Enhancement of Self Efficacy of Vocational School Students in Buffer Solution Topics through Guided Inquiry Learning

Ardiany M*, Wahyu W and Supriatna A
Deparmenten Kimia, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia

*mimy.ardiany16@gmail.com

Abstract. The more students who feel less confident in learning, so doing things that are less responsible, such as brawl, drunkenness and others. So researchers need to do research related to student self efficacy in learning, in order to reduce unwanted things. This study aims to determine the effect of guided inquiry learning on improving self-efficacy of learners in the buffer solution topics. The method used is the mixed method which is the two group pretest posttest design. The subjects of the study are 60 students of class XI AK in one of the SMKN in Bandung, consisting of 30 experimental class students and 30 control class students. The instruments used in this study mix method consist of self-efficacy questionnaire of pretest and posttest learners, interview guides, and observation sheet. Data analysis using $t$ test with significant $\alpha = 0.05$. Based on the result of inquiry of guided inquiry study, there is a significant improvement in self efficacy aspect of students in the topic of buffer solution. Data of pretest and posttest interview, observation, questionnaire showed significant result, that is improvement of experimental class with conventionally guided inquiry learning. The mean of self-efficacy of student learning there is significant difference of experiment class than control class equal to 0.047. There is a significant relationship between guided inquiry learning with self efficacy and guided inquiry learning. Each correlation value is 0.737. The learning process with guided inquiry is fun and challenging so that students can expose their ideas and opinions without being forced. From the results of questionnaires students showed an attitude of interest, sincerity and a good response of learning. While the results of questionnaires teachers showed that guided inquiry learning can make students learn actively, increased self-efficacy.

1. Introduction
Until now still found students who are not active when learning takes place. This is shown from students who are lazy to ask or answer. Students lack confidence and are not sure to be able to ask or answer questions, and do not want to compete. Such conditions indicate the low self-efficacy of the student. Research with guided inquiry learning and self-efficacy is still required in education world. Research has been done and can produce a positive self-efficacy in learning activities. It turns out that the success can be influenced by self efficacy such as the increase of understanding, development of high-level thinking and others. According to Tenaw 2013 [1] based on his research on the relationship between self efficacy and academic achievement, he suggested to innovate the learning process through the implementation of various strategies that can trigger student self-improvement to be better. This is suitable with national educational goals which is increasing confidence, and create a bright young generation.
Guided inquiry learning according to experts can influence student mind set and process skills in lab practice, so students can expose ideas/ thoughts and be challenged in learning chemistry / science. Guided inquiry learning is a learning based on students steps to find their own learning problems, through teacher guidance and aims to encourage students to become more courageous and have creative imaginary, which guided to discover ideas and thought or discoveries and tools that have never existed before Anam & Khairul 2015 [2]. This becomes the motivation for students to learn.

Research on self efficacy with cognitive abilities is interconnected. The higher someone's belief in learning, the more cognitive ability that can increases. In the current learning process of education is not enough only to teach (transfer of knowledge) but also educate (transfer of value). According to Lickona's 2013 [3] opinion, character education process involves various aspects of students, which is cognitive, affective, and psychomotor as an aspect of wholeness in the context of cultural life. It is also mentioned in Permendikbud No. 54 of 2013 [4], to achieve the competency standards of graduates, students need to have 3 dimensions that is knowledge, attitude, and skills.

In the learning process that can determine high student self-confidence is required in various affective, cognitive and psychomotor aspects. Where the students' graduation competence is influenced by the hard skill and soft skill aspects, which determine the quality of the graduation, One of soft skill that influences student learning motivation is self efficacy in the student. Self efficacy plays an important role in the advancement of education, Self efficacy can help students feel confident in their abilities, and able to effectively handle the difficulties they faced in the learning experience. According to Bendura 1994 [5] self efficacy is one's self-belief that it can handle situations and produce positive outcomes. This is consistent with the theory of Behaviorism which emphasizes behavioral change as a basis for the success of the desired learning process. Suyono and Hariyono 2011[6].

Guided Inquiry learning was first developed by Richad Suchman in 1996 [7] which views the nature of learning as a thinking exercise through questions. Then in the book Edi Hendri, Suchman (1962), put forward the core idea of inquiry learning: (1) Students will ask (inquiry) if they find confusing, unclear or discrepant events, (2) students have the ability to Analyzing their thinking, (3) the way of thinking can be taught and added to students, and (4) inquiry can be more meaningful and effective when done in group learning. Thus, this inquiry learning can develop student mindset more creative, logical and analytical.

