

## The difference of students' learning outcomes and science process skill which taught by guided inquiry and direct instruction with practicum integrated

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### Abstract:

This study aimed to determine differences of students' learning outcomes and science process skill which taught by using the guided inquiry model and direct instruction where both models were integrated with practicum on the topic of colligative nature of electrolyte solutions. The population in this study were all students of class XII MIA Binjai SMA 5 consisting of 6 classes. The sample was determined by purposive sampling technique, which taking 2 classes: XII MIA-1 (as the experimental class-I) applied Guided Inquiry learning model and XII MIA-2 (as the experimental class-II) applied Direct Instruction where both were practicum integrated. This study was conducted using the Quasi Experimental design with non-equivalent group pretest-posttest design. Data collection was done for pre-test and post-test by using twenty items of multiple choices instruments which were valid and reliable for learning outcomes, meanwhile six items valid essay test for science process skill. The results showed that there were differences in the average value of learning outcomes and science process skill with the values of each  $t_{\text{statistics}} > t_{\text{table}}$  namely  $7.082 > 2.0345$  and  $8.76 > 2.0345$ , while the difference in the average value of activities and attitudes of student learning during the learning process in the experimental classes I and II were 90.21 (very good) and 79.87 (good) and 88.54 (very good) and 77.43 (good). Based on the results of the questionnaire analysis, students agreed that Guided Inquiry model able to facilitate them in understanding the topic of colligative nature of electrolyte solutions because they could design their own experiments in practical activities.

### Keywords:

Direct instruction; guided inquiry; student's learning outcome; science process skills

### Introduction

One of currently problems which being experienced by the world of education is the low quality of education in Indonesia due to the weak learning process. Experience which is often faced by chemistry teachers is most students considering chemistry as a difficult subject. This may be caused by learning activities which were still teacher oriented such that less attractive and boring for students (Silaban & Simangunsong, 2015). One way to improve the quality of chemical learning able to be realized, through the success of students in obtaining good learning outcomes (Limatahu et al. 2017). In addition, chemical learning at this time still emphasizes the product not the process. Eventhough the essence, good mastery of the process will produce good products.

Good mastery able to be realized through science process skill. Science process skill is procedural, experimental skills and investigate the habits of scientific thinking or the ability of scientific inquiry (Asy'ari & Fitriani, 2017). Science process skill is the key to the development of science literacy that plays an important role in everyday life, especially to face complex science and technology problems in the twenty first century (Artayasa et al. 2017).

However, the facts show that understanding of science process skills which possessed by teachers in Indonesia is still in the low category (Bakri & Budi, 2015; Limatahu et al. 2017). By looking at existing problems, we need learning model which able to improve learning outcomes and activate student's science process skills. The most suitable learning model is the Guided Inquiry learning model (Arabacioglu & Unver, 2016; Limatahu et al. 2018; Sahyar & Hastini, 2017). In addition, there is

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also other model which able to be applied to science process skill, namely Direct Instruction learning which was integrated with practicum method. The application of a Guided Inquiry model able to improve student learning outcomes compared to Direct Instruction model. The results of other studies indicate that the Guided Inquiry learning model is influential to improve student's science process skills (Artayasa et al. 2017; Prayitno et al. 2017; Irwanto et al. 2018;) and may improve students' science process skills compared to Direct Instruction model (Rismawati et al. 2017). In this study, these both models will be compared to find the best result.

**Materials and Methods**

This research was conducted at SMA 5 Binjai which is located at Jl. Jambi No.2, Binjai Estate, Kota Binjai, Sumatera Utara 20723 in the odd semester of the 2018/2019 academic year. The

research was conducted for 3 months, starting from July 2018 to September 2018. The population in this study was all students of class XII MIA Binjai SMA 5 consisting of 6 classes. The independent variable in this study is Guided Inquiry learning model and Direct Instruction which both integrated with practicums whereas the dependent variable is the learning outcomes and science process skill of students. The control variable is the teacher who teaches with same topic, same the student handbook and same instrument. The sample was determined using purposive sampling technique which took 2 classes namely class XII MIA-1 (experiment I) applied Guided Inquiry learning model and class XII MIA-2 (experiment II) applied Direct Instruction integrated by practicum learning model.

This study was conducted using the Quasi-Experimental design with the type of non-equivalent group pretest-posttest design.

