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The Effect of ARIAS Model Learning on Mathematical Writing Skills Reviewed from Self-Efficacy

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Abstract

This study aimed to determine the influence of Assurance, Relevance, Interest, Assessment, Satisfaction (ARIAS) learning models on students' mathematical writing skills reviewed from self-efficacy. The type of research conducted in this study is a quasi-experimental research with a post-test nonequivalent control group design. The population in this study was students majoring in mathematics education at a University in Banten, Indonesia, then two classes are selected at random as research subjects. The data was obtained from mathematical writing ability tests and self-efficacy questionnaires, then processed with ANOVA (Analysis of Variance) tests. The results showed significant differences in mathematical writing skills between students who obtained ARIAS learning models with students who received regular learning, and there were significant differences in students' mathematical writing skills reviewed on their self-efficacy. The implication is known that students with high self-confidence have better writing skills than students whose confidence is low.

Keywords: ARIAS model, confidence, mathematical writing skills

INTRODUCTION

Education is one of the most important things for humans. National education helps develop abilities and the formation of intelligent nation character. Mathematics is one of the subjects that must be given to students from elementary school as a provision for students who can think logically, analytically, systematically, cryptically, creatively, and cooperatively. Education in Indonesia is still relatively low compared to other Southeast Asian countries, namely, judging from the results of TIMSS or PISA (Fauziah, 2015).

The attachment of Regulation of the Minister of National Education of the Republic of Indonesia Number 20 of 2006 on Content Standard stated the purpose of mathematics learning in school, namely so that students can: 1) understand concepts; 2) use their reasoning; 3) solve problems by understanding the problems and then making a mathematical model design; 4) communicate their ideas, and 5) concisely appreciate the benefits of mathematics in life (Fauziah, 2015). Pay attention to the third and fourth goals, explaining that mathematics education applied in Indonesia has focused on developing students' mathematical communication skills. However, not a few teachers generally do not pay attention to the goals mentioned above.

Alluding to mathematical communication skills is a person's ability to convey ideas using mathematical symbols and numbers with clear writing rules. In learning mathematics, revealing mathematical ideas is easy to convey if one uses the language of mathematics. As a result, mathematical communication is created. According to Baroody, there are five components in the activity of communication, including representing, listening, reading, discussing, and writing (Ramadhani *et al*., 2021). Thus, it is stated that writing activities are one of the communication components, namely mathematical communication included in it.

Mathematical writing is an activity that is inseparable from mathematics learning and is very important as a tool for the metacognitive development of a person (Knox, 2017). A person who can perform operations in mathematics with internal representations then can solve

mathematical problems to that level. Then, it does not come off with mathematical writing activities. For example, if someone is asked to communicate this to others or prove/recheck the calculation, then an excellent mathematical writing ability is needed at that time. According to Agustiani *et al*. (2018), mathematical writing is a complex process because it involves some advanced skills that include critical thinking, logical development, and coherence of ideas. Therefore, the ability to write mathematically must be taught from elementary education.

Writing mathematically is quite tricky for most students. This is influenced by the student's varying levels of mathematical writing ability. Many students can do math problems but are not good at communicating through words or writing mathematically (Kurniah *et al*., 2019). This is also found in the results of research conducted by Fauziah (2015), Accurso (2017) and Agustiani *et al*. (2018), which show that there is still a low mathematical writing ability among students. Coupled with the research of Prahmana *et al*. (2017) mentioned that even university does not offer enough support for students to develop their writing skills.

According to Burns (2004), a person who can write mathematics will show understanding, misconceptions, and feelings about things written. Furthermore, according to Astuti (2018), writing mathematics is an ability that uses activities in writing and mathematical learning experiences. So, it is concluded that writing mathematics is a communication activity to express ideas, understandings, and misconceptions related to mathematics, to others using the correct mathematical language.

Students' ability to write mathematics can be well-honed if, in the learning process, they are given the proper treatment. So, teachers need to choose a martial arts model that can invite active learners during writing activities. However, to develop mathematical skills, especially the ability to write mathematics, everyone must have a confident attitude and confidence in self-ability so that anxiety and doubt do not appear in that person. This attitude is referred to as a person's ability to fight in solving a problem to get optimal results (Hari *et al*., 2018). Stimulating a person's writing ability can be done by increasing self-confidence. So, when giving an argument or reason in solving a problem, a person has no doubt in making decisions and writing them smoothly. A person with high self-confidence has the ability to dare to argue, ask, or answer both in discussion forums and in writing them.

