Profile of the prospective teachers response to the development of scientific communication skills through physics learning

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Abstract. This article discusses the profiles of prospective physics teacher responses to the development of scientific communication skills through physics learning. Data were collected using questionnaires and interviews to strengthen the data obtained through questionnaires, data were analyzed descriptively. The results show that prospective physics teachers who have already joined the Teaching practice/Field Experience Program 2 (FEP 2) or who are currently following FEP 1, generally argue that the development of scientific communication skills can be conducted through subject matter learning, especially physics learning. Some prospective teachers give an anomalous response to some statements on the questionnaire, for example they agreed on the statement that the source of physics learning is sufficient from teacher's explanation, students do not need to read textbooks, not yet need to read scientific articles and scientific reports. Based on these findings prospective physics teachers should need to develop their’s good understanding of the aspects to be learned in developing scientific communication skills, as well as their ability in transferring or developing scientific communication skill integrated within physics learning need to be assessed.

1. Introduction
Communication skills are one of the essential skills for students to learn [1], because communication skills are one of the most important factors for problem solving [2]. Communication is the essence of science, so scientists should have communication skills as essential skills or basic skills to communicate their findings and ideas [3]. Thus it is necessary to learn effective communication skills so that students can convey information successfully from one person to another, even the quality of life is directly related to the quality of communication, and Effective communication is the key to success in life [1]. Successful people in the world are those who master the art of communication well [4]. Assessment and teaching of twenty-first century skills project (ATC21S) and Partnership for 21st Century Skills, place communication skills as one of the 21st century skills, as well as one of the competency [5,6].

Educational literacy research shows that different disciplines have a specific way of communication that needs to be mastered by students in order to succeed in the disciplines they studied [7], the research indicates that each of the disciplines has a distinctive way of communication according to the
characteristics of each discipline. In science learning, the type of communication that students need to master in order to succeed in their learning is a type of scientific communication. Scientific communication consists of several components, namely, (a) information retrieval, (b) scientific reading, (c) listening and observing, (d) scientific writing, (e) information representation, and (f) knowledge presentation [8]. Scientific communication skills are very important learned to students who study science, because these skills will help students to solve problems in science. One of the uses of sub-communication skills in solving physics problems is representing information in a problem, for example changing sentences information into a diagram or picture.

![A car with a speed of 15 m/s move to block up to speed 5 m/s. What is the average acceleration of the car?](image)

**Figure 1.** Example use of representational communication skills for problem solving.

The skill of scientific communication is one of the 21st century skills, learning of these skills is done in an integrated manner with subject matter learning [8-13], and thus the teacher must have a good ability to teach skill, including communication skills. Skills are part of the content knowledge that students must learn, content knowledge includes, knowledge (i), understanding (ii), skills (iii) and disposition (iv) [14]. Teachers should master the content knowledge where skills and pedagogy are included, then pack the content knowledge with pedagogical knowledge on specific content knowledge so that the content knowledge becomes “teachable” and “accessible” which are called Pedagogical Content Knowledge (PCK) by Shulman (1986). PCK should be provided to prospective teachers to become professional teachers, a study at a college in South Sumatera Province, Indonesia shows the low understanding of prospective physics teacher on some components of PCK, such as the ability of the teacher to respond to the wrong student answers [15], this indicates the lack of communication skills of prospective teachers in guiding students.

2. Method
The research was conducted at one of the College of Teacher Training and Education (STKIP) in South Sumatera Province, involving 36 respondents, namely prospective physics teachers. About 20 students who have joint the Field Experience Program (FEP) 2 and 16 students who are following the Program Experience Field (FEP) 1 were involved as participants. Students who have attended FEP 2 are students who have completed FEP 1 and teaching practice for 2 (two) months. While in FEP 1 students have joint the activity in peer teaching and micro teaching. So it is assumed that they have sufficient understanding of the learning practices that should be held by a prospective teacher. Respondents were asked to provide information on how their understanding of the importance of learning communication skills which integrated with the learning of physics. Data were collected through the use of questionnaire.

