Transcendent Journal of Mathematics and Application
ISSN 2964-1845
Vol. 1, No. 1, Oct 2022, pp. 11-18

Solving the Limits of Algebraic Functions using the Guided Inquiry Learning Approach

Nadya Alvi Rahma[1]* and Wahyu Nurhalimah[1]
[1] Mathematics Education Study Program, Sayyid Ali Rahmatullah Tulungagung State Islamic University, Tulungagung, 66221, Indonesia.
*Corresponding email: nadyaalvirahma@uinsatu.ac.id

ARTICLE INFO

Article History
Received : 06-10-2022
Revised : 30-10-2022
Accepted : 31-10-2022

Keyword
Guided inquiry;
Learning model;
Limit solution;
Mathematical thinking.

ABSTRACT

This study is motivated by students' work in answering questions about the limit of algebraic functions, which is still less creative, and teachers are still the domain of the learning process. As a result, students have been unable to appreciate the outcomes of their own discoveries or the outcomes of their own thinkin. This article is a quantitative study that seeks to ascertain the impact of the guided inquiry learning model on students' mathematical creative thinking skills in the context of limiting algebraic functions. The study was conducted at MAN 3 Blitar with research subjects from two level IX classes. Data derived from observations, documentation, and post-test questions. SPSS 24.0 was used to calculate the data, which was then compared to determine the correlation between the two samples. Based on expert validation results, the interactive multimedia developed is feasible with an average sigma percentage of 5%. Following research and observation, it is possible to conclude that the guided inquiry learning model has an effect on students' mathematical creative thinking skills. The guided inquiry learning model has a 62% influence on students' mathematical creative thinking skills.

DOI: …

1. INTRODUCTION

Teachers must create an effective learning environment in order for students to learn effectively and achieve optimal learning outcomes (Utami et al., 2015). The learning model is one of the success factors for both inside and outside-the-classroom learning (Afandi et al., 2013). This learning model focuses on the teacher, who must be vigilant in sorting and selecting which learning model is most appropriate for use in the classroom. A model capable of making students more active, creative, and innovative in problem solving. As a result, students are more competent in their ongoing learning.

The guided inquiry learning model is a type of learning model that teaches students to pay more attention and comprehend the material. Students are required to make hypotheses, design problem experiments, conduct experiments, then analyze and draw conclusions because they are presented with a problem formulation (Sukma et al., 2016). Students who are in accordance with expectations can be produced as a result of the learning process. According to previous research conducted by Kholik et al. (2016), which is about improving mathematics learning outcomes through the guided inquiry type cooperative learning model, the subject of the tangent line of the circle to the madrasah tsanawiyah students, there is a 21.88% increase in the completeness of the students' evaluation test results. The increase in effective student activity results in a 3.12% increase in results. 25% more skill and moderately skilled criteria. According to the results of the student response questionnaire, 84.38% of students strongly agreed or agreed with the guided inquiry type cooperative learning model.

According to Sipahelut & Palobo (2019), implementing the Guided inquiry learning model can improve student achievement. The data analysis revealed that the average in the first cycle was 67.6 with a classical completeness percentage of 28.5%, which increased to 73.31 with 100% classical completeness in the second cycle. According to Eftafiyana et al.

(2018), the significance value of the Kolmogorov Smirnov test has an effect on the experimental class's mathematical creative thinking ability posttest score of 0.135 > 0.05, as well as the experimental class student's learning motivation score of 0.200 ≥ 0.05, indicating that the effect is confirmed. The learning model has been shown to influence students' mathematical creative thinking skills. Inappropriate and monotonous learning models can make students bored and, as a result, unable to think creatively and mathematically. The Guided Inquiry model is one model that can be used to allow students to be dominant and active participants in their learning, as presented in this study.

Based on the above description, the researcher's proposed problem formulation is whether there is a correlation between the Guided Inquiry learning model and the ability to think creatively mathematically in solving the limit of algebraic functions.