**Table 1**  
Average value, standard deviation (s), and variance (S<sup>2</sup>) of learning outcomes

Experiment Class	Average Value		Standard of Deviation		Variance (S <sup>2</sup> )	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
I	28.33	88.94	7.25	6.82	51.01	48.09
II	28.03	77.73	7.28	6.38	51.423	39.53

**Table 2**  
Data on student science process skill

Experiment Class	Average Value		Deviation Standard		Variance	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
I	26.52	89.58	7.65	5.58	56.79	30.18
II	26.30	78.42	6.94	4.74	46.69	21.76

**Table 3**  
Average value of item points

Indicator of Scientific Process Skill	Average Value of Items Category			
	Experiment I		Experiment II	
	Pre-test	Post-test	Pre-test	Post-test
Observe	7.64	16.82	4.91	15.24
Grouping	4.27	13.79	4.91	12.97
Applying the Concept	3.42	13.33	4.30	11.39
Interpreting	5.03	14.24	4.76	14.45
Designing Experiment	2.76	17.33	3.54	11.12
Formulate a Hypothesis	3.39	14.06	4.15	13.24

**Table 4**  
Differences in student's science process skill

Aspect of Scientific Process Skill	Experiment I	Experiment II
Observing	84.42%	75.16%
Grouping	91.89%	82.83%
Applying the Concept	95.94%	83.82%
Interpreting	95.94%	83.33%
Designing Experiment	93.67%	79.27%
Formulating a Hypothesis	89.87%	74.73%

The procedure of the research conducted consists of four stages, namely: the pre-research, preparation, implementation and final stages. Data collection is done by pre-test and post-test. For learning outcomes using multiple choice instruments as many as twenty valid and reliable questions while in science process skill, the test instrument is applied through valid essay tests as many as 6 items. From the pre-test scores, students will then be tested for prerequisite analysis, namely Normality, Homogeneity and t-test of two parties. Furthermore, an analysis of differences in learning outcomes data and science process skill was analyzed by students who were taught using the Guided Inquiry and Direct Instruction integrated by practicum.

**Results**

*Students' learning outcomes*

Based on the data on students' learning outcomes which obtained in this study, the average, standard deviation, and variance obtained

from the pre-test and post-test data of the two experimental classes as in Table 1. The average value of the pre-test and post-test experimental class-I and experimental class II able to be seen in Fig 1. Based on student post-test's data, an analysis of the percentage of achievement of learning outcomes indicators able to be seen in Fig 2.

*Science process skills*

In this study, students' science process skill was measured by using essay-tests instrument. The criteria for measuring the achievement of science process skill are measured based on 6 (six) aspects of science process skill namely observing, grouping, applying concepts, interpreting, conducting experiments, formulating hypotheses (Asy'ari & Fitriani, 2017) which are divided into several points assessment on 6 items essay-test questions which have been made by the researcher. Data analysis of student is summarized in Table 2.

**Table 5**  
The test result of learning outcomes hypothesis

Data of Class		t <sub>statistics</sub>	t <sub>table</sub>	Information
Experiment I	Experiment II			
$\bar{X}_1 = 88.94$	$\bar{X}_2 = 77.73$	9.78	2.0345	H <sub>a</sub> is accepted, H <sub>o</sub> is rejected
$S_1 = 9.049$	$S_2 = 11.293$			
$S_1^2 = 79.39$	$S_2^2 = 123.66$			

**Table 6**  
Test results of post-test's data hypothesis

Data of Class		t <sub>statistics</sub>	t <sub>table</sub>	Information
Experiment I	Experiment II			
$\bar{X}_1 = 89.58$	$\bar{X}_2 = 78.42$	8.967	2.0345	H <sub>a</sub> is accepted, H <sub>o</sub> is rejected
$S_1 = 5.579$	$S_2 = 4.737$			
$S_1^2 = 30.183$	$S_2^2 = 21.759$			

**Table 7**  
Recapitulation of implementation of scientific process skill in guided inquiry learning model

Syntax of Guided Inquiry	Evaluation of Implementation					
	Observer 1		Observer 2		Observer 3	
	K1	K2	K3	K4	K5	K6
Step 1	85	70	80	84.75	84.5	70
Step 2	89.6	70	94.6	82.6	81	86
Step 3	90	94	84	90	92	86
Step 4	95	94.67	85	94.17	90.83	84.17
Step 5	93	94.71	91.57	92.57	95.29	94.71
Step 6	93.33	94.33	91.67	95	93.33	95

The value of pre-test and post-test science process skill in experimental class I and experimental class II able to be seen in Fig 3. The average value of student's initial and final abilities in the experimental class I and II for each item in

the indicator process science skill is shown in Table 3.

