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Improving students' writing skills of content and context aspect in biology using guided inquiry learning

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Abstract: This research aimed to improve student writing skills in biology learning. The subjects of this research were 28 students in senior high school. This research was classroom action research carried out for 3 cycles. Each cycle consists of planning, implementation and observation, also reflection. Research instruments were assessment sheets containing the aspects of writing content and context-based on writing skills rubric assessment adapted from Mclean and Wyse (2012). The research procedure were carried out by taking action based on the results of the evaluation of each cycle which forms the basis for improvement in the next cycle. Writing skills data was validated using triangulation techniques: observation, interviews, and documentation. Data analysis used qualitative descriptive. The results showed that the scores for the quality of the content and the context of the students' writing in the pre-cycle were at scores of 2, 3, and 4 with an average of 42% for the quality of the content and 53% for the quality of the writing context, all at level 1. Improvement in scores and the average percentage occurs in cycles I, II, and III which occurs linearly according to the increase in the quality score of the problem formulation, the summary of the results of collecting and processing information, as well as the results of discussions and conclusions, thus the application of the Guided inquiry learning model improves students' writing skills in learning biology.

Keywords: *Writing skills, Guided Inquiry, Content of writing, Context of writing*

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INTRODUCTION

Lately, communication skills are one of the skills needed and considered important in the world of work in the 21st-century era and the 4.0 Industrial Revolution (Kyllonen, 2012). Communication is an activity or process of exchanging information in everyday life through speaking, listening, reading, and writing activities (Luckock et al, 2006; Worth, 2004). Writing is an activity of giving birth and expressing ideas, feelings, experiences, and thoughts through the media in the form of writing (Zulkarnaini, 2014). Writing skills are a form of written communication skills (Azmussya'ni & Wangid, 2014; Wakhidah, 2012; Wambui, Kibui, & Gathuthi, 2012).

Writing skills in learning activities are important to develop because they are a form of communication skills that facilitate students to convey ideas, build understanding, and train thinking skills through written language (Azmussya'ni & Wangid, 2014; Dispriyani, Ramli, & Sumarjiyana, 2015; Moidady, 2014). Writing is an inseparable part of learning

activities (Suaedi, 2015). Writing helps students memorize and encourages critical thinking skills, self-reflection on mastery of concepts, and communication (Sinaga & Feranie, 2017). Writing skills are an effective tool to help students improve their understanding of knowledge concepts and train thinking skills (Morgan, Fraga, & Macauley, 2011; Reynolds, Thaiss, Katkin, & Thompson, 2012).

The results of observations on the writing skills of students in class XII MA showed that the students' writing products were in the form of notes on the subject matter in the form of copies of the teacher's PowerPoint slides. Analysis of the results of the writing using an assessment rubric adapted from Mclean and Wyse (2012) which consists of 5 levels. Each level has 2 aspects, namely the content and context aspects which consist of a score of 1 to 5. Content is information or messages conveyed by students through writing and identified from the suitability of information with the purpose of writing, while context is matters relating to governance rules. Writing such as the use of the General Guidelines for Indonesian Spelling (PUEBI) and punctuation. The results of the analysis of the content and context aspects show that the content and context of students' writing are identified at level 1 scores 2 and 3, thus students have low-level writing skills.

Writing skills are at a low level because students are not equipped with writing theory and practice in the learning process. The results of interviews during the observation process to students stated that there were no special assignments and training for writing in biology learning, writing activities were mostly carried out by recording (copying) material presented by the teacher through PowerPoint, doing practice questions or tests, and making reports when there were any practical activities. The second reason is that the writing activities carried out by students do not involve thinking activities because during learning students only copy material from the teacher when taking notes and copying the answers that have been written in the book when answering questions, thus it is necessary to have writing exercises accompanied by thinking processes for students.

