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IMPLEMENTATION OF DISCOVERY LEARNING MODEL WITH WINDOW SHOPPING APPROACH TO IMPROVE MATHEMATICAL COMMUNICATION ABILITY OF HIGH SCHOOL STUDENTS

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ABSTRACT

The low ability of students' mathematical communication in learning mathematics, especially in expressing mathematical situations or problems in the form of pictures, diagrams, language or mathematical symbols, or mathematical models makes students less active in learning and their learning motivation decreases. This study aims to determine the achievement of students' mathematical communication skills through the discovery learning model with a window shopping approach. The method in this study is a quasi-experimental research type consisting of 2 classes, namely the experimental class that uses the discovery learning model with the window shopping approach and the control class that uses ordinary learning at school with a total of 70 students from class XI SMA in one of the public high schools in Bandung. The research test instrument was in the form of a test that would be analyzed using SPSS 21 to compare learning outcomes between the experimental class and the control class. The result of the study was that the achievement of the students' mathematical communication skills in the experimental class was better than that of the control class at a significance level of 0.05 where the average communication ability of the experimental class was 81.74 and that of the control class was 77.31. The effectiveness of learning in the experimental class showed that it was more active in group discussions as indicated by the interaction and creativity of students in presenting learning material in each group, and almost 85% of students enjoyed learning using the discovery learning model with the window shopping approach.

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INTRODUCTION

Learning mathematics at elementary school to high school in the 2013 Curriculum for mathematics subjects at the secondary school level states that: (1) students can understand

knowledge (factual, conceptual, and procedural) based on their curiosity about science, technology, art, related culture visible phenomena and events; (2) processing, presenting, and reasoning in the concrete realm (using, parsing, assembling, modifying, and creating) and the abstract realm (writing, reading, counting, drawing, and composing) according to what is learned in school and other similar sources in point of view or theory.

While in the implementation of the 2013 Curriculum (Ministry of Education and Culture, 2013) standard intra-curricular learning processes developed on the principle of active student learning through observing (seeing, reading, listening, listening), asking (oral, written), analyzing (connecting, determining linkages, building stories/concepts), communicating (oral, written, pictures, graphs, tables, charts, etc.). So based on competency standards and learning process standards contained in the curriculum, the communication aspect is a skill that students must have.

In line with the foundation of the two curricula above, one of the mathematics education organizations in the United States, namely the National Council of Teachers of Mathematics (NCTM) (Yuniawati, 2011) states that the goals of learning mathematics in schools are for students to: (1) learn about the values contained in mathematics, (2) be confident in their mathematical abilities, (3) become problem solvers, (4) be able to communicate mathematically, and (5) can reason mathematically. So that from the objectives of learning mathematics mentioned above, NCTM determines five abilities that students need to have through learning mathematics, namely: (1) problem solving (2) reasoning and proof (reasoning and proof), (3) communication (communication), (4) connection (connection) and (5) representation (representation).

The ability to communicate ideas about mathematics and use mathematics as a communication tool is one of the mathematical powers, as stated in the NCTM (Sumarmo, 2012) which states that the appeal of mathematics is the ability to explore, construct conjectures, provide logical reasons, the ability to solve non-routine problems, communicate ideas about mathematics and use mathematics as a means of communication, connect ideas in mathematics, between mathematics, and other activities. .
Stacey also stated (Pujiastuti, 2014) that communication skills are one of the factors that contribute and also determine the success of students in solving problems. To solve problems effectively, students must have good communication skills.

The importance of developing mathematical communication skills was also stated by Greenes and Schulman (Ansari, 2012) that communication is: (a) strength for students in formulating concepts and strategies in mathematics; (b) as a capital of student success towards approaches and solutions in exploration and investigation in mathematics; and (c) as a forum for students to communicate with friends, to obtain information, exchange ideas and findings, brainstorm, assess and question ideas to convince others. This was confirmed (Kusumah et al., 2020) that communication skills are needed to understand mathematical ideas correctly. Weak communication skills will weaken other math skills. Students who have high mathematical communication skills can make various representations and more easily find alternative solutions to problems.