Then an analysis of the differences in the percentage of students' science process skill in each observed aspect during the learning process is seen in Table 4. Based on the percentage

difference in science process skill, we find the experimental class I is much higher than experimental class II. An analysis of the differences in the percentage of science process skill of

students each aspect of science process skill is given in Fig 4.

**Table 8**

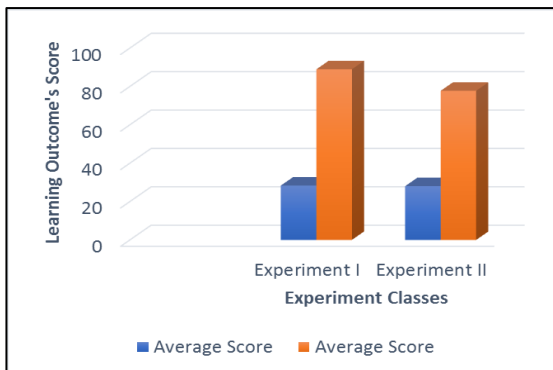
Recapitulation of scientific process skill's implementation in the direct instruction learning model

Syntax of Direct Instruction	Evaluation of Implementation					
	Observer 1		Observer 2		Observer 3	
	K1	K2	K3	K4	K5	K6
Step 1	71.6	70	70	70.3	70.8	70
Step 2	76.3	75	73.8	73.3	75.8	70
Step 3	70	70	70	70	70.8	75.8
Step 4	70.8	70.	76.6	70	70	75
Step 5	76.7	73	72.8	74.4	74.4	80.6

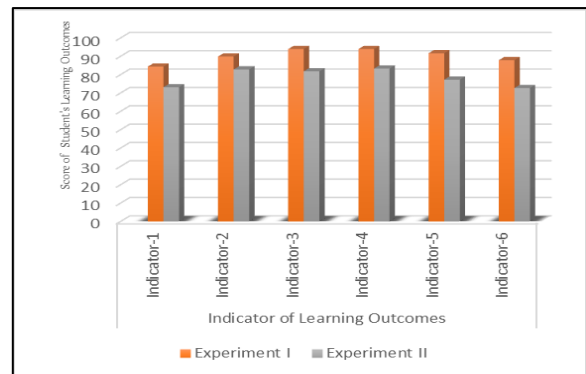
*Implementation of science process skills in learning models*

To obtain an overview of practical lectures' effectiveness with Guided Inquiry model, an observation sheet was made involving three observers. In this study, there are 3 observers. The results of the assessment in each Guided Inquiry syntax are given in Table 5. Based on Table 5, the percentage of implementation of each aspect of science process skill can be made using a Guided Inquiry model as shown in Fig 5.

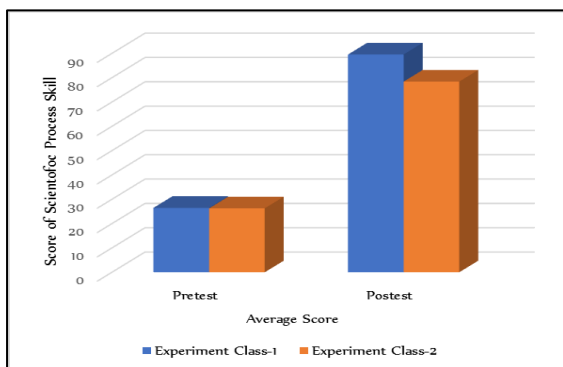
Furthermore, observations were made on the implementation of science process skill on the Direct Instruction integrated by practicum learning model in Table 6. From Fig 5, it seen that implementation of science process skill of students with a Guided Inquiry learning model has "Very Good" categorized on each syntax. Based on Table 6, a percentage of the feasibility in each aspect of science process skill can be made using Direct Instruction model as shown in Fig 6.



