A Study of Preservice Science Teachers' Articles: What do They Think the Educational Goal in SDGs should be Focused on?

Aris Rudi Purnomo 1*, Hasan Subekti2, Muhamad Arif Mahdiannur3

1,2,3Department of Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, Indonesia

Abstract. This study aimed at mapping scientific ideas and conceptual knowledge and expectation of the preservice science teachers (PSTs) towards educational research in SDGs context. Analysis of PSTs' articles and structured interview were performed to gather the information from 13 participants involved in this research. The data were analysed descriptively with the aid of NVivo 12 plus software. Three dimensions of analysis were carried out consisting of the definition, the importance, and the expectation of SDGs. The results indicate that PSTs put their ideas mostly on learning media, learning model, infrastructure, and teacher competencies. In terms of conceptual knowledge of SDGs, PSTs view SDGs as a set of continuous improvement of resources that should accommodate student skills, technology, knowledge, attitude, resources, research, and equality for creating quality education. These were gained after the PST involved in certain activities of teaching practices and managing references to accomplish their manuscript during Science, Environment, Technology, and Society (SETS) course. As a result, the degree of understanding is inherently related to the educational problems in which they were engaged to initiate solutions.

Keywords: SDGs, Quality Education, teaching-learning process, SETS.

1 Introduction

The educational institutions have put their efforts forward to implant Sustainable Development Goals (SDGs) into their teaching and learning practices [1]–[3]. For instance, Grindsted and Nielsen (2021) implement SDGs in the study of Geography within which students learn to capture the interaction humans and spaces and eventually realize it producing sustainability. The other implementation of SDGs is carried out within laboratory activities and projects to conserve energy and minimizing waste production [5]; hence, it impacts on students’ attitudes and competencies such as critical thinking and commitment [6] to save the world. In this sense, these practices perceived SDGs to be the ultimate factor to elevate students’ awareness of sustainability in their ecological relationship which accommodates both social and natural aspects.

In developing countries, such as Indonesia, achieving such a long-term vision is highly challenging though. One of the problems is dealing with the improvement over the standardized education as it is also stated in the SDGs [5], [7]. The inequality of infrastructure, persistent conflict and poverty reduce public participation towards school attendance and motivation to learn [8]. The study conducted by [9] revealed that limited access to education has placed practices of child marriage on alert which eventually gives domino effect on students becoming unsafe to pursue their study and produces social problems. The other found that by not looking at how students are treated to literally understand SDGs using appropriate curricula and more specific courses, they will not develop their potentials [5], [10], [11] such as critical thinking, communication, collaboration, and creativity [8], [11]. Besides, rapid changes of global needs have urged curriculum to be more flexible. However, educational practitioners and teachers are yet to be prepared.

To minimize the above problems, one of the possible solutions that universities can take part is that they must prepare and equip preservice science teachers (PTTs) to develop learning tools and convey adaptive learning models to the current situation where fulfillment of student need is more dynamic. To accommodate this plan, Indonesia has designed a curriculum called Kurikulum Merdeka Belajar that enables PSTs to strengthen their competencies through learning programs outside campuses such as kampus mengajar, apprenticeship in schools, assistance in research, teaching assistance in schools, humanitarian projects, entrepreneurship, independent projects, and thematic real work college. By participating in such cross-sectional activities, research conducted by [12] revealed that PSTs show enthusiasm and hard working due to real-life situation and support from colleagues. As an

* Corresponding author : arispurnomo@unesa.ac.id
inevitable result, transfer of knowledge and experience come with ease [13].

Besides above strategy, universities which focus on teacher training nowadays already provide courses, either integrated or not, close to daily life problems, such as biotechnology and SETS. These courses can stimulate PSTs to innovate the learning products [14] which are essential to solve societal problems as recommended in SDGs, and therefore affect PSTs' competencies and attitudes towards learning science. This study positions itself to explore the expectation of PSTs towards SDGs in Education through their work and ideas after following the program outside campuses and taking courses of integrated science. It is important to take this study as a preliminary study before implementing further research concerning curriculum that involves not only quality education but also the other goals such as good health and well-being, clean water and sanitation, and zero hunger. This integration functions to see the connection of one goal to the others. This research the asks about the extent to which PSTs know about SDGs and what educational practices can be used to convey SDGs in terms of quality education.

2 Method

This study involved participation from thirteen PST who previously joined the Program of University Public Teaching (Kampus Mengajar) for one semester and took a course of Science, Environment, Technology, and Society (SETS) during this research. The participants were selected using purposive sampling by which they possessed all characteristics needed for this research consisting of program or course and tasks. While taking SETS course, the participants must conduct literature review and connect to problems they encountered during the University Public Teaching. The goal of the task was authoring a paper about implementing one of the goals in SDGs in teaching and learning.

All the papers were analysed in terms of posing problems, formulating solution, and explaining expected impact. To elaborate the results of research, all PSTs were then interviewed using structured format. Five open-ended questions were carried out to ask conceptual understanding towards SDGs. The list of the question can be seen in Table 1. The results of interview were analysed using NVivo 12 plus software. In doing so, interview results were transcribed and coded into categories which describe definition, the importance, and expectation of SDGs. To portray the results, each of which was managed to show the proportion and then compared with PSTs’ statements to build understanding towards the PSTs’ expectation to implant SDGs in their teaching and learning agenda.

