OPEN ACCESS
Jurnal Riset Pendidikan MIPA, 5(2): 56-64, December 2021
ISSN 2549-0192 (e) | 2549-0184 (p)
https://new.jurnal.untad.ac.id/index.php/jrpm

The Effect of Discovery Learning Implementation Model on Buffer Material on Critical Thinking Ability and Metacognition Awareness of Senior High School Students

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Article History
Received 01 August 2021
Revised 03 September 2021
Accepted 10 October 2021

Keywords:
Discovery learning, critical thinking ability, metacognition awareness

Abstract

This study aims to determine the effect of applying the discovery learning model on critical thinking skills and metacognitive awareness of class XI IPA students at SMA Negeri 3 Palu. The research method used is a quasi-experimental design with a pretest-posttest control group design. The results of the statistical test for critical thinking skills obtained sig = 0.001 and metacognitive awareness sig = 0.031 with the criteria of accepting H_0 if Sig. > 0.05 and reject H_0 if Sig. <0.05. sig. value < 0.05, then H_0 is rejected. While the correlation test obtained sig. = 0.966 so that H_0 is accepted. The results showed that: (1) the application of the discovery learning model had a positive effect on students' critical thinking skills in the buffer material, (2) the application of the discovery learning model had a positive effect on students' metacognitive awareness in the buffer material, (3) there was no relationship between the ability critical thinking and metacognitive awareness of students on buffer material.

doi: 10.22487/j25490192.2021.v5.i2.pp.56-64

Introduction

Learning is a process that is developed by the teacher to develop the thinking skills of students and to increase their ability to construct new knowledge in an effort to master the concept of the subject matter.

The demand for curriculum 2013 learning requires an educational process that provides opportunities for students to be able to develop all their potential, related to attitudes (affective), knowledge (cognitive), and skills (psychomotor). Aspects of the scope of knowledge for the high school level in accordance with the graduation competency standards include factual, conceptual, procedural, and metacognitive knowledge (Kemendikbud, 2016). Metacognition is used as a graduation standard for high school students with the hope of being able to improve the thinking skills of students so that they can find themselves and transform complex information, check new information with those already in their memory, and develop into information or capabilities in accordance with environmental conditions throughout the space and time of his life. Metacognition is one of the parameters that must be achieved by upper secondary level students in the 2013 curriculum because it can support the learning success of students. Metacognition will encourage students' ability to solve problems and develop higher thinking skills (Purnamawati, 2013).

Metacognition is a person's knowledge, awareness, and control of the cognitive process (Gredler, 2011). Flavell's (1979), metacognition is an act in the thought process. Metacognition consists of self-regulation, reflection on oneself about strengths, weaknesses, and learning strategies. Metacognition can be used by a person to monitor his cognitive abilities and the extent to which he understands a problem. In the existence of metacognition in the context of learning, students know how to learn, know their learning abilities and modalities, and know the best learning strategies for effective learning. Metacognition includes two components, namely metacognitive knowledge, and metacognitive experiences (Masitoh et al., 2019).

In addition to metacognition awareness, students' critical thinking skills really need to be developed for the success of students in education and in social life. Critical thinking skills can be developed through the learning process. That is, in addition to learning to develop cognitive abilities for a particular subject, learning can also develop students' critical thinking skills. The learning process does not automatically develop critical thinking skills. Only the learning process encourages students to discuss, provides many opportunities to argue, uses ideas, provides opportunities for students to express ideas in writing, and encourages cooperation in studying and finding knowledge (Susanti, 2018).

