Metacognition ability of students through discovery learning practice guide on acid-base practicum

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Abstract. This research is aimed to analyze the students’ metacognition skills through practicum guide based on discovery learning in acid-base practicum. This research is a mixed method research which emphasis on quantitative and qualitative data collection that was done concurrently. Practicum guide arrangements were designed beginning with the selection of practicum materials, the arrangement of practicum guide content clues, the combination between learning content and syntax, expert validation, practicum trials and the analysis of trial data. Metacognition skills were measured through tests, questionnaires and interviews. Quantitative data were analyzed based on the metacognition skill percentage levels which were obtained from the test result. The research results showed the average scores of the test with metacognition indicators in the amount of 87, 94%, while the mean score of the questionnaire was 81.64%. Metacognition skill test level was low 17, 64%; moderate 61, 76%; and 20, 59% were at high levels. Based on the results, it was known that high-level students always realize what should be designed, be done, and feel capable to carry out the practicum. Thus, a practicum guide based on discovery learning can show the level of metacognition skill in every student.

1. Introduction
One of the that faced by students is how to become a member of 21st century society. In the framework of mastery of 21st century skills, the learning of science including chemistry is seen not only for the diversion of knowledge and skill, but also to build high-level thinking ability. For that, students should involve actively in learning activities to construct knowledge and involve in conceptual change. Through science learning, the teacher can develop various learning models that meet the constructivist aspects and appropriate with the characteristics of the Science subject as well as have the dimensions of attitude, knowledge, and skills. Compliance with the demands of the knowledge dimension, for example to strengthen the scientific approach, it needs to be applied a learning based on discovery/inquiry learning [1,2].

In the other side, one of the competency standards of SMA/MA graduates for knowledge domain is metacognition skill which is also reflected in the core competence of curriculum 2013. This development of metacognition is important to do, because student knowledge about cognition process can guide them in improving cognitive performance in the future, and for that matter, it needs to be designed the learning environment becomes more meaningful [3-7]. The expected learning environment is the one which can facilitate to construct his own knowledge. Ideally in a learning process in the educator class, should have an awareness to assess the thinking of before, during, and after a problem-solving process; and this condition is told to be "constantly involved in its own metacognis" [8,9]. To meet these expectations need to be prepared a good learning plan. Discovery learning is one of the recommended instructional models of
curriculum 13, and in accordance with the metacognition character that requires the students to constantly thinking about starting a challenge in stimulus, identifying until concluding problems [10].

Further, Haryani et al. stated that constructivist Lembar Kerja Peserta Didik (LKPD) based on learning models, in addition to facilitate constructivist also improve the motivation and mastery of students' concepts [11,12]. Other researchers found that through learning discovery learning in addition to more effective in the learning process in the classroom, the cognitive skill of students are also better, compared with conventional learning [13]. Practicum activities on existing teaching materials, in general are exercise and verification, it rarely constructivist. The usual approaches which used to develop a practicum guide are students complete the practicum guide and discuss their ways in pouring the ideas [14].

Such guidelines generally do not provide opportunities to develop high-level thinking ability, students are only required to orderly follow the steps, and usually not trained to formulate problems, hypothesize, plan experiments, solve/find problems, analyze data which obtained, and drawing the right conclusions [8]. In contrast, practicum guide based on discovery learning more emphasis on the discovery of previously unknown concept or principle, students are forced to always think since the proposing of the stimulus until concluding, and this is in accordance with the metacognition character [15].

Meanwhile, the characters of learner metacognition are different, so it needs a guide that facilitates to construct its own knowledge. Based on the various arguments that have been described then the problem formulation which to be solved is how the learners’ metacognition skill through the use of practicum guide based on discovery learning in Acid-base practicum.

2. Method
This research is a mixed method research which emphasis on quantitative and qualitative data collection that was done concurrently [16]. The research was conducted in Senior High School in the beginning of January 2018 with the research subject is one of the XI MIA classes and acid-base material. The practicum guide based on discovery learning that is applied to complete the teaching materials is done as much as 2 times meetings. After being given the treatment, the students in the group were given post-test in the form of conceptualized description with metacognition indicators, followed by response questionnaire as well as with metacognition indicators. The post-test and questionnaire result data were analyzed then taken the conclusion, the data analysis of research result was done descriptively-qualitatively [17].

3. Results and Discussion
The discovery learning practice guide used includes several cases that can be found in everyday life. This guide is different from the guidelines that exist in various high school chemistry materials. Students carry out scientist-like labs, allowing them to be more active, and more successful in increasing participation in the classroom, and more meaningful than existing verification guidelines [18-20]. The mean of posttest metacognition ability was 87.94 with highest score 99 and lowest score 73. On the other hand, the questionnaire data also support metacognition ability with mean equal to 81.64%. These findings suggest that the discovery learning practice guide provides a good learning environment for developing metacognition on acid-base materials [21].