Writing is a complex task, therefore writing skills are not acquired quickly and require regular and continuous practice (Graham et al, 2019). The form of exercise that improves writing skills is an activity in the form of a writing task that is integrated into the learning process (Hand, Prain, & Mcdermott, 2016; Tonissen, Lee, Woods, & Osborne, 2014). Writing assignments make students focus on understanding concepts and outlining their understanding of learning topics and communicating ideas in written form (Hand, Prain, & Mcdermott, 2016; Saleh, 2016). Writing which is a product of the learning process and a form of written communication skills is not produced through a simple thought process, but is effectively produced through a critical thinking process (Indriyanti & Prasetyo, 2018; Rahmawati, Widoretno, & Sari, 2016; Yusuf & Adeoye, 2012). Critical thinking is a form of high-level thinking process which includes the ability to understand a problem, compare some existing knowledge in the mind, and select information as a form of effort to find solutions and solve a problem (Cahyono & Mayasari, 2018).

Effective problem-solving efforts require sequential steps and are carried out using a scientific thinking approach (Sabaruddin, 2019). Scientific thinking is a thinking step that is carried out systematically through certain stages and solving problems can be done using the stages of the scientific method (Akhsani & Jaelani, 2018; Usrotin, Wiyanto, & Nugroho, 2013). The stages of the scientific method to solve problems begin with formulating the problem (Swantara, 2015). Problem formulation requires problem-solving through an

investigation process that begins with planning a problem-solving strategy or investigation plan, carrying out an investigation plan, collecting data, and drawing conclusions (Hendarto, Rinanto, & Ramli, 2019).

Efforts to find solutions to problems, formulate problems, plan investigation activities, carry out investigation plans and collect data, and draw conclusions are found in the Inquiry learning model (Meier & Vogt, 2015). The Inquiry learning model is divided into 4 levels based on the amount of information provided by the teacher for students and Guided inquiry is the third level of the Inquiry learning model, at this level, the teacher provides problems to investigate then students design an investigation plan, carry out investigations, collect information, and draw conclusions from the results of the investigation with the guidance of the teacher (Banchi & Bell, 2008). Guided inquiry has 6 stages, namely planning, retrieving, processing, creating, sharing, and evaluating (Branch & Oberg, 2004).

The planning stage accommodates students to formulate problems and develop an investigation plan (Ikbal, Nurhayati & Ahmad, 2018). The retrieving and processing stages accommodate students to carry out an investigation plan by collecting and processing data and information. The creating stage accommodates students in compiling the results of their investigations and conclusions in the form of a written report as a learning product (Ningsih & Said, 2018; Putra, Widodo, & Jatmiko, 2016). The evaluating stage accommodates students to provide feedback and revise writing (Branch & Oberg, 2004). The application of the guided inquiry learning model is assumed to be able to improve students' writing skills. This is following previous research from Mardiani, Supeno, and Maryani (2018) which has proven that guided inquiry is effective as an alternative in learning to improve students' scientific writing skills. Another research Palupi, Subiyantoro, Rukayah, and Triyanto (2020) has also concluded that Guided inquiry can improve students' explanatory writing skills.

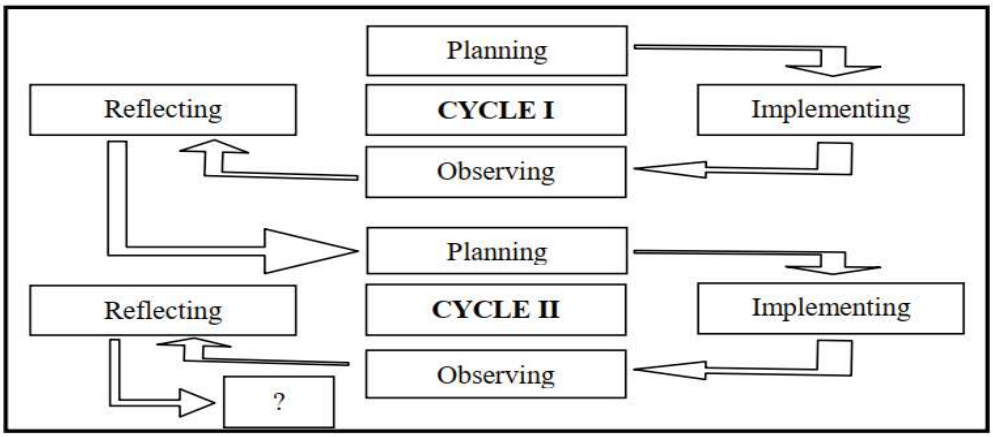
METHOD

This research is a classroom action research involving biology subject teachers and students. The research subjects were students of class XII MIPA at an MA in Surakarta, totaling 28 students. The research instrument consisted of a writing skill assessment sheet consisting of content aspects and written content adapted from Mclean and Wyse (2012). The research data is in the form of the results of the assessment of students' writing on aspects of the content and context of the writing and is supported by observational data and interview results. The data collection technique used the written documentation of students during learning activities in the form of worksheets (worksheets), observations of student performance assessments, and interviews.