Based on the results of interviews with chemistry teachers at SMA Negeri 3 Palu in the 2018/2019 academic year, students had difficulty working on and analyzing the questions on the Buffer material. This can be seen from the results of daily tests of students who generally get a score below the KKM (73) set by the teacher. The low ability to master the concept of buffer material at SMA Negeri 3 Palu is also due to the learning patterns in teaching the chemistry conventional method, where the teacher becomes the only information center for students. As a result,

One of the efforts that can be made in increasing quality of human resources in the field of education is to get used to forming a culture of critical thinking in students in the learning process (Sani, 2013). Learning is expected to provide opportunities for students to foster critical thinking skills. Training students to have critical thinking skills requires a learning model that can provide opportunities for students to optimize learning methods and develop reasoning power. Zamroni & Mahfudz (2009) add that one way to improve student's critical thinking skills is through the development of a learning model that contains three processes, namely (a) mastery of the material, (b) internalization, and (c) transfer of material in different cases.

One learning model that is expected to help students increase metacognition awareness and critical thinking skills of students is the discovery learning model (Andriani et al. 2017). This learning model is a learning model that emphasizes students to find their own problems given by the teacher so it is considered one of the suitable learning models to be applied in the learning process in schools based on material characteristics.

The stages in applying the discovery learning model to learning activities are stimulation, problem statement, data collection, data processing, verification, and generalization. At this stage, students can construct their own knowledge that can indirectly increase students 'metacognitive awareness and can develop students' critical thinking skills.

Some of the research results that have been carried out regarding the discovery learning model show the influence of learning models (problem-solving and cooperative learning models STAD type) and metacognition awareness on students' critical thinking abilities on salt hydrolysis (Murniaty, 2014). Other research conducted shows that there is an effect of the discovery learning model on metacognition awareness and mastery of the buffer concept. It was further explained that through the application of problem-solving steps in chemistry learning with the epistemology of science aspects, students could develop critical thinking skills (Afadil et al., 2014).

Based on the description above, the authors conducted a study entitled the effect of discovery learning implementation models on buffer material on metacognition awareness and critical thinking ability of Students in Class XI IPA SMA Negeri 3 Palu.

Materials and Method

The research method used in this study is a quasi-experimental design with a pretest-posttest control group design.

The sample was taken using a total sampling technique or saturated sample, namely class XI IPA 2 which consisted of 31 students, and class XI IPA 3, which amounted to 31 students and the two classes were as experimental classes. The measuring instruments used in this study were the description test to determine the critical thinking skills of students and the Metacognitive Awareness Inventory (MAI) questionnaire to measure the metacognitive awareness of students. After the data was obtained, a descriptive analysis was carried out, and a statistical analysis using the t-test, Test Gain, and correlation test. The statistical test was carried out at the 5% significance level. The improvement of students' critical thinking skills seen from the normalized gain value (gain normalization), with reference to the normalized gain classification according to Hake (1998), can be seen in Table 1.

Table 1. Classification of gain normalization

Gain Normalization Coefficient	Classification
$g < 0.3$	Low
$0.3 \leq g < 0.7$	Moderate
$g \geq 0.7$	High

Source: Hake (1998).

To determine the level of metacognition awareness of students by using the value of each metacognition awareness indicator in the MAI questionnaire, it was interpreted based on the rater's guidelines according to Arikunto (2013). Can be seen in Table 2.

Table 2. Metacognition awareness criteria

Score	Criteria
80 – 100	Very high
66 – 79	High
56 – 65	Enough
40 – 55	Low
<40	Very low

Source: Arikunto (2013).

Results and Discussion

1. The effect of the discovery learning implementation model on students' critical thinking ability in buffer material.

Based on the results of the t-test statistical analysis shows that the discovery learning model has a significant effect on the critical thinking skills of students. This can be seen from the acquisition of the average value of students' critical thinking skills in the control class and the experimental class differed Students' critical thinking in the experimental class was higher than the control class. This finding is in line with Murniaty (2014) that the application of the learning model can improve students 'critical thinking skills on salt hydrolysis material. Putri et al. (2018) concluded that the application of the guided discovery learning model can improve students' critical thinking skills.