However, there is a gap between the desired expectations and the fact that the mathematical communication abilities of Indonesian students are still low. included in levels 5 and 6 in the 2015 PISA assessment (Kusumah et al., 2020). The 2015 PISA results show that Indonesian students' scores for levels 5 and 6 only range from 0 - 0.6%. More specifically in learning geometry in the classroom, many difficulties are faced by teachers and students because learning geometry involves more abstract concepts than concrete concepts. Geometry learning is presented textually using pencil and paper and involves concepts that are not related to the

student's context causing students to have difficulty understanding the various geometric concepts presented. Likewise, the results of a preliminary study conducted on 36 students at one of the state high schools in the city of Bandung were still low. From the 6 description questions which include indicators of students' mathematical communication abilities, it was reported that the average score of mathematical communication abilities obtained by students only reached 10 and the highest score obtained by students only reached 14, while the ideal maximum score was 24. The average percentage of students' scores only reached 41.66. % of ideal maximum score. In general, the results of this study concluded that junior high school students' mathematical communication skills were still low.

As revealed in research results, (Kadir, 2010) reported that the average score for mathematical communication skills obtained by students was only 3.9, while the maximum score should ideally be 10, and in general concluded that students' mathematical communication skills were still low. Another fact from the results of research conducted by (Mikrayanti, 2012) regarding the mathematical communication skills of students in the good and poor school categories is not yet satisfactory. In good category schools the score was only 64.7% of the ideal score and in poor category schools the score was only 46.85%.

As stated by (Pujiastuti, 2014) that learning mathematics which consists of a series of activities that begin with an explanation of the material by the teacher, followed by giving a few sample questions, then a demonstration of the completion of some sample questions, and at the end of learning students are asked to complete practice questions will have an impact on students, including: (1) students think that mathematics cannot be learned alone, so students always wait for the teacher's help; (2) students feel very foreign to talk about mathematics, so that when students give explanations for their answers, they feel very surprised and afraid to give their considerations or answers; (3) students can work on math problems simply by imitating the examples or steps given by the teacher in class.

Currently there are many learning models used in the 2013 curriculum, one of which is the discovery learning model. The discovery learning learning model requires students to learn actively, where learning is not only assessed from the results, but from the learning process. From this learning process students can find problems and try to solve these problems, even students can find new knowledge from these problems. According to Dahar (Dhianti & Rahayu, 2017) there are some good knowledge gained by discovery learning, including how to improve students' mathematical communication skills as a whole and the ability to think freely.

In addition to the discovery learning model, it can be combined with a learning approach that is appropriate to the characteristics of students and the competencies to be learned, such as a scientific approach with window shopping techniques. This approach can encourage increased activity, strengthen the skills of students to communicate politely and is expected to have an impact on increasing learning outcomes in mathematics. Efforts to achieve the goals of learning mathematics can be done through the design of challenging activities demonstrating 5M scientific activities (observing, asking questions, gathering information, reasoning, and communicating). The results of research conducted by (Rahma, 2017) that students are very engrossed in learning with the window shopping approach because they can walk around while learning. Students who travel to other groups have the task of providing input or questions about the material being discussed. While the students who are in charge of guarding the stand are ready to conduct question and answer with other visiting groups.

Through the application of the discovery learning model with a window shopping approach, the author first hopesachievement of mathematical communication skills among students who

use the discovery learning model with the window shopping approach is better than students who use ordinary learning.

METHOD

This study uses analysis with quasi-experimental methods. This method was chosen according to its characteristics because the research questions to be answered include achieving mathematical communication skills and the process of using discovery learning models with a window shopping approach which involves only quantitative data in the form of pretest and posttest data. The population chosen in this study is one of the public high schools in Bandung. While the samples were students of class XI through a purposive sampling technique which consisted of two classes, namely an experimental class that used discovery learning model with a window shopping approach and a control class that used the usual learning model at school.

The purpose of taking samples like this is so that research can be carried out effectively and efficiently, especially in terms of supervision, conditions of research subjects, set research time, conditions of research sites and licensing procedures in accordance with the opinion(Arikunto, 2002).To measure students' mathematical communication skills, a written test was carried out before being treated as a pretest and after being treated as a posttest in both classes. These questions represent each indicator of mathematical communication ability. The research design used is researchExperimental Nonequivalent Pretest-Posttes Control Group Design stated(Ruseffendi, E., 2003). Briefly the research design is presented in Figure 2 below:

Group A	O	X	O
Group B	O		O

Figure 1. Nonequivalent Pretest-Posttest Control Group Design

Group A = Experimental group

Group B = Control group

O = Pretest = Posttest (Communication skillsmath)

X = Discovery learning model with window shopping approach

The relationship between the independent variables (discovery learning model with the window shopping approach), the dependent variable (mathematical communication skills.