METHODS

This research was conducted at MAN 3 Blitar. The first stage before doing research is to ask permission from MAN 3 Blitar by giving a research permit to the school on April 16, 2022. After getting permission orally and in writing by the school, the research begins by compiling a Learning Implementation Plan (RPP) to be implemented experimental class and control class. Then the lesson plan is consulted with the mathematics subject teacher in the class. This study took the entire population of class XI students at MAN 3 Blitar for the academic year 2021/2022. By using simple random sampling technique, a sample of 54 students was obtained consisting of class XI MIA I and class XI MIA V. The experimental class consisted of 27 students in class XI MIA I and the control class consisted of 27 students in class XI MIA V. The research was conducted from 12 May to 13 May 2022.

2.1. Guided Inquiry Learning Method

Guided inquiry learning is a learning model that emphasizes the process of concept discovery and the relationship between concepts, with students taking precedence over teachers (Sukma et al., 2016). The supervisor is only responsible for supervising and guiding students when they encounter difficulties or confusion. The following are the steps of the inquiry learning method:

a) Fostering a responsive atmosphere among students.
b) Bringing up the problem to be investigated (found).
c) Asking questions to students. The questions asked are seeking or asking for information related to the given problem.
d) Students formulate hypotheses or predict answers to these questions. The teacher helps with prompting questions.
e) Testing the hypothesis.
f) Conclusions are drawn by teachers and students.

The cycle of inquiry begins with observation, followed by questions, conjectures, data collection, and conclusion based on the data. This step of learning optimally emphasizes the process of student involvement and activity. This can result in learning activities that sharpen students' skills. Skills and creativity do not only occur in certain fields, such as art, literature, or science, but are also found in various fields of life, including mathematics (Amidi & Zahid, 2016). The ability to express ideas in solving mathematical problems is referred to as mathematical creative thinking. Mathematical creative thinking ability is a mathematical ability that includes four criteria: fluency, flexibility, originality, and elaboration (Dirlanudin, 2006).

2.2. Test Material

The research instrument is a tool for researchers in using data collection methods. The quality of the instrument determines the quality of the data collected. Therefore, compiling instruments

for research activities is an important step that must be understood correctly by researchers. The instruments used in this research are observation guide, test guide, and documentation guide. This study uses quantitative data analysis techniques, namely data analysis that can be realized by numbers obtained from the field. The quantitative data were analyzed by researchers using statistics. In the calculation of this study using the help of a computer SPSS 24.0 for windows. The tests carried out include normality test, homogeneity test, t test, and influence test.

The material for the mathematical ability test in the discussion of the limit of algebraic functions includes the following questions:

1. $\lim_{n\to 4} \frac{x^2-16}{x-4}$
2. $\lim_{n\to 5} \frac{x^2-x-20}{x-5}$
3. $\lim_{n\to 3} \frac{(x-2)^2-1}{x-3}$
4. $\lim_{n\to 0} \frac{6x^5-4x}{2x^4+4}$
5. $\lim_{n\to 4} \frac{x-4}{\sqrt{x}-2}$

3. RESULT AND DISCUSSION

The data from the post-test is used to determine mathematical creative thinking skills after treatment in the experimental class. The post-test, which consists of five questions, evaluates mathematical creative thinking components such as Fluency Thinking, Flexibility Thinking, Original Thinking, and Elaborative Thinking. The following Table 1 shows the post-test results data based on the mathematical creative thinking component on the material of the limit of algebraic functions of students in the experimental and control classes. Furthermore, the score of each student is calculated based on the assessment arranged for each type of creative thinking ability. This score is interpreted in the form of a value to determine the effect of the learning model on students' mathematical creative thinking abilities. The data scores and post-test scores for the mathematical creative thinking ability of the experimental class and control class students are presented.

Table 1. Score Data of Mathematical Creative Thinking Ability

Question number	Score (in total 27 student)			
	Fluency	**Flexibility**	**Originality**	**Elaboration**
Experiment Class				
1	88	0	0	0
2	0	84	0	0
3	0	0	48	0
4	0	0	0	64
5	0	0	0	79
Control Class				
1	69	0	0	0
2	0	57	0	0
3	0	0	53	0
4	0	0	0	47
5	0	0	0	41

The data obtained from the research results are based on the research conducted. The post-test value of students' mathematical creative thinking abilities will be analyzed in this study. The research instrument was tested first before being used to collect research data. A validity test and a reliability test were part of the research instrument test. Following the collection of research data, the data was analyzed using prerequisite tests and hypothesis testing. The homogeneity and normality tests are required. If the data is homogeneous and normally distributed, parametric statistical tests such as the t-test are used in the analysis. If the data is homogeneous and not normally distributed, use the Man Whitney test as a non-parametric statistical test.