Research conducted on the role of self efficacy can improve process skills in chemistry learning, and biology is developed by research Uzuntriyaki & Aydin 2009 [8].The meaningful learning of guided inquiry exists in the very close relationship between guided inquiry learning and laboratory activity. Thus, laboratory-based inquiry learning is expected to improve students’ understanding and even reduce students’ misconceptions, improve student laboratory skills, and students’ attitudes toward chemistry and laboratory work.

Guided Inquiry learning is a learning which will make students to be creative, active, critical and able to develop their ideas freely and deeply, so that they can express their imaginations and thoughts. Guided Inquiry learning has advantages according to Bruner 2008 [9], namely: (1) Students will understand the basic concepts and ideas better; (2) Assist in using memory / cognitive abilities and transfer in new learning process situations; (3) Encourage students to think of initiatives and formulate their own hypotheses; (4) provide intrinsic satisfaction; (5) The learning process becomes more stimulating.

So in particular this study aims to analyze the influence of guided inquiry learning on the increase of self efficacy on the topic of buffer solution. Based on the description above it is necessary to do research "The Influence of Guided Inquiry Learning to Improve Self Efficacy".

2. Experimental Method
Target of this research is student of SMK class XI SMKN 13 Bandung counted 60 student, class XIAK3 and XIAK4. The research design is a mixed method research. Mix Method is a research
method that combines quantitative and qualitative methods according to the research problem and to answer the problem formulation Creswell, 2012 [10].

According Creswell (2012) there are 4 types of mix methods are: embedded, explanatory, exploratory, and triangulation. Research type chosen by the researcher is embedded experimental that is research based on quantitative and qualitative data collection. The data were analyzed by the researcher separately.

The design of this study is the two group pre test post test design, which is described as follows:

\[
\begin{array}{ccc}
G1: & O1 & X1 & O2 \\
G2: & O1 & X2 & O2 \\
\end{array}
\]

**Figure 1.** Research design

Wiersma and Jurs, 1990 [11].

Information:
G1 Show Experiment Class, G2 Show Control Class, X1 Show Guided Inquiry Learning, X2 Show Conventional Learning, O: menunjukkan Pre test and Post test

Learning devices used in the study are: (1) Syllabus; (2) RPP; (3) LKS. The research instruments used are: (1) Observation Sheet of the implementation of Guided Inquiry Learning; (2) Self Efficacy Questionnaire Sheet; (3) Student Question Sheet; (4) Master Question Sheet; Interview Sheet.

Data collection methods used are the method of observation and test methods. The observation method is used to observe the inquiry of guided inquiry learning at the time of practicum learning in laboratory and the result of students’ self-efficacy abilities during the guided inquiry learning on the buffer material. The test is given at the beginning of the lesson and the end of the lesson.

The study was conducted 3 times. The first to third meetings are held for learning. While the initial and final tests outside the lesson. The teacher divided the students into 6 groups, each group consisting of 5 heterogeneous student.

Data collection techniques conducted in this study is to fill the self efficacy questionnaire. Students fill out the questionnaire test before learning and after learning. Grid of Self-Efficacy Self-Questioner
Table 1. Table Quisioner Self Efficacy