<table>
<thead>
<tr>
<th>No.</th>
<th>Questions</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What do you know about SDGs?</td>
<td>Definition</td>
</tr>
<tr>
<td>2</td>
<td>Where did you first hear the term? What is your response in the first place?</td>
<td>Definition</td>
</tr>
</tbody>
</table>

3 Result and Discussion

The first data of this research was obtained from analysis PSTs’ articles which have been submitted as a requirement to pass SETS course. The second data was taken from interview to clarify the ideas behind the articles and the essence of SDGs.

3.1 PSTs’ articles projecting towards SDGs

Thirteen PSTs dig down the ideas to formulate the way the quality education as one of the sustainable goals can be employed in the teaching learning process. As seen in Table 2, most PSTs choose to develop learning model and learning media when dealing with SDGs. These ideas result from the observation that problems in learning science are stimulated by the lack of learning experiences which need to entail student-student and student-teacher joyful interaction and interactivity. The target of this plan is to achieve competencies for critical thinking and literacy as targeted in 21st century learning [15].

Ideas of developing learning media are induced by the fact that quality education in science learning cannot be accomplished without the support of learning tools and laboratory equipment. Five PSTs plan to use digital applications such as PhET, augmented reality (AR), learning management system (LMS) which become immensely popular during coronavirus outbreaks. Such initiatives are perceived to be the prominent solution to enhance science learning which always provide realistic experience in observing natural phenomena, and thus giving deep understanding to students. Conclusion

The lack of ability of elementary school teachers in managing classes when implementing effective and fun learning during the new normal in Selayar Islands Regency is due to their lack of being able to guide, direct and guide all activities carried out by students with different characteristics. Then the obstacles caused during the new normal, there was a reduction in learning hours in elementary schools, namely face-to-face learning only lasted for 2 to 3 hours per day. with the number of students and the lack of media or teaching aids prepared by schools and needed by teachers. This has an impact on the achievement of learning objectives that cannot be maximized. Even during the new normal, as a classroom teacher, he has implemented several strategies or methods in learning, such as learning in
small groups, learning while playing, learning in the open, the question-and-answer method.

Table 2. Analysis of PSTs’ articles towards educational goal in SDGs

<table>
<thead>
<tr>
<th>PST</th>
<th>Problems</th>
<th>Aspects of analysis</th>
<th>Types of solution</th>
<th>Expected impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3</td>
<td>Lack of laboratory activities due to incomplete laboratory apparatus</td>
<td>Application of PhET to teach static electricity and force and motion</td>
<td>Learning media</td>
<td>Student can enhance their skills in data analysis and the work in laboratory.</td>
</tr>
<tr>
<td>2,4,13</td>
<td>Difficulties in connecting what students learn to natural events in daily lives.</td>
<td>Implementation of problem-based learning to learn biotechnology</td>
<td>Learning model</td>
<td>This model is expected to stimulate students’ scientific literacy.</td>
</tr>
<tr>
<td>5</td>
<td>Lack of analysis to accommodate the importance of both science process skills and experiential learning</td>
<td>Bibliometric analysis using Publish or Perish and VOS Viewers</td>
<td>Learning model, research skills</td>
<td>Teachers can search for students’ needs and formulate up to date strategy to enhance classroom learning.</td>
</tr>
<tr>
<td>6</td>
<td>Problems in learning biotechnology especially in the way modern biotechnology affects human life (bioethics)</td>
<td>Implementation of problem-based learning to learn biotechnology</td>
<td>Learning model</td>
<td>This model is expected to stimulate students’ critical thinking skills towards issues of bioethics.</td>
</tr>
<tr>
<td>7</td>
<td>The demand of students to have 4C skills in the 21st century</td>
<td>The use of problem-based learning to help students learn science</td>
<td>Learning model</td>
<td>Students can develop 4C skills through learning phenomena.</td>
</tr>
<tr>
<td>8</td>
<td>Student satisfaction experiencing</td>
<td>The use of assisted learning</td>
<td>Learning media</td>
<td>Students experience better satisfaction.</td>
</tr>
<tr>
<td>9</td>
<td>The decrease in student motivation due to the lack of experience to use interactive learning media</td>
<td>The use of Augmented Reality (AR) to teach classification of living things and non-living things, especially viruses</td>
<td>Learning media</td>
<td>Students can learn tiny particles and non-particles in a more realistic view.</td>
</tr>
<tr>
<td>10, 11</td>
<td>Lack of supervision of laboratory equipment and materials student learning due to insufficiency of teacher skills and time for developing activities</td>
<td>Classifying and registering any laboratory equipment and materials</td>
<td>Supporting infrastructure and competencies</td>
<td>Proper tools and materials can support science learning. Also, teacher competencies to use the apparatus increase.</td>
</tr>
<tr>
<td>12</td>
<td>Lack of motivation to learn science due to</td>
<td>Gamification to support student learning</td>
<td>Learning model</td>
<td>Student motivation can increase due to joyful learning.</td>
</tr>
</tbody>
</table>

The others, PST 10 and 11, look at a more specific problem that checking laboratory equipment and materials is not always correlated to insufficiencies. They found that problems with laboratory activities sometimes relate to teacher competencies in using laboratory activities and managing laboratory work. Hence, students in school do not possess experiences to study science using scientific method.