Table 2. Test Results of Test Instruments

Correlations

		S.1	S.2	S.3	S.4	S.5
S.1	Pearson Correlation	1	-.307	.469	.815**	-.234
	Sig. (2-tailed)		.389	.172	.004	.515
	N	10	10	10	10	10
S.2	Pearson Correlation	-.307	1	-.655*	-.163	-.327
	Sig. (2-tailed)	.389		.040	.653	.356
	N	10	10	10	10	10
S.3	Pearson Correlation	.469	-.655*	1	.149	.000
	Sig. (2-tailed)	.172	.040		.681	1.000
	N	10	10	10	10	10
S.4	Pearson Correlation	.815**	-.163	.149	1	.000
	Sig. (2-tailed)	.004	.653	.681		1.000
	N	10	10	10	10	10
S.5	Pearson Correlation	-.234	-.327	.000	.000	1
	Sig. (2-tailed)	.515	.356	1.000	1.000	
	N	10	10	10	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3. Test Instrument Reliability Test Results Data

Reliability Statistics

Cronbach's Alpha	N of Items
.729	5

Before conducting the post-test in the experimental class and control class, the test instrument was tested for validity first. The test was conducted to determine whether the test questions that would be used to measure the mathematical creative thinking of students in this study were valid or not. The test instrument in this study consisted of 5 description questions

in accordance with the material, basic competencies and indicators. In this study, the validity test used was the validity test carried out by experts in their field and empirical test.

This validity test was carried out by experts, experts were asked to express their opinions about the instrument. Experts will give an opinion that the instrument is suitable for use without revision, suitable for use after revision, or not suitable for use. The criteria in the test questions assessed in this validation include:

1) The suitability of the problem with the ability to think creatively mathematically.
2) The suitability of the form of the questions used with the rules of mathematical writing.
3) The form of the question does not contain multiple meanings.
4) The form of writing questions is simple and easy for students to understand.

Table 4. Homogeneity Calculation Results

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Hasil Kemampuan Berpikir	Based on Mean	.090	1	52	.766
	Based on Median	.071	1	52	.791
	Based on Median and with adjusted df	.071	1	50.283	.791
	Based on trimmed mean	.077	1	52	.782

Table 5. Normality Test Results

Tests of Normality

	Kelas	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Hasil Kemampuan Berpikir	Kelas A	.161	27	.070	.952	27	.234
	Kelas B	.223	27	.001	.924	27	.050

a. Lilliefors Significance Correction

In addition to the expert validity test, it is also carried out empirically. On the empirical validity of the instrument is given to students who have received the set material. In this test, the instrument was given to 10 respondents from class XI. Based on the test results, the r_{count} value for question number 1 is 1; r_{count} question number 2 is 1; r_{count} number 3 is 1; r_{count} question number 4 is 1; r_{count} for question number 5 is 1 and from all items the question produces a value of $r_{count} > r_{table}$ with = 10 and the data significance level is 5%, namely r_{table} = 0.632 so that all items are said to be valid.

Based on the test results, the overall test reliability value is 0.729 and at a significance level of 5% with N=10, dk=10-1 = 9 obtained r_{table}=0.6021. Because of $r_{count} > r_{table}$ or 0.729 > 0.6021, it can be concluded that the students' mathematical creative thinking ability test

questions are reliable instruments. Based on the homogeneity test, the significance value is 0.766, which means more than 0.05 or 0.766 > 0.05. So, it can be concluded that the data from the two classes used in the study is data that has a homogeneous variance. Kolmogorov-Smirnov test states that the experimental class and control class both have a significance value greater than 0.05. sig value. for the experimental class of 0.234 and the value of sig. for the control class of 0.050. So, it can be concluded that the data is normally distributed.