| Item Quotien | Poorly | Very Poorly | Average | Well | Very Well |
|--------------|--------|-------------|---------|------|-----------|
|              | 1      | 2           | 3       | 4    | 5         | 6     | 7     | 8     | 9     |
| 1. To what extent can you explain chemical laws and theories? | | | | | | | | | |
| 2. How well can you choose an appropriate formula to solve a chemistry problem | | | | | | | | | |
| 3. How well can you establish the relationship between chemistry and other sciences? | | | | | | | | | |
| 4. How well can you describe the structure of an atom? | | | | | | | | | |
| 5. How well can you work with chemicals? | | | | | | | | | |
| 6. How well can you describe the properties of element by using periodic table? | | | | | | | | | |
| 7. How well can you read the formulas of elements and | | | | | | | | | |
| 8. To what extent can you propose solutions to everyday problems by using chemistry? | | | | | | | | | |
| 9. How well can you interpret chemical equations? | | | | | | | | | |
| 10. How well can you explain the particulate nature of matter? | | | | | | | | | |
| 11. How well can you construct laboratory apparatus? | | | | | | | | | |
| 12. To what extent can you explain everyday life by using chemical theories? | | | | | | | | | |
| 13. How well can you collect data during the chemistry? | | | | | | | | | |
| 14. How well can you use the equipment in the chemistry laboratory? | | | | | | | | | |
| 15. How well can you understand the news/documentary | | | | | | | | | |
| 16. How well can you interpret graphs/charts related to chemistry? | | | | | | | | | |
| 17. How well can you write a laboratory report summarizing main findings? | | | | | | | | | |
| 18. How well can you interpret data during the laboratory? | | | | | | | | | |
| 19. How well can you solve chemistry laboratory? | | | | | | | | | |
| 20. How well can you recognize the careers related to chemistry? | | | | | | | | | |
| 21. How well can you carry out experimental procedure in the chemistry laboratory | | | | | | | | | |

Answer honestly

Answer according to your opinion Hint: Put a check mark (v) on the appropriate column with your opinion. Description: SS: Strongly agree S: Agree TS: Disagree STS: Strongly Disagree.

Table 2 Distribution of guided inquiry learning is by SS = 4, S = 3, TS = 2 and STS = 1, then summed. After that it is then inserted into MSI (Method Survivef Interval) to get the value that can be processed with SPSS.
Table 2. Distribution of Guided Inquiry Learning Inquiry Questions

| No | Task |
|----|------|
| 1  | I can identify the buffer solution components in guided inquiry learning |
| 2  | This learning makes it easy for me to interact with other friends |
| 3  | I am always keen to learn to understand the material of the buffer solution |
| 4  | I tried to put forward an opinion in the discussion |
| 5  | In the discussion, all group members are entitled to propose ideas / ideas |
| 6  | I became challenged to answer questions from other friends |
| 7  | I am excited to join practicum activities. |
| 8  | I feel happy to attend classes and labs |
| 9  | Guided inquiry learning makes learning chemistry easier with buffer material. |
| 10 | Guided inquiry learning facilitates students to ask questions and communicate these issues with other students |

Table 3 shows that self efficacy of the experimental students are better than the control class through guided inquiry learning on the topic of buffer solution through lab workshop. In Lickona's (2013) opinion, character education process involves various aspects of students, cognitive, affective, and psychomotor aspects Wholeness in the context of cultural life. It is also mentioned in Permendikbud No. 54 years 2013, to achieve the competency standards of graduates, students need to have 3 dimensions as knowledge, attitude, and skill.

3. Results and Discussion

Table 3 | Self Efficacy Student Score and Statistical Test Results

| Data            | Class Experiment | Control Class | Class Experiment | Control Class |
|-----------------|------------------|---------------|------------------|---------------|
| N               | 30               | 30            | 30               | 30            |
| Average         | 4.65             | 4.05          | 7.13             | 6.00          |
| SD              | 13.89            | 10.30         | 7.80             | 9.72          |
| Normalitas (Sig)| 0.503            | 0.244         | 0.991            | 0.126         |
| Homogenitas     | 0.11             | 0.11          | 0.311            | 0.311         |
| Uji t (Sig)     | 0.179            | 0.179         | 0.002            | 0.002         |

Trial Criteria
Reject $H_0$ if significance obtained $< \alpha$. Base on the Table Independent Samples Test
Value obtained significance $t$-test for Equality of Means is $0.002 < 0.05 = \alpha$. Therefore $H_0$ is rejected. There is a significant difference in self-efficacy between the experimental class and the control class. Self efficacy has an important role in improving students' confidence. Self-efficacy characters known as self-beliefs can improve the ability of individuals to form behavior that is relevant to a specific task or situation (Pervin, 1984)

Table 4 | The correlation between inquiry learning is guided towards the improvement of self efficacy of SMK students on the topic of buffer solution

In this study the authors do a correlation analysis that is technically correlation analysis
This is assisted with SPSS 22.0 for Windows software. The result of correlation analysis can be seen in table 4 below:

| Guided Inquiry Learning | Student Self Efficacy |
|-------------------------|------------------------|
| Guided Inquiry Learning | .737                   |
| Sig. (2-tailed)         | .047                   |
| N                       | 30                     |
| Student Self Efficacy   | Pearson Correlation    |
|                         | .337                   |
| Sig. (2-tailed)         | .047                   |
| N                       | 30                     |

From the above table it is found that the correlation value between guided inquiry learning to the increase of self-efficacy of students is 0.737 with the value of Sig. (2-tailed) is 0.047. Criteria Testing reject Ho if Sig. (2-tailed) <\(\alpha\), where \(\alpha = 0.05\) is the level of significance. Since the value of Sig. (2-tailed) between inquiry learning toward self-efficacy of students is 0.047 <0.05 then Ho is rejected.