The research was carried out for three cycles, each cycle consisting of planning, implementation and observation, also reflection stages. Each research cycle is the application of the Guided inquiry learning model to the material on enzymes and cell metabolism. The research procedure is carried out with actions based on the results of the pre-cycle evaluation and the next cycle is an improvement from the previous cycle. The detail of the procedures of classroom action research can be seen in Figure 1.

Cycle I actions was based on activities and findings on pre-cycle. In the pre-cycle, observations were carried out by existing learning during the learning process. Pre-cycle was done to plan the next action. The action begins in cycle I based on theoretical studies that

Figure 1. Model of classroom action research (Mahmud & Priatna, 2008)



aim to improve students' writing abilities in terms of content quality and writing context. Actions was carried out using Guided inquiry from Branch & Oberg (2004) with the dependent variables being content quality and writing context.

FINDINGS AND DISCUSSION

Findings. Students' writing ability, which is seen based on the quality of content and context according to Mclean and Wyse (2012) in the pre-cycle, is the basis for action in cycle I. Action in cycle 1 uses the original Guided inquiry learning from Branch and Oberg (2004). The findings in cycle I are as shown in Table 1.

The results of the reflection in cycle I become a follow-up in cycle II. The results of cycle I reflection can be seen in Table 2. The reflection results of cycle I in Table 2 then

Table 1
Cycle I findings

No	Guided Inquiry Stages	Findings
1	Planning	The teacher displayed the problem and at the same time provided a problem formulation for the students
2	Retrieving	Students search for and read various relevant literacy sources (books and internet search results)
3	Processing	The teacher opened an open question and answer session and provided an explanation of the material orally
4	Creating	Students were asked to fill out the worksheets and write conclusions obtained from group discussion activities and literacy studies
5	Sharing	Only one student presented the results of the group discussion due to time constraints and the teacher did not ask students to conclude the results of the discussion
6	Evaluation	The teacher only evaluated the presentation results of one student then immediately distributes the evaluation questions and closes the lesson

Table 2
Cycle I learning reflection

No	Disadvantages of Cycle I	Maintenance Plan
1	Students were still passive and no one formulates problems	The teacher provides instructions and opportunities for students to propose problem formulations
2	Not all problem formulations are answered	The teacher gives instructions to students to answer and propose hypotheses
3	Most discussions are still carried out in one class	The teacher gives clearer instructions to students to directly discuss in groups after the division of work groups
4	Not all student working groups present the results of discussions	Time limits for group discussions need to be clarified so that time does not run out at the end of class
5	Learning conclusions are drawn by the teacher	Teachers must provide opportunities for students to conclude the results of the learning that has been carried out

Table 3
Cycle II findings

No	Guided Inquiry Stages	Findings
1	Planning	There were 2 students who proposed problem formulations, but the students were not give the opportunity to propose hypotheses
2	Retrieving	Students search for and read various relevant literacy sources (books and internet search results)
3	Processing	The teacher occasionally still gives a brief explanation of the material to students
4	Creating	Students were asked to fill out the worksheets and write conclusions obtained from group discussion activities and literacy studies
	Sharing	All group representatives could present the results of the discussion
6	Evaluation	The teacher evaluated the results of the presentations of all groups and at the end of the lesson together with the students concluded the overall learning results

become the basis for improvement in cycle II. The findings in cycle II are as follows in Table 3.

The results of the reflection in cycle II become a follow-up in cycle III. The results of cycle II reflection can be seen in Table 4. The reflection results of cycle II in Table 4 then become the basis for improvement in cycle III. The findings in cycle III are as follows in Table 5.

The limitation of the research was the time available at the sample schools so that the research was conducted in only 3 cycles. The results of cycle III reflection are Table 6. The maintenance plan in cycle 3 has not been carried out due to the limited time provided by the school for student research.

