Profile of pre-service physics teachers’ decision-making skills related to electric circuit

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Abstract. Higher education is a process of developing human resources that master various skills needed to meet the challenges of the 21st century. One of the important skills to have in order to compete in facing the challenges of the 21st century is the decision-making skills. This study aims at describing the profile of pre-service physics teachers’ decision-making skills related to electric circuit. This research is a descriptive research conducted in the physics education program at one of the private universities in Jakarta. Data collection is done through the test of decision-making skills related to electric circuit. The collected data is analyzed quantitatively. The results showed that 0% of students were in the category of high decision-making skills, 20% on moderate decision-making skills, and 80% on low decision-making skills. Thus, the decision-making skills of pre-service physics teachers still belong to low category.

1. Introduction
Higher education is a place where the students are prepared to live their life in the future. It cannot be denied that in the 21st century, people are facing more challenges, both external and internal challenges. Therefore, it is considered crucial to prepare the students to face those external and internal challenges. The external challenges that might be appeared are in the form of globalization era with the enactment of the ASEAN Economic Community, environmental issues, advances in information technology, convergence of science and technology, knowledge-based economy, the rise of the creative and cultural industries, shifting of world economic power, influence and impact of techno-science, quality of investment and transformation in the education sector. Those external challenges require the college graduates to possess good communication skill, critical thinking, and problem solving ability. They are also demanded to become responsible citizens, to try to be tolerant and to be able to accept different views from the others so they are ready to survive in a globalized society. All of those qualities can be achieved if the students are prepared to develop their intelligence, talent, interest, and their working readiness. Beside the external challenges, the students also face challenges coming from internal side such as rapid population growth, depletion of natural resources, the energy crisis and many more.

Kerangka Kualifikasi Nasional Indonesia (KKNI) has been enacted by the Government of the Republic of Indonesia by involving all levels of higher education. KKNI is the framework of Indonesia's human resource qualification that matches, equalizes and integrates the education sector with the training sector and work experience in a work capability recognition scheme which is tailored to the
structure in various job sectors. KKNI is a manifestation of the quality and the identity of the Indonesian nation in relation to the national education system, the national job training system, and the national learning outcomes evaluation system owned by Indonesia in order to produce qualified and productive national human resources.

Higher education is expected to be able to develop human resources that master the skills needed to compete in facing the challenges of the 21st century. The curriculum of the study program should be built with reference to the KKNI, so the graduates can have the various skills required. Mastering various skills is such a guarantee for the students to be able to succeed in the 21st century. One of the most important skills to be trained and developed for students to be able to survive in the 21st century is decision-making skills [1]. One of the learning objectives of the Physics Education program at the sample university stated that Physics Education program graduates are required to be able to apply decision-making skill. This skill involves high-order thinking skill inside it. The decision-making skill becomes an essential part of thinking construction theory. The learning to think is important because [2] thinking is necessary to develop attitudes and perceptions that support the creation of positive class conditions, to acquire and integrate knowledge, to broaden knowledge horizons, to actualize the meaningfulness of knowledge, and to develop a favorable thinking behavior. In addition, decision-making skill can be utilized by their students when they live around the community. Thus, this skill is very important to be trained and developed in the learning process in higher education. This study aims at describing the profile of pre-service physics teachers’ decision-making skills related to electric circuit.

2. Method
This research is a descriptive research conducted at Physics Education Study Program in one of the private universities in Jakarta. The research subject was the 4th semester students consisting of 20 students. Figure 1 shows that the instrument used was the test of decision-making skills in the form of essay related to electric circuit. Data collection was done through decision-making skills test, and the data collected were analyzed quantitatively and were then described.

![Example of test instrument of decision-making skill](image)

Figure 1: Example of test instrument of decision-making skill.

