they have faced. The third indicator was contemplating. The students can determine the purpose of the problem, detect errors in answers, and make conclusions correctly (Dian et al., 2018).

When solving problems in the post-test, two students from each class answered the questions correctly. However, there were visible differences in how the students answered the questions. The students from the experimental class answered the questions systematically and structured according to the indicators of mathematical reflective thinking. The students wrote down what was known in full, determined the main problem, described answers in detail, and provided a conclusion. Even though both answers were correct, it can be seen which students described solutions in a systematic and detailed manner and answered the questions in a simple manner. At this stage, the students connected a lot of experience and knowledge. This result is in line with previous research conducted by Siti Faujiyah, who

states that the Probing-Prompting learning model improves mathematical connection abilities (Faujiyah, 2019). Before carrying out learning activities, teachers must prepare an overview of the benefits of learning by reflecting on students' daily lives. The results and discussion section contains research findings obtained from research data and hypotheses, discussion of research results, and comparisons with similar theories and/or similar research. The results and discussion section can be divided into several subsections.

CONCLUSION

Based on the analysis, it can be concluded that the Probing-Prompting learning model influenced students' mathematical reflective thinking skills. The two-way ANOVA test states that the effectiveness of the probing-prompting model on mathematical reflective thinking skills was 0.001. Therefore, the Probing-Prompting learning model positively influenced students' mathematical reflective thinking skills on the relations and functions learning materials. The result implies that teachers can use this learning model to improve students' reflective thinking skills. Also, further researchers can use this model on other abilities.

REFERENCES

Agustan, S., Juniati, D., Yuli, T., & Siswono, E. (2017). Reflective thinking in solving an algebra problem: A case study of field independent-prospective teacher. *Journal of Physics: Conference Series, 893* (1), 1-6.

Aldahmash, A. H., Alshalhoub, S. A., & Naji, M. A. (2021). Mathematics teachers' reflective thinking: Level of understanding and implementation in their professional practices. *PLOS ONE*, *16*(10), 1-17.

Ariestyan, Y., Sunardi, S., & Kurniati, D. (2016). Proses berpikir reflektif siswa dalam menyelesaikan soal matematika materi sistem persamaan linear dua avriabel. *KadikmA*, *7*(1), 94-104.

Choy, S. C., & Oo, P. S. (2012). Reflective thinking and teaching practices: A precursor for incorporating critical thinking into the classroom?. *Online Submission*, *5*(1), 167–182.

Danaryanti, A., & Tanaffasa, D. (2016). Penerapan model probing prompting learning untuk meningkatkan kemampuan koneksi matematis siswa SMP. *EDU-MAT: Jurnal Pendidikan Matematika*, *4*(1), 8–14.

Dewey, J. (1910). *How we think*. Boston: D.C. Heath & CO.

Dian, C. K., Kriswandani, K. & Ratu, N. (2018). Analisis kemampuan berpikir reflektif dalam menyelesaikan soal cerita materi persegi bagi siswa kelas VIII SMP kristen 02 Salatiga tahun ajaran 2017/2018. *Paedagoria: Jurnal Kajian, Penelitian dan Pengembangan Kependidikan, 9*(1), 1–4.

Dominikus, W. S., Nenohai, J. M. H., & Hale, M. (2020). Increasing students' mathematical communication skills by applying probing-prompting learning model based on Belu culture artefact. *Journal of Physics: Conference Series*, *1657*(1), 1-5.

Faujiyah, S. (2019). *Pengaruh model pembelajaran probing prompting terhadap kemampuan koneksi matematis siswa pada pokok bahasan bangun datar segiempat kelas VII SMP kawung 2 Surabaya*. (Doctoral dissertation, Wijaya Kusuma Surabaya University).

Gürol, A. (2011). Dertermining the reflective thinking skills of pre-service teachers in learning and teaching process. *Energy Education Science and Technology Part B: Social and eductional Studies, 3*(3), 387–402.

Hartati, S., Bilqis, R. A., & Rinaldi, A. (2020). Mathematical problem-solving abilities and reflective thinking abilities: The impact of the influence of eliciting activities models. *Al-Jabar: Jurnal Pendidikan Matematika, 11*(1), 167–178.

Kamilah, S., Hardeli, & Azra, F. (2021). Validity and practicality of electrolyte and non-electrolyte solution modules posit on guided inquiry with probing prompting technique for grade X in senior high school. *Journal of Physics: Conference Series*, *1788*(1), 1-9.