Table 4
Cycle II learning reflection

No	Disadvantages of Cycle I	Maintenance Plan
1	Students were still passive and there were only two children submitting the formulation of the problem	The teacher provides instructions and opportunities for students to propose problem formulations
2	Many students when discussing were not serious and often ask the teacher	The teacher gives instructions to students to pay more attention to the previous teacher's explanation regarding the implementation of the discussion
3	The teacher occasionally still provides explanations of the material when students discuss	Teachers reduce providing explanations of material when students on discussion.

Table 5
Cycle III findings

No	Guided Inquiry Stages	Findings
1	Planning	There were 4 students who proposed the formulation of the problem, and students were given the opportunity to submit hypotheses
2	Retrieving	Students search for and read various relevant literacy sources (books and internet search results)
3	Processing	The teacher was only a facilitator, students were not given an explanation of the material but the teacher went around to each group to ensure the results of the students' work
4	Creating	Students are asked to fill out the LKPD and write conclusions obtained from group discussion activities and literacy studies
5.	Sharing	All group representatives could present the results of the discussion
6.	Evaluation	The teacher evaluated the results of the presentations of all groups and at the end of the lesson together with the students concluded the overall learning results and provided reinforcement

The data validation test was carried out using a triangulation method. Data analysis is descriptive qualitative according to the analysis model of Miles and Huberman in Rijali (2019) which consists of 3 components including reduction, display, and verification/ conclusion drawing.

Reduction is done by selecting student writing that is following the material studied in each cycle and writing is included in the category of content assessment and writing context. Farhana, Awiria, and Muttaqien (2019) state that data reduction in classroom action research includes the process of setting focus and reducing data so that it is easy to read or present and process, including excluding data that is not suitable for use and can cause extreme discrepancies. The results of content data reduction and the context of students' writing were then analyzed using the Mclean and Wyse (2012) assessment rubric. The display is carried out by presenting the results of the analysis of students' writing in a table of percentages of

Table 6
Cycle III learning reflection

No	Disadvantages of Cycle I	Maintenance Plan
1	There were still students who were passive and there were only 5 children who proposed problem formulations and 2 children who proposed hypotheses	The teacher provides instructions and opportunities for students to submit problem formulations and hypotheses
2	Students when on discusson there were still lacking of confidence and often ask the teacher to confirm their answers	Teachers should not directly answer thequestions from students but should motivate them to be more confident in the results of their searches and discussions
3	The teacher occasionally still provides explanations of the material when going around to discussion groups	Teachers reduce providing explanations of material when students on discussion

content quality and context in each cycle and diagrams comparing the quality of content and context of students' writing in all cycles. Verification or conlusion drawing is done by comparing the content quality data and the writing context of students in all cycles to answer the problem formulation that has been made.

*Discussion***.** Research as an effort to improve students' writing skills is carried out by applying the guided inquiry learning model in biology learning. The results of the research are students' writing products in the form of worksheets obtained during learning activities using the guided inquiry model, including problem formulation writing accommodated in the syntax planning stage, summary writing of search results, and information gathering accommodated in the retrieving and processing stage, as well as writing discussion results and conclusions that are accommodated in the creating stage. Writing skills which consist of aspects of the content and context of writing were analyzed based on an assessment rubric adapted from Mclean and Wyse (2012).

The Aspects of Writing Content. Written content is information or messages that the author wants to convey through writing (Huang, Berg, Siegrist, & Damsri, 2017). The overall written content has indicators: Range; Audience/Reader and Destination; Structure and Cohesion; Register; Plans, Concepts, Evidence, and Reviews (Mclean & Wyse, 2012). The results of the students' writing skill scores in the aspect of writing content are shown in Table 7.

Based on Table 7, the score of students' writing skills in the aspect of writing content shifted in the range of scores from 1 to 3 at level 1 during pre-cycle learning to cycle III. Aspects of writing skills, namely the content and context of writing each have 5 levels with an assessment score of 1-5 at each level based on the assessment rubric of Mclean and Wyse (2012). Students' writing is assessed on indicators of writing content aspects at level 1 according to Mclean and Wyse (2012) having the following characteristics: in the form of short texts with simple structures; according to learning objectives; contain simple ideas, opinions, and factual information; and shows a limited order of understanding.