RESULTS AND DISCUSSION

Results

The following presents the descriptive results of the value of students' mathematical communication skills from each experimental class that uses the discovery learning model with the windows shopping approach and the control class with ordinary (conventional) learning.

Table 1. Descriptive Statistics

	Class	N	Means	std. Deviation	std. Error Means
Pretest	Experiment	35	31.29	15,721	2,657
	Control	35	27.46	12,500	2.113

Postest	Experiment	35	81.74	5,081	.859
	Control	35	77.31	5.310	.898

Based on table 1, it was obtained that the average posttest ability test score for the experimental class was 81.74 and the control class was 77.31. Descriptively, the achievement of the experimental class was better than that of the experimental class.

Table 2. Normality Test

Tests of Normality

Data	Kelas	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pretest	Eksperimen	.111	35	.200*	.962	35	.255
	Kontrol	.090	35	.200*	.961	35	.253
Postest	Eksperimen	.124	35	.190	.972	35	.511
	Kontrol	.117	35	.200*	.961	35	.244

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on table 2 using the methodKolmogorov-Smirnova Because the number of class data is more than 60, namely 70, the value of Sig. pretest and posttest data for both the experimental class and the control class are greater than 0.05. So it can be concluded that all data comes from populations with normal distribution. Then it will be continued with homogeneity test and independent sample t test.

Table 3. Independent Sample Tests

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Differences	std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	2,432	.145	1.128	68	.244	3,829	3,395	-2,946	10603
	Equal variances not assumed			1.128	64,714	.244	3,829	3,395	-2,952	10609
Postest	Equal variances assumed	.004	.948	3.128	68	003	3,886	1,242	1,407	6,365
	Equal variances not assumed			3.128	67,867	003	3,886	1,242	1,407	6,365

Based on table 3 test resultsLevene's shows that the pretest sig value is 0.145 and the Sig. psotest 0.948 is greater than the significance level of 0.05, thus the pretest and posttest values of the two classes are said to be homogeneous. The results of the t-test for Equality of Means obtained the value of Sig. (2-tailed) pretest data of 0.063 is greater than 0.05 so that it is said that there is no significant difference between the experimental class and the control class. However, for the posttest data, the value of Sig. (2-tailed) 0.003 is less than 0.05 so that it is said that there is a significant difference between the experimental class and the control class, meaning that the achievement score of the experimental class is better than the control class.

Discussions

Based on the results of the pretest test, the students' mathematical communication skills in the experimental and control classes were not significantly different. This is supported by the condition of the class in the school where the ability of students is spread evenly between high, medium and low ability students. However, after carrying out research using the

discovery learning model with the window shopping approach in the experimental class, it showed significant results with control class students who used ordinary (conventional) learning.

This can be seen in the various activities that took place in the experimental class where students could discuss in groups, actively ask questions, and share knowledge as expressed by(Dhianti & Rahayu, 2017)that with the discovery learning model the teacher acts as a guide by providing opportunities for students to learn actively, as the opinion of the teacher must be able to guide and direct student learning activities in accordance with the objectives. The use of the discovery learning model, wants to change passive learning conditions to be active and creative.

Likewise with the window shopping approach, knowledge sharing activities will be achieved, because students will go around visiting other groups to see, ask questions, and try to do practice questions that are not in their group. This is reinforced by Goeswarno's opinion(in Rahma, 2017)usually interpreted as walking activities in the market or mall just to look around without shopping. In this learning model there are activities of students walking around looking at the results of other groups' work. Each group member gets a division of tasks in window shopping. There are group members in charge of keeping the shop and others walking around to visit other groups' shops. This is confirmed by research(Kurdish, 2018)With the window shopping approach, having peer tutors attracts participants to play a more active role in the learning process and lightens the role of the teacher because they are no longer the only source of learning.

The following picture shows the preparation of students in maintaining their respective stands

Figure 2. Matrix group with McD theme

Figure 3. Group with Ice Cream theme

Figures 2 and 3 show the preparation of each group for marketing and presentation. Some of them share the task of guarding the booth and some go around to other groups to find and explore material that is not in their group, then they collect all the material to be discussed jointly by the group so as to obtain complete lesson material for all groups.