According to Mulyani (2018) and Bandura & Adams (1977), self-confidence is a person's belief in the ability to do things. Bandura mentioned that self-confidence affects students' learning achievements. This statement is by the results of Mulyani's research (2018). According to Mulyani, students' low confidence in mathematics subjects is known from the number of students who do not want to try to solve many math problems and that students show a lack of attitude. They quickly give up when faced with a complicated task/problem. Furthermore, the most influencing factor in learning mathematics is confidence in self-ability towards lessons (Kusuma, 2014).

From the above discussion, the teacher plays a vital role in choosing the appropriate learning model to improve students' mathematical writing skills and student confidence during learning. According to Everatt *et al*. (2019), good teaching quality is seen as beneficial to the ability to read and write mathematics. The ARIAS learning model is one of the learning models with components that have the potential to hone students' mathematical writing skills and self-confidence.

According to Swastika & Narendra (2019) and Kadek *et al*. (2017) ARIAS learning model is designed to activate students as well as increase student motivation during learning. Its implementation in learning is to design a learning and give rise to five components of ARIAS, namely Assurance, Relevance, Interest, Assessment, Satisfaction. The Assurance component shows that the beginning of learning will bring confidence in students to be involved in the learning process. One way is to provide relatively easy questions so that students feel confident in their abilities and that they can follow their learning well. Furthermore, in the

Assessment component, there are activities that ask students to make presentations on the results of their discussions, and other groups are required to provide responses. Activities at this stage contribute greatly to students' self-confidence. Furthermore, in the Assessment component, there is also a learning stage that asks students to write their evaluation individually on the worksheets given. Then have a group discussion and write down the results of the discussion. The results of the discussion were directed by the lecturer and asked to make a detailed conclusion of the written material. Activities at this stage contribute greatly to the writing ability of students. According to Mustami & Safitri (2018), the main elements in ARIAS help students develop confidence, improve students' abilities, one of which is writing skills and adaptability to learning situations and conditions, and increase their interest in learning. Thus, the influence of the ARIAS learning model on writing skills and reviewed from student confidence will be seen in this study.

The formulation of the problems in this study is: 1) is there a significant difference in mathematical writing skills between students who get the ARIAS learning model and students who get regular learning?; 2) are there significant differences in students' mathematical writing skills when reviewed from self-efficacy?; and 3) are there significant differences in students' mathematical writing skills when viewed from the interaction between types of learning with self-efficacy?. Thus, the point of this study is to find out the mathematical writing skills of students with the ARIAS learning model reviewed from self-efficacy.

METHOD

This type of research is a quasi-experimental research with *a posttest only control* design. The population is all students majoring in mathematics education at a university in Banten, Indonesia. The sample consists of two randomly selected classes from students majoring in education in semester 6 consisting of two classes of 26 students each for experimental and control classes that will be given the same subject matter and tests. The test is given at the end of learning to see the writing ability of each group.

The research is carried out in the 2020/2021 teaching year. The procedure in the research consists of three stages, including preparation, implementation, and data analysis. In the implementation stage, one of them is to do learning according to the ARIAS learning model. The steps include five components of ARIAS, namely assurance, relevance, interest, assessment, and satisfaction. Its implementation in learning is at the beginning of learning, starting with 1) preliminary activities, namely: a) opening lessons with greetings, attendance checks, and prayers; b) conditioning the class so that learning can take place conducively, then conveying learning goals; c) motivating and engaging students to be active in learning; d) the "assurance" component is raised by sharing a question sheet where the difficulty level of the problem is easy and realistic to complete or in accordance with the ability of the student to bring out his confidence; e) the problem is done independently then directly discussed. 2) The core activity is to bring up the component "relevance": a) explain the material and its relevance to understanding the material to the needs of students. Students pay close attention to the explanation; b) the material delivered is tailored to the student's life and provides relevant examples; c) after finishing explaining the material, as a component of the "interest", students are divided into 4 groups with heterogeneous abilities (attracting interest with variations in learning). Each group is given different problems as the discussion material. Each group then presents the results of the discussion both in the form of completed answers and considerations to their problems (attracting interest by providing opportunities for students to actively participate in learning); d) in the component of "assessment", other groups conduct evaluations and investigations of advanced group presentations and each group is obliged to provide responses; e) lecturers guide the course of group discussions well and provide

directions that support the involvement of all students; f) after all groups have finished the presentation, the lecturer provides evaluation and correction of the student's wrong answers and explains again if there is something that has not been understood. 3) Closing activities: a) lecturers provide opportunities for students to summarize today's material or improve the results of the discussions that have been discussed; b) provide practice questions to be done individually at home; c) lecturers evaluate learning activities in general and make conclusions from the material that has been discussed; d) as a component of "satisfaction", lecturers give awards to students who are active during learning and the best group in the form of additional grades.