The result of students’ decision-making skill test was assessed by using a scoring rubric. Table 1 shows that scoring rubric for the result of student decision-making skill test consisted of indicator and score.
Table 1. The scoring rubric of the student’s decision-making skill.

| Indicator                          | Score |
|-----------------------------------|-------|
| Appropriate decision with adequate reason | 2     |
| Appropriate decision with inadequate reason | 1     |
| Inappropriate decision             | 0     |

3. Result and discussion

The result of data analysis in table 2 shows that students’ decision-making skill is still in low category. Based on the analysis of the students’ answers, it was found that low decision-making skill was caused by the inability of the students to integrate knowledge gained in physics classroom with the real problems. In fact, the knowledge of science is used and influential in decision making [3,4,5]. Yet, students have difficulty in integrating knowledge gained in science with real-world problems [6].

Table 2. Percentage of students by category decision-making skills.

| Category of Decision-making Skill | Average Score of Decision-making Skill | % Number of Students |
|-----------------------------------|---------------------------------------|----------------------|
| Low                               | 0 ≤ x ≤ 0.5                           | 80 %                 |
| Moderate                          | 0.6 ≤ x ≤ 1.5                         | 20 %                 |
| High                              | 1.6 ≤ x ≤ 2                           | 0 %                  |

The low student decision-making skill is also due to the mistake in selecting the decision-making steps used. The use of good decision-making measures is influential in the selection of the best decision [7,8]. Based on the analysis of the students’ answers, it was found that the students only thought about the advantages of selected alternatives and did not think about the consequences or weaknesses of the chosen alternative. In addition, the students did not think about what their goal really is.

Decision-making is a process of thinking in the form of selection of the best alternative out of several other alternatives that are done systematically to be used as a solution of the problems encountered. Uncertainty in thought can limit the appreciation of different choices and implications. Most of the errors done in decision making are due to deciding the first thing that came to mind without taking time to think about other alternatives, to consider the consequences or weaknesses of the various sets of actions, and to seriously consider meaningful effort [9,10].

Decision-making has a number of systematic strategies, methods or approaches. Those are said to be systematic because decision-making involves several clear steps in solving a problem. The decision-making procedure serves as a guide for students so they can consider issues and problems from different perspectives. The clarity of the step makes decisions both orderly and directed, which means that the activity is always directed to produce solutions and actions that are firmly for the achievement of goals [11].

There are seven steps that are generally used in making a decision. The seven-step decision-making process has been used at the university level and has become a very useful tool in supporting students’ decision-making because of its clarity, simplicity, and widespread application to problems [12]. The seven steps of the decision-making process are as follows: first, identify the problem: what is the core of the problem you see?; second, find the options: what are the options? (providing possible solutions to this problem); third, set the criteria: how do you choose between these options? (explaining important considerations and what is valued in a result); fourth, search for information: do you have enough information about each option to evaluate based on your criteria? What scientific evidence is involved in this problem? What additional information do you need to help you make a decision?; fifth, make an analysis: discuss each option considered by criteria. What is the risk of each choice?; sixth, decide a choice: Which option do you choose? and seventh, make a review: what do you think of the decision you made? How do you improve the way you make decisions?

The challenges that the students usually encounter in decision-making process is to evaluate the advantages and disadvantages of alternatives and to raise the choice [13], less specificity when
considering options [14,15,16]. In addition, students also find it challenging to emphasize value on cost, seek additional scientific information, and find different options [17,18,19].

The fact that the students did not use good decision-making strategies or still make mistakes in decision-making that later impacted on low decision-making skills can be caused by the absence of decision-making training. Training on how to use good decision-making steps will help the students develop their decision-making competencies [20]. The debriefing orientation of decision-making training is incorporated into the instruction of the designed and planned lesson [9]. The subjects that play a role in developing decision-making skills in addition to assisting in understanding content are science subjects [21,22]. In the meantime, the planned instruction is that which involves students in decision making. The learning that does not involve students in decision making leads to low decision-making skills [23].

4. Conclusions
Pre-service physics teachers’ decision-making skills related to electric circuit are mostly categorized as low, some students perform moderate skill level, and no student has high skills. Thus, it is recommended to the next researcher to develop a learning program that can train the pre-service physics teachers’ decision-making skills.

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