Table 6. T-test Results Post-test scores

Group Statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Hasil Kemampuan Berpikir	Kelas A	27	69.2593	12.30257	2.36763
	Kelas B	27	49.4444	12.73497	2.45085

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil Kemampuan Berpikir	Equal variances assumed	.090	.766	5.815	52	.000	19.81481	3.40769	12.97679	26.65284
	Equal variances not assumed			5.815	51.938	.000	19.81481	3.40769	12.97660	26.65303

Based on the results of the t test, it can be concluded that there is an effect of the application of the guided inquiry learning model on the mathematical creative thinking ability of students in class XI MAN 3 Blitar on the limit of algebraic functions. The influence of the Guided Inquiry learning model on the mathematical creative thinking ability of students in class XI MAN 3 Blitar on the material limit of algebraic functions is 0.331. In the interpretation table, Chohen's value is 62% which is relatively low. So it can be concluded that the application of the guided inquiry learning model to the mathematical creative thinking

ability of students in class XI MAN 3 Blitar on the material limit of algebraic functions gives a large effect of 62% which is classified as low.

This study was conducted to determine whether there is an influence of the guided inquiry learning model on the mathematical creative thinking ability of students in class XI MAN 3 Blitar on the material limit of algebraic functions. Guided inquiry learning model is a learning model that refers to investigation activities and explains the relationship between objects and events. The form of guided inquiry learning is in the form of motivating students to investigate existing problems by using scientific skill methods in order to find explanations (Adiputra, 2017).

Based on the level of students' mathematical creative thinking skills, the average experimental value of 69.2593 is classified at level 3, namely meeting the characteristics of students being able to show fluency and flexibility or novelty and flexibility in solving problems. While the average control class is equal to 49.4444 belongs to level 2 which is quite creative with the criteria that students are able to show novelty or flexibility in solving or proposing problems.

4. CONCLUSION

Based on the formulation of the problem and the proposed hypothesis, as well as the results of research based on data analysis and hypothesis testing, the conclusions that can be put forward in this research are as follows:

1. There is a significant effect between the application of the guided inquiry learning model on the mathematical creative thinking ability of students in class XI MAN 3 Blitar on the material limit of algebraic functions.
2. There is a difference in the effect of the guided inquiry learning model with other learning models on the mathematical creative thinking ability of students in class XI MAN Blitar on the material limit of algebraic functions. This can be seen from the average value, namely the class that uses the guided inquiry learning model is greater than the class that does not use the guided inquiry learning model, which is 69.2593 and 49.4444.
3. The influence of the guided inquiry learning model on the mathematical creative thinking ability of class XI MAN 3 Blitar students on the material limit of algebraic functions is 62% which is classified as low
4. The school can use the guided inquiry learning model as an alternative learning from the many types of learning models in order to improve students' mathematical creative thinking skills in improving the quality of students.

ACKNOWLEDGMENTS

Thank you to MAN 3 Blitar's Principal and Teachers for granting research permission and assisting with the research process. Thank you to everyone who took the time to respond. The author would also like to thank all of the referees who provided suggestions for improvement in the writing of this article.

REFERENCES

Adiputra, D. K. (2017). Pengaruh Metode Pembelajaran Inkuiri Terbimbing dan Keterampilan Proses Sains terhadap Hasil Belajar IPA Kelas VI di SD Negeri Cipete 2 Kecamatan Curug Kota Serang. *Jurnal Pendidikan Dasar Setia Budhi*, *1*(1), 22–35.

Afandi, M., Chamalah, E., & Wardani, O. P. (2013). *Model dan Metode Pembelajaran Di Sekolah*. UNISSULA Press.

Amidi, & Zahid, M. Z. (2016). Membangun Kemampuan Berpikir Kreatif Matematis Dengan Model Pembelajaran Berbasis Masalah Berbantuan E-Learning. *Seminar Nasional*

Matematika X Universitas Negeri Semarang 2016, 586–594.