Khusna, A. H. (2021). Scaffolding based learning: strategies for developing reflective thinking skills (a case study on random variable material in mathematics statistics courses). *Journal of Physics: Conference Series, 1940*(1), 1-8.

Lutfia, A., Asyhari, A., & Saidy. (2020). Effectiveness of the implementation of probing-prompting learning model on student learning outcomes in the discussion of static fluid. *Journal of Physics: Conference Series*, *1572*(1), 1-5.

Mustika, H., & Buana, L. (2017). Penerapan model pembelajaran probing prompting terhadap kemampuan pemecahan masalah matematika siswa. *MES: Journal of Mathematics Education and Science*, *2*(2), 30-37.

Nindiasari, H. (2011). Pengembangan bahan ajar dan instrumen untuk meningkatkan berpikir reflektif matematis berbasis pendekatan metakognitif pada siswa sekolah menengah atas (SMA). *Seminar Nasional Matematika Dan Pendidikan Matematika,* 2, 251–263.

Nurhayati, E. (2019). Penerapan teknik probing-prompting dalam pembelajaran matematika siswa kelas X SMK TI garuda nusantara Cimahi. *Journal on Education, 1*(2), 410-418.

Oktaviana, M., Nurhanurawati, & Djalil, A. (2013). Pengaruh model pembelajaran kooperatif dengan teknik probing-prompting terhadap pemahaman konsep matematis. *Jurnal Pendidikan Matematika Universitas Lampung*, *1*(5), 1-11.

Perrianty, F., Zainul, R., Julita, R., & Yenti, R. (2019). Improving critical thinking skills through module solubility and solubility results based on discovery learning with probing prompting techniques at SMAN 1 Pariaman. *International Journal of Progressive Sciences and Technologies (IJPSAT)*, *16*(1), 246-250.

Ramadhani, N. F., & Aini, I. N. (2019). Kemampuan berpikir reflektif matematis siswa dalam menyelesaikan masalah yang berkaitan dengan bangun ruang sisi datar. *Prosiding Sesiomadika: Seminar Nasional Matematika Dan Pendidikan Matematika*, *2*(1), 754–761.

Rahmi, N., Zubainur, C. M., & Marwan. (2020). Students' mathematical reflective thinking ability through scaffolding strategies. *Journal of Physics: Conference Series*, *1460*(1), 1-8.

Suharna, H. (2012). Berpikir reflektif (reflective thinking) siswa SD berkemampuan matematika tinggi dalam pemecahan masalah pecahan. *SemNas Matematika dan Pendidikan FMIPA UNY*, 377–381.

Supriyadi, S & Sundara, K. (2018). Pengaruh model pembelajaran probing prompting terhadap aktivitas dan hasil belajar siswa pada mata pelajaran PPKn kelas VII di MTs hidayatullah Mataram tahun pelajaran 2017/2018. *CIVICUS: Pendidikan-Penelitian-Pengabdian Pendidikan Pancasila dan Kewarganegaraan, 6*(1), 58–62.

Supriyaningsih, N., Kriswandani, & Prihatnani, E. (2018). Profil kemampuan berpikir Reflektif siswa SMP dalam menyelesaikan soal matematika pisa Pada konten quantity. *Prosiding Seminar Nasional Etnomatnesia*, 366–378.

Susanti, E. (2017). Penerapan model pembelajaran probing-prompting untuk meningkatkan kemampuan berpikir kritis matematis siswa kelas XI IPA MAN 1 kota Bengkulu. *Jurnal Pendidikan Matematika Raflesia*, *2*(1), 96-107.

Tuerah, P., Regar, V. E., & Tuerah, I. J. C. (2020). The analysis of student learning outcome using a probing prompting learning model. *International Journal of Psychosocial Rehabilitation*, *24*(02), 2574–2582.

Upita, M. (2018). *Penerapan teknik probing-prompting untuk meningkatkan pemahaman konsep matematika siswa*. (Skripsi, UIN Ar-Raniry Banda Aceh).

Utami, D. (2016). Penerapan model pembelajaran probing prompting dalam pembelajaran mengabstraksi teks negosiasi pada siswa kelas X SMA/MA. *Riksa Bahasa*, *2*(2), 151–158.

Widyastuti, R., Suherman, Anggoro, B. S., Negara, H. S., Yuliani, M. D., & Utami, T. N. (2020). Understanding mathematical concept: The effect of savi learning model with probing-prompting techniques viewed from self-concept. *Journal of Physics: Conference Series*, *1467*(1), 1–7.