This means that there is a relationship between inquiry learning to the improvement of students' self efficacy. To see how the relationship between inquiry learning on the improvement of students' self efficacy is seen from the value of the coefficient of determination categorized in the following table 5.

| Determination Coefficient Interval | Classification          |
|-----------------------------------|-------------------------|
| 0.000 – 0.199                     | very low / Weak can be ignored |
| 0.200 – 0.399                     | Low/ Weak               |
| 0.400 – 0.599                     | Medium                  |
| 0.600 – 0.799                     | High / Strong           |
| 0.800 – 1.000                     | Very high / very Strong |

Based on the output of SPSS 22.0 for Windows. Obtained coefficient of determination is presented in the table 6 below:

| Model | R   | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-----|----------|-------------------|---------------------------|
| 1     | .737| .543     | .734              | 8.13324                   |

a. Predictors: (Constant), Guided Inquiry Learning

Determined coefficient value of 0.543. The value is at the interval of 0.400 - 0.599. This means the relationship between inquiry learning and self-efficacy in moderate students.

R Square or coefficient of determination has result of calculation equal to 0.543 has meaning that the increase of self efficacy of student influenced by inquiry learning equal to 54.3%, while the rest that is 100% - 54.3% = 45.7%, influenced by other factors not examined by writer.

Next is a simple regression analysis. Simple regression analysis technique used to find out how the dependent variable (Y) improvement of self efficacy of students can be predicted through independent variables (X) guided inquiry learning.
Table 7 Coefficients 

| Model                  | Unstandardized Coefficients | Standardized Coefficients | T     | Sig. |
|------------------------|-----------------------------|---------------------------|-------|------|
| (Constant)             | 55.043                      | 10.156                    | 5.420 | .000 |
| Guided inquiry learning| .165                        | .335                      | .037  | .195 |

a. Dependent Variable: student self efficacy

From the data processing using the existing facilities in the software SPSS 22.0 for windows obtained the estimated value of regression coefficient as follows:

\[ a = 55.043 \]

\[ b = 0.165 \]

Of these results obtained by regression equation as follows:

\[ Y = 55.043 + 0.165 \times X \]

Based on the above equation the regression model can be interpreted that the constant is 55.043, meaning that if the inquiry learning is guided (X) the value is 0.165 then the student self efficacy improvement (Y) is 55.043. The regression coefficient of inquiry learning variable (X) is 0.165, meaning that if the inquiry learning is guided to increase 1 unit, then the student self efficacy (Y) will increase by 0.165. Coefficient of positive value means there is a positive relationship between guided inquiry learning on the increase of self-efficacy of students, the more up inbuilt learning is guided then the increased self-efficacy students.

From the above table found that the correlation value between guided inquiry learning toward the students' cognitive improvement is 0.543 with the Sig score. (2-tailed) is 0.047.

Testing Criteria

Reject \( H_0 \) if Sig. (2-tailed) < \( \alpha \), where \( \alpha = 0.05 \) is the level of significance. Because the value of Sig. (2-tailed) between inquiry learning is guided against increasing efficacy Student self of 0.047 < 0.05 then \( H_0 \) rejected. According to Hasheminasab, et al 2014[12], stated that there is a correlation between discipline with self efficacy and achievement academic.

Table 8. N-gain Independent Samples Test

| GainScore               | Levene's Test for Equality of Variances | t-test for Equality of Means | 95% Confidence Interval of the Difference |
|-------------------------|----------------------------------------|-----------------------------|----------------------------------------|
|                         | F          | Sig. | t   | Df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Equal variances assumed | .675       | .415 | .482 | 58 | .032          | .19667          | .40832 | -.62068 | 1.01401 |
| Equal variances not assumed | .482       | 55.537 | .032 | .19667 | .40832 | -.62145 | 1.01478 |

Trial Criteria

Reject \( H_0 \) if significance obtained < \( \alpha \). Base on the Table Independent Samples Test Value obtained significance t-test for Equality of Means adalah 0.032 < 0.05 = \( \alpha \). Therefore \( H_0 \) is rejected. There is a significant difference in self-efficacy between the experimental class and the control class.

