Profile of science communication competence of junior high school students on science lesson

T Hermawansyah¹*, T Rahman² and S Anwar³

¹ Program Studi Pendidikan IPA, Sekolah Pascasarjana, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia
² Departemen Pendidikan Biologi, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia
³ Departemen Pendidikan Kimia, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia

*tentenhermawansyah@student.upi.edu

Abstract. Communication skills are important part of the curriculum and education programs. This study aims to describe science communication competence of a junior high school student in Cianjur. This research uses a descriptive method. The data analyzed quantitatively and presented in percentage. The result of students’ science communication competence test is low. Addressee-oriented communication competency reaches 44.97% and Subject-adequate communication reaches 19.85%. Overall students’ science communication competence is very low. There needs to be an improvement over it. One of the factors that cause the result is the lack of learning activities and teaching materials content that oriented to science communication. Researchers recommend improvements to learning activities and teaching materials that oriented to science communication competence.

1. Introduction
Communication skills are important part of the curriculum and education programs in different countries [1]. Communication in science is necessary. The credibility of science and science communication are interdependent [2]. Science communication competencies enable students to participate in decision-making processes and may engage more effectively in cooperative learning [3]. Nonetheless science education and science communication has little connection [4]. Related fields such as argumentation or explanation have been extensively studied, but the studies have not yet comprehensively supported the idea of science communication [5].

Science communication refers to the dialogue of scientists with the public in making decisions [4]. Nonetheless students do not communicate to the public in decision-making related to science. In the context of science education in schools, students’ science communication competencies are concerned with explaining science content that is oriented towards the subject of knowledge and recipients [6].

Kulgemeyer and Schecker [3] proposed four aspects of science communication. These aspects are factual content, context, code and representation form. Factual content relates to selected science topics communicator choose to communicate. Examples of factual content such as concept of white light dispersion into multiple spectral color. Context relates to the science phenomenon in life. As for example, explaining the concept of dispersion through the context of the rainbow. Code is an aspect
related of language selection. Communicators may choose to explain in scientific language or in everyday language. Aspect of representation tool is the ability of communicators in choosing the appropriate representation tool. Examples of representation tools such as images, maps, photos, diagrams, tables and so on.

The success of science communication needs to be oriented towards the recipient and the subject matter is adequate. Kulgemeyer [3] divides scientific communication into two perspectives, there are addressee-oriented communication and subject-adequate communication. During the communication process, researcher should try to meet the assumed needs of the audience (addressee-oriented communication) and follow the factual content structure (subject-adequate communication) [5]. The ability to balance them is very important [6]. There is not much information about students’ science communication competence that focus on addressee-oriented communication and subject-adequate communication.

Based on those findings, there is a need to conduct a research to determine the profile of students’ science communication competence. The aim of the study is to get the picture of students’ science communication competence. The results of the study can be used as the guidelines in selecting suitable model or strategy in the implementation of science communication competence into science education.

2. Method
The method used in this research is descriptive method. Student's science communication competence measured through written test of science communication competence test [7]. The results are presented in percentage form and analyzed descriptively. The participants are students of SMPN 2 Karangtengah Cianjur in the academic year of 2017/2018 from the age of 13-15 years. The number of participants was 88 students. There are no specific criteria in the selection of participants.

The main instruments used in this research were written test item Science Communication Competence Test. Interviews and observations were used as additional source of information in the study. The instrument of science communication competence pay attention to the aspect and perspective of science communication competence. The indicators of Science Communication Competence Test are described in Table 1.

| Table 1. Indicator of each aspect and perspective of science communication competence test. |

|                          | Addressee Oriented Communication | Subject Adequate Communication |
|--------------------------|----------------------------------|-------------------------------|
| Context                  | TW1                              | -                             |
| Code                     | E2, TW2                          | E3, ED4                       |
| Representation           | ED1                              | ED5, E4                       |
| Content                  | TW6                              | TW 7                          |

As indicators of addressee-oriented communication perspective, students should be able to reflect on the subject matter in a context appropriate to the audience, students should consider the use of language, representational tools and factual content appropriate for the recipient. Indicators for the subject-adequate communication perspective, students should consider the correct use of language, representation tools and factual content in relation to adequate presentation [3].

Kulgemeyer [7] develops a science communication competence assessment that pay attention to the aspects and perspective science communication competence. The instrument can be used to measure students' science communication competencies. Example of the test item can be seen by Figure 1.

Figure 1 shows an example of a science communication competence test item. This item test is addressee-oriented communication perspective test item. This test item connects different scientific background articles to different recipients. The articles are describing different context of heat transfer. The full instrument test available in English [7].
3. Result and discussion
The result shows profile of student science communication competence. Overall, student’s science communication competence is low. The reason and suggestion will be explained. Table 2 shows the result.

Table 2. Profile of students’ science communication competence.

|                          | Addressee-Oriented Communication | Subject-Adequate Communication |
|--------------------------|----------------------------------|--------------------------------|
| Context                  | 70.08 %                          | -                              |
| Code                     | 51.70 %                          | 50.45 %                        |
| Representation form      | 28.79 %                          | 2.27 %                         |
| Factual content          | 49.32 %                          | 6.82 %                         |
| Mean                     | 49.97 %                          | 19.85 %                        |

The test results showed that the students' science communication competency is low. The average science communication in the perspective of addressee-oriented communication only reached 49.97%. This achievement is certainly very low. It shows that students are not good in science communication competence to the needs of the recipient. Similarly, subject-adequate communication which only reached the results of 19.85%. Students have not been able to communicate scientifically well and in accordance with the material presented. Subject-adequate communication students are lower than addressee-oriented communication. The ability to balance them is very important [6].

Findings from observation show that science learning in classroom has not supported science communication to develop. Science communication competencies enable students to participate in decision-making processes and may engage more effectively in cooperative learning methods [6]. In addition, existing teaching materials are inadequate to develop science communication either. Textbooks are one of the most popular printed materials graphically used for communication and sharing of
scientific ideas [8]. The implication for science education is that we may need to teach students to identify the embedded frames in the text and to switch between them if they want to understand what the text is trying to communicate [4].

Based on the table, the results of science communication aspects of the context with the addressee-oriented communication perspective showed a fairly good result (70.08%). Based on this result, junior high school students are good enough to understand the suitability of science communication context. Context related to the target audience is an essential aspect and there are no need separation indicators of perspective because every context needs to include facts [3].

Aspect of representation form is lowest competence. Representation form is often considered an efficient and effective way to introduce and illustrate abstract concepts [9]. Thinking with images plays a central role in scientific and communication creativity but is neglected in the science classroom [10].

Other aspects such as code and factual content aspects are also low. Contents knowledge is very important in scientific communication even it is the basis of communication [6]. The more turgid, dense, abstract science language presents its own challenges for students [11]. A novice in science may require everyday language to approach a particular fact [6].

4. Conclusion

Student’s science communication competence is still very low. There needs to be an improvement on the students' science competence in all aspects and perspectives of science communication competence. Learning on the classroom and teaching materials are expected to support the improvement of science communication.

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