The results of the analysis of students' writing skills on the content aspect show that the guided inquiry learning model can improve students' writing skills. The improvement of students' writing skills is known through the acquisition of the class average score in each

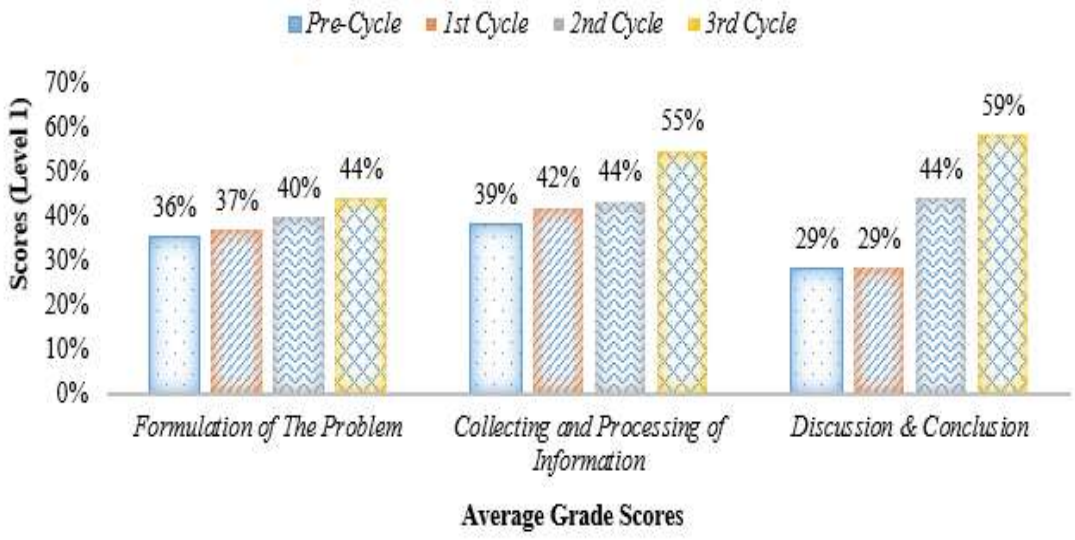
Table 7
Students' scores in writing content aspect

		Formulation of The Problem				Collecting and Processing of Information				Discussion & Conclusion			
	Cycle	Pre-	I	II	III	Pre-	I	II	III	Pre-	I	II	III
Level 1	Score 1					11%	4%			39%	32%		
	Score 2	89%	82%	68%	46%	54%	50%	50%	82%	46%	54%	46%	64%
	Score 3		7%	21%	43%	25%	36%	39%	7%	4%	4%	43%	25%

aspect which generally increases after the implementation of pre-cycle learning to cycle III. The detail of increasing of the class average score in each aspect can be seen in Figure 2. This finding is in line with previous research which states that guided inquiry is effective for improving students' writing skills. Hendra, Septianti and Ismayani (2019) proved that guided inquiry was effective as an alternative in learning to improve students' argumentation writing skills; Zulaeha (2013) on report writing skills; Dispriyani, Ramli, & Sumarjiyana (2015) and Mardiani et al. (2018) on scientific writing skills; Meliyawati (2017) on short story writing skills; and Palupi, Subiyantoro, Rukayah, and Triyanto (2020) on explanatory text writing skills.

The increase in writing skill scores, especially in the aspect of written content, shows that students do not just copywrite but also involve thinking activities in understanding all information related to learning topics. Indriyanti and Prasetyo (2018) states that writing which is a product of the learning process and a form of written communication skills is not produced through a simple thought process but is produced through a critical thinking process. Critical thinking is a form of high-level thinking process which includes the

Figure 2. Average grade scores of students' writing content aspects in each cycle



ability to understand a problem, compare some existing knowledge in the mind, and select information to find solutions and solve a problem (Cahyono, 2017; Yusuf & Adeoye, 2012). guided inquiry accommodates students to be actively involved in critical thinking, gain a deeper understanding of curriculum content and develop skills through the use of various sources of information (Gunardi, 2020).