The process in applying this model represents a learning cycle, students will actively participate in learning, and students are trained to think to solve problems. Students are encouraged to think critically, analyze themselves, so they can find general concepts or principles based on the material/data that the teacher has provided.
The ability to think critically is the ability and tendency of a person to make and assess conclusions based on evidence and logical settlement methods so that the best solution or solution is obtained, so it can be said that critical thinking skills basically must be trained and learned (Aryana, 2009).

The application of discovery learning models can improve students 'understanding of chemical materials, especially buffer material. In addition, by constructing their own understanding, it is hoped that it can improve students' critical thinking skills.

Students' critical thinking skills were obtained by calculating the pretest and posttest scores obtained by the experimental class and control class. The pretest, posttest, and N-gain results for critical thinking skills can be seen in Tables 3 - 4.

Table 3. The value of the pretest and posttest results of students' critical thinking abilities

Critical Thinking Ability	Experiment Class		Control Class	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Induce and consider the results of the induction	23.55	97.77	20.00	85.48
Defining terms and considering them	11.94	77.42	9,19	61.61
Observe and consider the results of observations	10.22	37.96	10.54	25.27
Focusing questions	23.23	45.16	17.74	41.94
Determines action	11.72	48.06	11.29	27.20

Table 4. N-gain value normalized students' critical thinking ability

Critical Thinking Ability	Experiment Class		Control Class	
	N-gain	Category	N-gain	Category
Induce and consider the results of the induction	0.96	High	0.82	High
Defining terms and considering them	0.74	High	0.58	Moderate
Observe and consider the results of observations	0.31	Moderate	0.16	Low
Focusing questions	0.87	High	0.80	High
Determines action	0.41	Moderate	0.18	Low

The average comparison of each indicator of critical thinking skills in the experimental class and control class is presented in Figure 1.

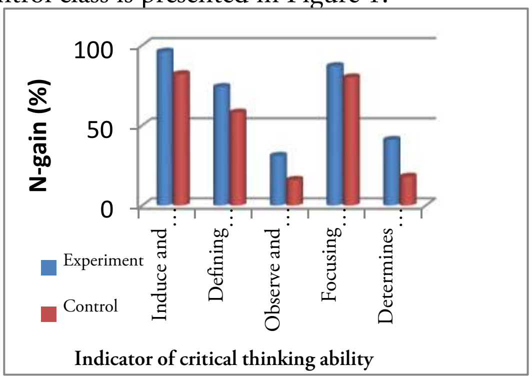

Figure1. Comparison of the average of each indicator of students' critical thinking skills in the experimental class

Based on statistical tests, the sig value was obtained 0.001 < 0.05, so it was concluded that there was an effect of the discovery learning model on the critical thinking skills of students. This can be seen from Figure 1, where the average value of students' critical thinking abilities in the experimental class is higher than the control class in each indicator of critical thinking skills.

The critical thinking skills of students in this study consisted of 5 indicators:

1) Induce and consider induction results

Critical thinking of students on indicators induces and considers the results of the induction with the aspect of making conclusions (inference). On this indicator, students are given research result data regarding a solution before and after the addition of acids, bases, and dilutions. It is expected that students can analyze the conclusions that the researcher reveals and provide an explanation of these conclusions.

Based on Figure 1, it can be seen an increase in the N-gain ability value inducing and considering the results of the induction of students in the experimental class (96%) higher than the control class (82%). The ability to induce and consider the results of induction, students in the experimental class are in the high category and the control class is also in the high category. The results of the pretest and posttest in Table 3 show that the pretest results of the experimental class (23.55%) were higher than the control class (20.00%), as well as the posttest results showing the experimental class (97.77%) was higher than the control class. (85.48%). It shows that there is an effect of discovery learning model on students' critical thinking skills on indicators of inducing and considering the results of induction.

This is because the experimental class used *discovery learning model* which consists of six stages. In the process of discovery learning, the skills to make generalizations (inductive thinking) can be trained in the sixth stage, namely making conclusions. At this stage, the teacher guides the students to make conclusions based on the data obtained based on experiments. This statement is in accordance with the opinion of Haris et al. (2014) that the conclusion aspect is trained in the discovery learning model through stages that invite students to solve problems and consider relevant information. So as to be able to draw and draw conclusions with sound considerations.

