Application of expert-notice dialogue (END) method to assess students’ science communication ability on biology

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Abstract: Student’s science communication ability can be assessed by the Expert-Notice Dialogue (END) method which focusing on verbal explanations using graphs or images as a tool. This study aims to apply the END method to assess students’ science communication ability. The study was conducted in two high schools with each sample of one class at each school (A and B). The number of experts in class A is 8 students and 7 in class B, the number of notice in class A 24 students and 30 in class B. The material chosen for explanation by expert is Ecosystem in class A and plant classification in class B. Research instruments are rubric of science communication ability, observation rubric, notice concept test and notice questionnaire. The implementation recorded with a video camera and then transcribed based on rubric science communication ability. The results showed that the average of science communication ability in class A and B was 60% and 61.8%, respectively, in enough categories. Mastery of the notice concept is in good category with 79.10 averages in class A and 94.64 in class B. Through the questionnaire notice it is known that the END method generally helps notice in understanding the concept.

1. Introduction

Science communication competence (SCC) is one of the fundamental things in the curriculum of many countries [1], including Curriculum 2013 in Indonesia. The implementation of learning demanded by the 2013 curriculum is a scientific approach. Through a scientific approach students are introduced to the ability to observe, reason, experiment, associate and communicate.

Communication is an important part in scientific learning and the basis for constructing scientific knowledge, therefore scientific communication is one of the important foundations for science learning. Scientific communication can be clearly distinguished from other communications. Scientific communication uses certain grammar rules as well as the choice of words or terms with certain rules [2].

Student communication skills include oral and written skills. Many experts find ways to measure students’ communication skills. One indicator of the science process skill is communication skills [3]. Sub-indicators of communication skills include the ability to: describe empirical data of experimental or observational results with graphs and tables or diagrams or alter them in the form of one, organize and submit reports systematically and clearly, explain experimental or research results, read graphs or tables or diagrams and discuss the results of the activities of a problem.
Another way to assess the communication skills of science is to use the Expert-Notice Dialog (END) method developed by [1]. The END method focuses on verbal explanations with the use of graphics or images as a tool [1]. Experts referred to this END method is the student giving the information and notice is the student as the recipient of the information. The END method can be used in assessing the expert’s communication skills of learning time by using peer tutoring method. Peer tutoring is one of cooperative learning methods, by pairing students who have asymmetric relationships in order to share, work together to achieve the goals set by teachers [4]. Peer tutor is a learning strategy in which a competent student is provided with minimal training and guidance in learning skills or concepts to his peers. In peer tutoring students are divided into groups and students learn by assisted by one of them who acts as tutor (expert) [5].

Peer is a group of people or students who have the same age and ability [6]. Learning activities with peer tutoring methods have been frequently implemented in the classroom, but so far not been assessed the ability of science communication tutor (expert). In this study, an expert judgment was conducted based on the assessment of the END method. The science communication skills assessed are focused on oral communication skills.

Method END has indicators in its assessment, this indicator developed by Merten (1995) and Rusch (1999) in [1]. END method indicators include: 1) cognitive categories that include give examples, using graphics, create graphics, linking graphics, varying models when explaining, varying abstraction levels and using understandable languages, 2) Content knowledge, including providing concise, clear and precise answer, and 3) Volitional change, including non-interruption when notice speech, confirming understanding, giving direct directions to the notice, asking for prior knowledge, asking for needs, preparing for introduction, investigating prior knowledge and introducing topics. The overall indicators assessed amounted to 15 indicators.

The concept chosen in this study is ecosystem with sub concept of environmental damage and classification of plants in Senior High School. This material is chosen because the information is interesting and many examples are used related to daily life so that the notice is expected to be enthusiastic in receiving information.

Based on that background then the research question on this research is: 1). How are students' science communication skills assessed by the END method? 2). How to master concept the notice after done END method? And 3) How is the notice response to the implementation of END?