From Table 2, the data also shows that PSTs consider using their media and learning model to guide the teaching and learning about biotechnology and viruses. The statements from these different PSTs below describe the reasons why they select these topics.

“I decided to look at the problems in my hometown.”

In general, students over there have difficulty to understand the concepts in biotechnology like antibody monoclonal, in vitro fertilization (IVF), and tissue...
culture. The issues circulating around these concepts become popular to raise the debate”. PST 4

“I remembered when I was in high school, biotechnology to me seemed very easy to understand. Making Tempe, alcohol, soy sauce and everything else were familiar. Related to SDGs, the food produced using microorganisms can help people take care of their health. And without education, it does not make sense people realize this importance”. PST 13

“Viruses are tiny non-living things and sometimes become living things. Due to pandemic, topic about viruses is popular. That is why I choose the topic and use the digital media like AR to make students see the viruses like real ones”.

These three statements indicate that the topics close to everyday life provide access to teachers to anchor SDGs like combating diseases [2], [16]; and producing food. [17] also stated that biological topics can be used as contexts for SDGs because these offer students with a lot of practices.

3.2 Conceptual Understanding of SDGs

In this research conceptual understanding begins with the definition of SDGs to measure the extent to which the PSTs know about SDGs. According to Figure 1, most PSTs define SDGs to sustainability concept referring to the continuation of environmentally friendly program to conserve resources and develop mental and physical building. Below is the statement of PST in relation to such a theme.

“The SDGs are sustainable development created by the United Nations. There are seventeen goals for the SDGs and one of them is increasing education as the basis of idea of my article, sir”. (PST 1)

The second proportion of the theme is innovating development. The PSTs call SDGs as a foundation to broaden the innovation to minimizing problems that can affect national stability, including education. The problems will remain the same and have interrelation cause and effect if the advancement of SDGs is not implemented.

“SDGs are a set of ways to do continuous innovation to advance a country, for example in solving problems of education or other things such as sanitation, energy, and poverty. I think they link to each other. If we want to solve the problem, each goal in SDGs must be implemented well”. (PST 2).

The other three definitions have the same proportion, including multifaceted goals, resource management, and social improvement. In this sense, PSTs found that SDGs which bring biological, social, and educational aspects altogether which eventually sustain the progress of global changes as these include indicators such as support for culture, training in continuous education, and management of energy and waste [11].

In terms of education, Figure 2 shows that PSTs expect and recommend seven indicators that should be accommodated when SDGs are infused into teaching and learning process, namely, student skills, technology, knowledge, attitude, resources, research, and equality. Most PSTs agree to put the student skills in the first place of the proportion followed by technology. Skills and technology nowadays become interrelated and access to digital information will influence the way people think, especially to urbanization case which is very common in Indonesia; and finally, people turn to be more democratic and humanist [8]. In other words, good quality education change people’s behaviour so as to reduce conflict and spread [6].
The items share equal proportion for knowledge-attitude and resource-research-equality. In practice, these findings items in line with research that during science learning, especially laboratory activities, students are required to show objectiveness and responsibility while observing objects, measuring variables, and presenting data [18], [19], and therefore, the results of the learning process should support the theories, laws, and principles. Even if the data do not match with the previous work of experts, the students still need to clarify whether the procedures have been followed well or not and what variables might affect the results.

The overall images of PSTs plan and expectation of the SDGs are illustrated in Figure 3. PSTs stated that in terms of understanding SDGs they propose three domains, definition, focus, and indicators. To successfully implemented within teaching and learning, PSTs need to consider at least two aspects in the definition and indicators (bold text) since these data are common in PSTs, meaning that they are familiar with the concepts. Sustainability and innovation relate to the advancement of student skills or competencies and technology for use in class.

4 Conclusion

As showed in the findings, PSTs find that SDGs are essential to be implemented during teaching and learning process. To do so, they need to declare the definition and indicators to achieve the accomplishment of SDGs. There are five items to define SDGs, that is, sustainability, innovation, multifaceted goals, managing resources, and social improvement. Seven indicators are proposed to measure the success of embedding SDGs, consisting of the increase in student skills, technology being used, knowledge, positive attitude, resources, and equality for chances to learn. Three strategies are employed to create quality education, namely, developing learning media, learning model, and infrastructure.

Acknowledgement

We would like to thank Directorate of Research, Technology, and Community Service, Directorate General of Higher Education, Research and Technology for the research Grant under the scheme of National Competitive Basic Research No. 126/E5/PG.02.00.PT/2022. Also, we thank Universitas Negeri Surabaya for providing chances and research facilities to finish all the procedures for this research.

References