Questionnaire consists of 18 statements about learning scientific communication skills that are integrated with the subject matter of physics. The options provided in the questionnaire consisted of strongly agree, agree, disagree and strongly disagree. Scoring using a likert scale of 4 points. A score of 4 is given in the strongly agree option for a positive statement and strongly disagree for a negative statement. Score 3 is given on the option of agreeing to a positive statement and not agreeing to a negative statement. Score 2 is given on the option of disagreeing for a positive statement and agreeing
to a negative statement. As well as score 1 given on the option strongly disagree for a positive statement and strongly agree to a negative statement.

Data analysis was done descriptively by exposing the research findings. The data derived from the questionnaire were quantified and calculated the average score of responses given by the prospective teachers to the statement and presented in percentage form.

3. Result and discussion

3.1. Student’s response to development of scientific communication skills through physics learning

The response of prospective physics teacher students about learning scientific communication skill is revealed through questionnaire. The questionnaire was distributed to prospective teacher students then analyzed to reveal how the opinion of prospective teacher students to teach communication skills to students through physics learning. Research result shows that in general of prospective teachers argue that learning communication skill is important through learning of physics material. This can be seen from the average score of responses given by the students in the dispersed questionnaire is at grade 58.22 from a maximum score of 72 or 80.86% in the percentage score.

Some prospective physics teachers gave anomaly response to the questionnaire statement including the first statement on the questionnaire that “sources of information to acquire knowledge in physics learning is sufficient from the explanations of teachers and textbooks”, there are 22.22% prospective teachers stated strongly agree with this statement and 30.56% prospective teachers agreed, this anomalous response provides information on the misunderstanding of prospective teachers, that the source of learning is sufficient from the explanations of teachers and textbooks only, merely 47.22% prospective teachers declared disagreement which means they realized that the source of learning comes not only from the explanations of teachers and textbooks, there is not even a prospective teacher who states strongly disagree. Though so many other learning resources that can be utilized by students to obtain information related to the subject matter being studied, such as online learning resources (internet), learning videos, learning games, experts and others that should be understood by prospective teachers as sources of information that supports learning done.

The prospective teacher’s response to the statement number 3 “students have not been able to understand scientific reports such as research reports, so students are not yet time to read scientific reports” shows that some prospective students consider scientific reports not important for students to read them, whereas scientific reports are an important source of knowledge, especially in the fields of science, recent scientific reports provide the latest information on the development of science, so reading scientific reports relevant to the field of science being studied becomes very important. Prospective teacher’s student who agreed to this statement as many as 36.11%. More surprising again, all the students who agree with this statement are prospective teacher student who has completed FEP 2, while the prospective teachers who are still joining FEP 1 and not yet joint FEP 2, no one agrees with this statement.

Another anomaly finding is in the sixth statement “students do not need to read physics textbooks because it is difficult to understand, students simply read physics books that are easily available on the market only”, where 11.11% prospective teachers student stated strongly agree and 27.78% students agreed, that means 38.89% of prospective teachers do not understand that the main source of information relevant to the subject matter is the textbook, physics books sold on the market have been partially reduced so that the information obtained is incomplete as contained in textbooks, even physics books published by Centre of Curriculum and Textbook (Puskurbuk) still there is a fallacy of the concept [16]. In addition to the above three statements, there are still other statements that prospective teacher student responded to anomalously although the percentage is small, namely statement number 7 “developing scientific communication skills can be done through observation” there are 13.89% students who disagree, statement number 10 “Write a summary of the material under study including developing communication skills” there are 13.89% of students who disagree, statement number 11 “writing reports of experimental activities should be undertaken to train in developing communication skills” there are 5.56% who disagree, and statement number 12 “students need to be trained to write essays in order to develop communication skills” there are 8.33% of students who disagree.
Statements about the development of communication skills through knowledge representation responded positively by the students, it means through the ability of representation as the ability to transform an information into another form, is one of the factors that can develop communication skills. According to the student the ability of representation is often used in solving physics problems, problem of physics often cannot be answered if the information problem is not represented in advance in the form of drawings or sketch, so this factor is very potential to develop communication skills through the learning of physics.

