High school physics teacher’s competences in designing physics lesson plan for improving student’s energy literacy

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Abstract. This research has been conducted to improve the ability of high school physics teachers in developing energy literacy based physics learning. The efforts to improve teacher competencies are conducted through training with blended learning modes. The ability of teachers in developing energy literacy based physics learning was assessed from the training product: lesson plan. The teacher’s lesson plan was assessed using lesson plan assessment instrument. Physics teachers who have attended First Phase of training for one week are able to develop physics lessons for selected topics that can increase students’ energy literacy.

1. Introduction

Search and utilization of energy has a strong relationship on standards of people's living. The issue of energy has influence and be influenced by major economic sector. Efficiency in energy use and reduced energy consumption is also needed in the face of climate and to achieve sustainable economic growth [1].

Indonesia is a large country that producing energy and energy users. The constraints faced by Indonesia are the depletion of fossil energy reserves, limited public access to energy, and limited mastery of technology to develop alternative energy utilization [2].

Energy related issues are addressed through various strategies such as fossil energy resource exploration, renewable energy use, diverting energy consumption patterns to more environmentally friendly for various sectors [2].

Awareness and community participation in addressing energy issues is also important [3]. Therefore society is expected to have energy literacy [4].

Energy literacy is an understanding of the nature and role of energy in the universe and in our lives. Energy literacy is also the ability to apply thin understanding to solve problems [5].

The indicators of energy literate person:

a. can trace energy flows and think in terms of energy systems
b. knows how much energy he or she uses, for what, and where that energy comes from
c. can assess the credibility of information about energy
d. can communicate about energy and energy use in meaningful ways
e. is able to make informed energy and energy uses decisions based on an understanding of impact and consequences
f. continues to learn about energy throughout his or her life.
Research related to energy literacy has been done a lot. Energy Literacy is an educational endeavor that helps pave the way for a safer energy future by empowering individuals to choose appropriate energy-related behaviors throughout their lives [6].

The framework of developing the energy literacy instrument has been developed covering three aspects of outcome components namely cognitive, affective, and behavioral [6]. Contextualized instruments can assess the energy literacy of SMP and SMA students in a multidimensional [7]. Utilization of computer-based tests can reach a wider population [8]. Energy and climate literacy should be combined and ideally incorporated into the school curriculum [9]. Energy Literacy can be achieved through the education sector [10]; [11]; [12].

Schools in Indonesia are expected to contribute to the energy literacy of students as well as the community. This hope is in line with the literacy movement programmed by the Indonesian government through the Ministry of Education and Culture. Energy literacy is more closely related to science, physics, chemistry, and biology [5]. In terms of competency attitudes, knowledge and skills in the 2013 curriculum, high school physics subjects have the potential to grow and develop energy [13]. The role of high school physics teacher is quite important in teaching physics that can cultivate energy literacy.

The competence of teachers in implementing physics learning that integrates energy literacy needs to be improved through various programs. Professional communities such as the MGMP are an appropriate forum for improving the professionalism of teachers. Training programs should be synchronized with the MGMP program so as not to undermine the teacher's primary obligation as an educator in the school. The training modes that the teacher is interested in are blended training that incorporates face-to-face mode on MGMP day and the next online mode on weekdays [14].

The issues to be answered in this paper are:

a. How is the competence of physics teachers in developing physics learning plans for to improving energy literacy?

b. How does the training program affect teacher competences upgrading?

2. Methods
The participants were 10 high school physics teacher from Garut city who attended training stage 1. at stage 1 held one-day face-to-face training and online training for 1 week. During online training participants are required to create a lesson plan for 1 topic that is integrated with the content of energy literacy. The ability of teachers in developing energy literacy based physics learning was assessed from the training product: lesson plan.

Table 1. Instrumen for assessing lesson plan.

| No. | Rated aspect                                                                 | Criteria | Yes | No |
|-----|------------------------------------------------------------------------------|----------|-----|----|
| 1.  | Formulate learning objectives                                                  |          |     |    |
| 2.  | Formulating indicators of learning outcomes that correspond to the base by integrating literacy kompetensi energy |          |     |    |
| 3.  | Pembalajarn formulate objectives according to the indicators that integrate the Energy Literacy |          |     |    |
| 4.  | Develop and organize appropriate learning materials that integrate learning objectives Energy Literacy |          |     |    |
| 5.  | Choosing the appropriate learning resources related to the Energy Literacy     |          |     |    |
| 6.  | Planning for Learning Steps                                                    |          |     |    |
| 7.  | Planning the scenario of learning activities in accordance with the Energy Literacy indicators that integrate into the material being studied |          |     |    |
| 8.  | Determining ways to motivate students to have concern for energy issues in physics |          |     |    |
| 9.  | Preparing questions related to the Energy Literacy                            |          |     |    |
| 10. | Planning Assessment                                                           |          |     |    |
| 11. | Determine the procedures and forms of assessment in accordance with the indicators and integrating the learning objectives Energy Literacy |          |     |    |
| 12. | Develop assessment instruments and answer keys                               |          |     |    |
3. Results
After attending Phase 1 training, participants submitted the task of creating a lesson plan. Assessment of lesson plan using assessment instrument as in table 1 obtained. The result of mean score is 86.9, as shown in table 2.

The criteria for this average are included in the good category. Through 4 hours face-to-face lessons, participants can understand how to develop a lesson plan that integrates the charge of energy literacy in theory. So in the online training process teachers do not face too many obstacles in the practice of developing the lesson plan. technical constraints in the preparation of the lesson plan in the form of the latest lesson plan, the formulation of indicators of achievement of competence, the formulation of goals, learning scenarios can be resolved through online discussion.

| Table 2. Score of participants. |
|----------------------------------|
| Participant | Score |
| 1           | 82    |
| 2           | 87    |
| 3           | 95    |
| 4           | 80    |
| 5           | 85    |
| 6           | 90    |
| 7           | 85    |
| 8           | 85    |
| 9           | 90    |
| 10          | 90    |
| Average:    | 86.9  |
| Criteria:   | Good  |

The "good" criterion for the lesson plan, does not guarantee the instructional design developed by the teacher can increase the student's energy literacy. The lesson plan should be completed with learning media, student worksheets, assessment instruments that support the development of student energy literacy.

4. Conclusion
Physics teachers who have attended First Phase of training for one week are able to develop physics lessons for selected topics that can increase students' energy literacy. The phase 1 of training program has upgrading the teacher’s competences in designing lesson plan.

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