This is according to previous research that without study guide as practicum guide, metacognition ability of experimental class learners did not change significantly with control class because only used learning model [22]. Figure 1 shows the recapitulation of metacognition ability test results of learners for each indicator. At the stage of giving stimulus learners in groups are given problems that will arouse students' curiosity and motivate them to be able to identify problems. The metacognition indicator most dominated by the learner is identifying 100% information on item 3a, followed by choosing the operation that used is 99.26% in item 2b. The percentage of the metacognition indicator is supported by previous research, that metacognition ability is actually owned by everyone, but awareness of itself in metacognitive thinking that still needs to be developed and excavated [23-24]. Identifying information is obtained from the skills of analyzing the cases contained in the practice guide, with the stimulus in the form of cases, the students stimulated to
identify problems [25]. Further metacognition skills about knowing what and how it is gained while learners are faced with problem-solving skills in a practicum guide. The analysis of data from the post test results in general in the criteria is very well in line with the statement of Astra et al. which states that learning discovery learning facilitates learners to discuss so that achievement of goals can be achieved. Achieving a goal is one indicator of metacognition [26].

Metacognition indicator analyzing and interpreting data only at level enough equal to 61.03% this matter because learners still not accustomed in doing practicum without explanation first. Learners are instructed to learn about the acid-base indicator material then for technical and data processing learners are guided through a discovery learning practice guide. Thus reasonable if learners feel confused in processing the data that have been obtained

![Figure 1. Percentage of achievement of metacognition indicator based on metacognition ability test result of learners](image)

Analysis of the results of questionnaires metacognition ability capability obtained an average percentage of achievement of 81.64%. These results indicate that there is a self-assessment of learners with regard to their metacognition ability after applied learning with the help of discovery learning practice guide. To get an idea of the metacognition level generated from the test results then the metacognition indicators are grouped into various levels. The resulting metacognition ability was 17.64% at a low level; 61.76% moderate; and 20.59% are at high levels.

The level analysis of the test results when associated with the results of the self-assessment questionnaire generally has a good correlation. Learners who are included in the category of high and moderate levels have high metacognition capabilities and is also in the category of developing very well and well developed. On the contrary, there are learners who are at low level it has good metacognition ability. With regard to an anomaly or non-conformity of self-assessment by learners, Metcalfe states that the discrepancy occurs because people usually choose the option they think is more reasonable or they choose the ideal statement and is the optimal choice in self assessment, resulting in failure to recognize that a person has weak faculties, and will generate the opinion that an incompetent person is likely to overestimate their ability assessment [27].

The existence of non-conformity of the students' self-assessment in the questionnaire of metacognition ability capability, cause the ability of metacognition of learners is not only measured from the questionnaire but also can be measured from direct observation to individual learners through log book other than that researchers also use interview method to detect the ability indeed that is in the learners themselves. During interviews, low-level learners are not able to explain the problem solving that has been done. In addition,
the response of learners to the same questions that exist in the questionnaire also experienced a difference. The following is an excerpt of interviews to learners:

"I still find it difficult to determine the purpose of learning only from the analysis of a problem, I should have read directly from the book and know from the teacher saying that the purpose of learning is ....”

Based on the results of the interview note that there is a difference of answers between the results of responses made by the students themselves as well as interview results are asked directly by researchers. This can happen because the learner is not in a focused state when filling out the response or the learner is just exaggerating. The results of an anomaly study in accordance with research conducted by Muna et al., ie learners who have a problem solving problem (written test) that is not in tune with his metacognition ability because students judge the ability metakognisinya higher or lower than its performance in solving the problem of the tests given [28]. In contrast to learners from low-grade groups, learners from high and moderate groups with metacognition skills who are in well-developed and well-developed categories have the same answers when they are given questions about concepts and questions similar to those in the response questionnaire learners.

4. Conclusion
Discovery learning-based practice guide has a role in improving the metacognition of learners, the role is derived from the learning steps in discovery learning syntax in accordance with indicators of metacognition ability. Discovery learning-based practice guide contains skills to identify problems from given stimuli, collect data and draw conclusions, proven to provide a good learning environment in developing metacognition thinking skills. The results showed the average score of the test with metacognition indicator of 87.94%, while the average score of the questionnaire was 81.64%. Metacognition ability test level was 17.64% low; 61.76% moderate; and 20.59% are at high levels. Based on the results of metacognition capability analysis from both test and questionnaire, and supported by interview results, it is known that high-level learners always realize what should be designed, done, and feel able to carry out the practicum.

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