The instruments are post-test and learning style questionnaires. Post-test in the form of 5 items of the description question in the transformation geometry material to measure the mathematical writing ability of students with a maximum score of each question item is 4. The questionnaire is in the form of 60 statements representing each indicator of confidence. The questionnaire scale model used on the Likert scale with 4 answer options is strongly agreed, agreed, disagreed, and strongly disagreed, which will be given a score of 1, 2, 3, and the highest is 4. The questionnaires used have all been validated, which means that the instrument can be used to measure what should be measured and the reliability results are known to be moderate, namely .446, which means that a questionnaire that has been compiled tends to show changes if tested again at other times and other subjects. One example of a confidence questionnaire statement for the "optimistic" indicator is "I believe I can solve even difficult problems". The instrument is given to both classes then the data is analyzed with the ANOVA test.

RESULT AND DISCUSSION

The following are the test results of the data obtained, namely student learning results as measured by mathematical critical thinking skills tests after being given ARIAS learning for practical classes and ordinary learning for online control classes. Data is also obtained from learning style questionnaires distributed to students before learning begins. Table 1 present the student mathematical writing skills test results reviewed from confidence.

Table 1. Description of Student Mathematical Writing Skills Test Results Reviewed from Confidence

Group	Self-confidence_	Mean	Std. Deviation	N
ARIAS	Low	9.00	1.826	4
	Keep	14.60	1.897	10
	Tall	16.83	1.850	12
	Total	14.77	3.253	26
Usual	Low	9.33	2.708	12
	Keep	12.75	.886	8
	Tall	15.17	1.602	6
	Total	11.73	3.144	26
Total	Low	9.25	2.463	16
	Keep	13.78	1.768	18
	Tall	16.28	1.904	18
	Total	13.25	3.520	52

From Table 1, it is known that the average mathematical writing ability of students given ARIAS learning is better than in regular classes. Based on students' confidence, the average mathematical writing ability of students with high self-confidence is better than those with low confidence. Furthermore, the Harley test was conducted and it is known that $F_{calculates}$ 1,386 < F_{table} 1.8 with a significant level of .05 which means a homogeneous data variant. The results of the normality test were obtained asymp.sig values. (2-tailed) of .094 which is > .05 so it is known that the data is distributed normally. Based on these results, it is concluded that the research data has the same variant and the data is worth using so that the data can proceed to the hypothesis test, namely the significance test with the ANOVA test (see Table 2).

In Table 2, the known sig value of the variable "Group" is .029 < .05, which means that the hypothesis is accepted. It means that there is a difference in students' mathematical writing skills between those given learning with the ARIAS model and ordinary learning. Based on Table 1, it is known that the average value of mathematical writing ability of the ARIAS group is greater

than the ordinary group. So, it can be concluded that the mathematical writing ability of students with ARIAS model learning is significantly better than ordinary learning.

Table 2. ANOVA Test

Source	*df*	Mean Square	*F*	Sig.
Corrected Model	5	90.537	23.258	.000
Intercept	1	7465.609	1917.822	.000
Group	1	12.536	3.220	.029
Self-confidence_	2	162.076	41.635	.000
Group * Self-confidence_	2	4.900	1.259	.042
Error	46	3.893		
Total	52			
Corrected Total	51			

R Squared = .717 (Adjusted *R* Squared = .686)

The analysis will be carried out to answer the formulation of research problems.

Analysis of Mathematical Writing Skills with ARIAS Learning

According to Elyani et al. (2019), the ARIAS model effectively improves students' ability to solve mathematical problems. In its application, the ARIAS learning model consists of five components raised from the beginning until the learning is completed. If reviewed by each component, for example, the “assurance” component is an interest, in its application at the beginning of learning, students are given the most accessible questions related to material perception. There are gradually more challenging questions at the end related to the material discussed. This is done to bring out students' confidence because with easy questions and students feel they can solve them, then indirectly, students will believe in their ability to be delivered. Furthermore, the learning process is designed as attractively as possible. One of the applied ways is to use mathematical applications (GeoGebra) in displaying the problem-solving process. This is done as one way to attract students’ “interest” component during learning.

Each component in the ARIAS learning model contributes to students' math writing skills. If viewed from the assessment component in its application, it is designed as an activity that invites students to resolve the problems that they completed with the mathematics application earlier in their own words. Students are also given questions and "wrong" solutions and then ask students to do an analysis and explain the results of the analysis in writing. This is a successful effort made on the ARIAS learning model so that the mathematical writing skills are better than ordinary learning. According to Knox (2017), writing through the problem-solving process is one strategy that can be used to help develop one's writing skills.

The learning process with the ARIAS model is also packaged by directing students to write the results of independent observations before discussing, then when the discussion students are asked to write the results of the discussion, and at the end of learning students are also asked to summarize or improve the results of the discussion after being given direction by the lecturer. Students are certainly very accustomed to writing their arguments in solving math problems or just making a rebuttal of a statement. Hence, it has a great influence and a contribution to the ability of students to write mathematics.