Figure 4. Group representatives present their work

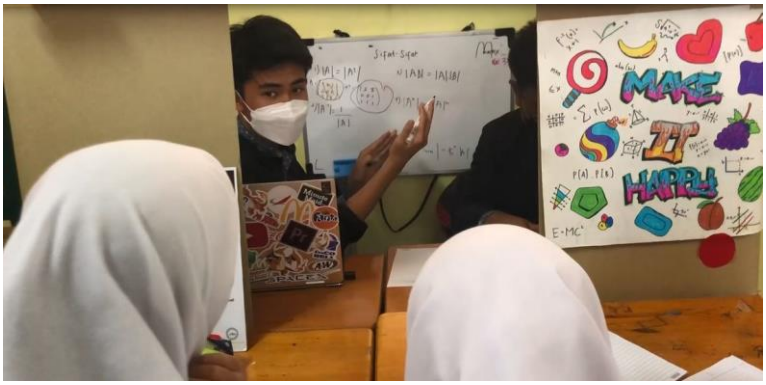

Figure 5. Interaction between groups

Figures 4 and 5 show group representatives presenting learning material in accordance with the distribution of group material. In group division the teacher divides the learning material according to the group so that the same material does not occur in each group. Figure 4 shows the students explaining the inverse matrix material through the brochures they compiled and then tested it on other group members. Figure 4 shows the group participants asking questions about the determinants of the matrix, then the group members who guard the stands explain in an interesting way. In picture 5 other group members who want to ask questions they have to order a menu on the menu of choice, then they queue to wait to get service like they ordered food at McDonald's.

This is in line with research(Surur et al., 2019)that in learning mathematics that uses the discovery learning learning model, students are expected to be able to find concepts and principles through their own mental processes. In finding concepts, students make observations, classify, make guesses, explain, draw conclusions and so on to find some concepts or principles.

Related to the mathematical communication skills of students who learn by using the discovery learning model with a window shopping approach, it shows that students are more active in expressing opinions, students are able to draw a given situation, carry out the steps for calculating problem solving as shown in the following figure.

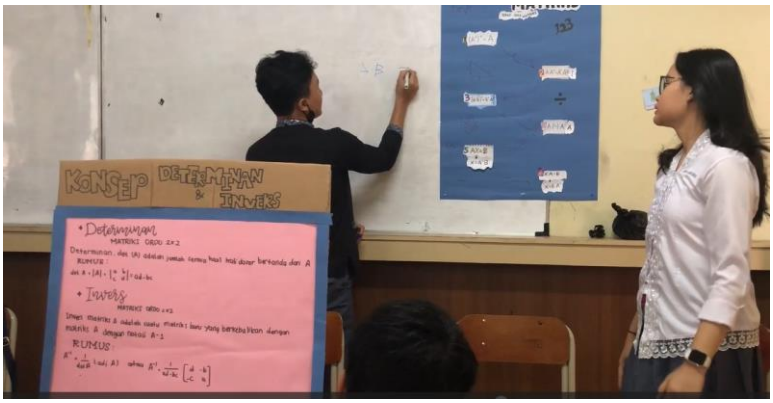

Figure 6. Group participants are trying to do the practice questions

Figure 6 shows group participants working on questions related to problems raised by other groups, in line with the activity above it turns out that the discovery learning model can increase student activity at the confirmation stage. This is in line with research conducted by(Kanah & Mardiani, 2022)that learning discovery learning in groups students can find or discuss the results of solutions with their group friends, so that with the group learning process students can learn independently to find mathematical problems, so as to increase student learning independence. This is also confirmed by research(Affandi et al., 2022)that the learning model of discovery learning has a positive effect on student success and the effectiveness of learning in the classroom.

In order for class discussion activities to continue to be active, the teacher needs to accompany and go around watching each group interact with each other then giving emphasis to groups that have difficulty explaining concepts as well as giving awards to groups that are able to explain clearly and precisely. This was also stated by(Putra & Purwasih, 2016)the teacher should need to motivate other students who are not used to being active by providing opportunities for them to ask questions or express opinions during class discussions. Students who start to have the courage to ask and argue must continue to be motivated by asking them to always participate actively during learning. To be able to participate actively, of course these students learn in advance the material to be discussed.

CONCLUSION

The results of this study stated that the achievement of mathematical communication skills of students who studied using the discovery learning learning model with the window shopping approach was significantly better than students who studied using the usual model carried out at school. Where the average posttest achievement of the experimental class students was 81.74 for the experimental class and 77.31 for the control class, after testing the hypothesis using the independent t test there was a significant difference of.003 is smaller than $\alpha = 0.05$so that it shows the significance that the discovery learning learning model is better than the usual learning model that is carried out in everyday schools.