The same thing was expressed by Champine et al. (2009) that the conclusions formulation activity trains the ability to make final decisions and argues to defend their decisions. Whereas the control class with a conventional learning model emphasizes the teacher so that students are less active in learning so that the ability to think critically of students does not develop.

2) Define terms and considers them

Students' critical thinking skills indicators define terms and consider them. The strategy of making definitions, namely acting by providing further explanations is the goal of indicators defining terms and considering them. Students are given acid and base data with certain concentrations and it is hoped that students will be able to define the solution whether it is classified as a buffer or not by considering the reaction equation.

Based on Figure 1, it can be seen an increase in the N-gain ability value define terms and consider students in the experimental class (74%) were higher than the control class (58%). Ability on indicators define terms and consider them, experimental class students are in the high category while the control class is in the medium category. The pretest and post-test results in Table 3 show that the pretest results of the experimental class (11.94%) were higher than the control class (9.19%), as well as the post-test results showing the experimental class (77.42%) were higher than the control class (61.61%). It shows that there is an effect of discovery learning models on students' critical thinking skills on the indicators of defining terms and considering them.

This is because the experimental class uses a discovery learning model. Through LKPD which is arranged in accordance with the symptom of the discovery learning model, students are trained to formulate problems so that they are able to develop their thinking skills so that students play an active role in finding the problems they will formulate, students are more cooperative in discussing with their groups so that they are more mutually exclusive communicate with each other to help solve the problem. For example, when students investigate whether a solution will produce a buffer mixture, it can be seen by looking at the data on the volume of the solution, the molarity that exists and the reactions that take place, so that through discovery learning,

This statement is supported by the opinion of Desmita (2006) which states that the critical thinking skills of students can be improved by implementing learning that allows students to take an active role in the learning process and is student-centered which provides freedom of thought and freedom of action to students in understanding knowledge and solution to problem. The same thing was stated by Forawi (2016) that the critical thinking ability of students can be improved through the relationship discovery learning model, the level of intellectuality of students, and adequate learning material. Whereas in the control class which was taught using conventional learning models, students' critical thinking skills were less developed.

3) Observe and consider the results of observations

Students' critical thinking skills are indicators of observing and considering the results of observations with the aspect of building basic skills, students are invited to critically find their own understanding of the material being taught through practicum followed by discussion. In this indicator, pH, molarity, volume, and Ka/Kb value are presented. It is hoped that students will be able to determine the amount of salt that must be added to make the pH of a certain buffer.

Based on Figure 1, it can be seen that the increase in the N-gain value of the ability to observe and consider the observation results of the experimental class students (31%) is higher than the control class (16%). The ability of the indicators to observe and consider the results of observations of students in the experimental class is in the moderate category while the control class is in the low category. The results of the pretest and posttest in Table 3 show that the pretest results of the experimental class (10.22%) are lower than the control class (10.54%), but the posttest results show that the experimental class (37.96%) is higher than the control class (25,27%). It shows that there is an effect of the discovery learning model on students' critical thinking skills on observing indicators and considering the results of observations.

This is because the experimental class uses learning methods of *discovery learning*, students are given the opportunity to do thinking activities such as asking questions, arguing in discussions, and trying themselves in finding concepts, while the teacher only acts as a motivator, facilitator, and learning management. This statement is in accordance with the expression of Kazempour (2013), that the learning process through interaction in the form of discussion can train students' analytical skills. Through observation, students can prove the correctness of their theory so that their knowledge of related concepts becomes more mature. So that students in the experimental class are better able to analyze and relate the concepts used in determining salt in the pH of a certain buffer, compared to the control class with a conventional learning model of teacher-centered learning,

4) **Focusing questions**

Students' critical thinking skills on indicators focus on questions with the aspect of giving a simple explanation. The ability to focus questions is the ability of students to find/formulate problems from a given case or phenomenon. This indicator is presented with an example of a material in everyday life that contains a buffer, then it is hoped that students will be able to determine the buffer components contained in the material.