2. Methods
The research method used is descriptive. The study was conducted in two high schools located in Bandung Indonesia with each sample of 1 class from each school (A and B). The sample was selected by cluster random sampling technique. In each class student are selected to be the expert, ie students who have the highest biological ability in the classroom. In class A selected 8 students become the expert and 24 students become the notice. Students are divided into 8 groups, each group consisting of 3 the notice and 1 the expert, so each group consists of 4 students. In the class B selected 7 the expert and 30 the notice. Class B students are divided into 7 groups with each group of 4-5 student. Each the expert in each group describes ecosystem material (environmental damage) to the nitive in class A and classification materials of Angiospermae plants in class B verbally with the help of graphics and images.

Instruments used in this study include: rubric science communication skills, science communication skills observation sheets, concept tests for notice and questionnaires for notice. Implementation of the study recorded with a video camera then transcribed based on rubric science communication skills. Indicators assessed for scientific communication skills consist of 15 indicators adapted from [1].

Observation sheets are used by observers to assess students' science communication skills at learning. The indicator used on the observation sheet consists of 6 indicators. The choice of 6 indicators is based on Kulgemeyer & Schecker's opinion, which states that the explanations of good quality category if there are six indicators emerged, the six indicators are: preparing introduction, making and using graphics, giving direct direction, stating prior knowledge, providing answers concise, clear and precise answer and give examples.
The concept test given on the notice aims to identify the notice understanding of the material described by the expert. In class A the 20 test questions consist of 15 multiple choices and 5 essays. In class B test questions amounted to 28 consisting of 25 multiple choices and 3 essays. The previous test instrument was tested and calculated the degree of difficulty, distinguishing power, validity and reliability. Questionnaire notice is used to obtain data about the notice response to expert performance.

The rubric analysis of students’ science communication skill in the form of rubric of video analysis and observation sheet based on END is done as follows:

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R \quad \frac{\% X = \text{---} \times 100\%}{\text{SM}}
\]

Description : \( \% X = \) percent value searched
\( R = \) number of indicators based on assessment results
\( \text{SM} = \) maximum score of assessment criteria

The categories of communication skills are listed in Table 1.

### Table 1. Categories of Communication Skill

| Percentage         | Category   |
|--------------------|------------|
| 86% - 100%         | Very good  |
| 76% - 85%          | Good       |
| 60% - 75%          | Enough     |
| 46% - 59%          | Poor       |
| \( \leq 45\% \)    | Very poor  |

3. Result and Discussion

3.1. Student Science Communication Skills Through Expert-Notice Dialogue

Data of communication ability were analyzed from learning video recording transcripts with END method, then the communication ability was categorized pursuant to Purwanto [7]. Indicator of science communication ability adapted from [1] with number of 15 indicators. In addition to the scientific communication skills gained from the transcript of video recordings, observations were also made at the time of learning with focus on 6 indicators. Table 3.1. describes students’ science communication skills (Expert) in class A and class B based on video analysis. The number of experts in class A of 8 students and in class B as many as 7 students.

### Table 2. The Expert science communication skills in Class A and Class B based Video Analysis

| No | Indicator                        | A                  | Class | B                   | Assess-ment Category |
|----|----------------------------------|--------------------|-------|---------------------|----------------------|
|    |                                  | Number of experts that generate indicators | Percentage (%) | Assessment category | Number of experts that generate indicators | Percentage (%) | Assess-ment Category |
| 1. | Give examples                    | 8                  | 100   | Very good           | 6                    | 86                  | Very good           |
| 2. | Using and create graphics/picture| 8                  | 100   | Very good           | 4                    | 57                  | Poor                |
| 3. | Linking graphs                   | 4                  | 50    | Poor                | 2                    | 28                  | Very poor           |
| 4. | Varying models when explaining   | 3                  | 37.5  | Poor                | 3                    | 43                  | Very poor           |
Table 2 shows that the expert science communication skills in Class A and class B are different. The ability using and create graphics/picture, confirming understanding and preparing the introduction in class A is better than in class B. Conversely, the ability to ask prior Knowledge and investigate prior knowledge at the beginning of explanations in class B is better than class A. This is possible because the material delivered by the expert in class A and B are different. Difficulties and complexity of the material affect the expert's ability to explain it. In this study the concept of Angiospermae plant classification is considered more difficult than Ecosystem concept, because the expert must explain about the plant phenetic which is considered relatively new for high school level. In college students are more interested in studying the kinship of living things with phenetics [8]. In other indicators, there are generally similar skills of communication skill between class A and class B. Although there is a difference of expert skill in communicating science, but the average value obtained by the expert is in enough category in both classes (60.0% class A and 61.8% class B).