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REFERENCES

Affandi, Y., Darmuki, A., & Hariyadi, A. (2022). The Evaluation of JIDI (Jigsaw Discovery) Learning Model in the Course of Qur an Tafsir. *International Journal of Instruction*, *15*(1), 799–820. https://doi.org/10.29333/iji.2022.15146a

Ansari, B. I. (2012). *Komunikasi Matematik dan Politik Suatu Perbandingan: Konsep dan Aplikasi*. Banda Aceh: Yayasan Pena.

Arikunto, S. (2002). *Prosedur Penelitian Suatu Pendekatan Praktek.* Jakarta: PT. Rineka Cipta.

Dhianti, L., & Rahayu, W. (2017). Meta Analisis: Pengaruh Model Discovery Learning Terhadap Peningkatan Kemampuan Berpikir Kritis Matematika. *Jurnal Derivat: Jurnal Matematika Dan Pendidikan Matematika*, *10*(2), 153–164. https://doi.org/10.31316/jderivat.v9i2.4240

Kadir. (2010). *Penerapan Pembelajaran Kontekstual Berbasis Potensi Pesisir sebagai Upaya Peningkatan Kemampuan Pemecahan Masalah Matematis, Komunikasi Matematis, dan Keterampilan Sosial Siswa SMP*. Disertasi Pada SPs UPI. Bandung: Tidak Diterbitkan.

Kanah, I., & Mardiani, D. (2022). Kemampuan Komunikasi dan Kemandirian Belajar Siswa Melalui Problem Based Learning dan Discovery Learning. *Plusminus: Jurnal Pendidikan Matematika*, *2*(2), 255–264. https://doi.org/10.31980/plusminus.v2i2.1825

Kemdikbud. (2013). *Model Pembelajaran Penemuan (Discovey Learning)*.

Kurdi, M. (2018). Window Shopping : Model Pembelajaran yang Unik dan Menarik. *Jurnal Lingkar Widyaiswara*, *4*(3), hlm. 27-34.

Kusumah, Y. S., Kustiawati, D., & Herman, T. (2020). The effect of geogebra in three-dimensional geometry learning on students' mathematical communication ability. *International Journal of Instruction*, *13*(2), 895–908. https://doi.org/10.29333/iji.2020.13260a

Mikrayanti. (2012). *Meningkatkan Kemampuan Penalaran dan Komunikasi Matematis Siswa Sekolah Menengah Atas melalui Pembelajaran Berbasis Masalah*. Tesis: Sekolah Pasacasarjana Universitas Pendidikan Indonesia Bandung.

Pujiastuti, H. (2014). *Pembelajaran Inquiry Co-Operation Model untuk Meningkatkan Kemampuan Pemecahan masalah, Komunikasi, dan Self-Esteem Matematis Siswa SMP*. Disertasi SPS UPI Bandung: Tidak diterbitkan.

Putra, H., & Purwasih, R. (2016). Meningkatkan Prestasi Belajar. *Jurnal Ilmiah UPT P2M STKIP Siliwangi*, *3*(1), 128–136. https://e-journal.stkipsiliwangi.ac.id/index.php/p2m/article/view/170

Rahma, W. (2017). Pengaruh Penggunaan Metode Kooperatif Window Shopping Terhadap Partisipasi Bimbingan Konseling Klasikal. *Jurnal Penelitian Pendidikan Indonesia*, *2*(2), 1–8.

Ruseffendi, E., T. (2003). *Dasar-dasar Penelitian Pendidikan dan Bidang Non-Eksakta Lainnya*. Semarang: UPT UNES PRESS.

Sumarmo, U. (2012). *Proses Berpikir Matematik: Apa dan Mengapa Dikembangkan?, Kumpulan Makalah Berpikir dan Disposisi Matematik serta Pembelajarannya, 435-493*. Bandung: FPMIPA UPI.

Surur, M., Oktavia, S. T., Prodi, D., Ekonomi, P., Prodi, M., & Ekonomi, P. (2019). Pengaruh Model Pembelajaran Discovery Learning. *Jurnal Pendidikan Edutama*, *6*(1), 11–18.

Yuniawatika. (2011). *Penerapan Pembelajaran Matematika dengan Strategi React untuk Meningkatkan Kemampuan Koneksi dan Representasi Matematik Siswa Sekolah Dasa*. Edisi Khusus No.2 Agustus 2011. ISSN: 1421-565X.