Based on Figure 1, the increase in the N-gain value of the ability to focus on questions from experimental class students (87%) is higher than the control class (80%). Skills on the indicator focus on questions from experimental class students are in the high category and the control class is also included in the category high. The result pretest and posttest in Table 3 show that the pretest results of the experimental class (23.23%) are higher than the control class (17.74%), but the posttest results show that the experimental class (45.16%) is higher than control class (41.94%). %). It shows that there is an effect of the discovery learning model on students' critical thinking skills on indicators of focusing questions.

The ability to focus on questions with sub-indicators provides a simple explanation for the experimental class is higher than the control class, this is because the ability of the explanatory aspects is trained in the experimental class through all stages of discovery learning including orientation, hypothesis generation, hypothesis testing, conclusion, and regulation, also at the stage apperception, formulating learning objectives and drawing conclusions at the end of learning (Veermans, 2002).

When implementing learning with the discovery learning model, students are accustomed to understanding in depth the existing case before starting to formulate the problem so that students can focus on the problems of the case. For example, when students are given various mixtures and asked to investigate which mixture will be the buffer, the students will formulate a problem: how does a solution qualify as a buffer? In addition, discussion activities make students have an active attitude to ask questions. Friends and teachers indirectly foster the ability to focus on students' questions.

In addition, providing an explanation shows the ability of students to express arguments during learning. This opinion by Champine et al. (2009) where the conclusions formulation activity trains students' ability to explain because students are expected to be able to make final decisions and argue to defend their decision.

5) **Determines action**

Students' critical thinking skills indicators determine action with the aspects of developing strategies and tactics. The ability to determine actions is the ability of students to determine the results of considerations based on existing facts. To test this indicator, students are asked to determine the final result of a solution correctly. In this indicator, two types of solutions are presented with certain volumes and molarity. It is hoped that students will be able to determine how much volume is needed to make a buffer with a certain pH.

Based on Figure 1, it can be seen that the increase in the N-gain value of skills determines the actions of the experimental class students (41%) higher than the control class (18%). indicators determine the actions of the experimental class students including the medium category while the control class is in the low category. The results of the pretest and posttest in Table 3 show that the pretest results of the experimental class (11.72%) are higher than the control class (11.29%), but the posttest results show that the experimental class (48.06%) is higher than the control class (27,20%). It shows that there is an effect of the discovery learning model on students' critical thinking skills on indicators of determining action.

Students' critical thinking skills indicators determine action with the aspects of strategy and tactics, the experimental class is higher than the control class. This is because the experimental class with the learning model of discovery learning which is centered on students triggers discussion which is an effective way of increasing critical thinking skills (Hassaubah (2004). Through discussion, students can share ideas, thinking perspectives, and experiences as well as consider, reject, and accept their own and other people's opinions so that they are free to think and act. In this case, students with discovery learning models are better able to determine what actions are used to determine the concepts used in determining how much volume to add to make a solution buffer with a certain pH.

Students' critical thinking skills can be trained through student-centered learning and support such discussion processes of *inquiry learning* (Seranica et al., 2018), project-based learning (Mahanal & Zubaidah, 2009), and discovery-based learning models (Kosasih, 2015). The increase in students' critical thinking skills in this study was due to the overall syntax of discovery learning models that encouraged students to think deeply. This is reflected in discovery learning activities which have 3 characteristics, namely: (1) exploring, and solving problems to combine and generalize knowledge, (2) centering on learners, and (3) combining new knowledge (Hamaiyah & Jauhar, 2014).