In addition to the communication skills of the transcribed video, there is also an observation of learning by focusing on six indicators. These six indicators determine the quality of the expert explanations, if these six indicators appear, it is certain that the quality of the expert explanations is categorized good. The result of the observation analysis is shown in Figure 1.
Figure 1. Result of Class A and Class B Observation Analysis (%)

Description: 1. Give examples
2. Using and create graphics/picture
3. Provide concise answers, clear and precise
4. Confirm understanding
5. Giving direct direction to the notice
6. Prepare the introduction

Figure 1 shows that there is a similarity in scientific communication skills derived from video transcript analysis and observational analysis results during learning in both classes. In class A the indicator gives examples, using and create graphics/picture and preparing the introduction are in very good category (86% -100%). In class A very good category indicator is an indicator to give examples and giving direct direction to the notice. In both classes the expert's ability is very good. Giving an example and an analogy when explaining are very important, as it maximizes understanding and memory [9].

Indicators providing concise, clear and precise answers in class A show very poor category. This is because the notice is less active in asking questions, so the expert does not bring up this indicator. Indicators whose category is very poor in class B is an indicator of preparing the introduction. Only 2 of the 7 the expert have this indicator. The expert capable of preparing the introduction are characterized by the expert planning skills in considering the notice characteristics. With an introduction that has relevance to everyday life the process of giving explanation from the expert becomes more interesting because it makes it easier to the notice in receiving information.

3.2. Mastery of the Notice Concept After Learning With The Expert The -Notice Dialog Method

After the notice receives an explanation from the expert, the notice is given a concept mastery test in order to know the mastery of the notice concept after being given an explanation by the END method. From the results of concept mastering tests can be seen the tendency of the relationship between the science communication skills of each the expert with the score of concept mastery the notice in the group where the expert gives an explanation. The results of mastering the concept of the notice on class A and class B are listed in Table 3.2.

| No. | Expert | Class A | Class B |
|-----|--------|---------|---------|
|     | The Notice | The Notice | The Notice | The Notice |
|     | Score | Average | Score | Average |
| 1.  | 1 | 65.70 | 1 | .9750 |
|     | 2 | 74.28 | 2 | 97.50 |
|     | 3 | 82.85 | 3 | 95.00 |
|     | 4 | 95.00 | 4 | |
| 2.  | 1 | 91.42 | 1 | 97.50 |
|     | 2 | 91.40 | 2 | 90.00 |
|     | 3 | 83.79 | 3 | 96.00 |
|     | 4 | 100.00 | 4 | |
Table 3 shows the number of the notices in class A with score upper than the Standard Minimum Score (SMS) 75. The number of students with scores upper SMS is 19 students out of 24 notice, which means that 79.1% the notice has a score upper SMS and is good category [7]. While in class B 100% the notice has score upper 75 and included very good category (average 94.6). Its shows that the explanation of the expert has a good impact on the mastery of the notice concept.

The results of the questionnaire analysis support the concept mastery of the notice data. In both of the classes the notice stated that the expert’s explanation helps the notice to understanding the concept (83.3% in class A and 100% in class B).

### 4. Conclusion

Based on the result of the research, it can be concluded that: students' science communication skill with expert-notice dialog method shows average value of 60% in class A and 61.8% in class B and included enough category. The notice’s mastery of concept is in good category in class A with average score 79.1 and very good category in class B with average score 94.6. Through the questionnaire notice it is known that expert explanation helps notice in understanding the concept (83.3% in class A and 100% in class B).

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