The Aspect of Writing Context. The context of writing is an internal aspect that surrounds and its existence supports the formation of writing (Rahmawati, Widoretno & Sari, 2016; Rosmawaty, 2011; Shabry, 2011). Context is related to the mechanics of writing in the form of writing rules and the overall context consists of indicators: Diction Selection (Vocabulary); Grammar; Spelling; Punctuation; Readability (Mclean & Wyse, 2012). The results of the students' writing skill scores in the aspect of writing context are shown in Table 8.

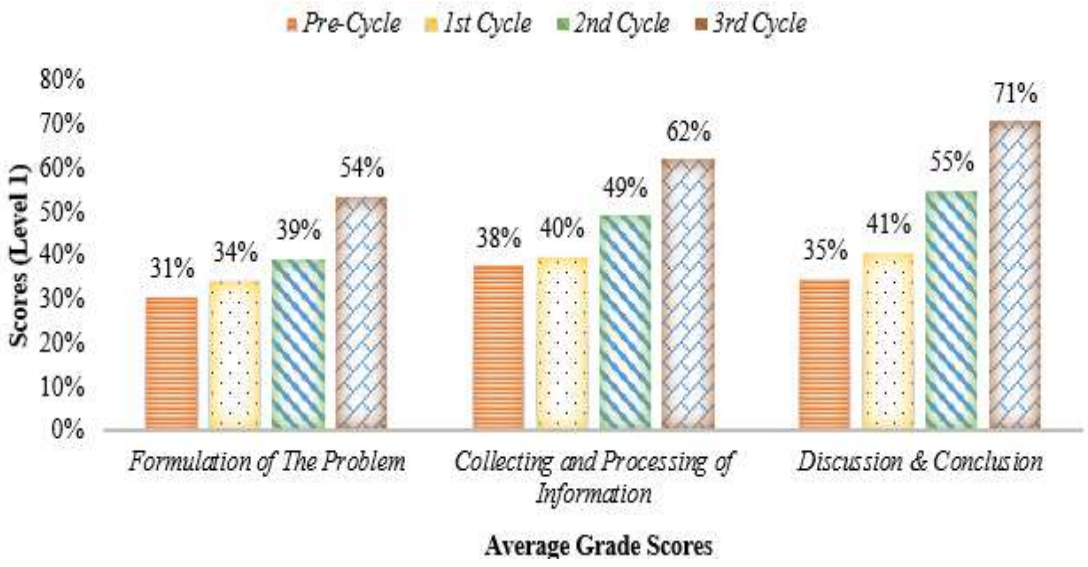
Table 8
Students' Scores in Writing Context Aspects

		Formulation of The Problem				Collecting and Processing of Information				Discussion & Conclusion			
	Cycle	Pre-	I	II	III	Pre-	I	II	III	Pre-	I	II	III
Level 1	Score 1					4%	4%			25%	4%		
	Score 2	25%	7%	71%		71%	61%	21%		43%	57%	4%	
	Score 3	64%	82%	18%	89%	14%	25%	68%	46%	21%	29%	75%	18%
	Score 4								43%			11%	57%
	Score 5												14%

Based on Table 8, the students' writing skill scores on the written content aspect shifted in the range of scores from 1 to 5 at level 1 during pre-cycle learning to cycle III. Students' writing is assessed on the indicators of writing context aspects at level 1 according to Mclean & Wyse (2012) having the following characteristics: most of the writing can be read; write in upper/lowercase and italics/upright but less consistent; use a limited vocabulary that can be memorized or formulated; use basic punctuation (eg period, comma) inconsistently; writing with basic sentence structures and limited verb forms; and inconsistently uses obvious spelling variations.

The results of the analysis of students' writing skills in the aspect of the writing context show that the Guided inquiry learning model can improve students' writing skills. The detail of increasing of the class average score in each aspect can be seen in Figure 3. The increase in writing skill scores, especially in the aspect of the writing context, shows that Guided inquiry accommodates students to be actively involved in critical thinking, gain understanding and develop skills through the use of various sources of information (Gunardi, 2020). The use of various sources of information as learning materials is not only intended for learning topic material that is written as written content, but also for understanding matters relating to good and correct writing rules. The increase in writing skill scores, especially in the context of writing, shows that students learn that in written language, a writer must know and even master writing procedures that are following the rules specified in the PUEBI, including the

Figure 3. Average grade scores of students' writing context aspects in each cycle



use of punctuation, spelling, and capital letters. Hasrianti (2021) stated that the use of correct punctuation and spelling is important in compiling an article because it can help the reader to understand the message conveyed by the author so that the reader does not misunderstand the meaning of an article.