Table 9. Table showing the conclusions of the influence of Guided inquiry
learning in self-efficacy of SMK students in the topic of buffer solution the topic

| Average t | Average t |
|-----------|-----------|
| Guided Inquiry learning | self efficacy |
| (N=30, sig=0.05) | (N=30, sig=0.05) |
| Post test | 0.00 | 0.737 | 0.047 |
| N-Gain | 0.00 | 0.487 | 0.032 |

Table 9 shows that there is an influence of guided inquiry on the improvement of self-efficacy of SMK students on the topic of buffer solution. According to Tenaw (2013) based on his research on the relationship between self-efficacy and academic achievement he suggested that innovation in the learning process through the implementation of various strategies that can trigger student self-improvement to be better.

**Figure 2.** shows that there is an influence of guided inquiry on the improvement of self-efficacy of SMK students on the topic of buffer solution by looking at the experimental N-gain class grade compared to the control class.

\[ G = \text{posttest score} - \text{pretest score} \]

Hake, 1999 [13]

Research on improvement of concept and self-efficacy through model of Oriented Guided Inquiry Learning by Oktarina (2016). The results of this study can improve the mastery of concepts and self-efficacy through this inquiry learning with the concept of making colloids.

**Figure 3 Show there are 2 meeting of Practicum at the Laboratory by filling out the student questionnaire in conducting the guided Inquiry learning activity.** The 1st meeting is explaining the nature of the buffer solution. The second meeting is measuring the pH of the buffer solution.

**Figure 3. The Nature of The Butter Solution (One meeting)**

The graphic shown above shows the guided and conventional inquiry teaching activities in the experimental class and control class with the material explaining the nature of the buffer solution.
Figure 4 The experiment class shows better activity than the control class. Measure The pH of The Buffer Solution

Figure 4 Show Measure The pH of The Buffer Solution (second meeting)
The graphic shown above Guided and conventional guided inquiry teaching activity in the experimental class and control class with the material Measuring the pH of the Buffer Solution. The experiment class shows better activity than the control class Figures 3 and 4 show guided inquiry learning through practicum on the buffer topic at the first meeting between the control class and the experiments there are differences, in which the experimental class is better than the control class at the first and second meeting. This shows the guided inquiry learning success in this study. Guided inquiry learning is a learning based on students' steps to find their own learning problems, through teacher guidance and aims to encourage students to become more courageous and creatively imaginative, guided to discover ideas and ideas or discoveries and tools that have never existed before Anam & Khairul 2015 [14]

In Guided Inquiry Learning, it is seen show the teacher’s activity in the laboratory pursuit activities is collaborated in the buffer solution topic.

Table 10. Show data on the implementation Guided Inquiry Learning Guidance of Buffer Solution Practicum

| Implementation of Guided Inquiry Practicum | Psychomotor | Cognitive | Affective |
|-------------------------------------------|-------------|-----------|-----------|
| Pert. 1                                   | 82.8        | 83.3      | 82.5      |
| Pert. 2                                   | 83.6        | 83.7      | 83.5      |

Figure 5 Show grafic on the implementation Guided Inquiry Learning Guidance of Buffer Solution Practicum

Figure 5 Demonstrates the guided Inquiry learning experience on the topic of the laboratory buffer solution in the laboratory, an increase from the average of the second meeting of meeting 1
Pert 1 Explains the nature of the buffer solution
Pert 2 Calculates the pH of the Solution

4. Conclusion
Based on the result of research and discussion, it can be concluded that there is a significant improvement in self efficacy of students in guided inquiry learning with buffer topic from experimental class compared with control class with mean value of 0.047. While the influence of inquiry learning is guided towards self efficacy students of the experiment class compared with control class is 0.737 with regression equation for guided inquiry relationship with self efficacy:

\[ Y = 55.743 + 0.165X \]

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The authors also feel that in guided inquiry learning is accompanied by this experiment takes quite a long time to do, and requires hard work for teachers to create a fun learning for students.

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