Analysis of Mathematical Writing Skills is reviewed from Student Confidence

In Table 2, it is known that the sig value of the variable "Self-confidence" is .000 < .05, which means that the hypothesis is accepted, or in other words, there is a difference in students' mathematical writing ability judging by their confidence. Based on Table 1, it is known that the average mathematical writing proficiency test results of students with high, medium, and low self-confidence are 16.28, 13.78, and 9.25. These results show that students with high self-confidence have better writing skills than students with low confidence. According to K. C. & Ghimire (2020) and Guce (2017), writing activities are an excellent way to motivate students while providing a writing experience

because they invite students to be directly involved in learning, not just passive listening. This is also confirmed by the statement of Özcan & Eren Gümüş (2019) that self-confidence is one of the indicators to motivate and reduce a person's mathematical anxiety, which then has an indirect effect on his mathematical problem-solving performance.

The fact in the field is that students whose mathematical writing skills are high are active during learning. The student also often asked questions and was not afraid to try to argue during the question-and-answer session. Students like this have the characteristics of someone with high self-confidence. This is supported by Psycharis & Kallia's (2017) opinion that confidence plays a vital role in education because students who believe in their abilities do not avoid complex tasks, but instead they perceive them as challenges that need to be addressed.

Furthermore, when viewed from the perspective of the confidence indicator, namely the ability to argue and respond to questions, students who believe in themselves highly can be seen from the bold attitude of their opinions and answers during discussions. This bold attitude then triggers their writing skills because at the stage of the ARIAS learning model, there is an "assessment" component that directs students to directly write their arguments during the discussion process. The next indicator of confidence is to do activities without hesitation, and be able to make decisions quickly. Students with high self-confidence have a confident attitude toward their abilities, so anxiety and doubt do not appear. This attitude is referred to as one's ability to fight in solving a problem so that it gets optimal results (Hari *et al.*, 2018). This is shown when students give arguments or reasons when solving a problem. They have no qualms in making decisions and writing them smoothly. A person with high self-confidence has the ability to dare to argue, ask, or answer both in discussion forums and in writing them.

According to Naghsh Daemi *et al.* (2017), there is a positive relationship between the learning environment and one's confidence. Hence, the learning process with the ARIAS model is successfully packaged so that it creates a conducive learning environment to bring out students' confidence during learning. This shows that bringing up and maintaining trust and confidence in students is very important so that their thinking skills improve, especially their mathematical writing skills.

Interaction Analysis

In Table 2, the known sig value of the variable "Group*Self-confidence" is .042 < .05, which means that the hypothesis is accepted, or in other words, there is an interaction between the class group and the student's confidence in determining the student's mathematical writing skills. Based on Table 1, it is known that the ARIAS class student group obtained the highest average mathematical writing ability of students, with high confidence of 16.83. The results of this test are a finding that can be used as a reference for teachers in delivering materials to their students. Teachers must pay attention to how to start learning by bringing up student confidence first and do not forget to maintain student confidence during learning to optimize their learning outcomes. As Perdana (2019) mentioned, people who have good confidence have positive feelings about themselves, have strong beliefs in themselves, and have accurate knowledge of their abilities.

In its application, at the beginning of learning, the ARIAS model has set the existence of an “assurance” component, namely how to bring confidence in one's abilities. One of the problems is providing questions with sequential difficulty levels that start from the easiest. This dramatically affects the student's responsibility to be more involved during learning activities, stimulates the sense of trust that can follow the lesson, and stimulates the sense of confidence in one's abilities. Easy questions were given.

Furthermore, students' self-confidence is maintained by directing students to write down the results of their work and bring up the “satisfaction” component. This component plays a role in bringing out a sense of pride in the results of one's work so that one is motivated to continue to show other work results. One of the

steps taken is to ask students to represent the results of their work and write them in front of the class.

The "relevance" component gives rise to activities that require teachers to mention learning goals and express to students the importance of understanding the material taught. This contributes to student confidence because with a clear goal, students will dare to make decisions without hesitation and not awkward in acting. As written by Blegur (2020), goal setting is very important for learners because it can help them focus on the planned conditions, encouraging the best effort to achieve the goals.

CONCLUSION

This study concludes that there is a significant difference in mathematical writing ability between students who get the ARIAS learning model and students who get ordinary learning, and there are significant differences in mathematical writing ability. Students are viewed on their confidence. Furthermore, it is known that there are significant differences in the ability to write students mathematically when viewed from the interaction between learning with confidence. Students with high self-confidence have better writing skills than students with low self-confidence. So, it is recommended to always bring up and maintain student confidence in the learning process.

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