The score of students' writing skills during the pre-cycle learning process to cycle III can only be analyzed by 25 people from a total of 28 students in class XII MIPA because 3 people did not participate in learning activities from the beginning so data reduction was carried out. Data reduction is done so that the main data can be selected and then analyzed. Farhana, Awiria, and Muttaqien (2019) stated that data reduction in classroom action research includes the process of setting focus and reducing data so that it is easy to read or display and process, including excluding data that is not suitable for use and can cause extreme gaps.

The data obtained in the pre-cycle learning activities showed that the score of writing skills which consisted of aspects of the content and context of writing was low. Low writing skills in pre-cycle learning activities are improved through learning using the Guided inquiry model in cycles I to cycle III. Guided inquiry has 6 stages, namely planning, retrieving, processing, creating, sharing, and evaluating (Branch & Oberg, 2004). Learning with Guided inquiry can improve writing skills because there are stages that allow writing in the form of reports/portfolios accompanied by a thought process and following with the stages of the writing process. Guided inquiry involves the active role of students in designing procedures (methods) and carrying out investigations, gathering information, and drawing conclusions based on the results of the investigation with the help and guidance of teachers (Muzari, 2019). During learning, students document the results of their thinking during the investigation in written form and are collected in the form of a report at the end of the lesson (Dispriyani et al, 2015).

The results of the analysis of students' writing skills scores in the first cycle of learning showed an increase in scores from pre-cycle learning, both in terms of content and writing context. The guided inquiry learning model was also applied in the learning activities of cycle II and cycle III to improve students' writing skills from the previous cycle. Analysis of the percentage score of students' writing skills in the second cycle of learning activities showed an increase in the percentage score of the first cycle of learning activities, as well as the third cycle which showed an increase in the average percentage score of the second cycle of learning. In general, the student's writing skills from pre-cycle learning activities to cycle III increased significantly, the increase that occurred was an increase in the score not an increase in level. The increase in writing skill scores was because students were provided with the theory and practice of writing in the learning process. This is in line with the findings of Hand, Prain and Mcdermott (2016) and Tonissen, Lee, Woods, and Osborne (2014) which state that writing skills can be improved by providing training in the form of activities in the form of writing assignments that are integrated into the learning process. Writing assignments make students focus on understanding concepts and outlining their understanding of learning topics and communicating ideas or ideas in written form (Saleh, 2016).

The students' writing skills in the aspect of content and writing context have different score increases from pre-cycle to cycle III. The difference in the increase in scores for aspects of content and writing context occurs because they have different achievement indicators. The increase in the percentage score of writing skills in the aspect of content and writing context did not occur in all students, but some students had a fixed percentage score in each cycle and some experienced a decrease in the percentage of reading skills scores in cycle I or cycle II. The decrease in the percentage of writing skills scores on aspects of the content and context of writing shows that students have not been able to integrate prior knowledge with new information or ideas in writing, and the form of writing exercises directed at students has not reached the target (Hoch, McCarty, Gurvitz, & Sitkoski, 2019). The average writing skills of students in the aspect of content and writing context have increased from pre-cycle, cycle I, cycle II, and cycle III after applying the Guided inquiry learning model, thus it been proven that the application of the Guided inquiry learning model can improve students' writing skills.

CONCLUSION

The writing skills of students have increased linearly based on the average score on the aspect of content quality and writing context from the pre-cycle stage to cycle III. The increase in scores on aspects of the content and context of writing from pre-cycle to cycle III is seen based on the average score of students' writing starting from the formulation of the problem, the summary results of collecting and processing information, as well as the results of discussions and conclusions. The application of the Guided inquiry learning model can improve students' writing skills.

Given the importance of writing skills as communication skills that must be mastered by students and needed in the world of work, teachers should pay more attention and continue to strive to improve students' writing skills in the classroom. The results of this study can be practically applied to learning by applying the Guided inquiry learning model to improve students' writing skills. Furthermore, it is hoped that the results of this study can also be

used as the basis for further research on improving students' writing skills, especially in learning biology.

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