3.2. Comparison of student responses that have been completed FEP 2 and who are following FEP 1 towards the development of scientific communication skills

Based on data obtained from questionnaires on prospective physics teachers who have completed FEP 2 and who are following FEP 1 obtained the view that both groups of prospective teachers on average gave the same response to the questionnaire about learning scientific communication skills through physics learning. This shows that both groups of students have the same view that the development of scientific communication skills is very possible to be done on the learning of physics.

![Figure 2](image1.png)

**Figure 2.** Graph comparison of scores and percentage of student response scores, between completed FEP 2 and ongoing FEP 1 to the learning of scientific communication skills through physics learning.

The average score obtained by the group of prospective teachers who have completed the following FEP 2 is 58.20 or 80.83%, while the average score of students who are following FEP 1 is 58.25 or 80.90%. Comparison of scores and scores percentage of prospective teacher student response who have followed FEP 2 with those following FEP 1 to the development of scientific communication skills through the study of physics seen in Figure 2. Although on average the response scores of both groups of students showed no difference, but some questions on the questionnaire were responded differently by both groups, especially on statements that are anomalously responded.

![Figure 3](image2.png)

**Figure 3.** Chart of anomaly response comparison between students who have completed FEP2 and who are following FEP1.
In figure 3. Statements of number 1, 5 and 6 are negative mapping, prospective teacher students should not choose SA or A, but some prospective teachers choose SA and A on this statement. While number 7, 10, 11 and 12 are positive statements of prospective teachers should nobody choose the option D and SD. The graph above shows that students who has been completed FEP 2 are more likely to respond to anomalies compared with the group of students who are currently ongoing FEP 1 in statements 1, 5 and 6. While statements number 7, 10, 11 and 12 anomaly responses actually found in students who are currently ongoing FEP 1. Based on clarifications with prospective teachers who has been completed FEP 2 on their anomalous responses to statements 1, 5 and 6, they said because generally the material of physics is difficult to understand without any explanation from the teacher, so the teacher's explanation is considered enough without reading the textbook, in addition to difficulty obtaining it, textbooks are also difficult to understand without the help of teacher explanations. Physical books sold on the market are easier to obtain and understand.

Responses to the questionnaire statement were dominant anomaly in the group of students who were following the FEP 1 number 7, 10, 11 and 12 occurs because students consider that observation is not something that can improve communication, prospective teachers assume that observation only uses the eye senses, whereas communication is necessary with oral or written. Students have not realized that with observation they will understand a phenomenon and will easily convey it to others. Some of the students also stated that make a summary of the material, writing reports and writing essays are very difficult things. Therefore, if associated with the development of scientific communication skills it will be difficult to develop through this activity.

Based on research findings, it is very urgent to improve professional skills such as teach scientific communication skills to prospective teachers whether the exercise or the application aspects of communication skills through the learning of physics. Assessment needs to be done to ensure student capability whether it has sufficient ability to teach the development of scientific communication skills through physics learning when students are following FEP 1 and FEP 2.

4. Conclusion
Prospective physics teachers who became the participant of this research generally agree that the development of scientific communication skill is done integrally within subject matter, especially can be developed through the learning of physics. Some students’ responses to the anomaly questionnaire statement indicate due to the students’ perceptions of the learning conditions they experienced while performing FEP 2. Meanwhile students usually achieve the material physics only from the explanation from the lecturer without the need to read textbooks that is quite difficult to obtain, understanding of textbooks by students is also quite difficult if not assisted by explanation from the lecturer.

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