2. **The effect of the discovery learning implementation model on students' metacognition awareness of buffer material**

The students' metacognition awareness was obtained from the results of the Metacognitive Awareness Inventory (MAI) test given to the two classes tested, namely the experimental class and the control class. The questionnaire contained 52 statements referring to the 8 components of metacognitive knowledge. According to Schraw & Moshman, (1995) states that the components of metacognition are divided into knowledge about cognition and regulation of cognition. Knowledge of cognition consists of declarative knowledge, procedural knowledge, and conditional knowledge. Meanwhile, the regulation of cognition consists of a) planning, b) information management strategies, c) comprehension monitoring, d) debugging strategies, and e) evaluation.

Based on the results of the inferential analysis in general, it shows that the discovery learning model has an influence on the metacognitive awareness of students in the buffer. Based on the SPSS test, it was obtained sig = 0.031 < 0.05, which means that there is a significant difference between the metacognitive awareness of students in the experimental class who teaches the discovery learning model and the control class who is taught using the direct learning model. The results of this study are in accordance with the research of Nashrah et al. (2018), which states that the discovery learning model has an effect on the metacognitive awareness of students on the buffer material. Tamsyani, (2016), explains that there is an influence of the discovery learning model and guided inquiry on the metacognitive awareness of students on the subject matter of acid-base.

Based on Table 5, it can be seen that the average metacognition awareness of students in the experimental class (79.23%) who taught using the discovery learning model was higher than the control class (76.15%) who was taught using the direct learning model.

The percentage of knowledge about cognition of students in the experimental class and control class can be seen in Table 5.

Table 5. Percentage of knowledge about students' cognition in experiment class and control class

Indicators of Knowledge about cognition	Class			
	Experiment		Control	
	Score (%)	Category	Score (%)	Category
Declarative Knowledge	78.33	T	75.60	T
Procedural Knowledge	78.63	T	73.59	T
Conditional Knowledge	80.16	ST	76.61	T
Average	79.04	T	75.27	T

Metacognition awareness of students about aspects of knowledge about cognition is seen from three indicators, namely declarative knowledge, procedural knowledge, and conditional knowledge. The results of the questionnaire analysis of students' metacognition awareness in the experimental class and control class can be seen in Table 5.

Declarative knowledge indicators include students having prior knowledge, information on the material to be used, knowing their intellectual skills and abilities, and knowledge obtained through/from demonstration presentations and discussions. The score of metacognition awareness for indicators of declarative knowledge of experimental class students (78.33%) was higher than the control class (75.60%).

Procedural knowledge indicators include applying the knowledge they have for specific purposes and completing and implementing learning procedures. The percentage of indicators for procedural knowledge of students in the experimental class (was 78.63%), while in the control class (73.59%). This is because, in discovery learning, groups are formed to discuss problems that arise so that there is interaction between students which allows them to exchange opinions.

Conditional knowledge indicators that include students can determine when learning procedures/strategies are used and how learners acquire knowledge through certain learning methods. Based on the data analysis in Table 5, it can be seen that the percentage on this indicator of experimental class students (80.16%) is higher than the control class (76.61%).

The average metacognition awareness of the dimensions of knowledge about the cognition of students in the experimental class (79.04%) who taught using discovery learning models was higher than the control class (75.27%) who were taught using direct learning models. This is because students who are taught with the discovery learning model require students to be active in the learning process, especially in solving problems. That discovery learning is one of the important learning models for learning problem-solving techniques (Domin, 1999).

The percentage regulation of cognition (regulation of cognition) of students in the experimental class and control class can be seen in Table 6.

Table 6. Percentage of regulation of students' cognition on experiment class and control class

Indicators of regulation of cognition	Class			
	Eksperiment		Control	
	Skor (%)	Category	Skor (%)	Category
Planning	80.65	ST	76.15	T
Information management strategy	77.18	T	74.03	T
Monitoring of understanding	80.07	ST	76.96	T
Improvement strategy	83.23	ST	82.42	ST
Evaluation	75.94	T	75.54	T
Average	79.23	T	76.15	T

Discovery learning approaches such as investigations help students find out for themselves the basic principles in emphasizing the direct experience of students (Hudson, 1996). In addition, the discovery learning model of applying learning using the problems presented by LKPD can facilitate metacognitive abilities including declarative knowledge, procedural knowledge, and conditional knowledge because students are trained to regulate the knowledge that has been obtained before processing and evaluating to solve learning problems.