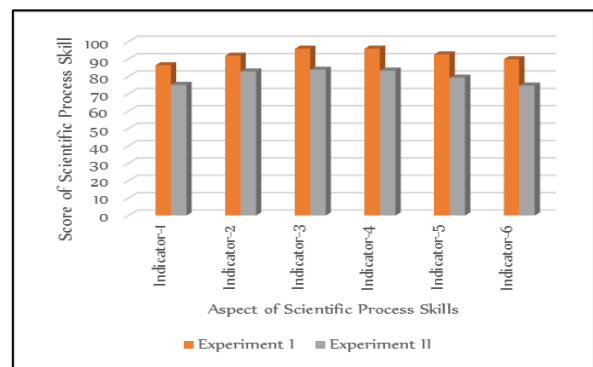
**Fig 1.** Graphic of student's learning outcomes



**Fig 2.** Percentage of achievement learning outcomes



**Fig 3.** Differences in the value of learning outcomes test



**Fig 4.** Differences of scientific process skill in each aspect

## Discussion

Based on the results of data analysis, the differences in the average value of the learning outcomes (post-test) of students in the experimental classes I and II were 88.94 and 77.73. The high average learning outcomes in the experimental class-I is caused by application of Guided Inquiry learning model, such that students are given opportunity to find and collect a series of basic concepts through practical activities. This affected students able to formulate answers based on given problems and proving it through experimental activities which carried out by themselves. Of course, this provides very good benefits to improve student learning outcomes.

The low learning outcomes in the experimental class II due to the learning process which still applying direct learning model (Direct Instruction), in which the teacher is still the center of learning by demonstrating practical activities, consequently most students become bored in learning because they cannot actively find concepts through experimental activities simple (practicum).

This is in line with the research conducted by Wulandari (2016) which concluded that learning with the Guided Inquiry model on the Colligative Characteristics of the Solution can improve the learning outcomes of TKJ-I students in Way Kanan High School by 88.89% with complete and very good categories. This is because in Guided Inquiry learning students are required to be active to think critically, find problems with reasoning, and

develop knowledge independently so that it will be more embedded in the mind and more remembered by students.

Based on the results of data analysis, the differences in the average value of science process skill (post-test) of students in the experimental class I and II were 89.58 and 78.424. The high average science process skill in the experimental class-I was reached because in the experimental class, students allowed learning through simple experimental activities and applying aspects of science process skill in it, such that the improvement of science process skill is very possible to be achieved through practicum integrated. The results of this study are reinforced by research conducted by Abungu et al. (2014) that science process skill of students who are taught with the Guided Inquiry model are better than the direct learning model with practicum-based treatment in the two experimental classes at SMAN 2 Samarinda in the material of colligative solutions (Varadela et al. 2017). Then, Hubbi et al. (2017) which concluded that there is a significant effect of the use of practicum in the application of the Guided Inquiry learning model towards student chemistry learning outcomes.

The relationship between learning outcomes and science process skill of students obtained based on the results of the study is there is a relationship that is directly proportional between the average value of tests of students' science process skill.

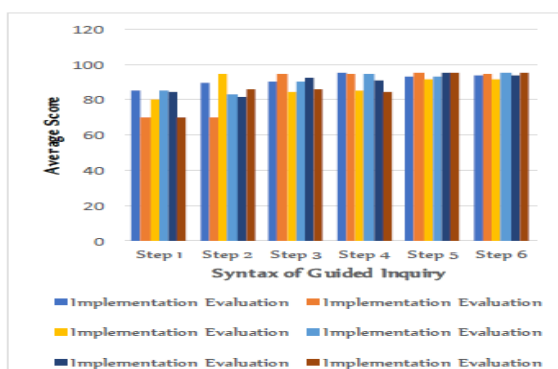


Fig 5. Percentage of implementation science process skill's aspects

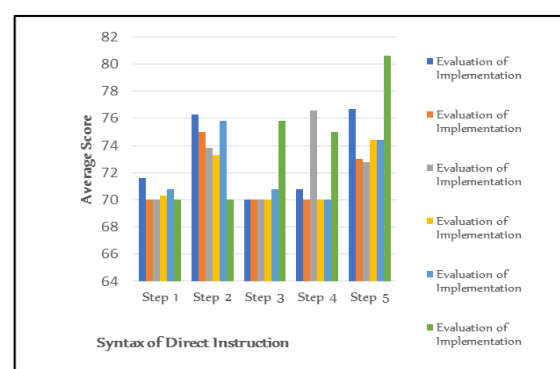


Fig 6. Implementation of Science Process Skill in Direct Instruction

## Conclusion

The conclusion which was obtained in this study is: There are differences in learning outcomes and science process skill of students which taught by using guided inquiry model and direct instruction where both practicum-

integrated in the topic of colligative nature of electrolyte solutions at SMAN 5 Binjai.

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