Dirlanudin, D. (2006). Pengembangan Bakat Kreativitas Anak. *Jurnal Teknodik*, *10*(19), 174–187. https://doi.org/10.32550/teknodik.v10i19.399

Eftafiyana, S., Nurjanah, S. A., Armania, M., Sugandi, A. I., & Fitriani, N. (2018). Hubungan Antara Kemampuan Berpikir Kreatif Matematis Dan Motivasi Belajar Siswa Smp Yang Menggunakan Pendekatan Creative Problem Solving. *TEOREMA : Teori Dan Riset Matematika*, *2*(2), 85. https://doi.org/10.25157/teorema.v2i2.1070

Kholik, A., Holisin, I., & Kristanti, F. (2016). Peningkatan Hasil Belajar Matematika Melalui Model Pembelajaran Kooperatif Tipe Guided Inquiry Pokok Bahasan Garis Singgung Lingkaran pada Siswa Madrasah Tsanawiyah. *MUST: Journal of Mathematics Education, Science and Technology*, *1*(1), 1. https://doi.org/10.30651/must.v1i1.94

Sipahelut, B., & Palobo, M. (2019). Implementasi Model Pembelajaran Guided Inquiry untuk Meningkatkan Prestasi Belajar Matematika. *Jurnal Magistra*, *6*(1), 2019–2042. http://ejournal.unmus.ac.id/index.php/magistra

Sukma, Komariyah, L., & Syam, M. (2016). Pengaruh Model Pembelajaran Inkuiri Terbimbing (Guided Inquiry) dan Motivasi Terhadap Hasil Belajar Fisika Siswa. *Saintifika*, *18*(1), 59–63.

Utami, N. I., Prayitno, B. A., & Santosa, S. (2015). The Influence of Collaborative-Constructivist Learning Model Toward Critical Thinking Ability of X Grade Students At SMA Negeri 2 Karanganyar in Academic Year 2012/2013. *Jurnal Pendidikan Biologi*, *7*(3), 37–48.

Solving the Limits of Algebraic Functions using the Guided Inquiry Learning Approach

ORIGINALITY REPORT

20%	17%	15%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	jppipa.unram.ac.id Internet Source	1%
2	j-cup.org Internet Source	1%
3	journal.ikipsiliwangi.ac.id Internet Source	1%
4	M. Sandeep, A. Sivanesh Kumar. "A Sequenced Approach for Customer Data Processing in Banking Applications between Various Services with Novel Decision Tree and K nearest Neighbour", 2022 International Conference on Edge Computing and Applications (ICECAA), 2022 Publication	1%
5	Faisol Hidayatulloh, Faridatun Nurus Sholihah, Eliza Verdianingsih. "The Effect of Online Learning on Mathematical Communication Ability in 10th Grade Senior High School", APPLICATION: Applied science in Learning Research, 2022	1%

	Publication	
6	repository.lppm.unila.ac.id Internet Source	1 %
7	www.neliti.com Internet Source	1 %
8	www.researchgate.net Internet Source	1 %
9	eudl.eu Internet Source	1 %
10	ejournal.unmus.ac.id Internet Source	1 %
11	www.ojs.excelingtech.co.uk Internet Source	1 %
12	stkipsetiabudhi.e-journal.id Internet Source	1 %
13	www.ijere.com Internet Source	1 %
14	repositori.uma.ac.id Internet Source	1 %
15	jurnal.unimed.ac.id Internet Source	1 %
16	Farfan Caudillo Miguel Angel. "Izquierda y estado en Mexico: Relaciones politicas en una decada de crisis, 1968-1979", TESIUNAM, 1985 Publication	1 %

17	www.globalscientificjournal.com Internet Source	1 %
18	Sinta Wdiya Ningtias, Rahayu Soraya. "PENGARUH MODEL INKUIRI TERBIMBING TERHADAP KEMAMPUAN KOMUNIKASI MATEMATIS SISWA", Jurnal Muara Pendidikan, 2022 Publication	1 %
19	jurnal.iainponorogo.ac.id Internet Source	1 %
20	files.eric.ed.gov Internet Source	1 %
21	journal.unj.ac.id Internet Source	1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		