Metacognition awareness of students about the regulatory aspects of cognition is seen from five indicators, namely planning, information management strategies, monitoring of understanding, improvement strategies, and evaluation. Based on Table 6, it can be seen that the level of metacognition awareness about the regulatory aspects of students' cognition for each indicator. The first indicator is planning which includes students being able to plan, determine goals and manage learning resources. The percentage of metacognition awareness on this indicator shows that students in the experimental class (80, 65%) were higher than the control class (76.15%).

The second indicator is a strategy for managing information which includes a sequence of skills or strategies used by students to process information efficiently (organizing, combining, concluding, focusing, or determining priorities) The percentage of metacognition awareness in this indicator shows that students in the experimental class (77,18 %) higher than the control class (74.03%).

The third indicator is the monitoring of understanding which includes the assessment of learning strategies used by students. The percentage of metacognition awareness in this indicator shows that students in the experimental class (80.07%) were higher than the control class (76.96%).

The fourth indicator is the improvement strategy which includes strategies or steps used by students to correct misunderstandings. The percentage of metacognition awareness in this indicator shows that the experimental class students (83.23%) are higher than the control class (82.42%).

The fifth indicator is an evaluation which includes the analysis of the acquisition and effectiveness of the strategies used by students in learning activities. The percentage of metacognition awareness in this indicator shows that the experimental class students (75.94%) are higher than the control class (75.54%).

The average metacognition awareness in the dimensions of cognitive regulation of students in the experimental class (79.41%) who taught using discovery learning models was higher than the control class (77.02%) who were taught using direct learning models. This is because in the experimental class which is taught with the discovery learning model, students are trained to practice their cognitive regulation, and students are able to organize or organize every activity they will do so that the expected goals can be achieved. In addition, the regulation of students' cognition will increase the motivation and active participation of students in the learning process.

3. The relationship between critical thinking ability and metacognitive awareness of students in buffer.

Based on the results of the inferential analysis in general, the hypothesis test that was carried out showed a sig value of 0.966> 0.05. This means that there is no significant relationship between critical thinking skills and metacognition awareness. The results of this study are consistent with the results of previous studies. Danial (2010) stated that there is no correlation between students' metacognitive awareness and mastery of basic chemical concepts. The same finding by Nashrah et al. (2018) states that there is no relationship between metacognitive awareness and students' conceptual mastery of the buffer material. A different statement was made by Murniaty (2014), that there is an interaction between the learning model and metacognition awareness in influencing the critical thinking skills of class XI IPA students of SMA Negeri I Barru.

The absence of a relationship between students' critical thinking skills and metacognition awareness is due to the lack of or low awareness of some students in responding to the statements in the MAI (Metacognitive Awareness Inventory) questionnaire as well. Furthermore, the absence of the above relationship can also be caused because when students fill out the MAI (Metacognitive Awareness Inventory) questionnaire very quickly it seems that students do not understand the statements in the questionnaire, and also because students filling out the MAI questionnaire tend to judge themselves objectively. Otaya's research results in Parlan et al. (2019) show that some students try to assess themselves objectively.

Conclusions

Based on the results of the research and discussion, it can be concluded that: the implementation of the discovery learning model has a positive effect on the critical thinking skills of students on the buffer material, the implementation of the discovery learning model has a positive effect on the metacognitive awareness of students on the buffer material, there is no relationship between critical thinking skills and metacognitive awareness of students on the buffer material.

Acknowledgments

The authors realize that since the beginning of the research implementation until now, the author has received a lot of assistance, direction & motivation from various parties, especially the Head of SMAN 3 Palu who has given permission to conduct research.

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