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Readability of geothermal energy information in vocational textbooks

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Abstract. The development of renewable energy in a country is influenced by public understanding by its people and this understanding is influenced by public literacy. To improve this, effort is needed to increase the level public literacy by improving readability. We study the readability of geothermal energy in vocational high school textbooks written in Indonesian. This is conducted because it is considered to have an effect on the low utilization ratio in the country. This readability research uses survey methods with population is student in vocational high school. Text material is read by the respondent and they are asked to give the impression whether the text is easy or difficult to understand. From this study, the factors that influence the ability to understand text information are displayed. The purpose of this study is to improve geothermal energy literacy, there for the application and development of this energy increase in the future.

Introduction

Indonesia is one of the developing countries and energy supply is an important factor for all-around development. The country's energy consumption still depends on non-renewable energy such as crude oil, coal and natural gas as sources of energy. Utilization of fossil fuel continuously contributes to huge amount of greenhouse gases emission that leads to climate change [1]. Indonesia is rich with abundant renewable energy sources such as bioethanol and biodiesel plant, geothermal, micro hydro, solar and wind energy. These sources are alternative solutions to providing environmentally friendly energy. Data obtained from the Ministry of Energy and Mineral Resources shows that 40% of geothermal energy is produced in Indonesia with only about 1924.5 MW or 6% utilized [2]. This means that the potential use of new renewable energy is not maximized.

1.1. Geothermal energy

In assessing the possibility of the future of each type of renewable energy, it is important to know what factors tend to increase or reduce their future output. Among them are energy returns to input energy, technical potential, impacts that will occur on land use, climate, and other environmental changes on its availability, and as an alternative, the effects of renewable energy production on the environment [3]. Geothermal is an abundant and environmentally friendly resource, with its availability and load factors not dependent on external sources, thereby, making it one of the main resources of sustainable energy.

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Geothermal energy is considered a renewable resource because of the energy extracted from the earth. Even if geothermal energy is used to meet 100% of human energy needs, it will only represent a small part of the earth's total energy reserves [4].Only a small portion of the world's geothermal potential has been developed. This is due to the various obstacles associated with its development in a country such as government policies, regulations, human resources, incentive infrastructure [5]. As shown in Table 1. Currently, there is a total of 13 geothermal power plants in Indonesia with the target of installing up to7241 MW by 2025 [6].

Table 1. Indonesian geothermal power plant.

No	PLTP	Total Capacity	WKP, Location
1	PLTP Sibayak	12 MW	Sibayak – Sinabung, Sumatera Utara
2	PLTP Sarulla	330 MW	Sibual-buali, Sumatera Utara
3	PLTP Ulubelu	220 MW	Waypanas, Lampung
4	PLTP Salak	377MW	Cibeureum – Parabakti, Jawa Barat
5	PLTP Wayang Windu	227 MW	Pangalengan, Jawa Barat
6	PLTP Patuha	55 MW	Pangalengan, Jawa Barat
7	PLTP Kamojang	235 MW	Kamojang – Darajat, Jawa Barat
8	PLTP Darajat	270 MW	Kamojang – Darajat, Jawa Barat
9	PLTP Dieng	60 MW	Dataran Tinggi Dieng, Jawa Tengah
10	PLTP Karaha	30 MW	Karaha Bodas, Jawa Barat
11	PLTP Matalako	25 MW	Matalako, NTT
12	PLTP Ulumbu	10 MW	Ulumbu, NTT
13	PLTP Lahendong	120 MW	Lahendong Tompaso, Sulawesi Utara

1.2. Geothermal renewable energy education in Indonesia

Education is very important as it aids in preparing Human Resources for national and state development. It is also an agent of strong social change, capable of raising awareness for new growth and a future for the development of sustainable renewable energy.

One of such learning resources commonly used to acquire this knowledge is in the form of textbooks. It plays a strategic role, as a practical implementation of the curriculum, therefore, the need for quality textbooks is essential. This is in accordance with Law Number 20 of 2003 and the curriculum law initiated in 2004 which comprises of integrated attitude, knowledge and skills to develop students' potential. Due to these laws, textbooks contents of the lesson would not only be theoretical but contain practical objectives to guide students into carrying out positive tasks.

The use of simple sentences makes the material presented easy to comprehend by students, thereby increasing their competency level. However, the use of difficult sentences, above the “readability level” make it difficult for students to understand.

The readability index is used in evaluating an educational textbook [7]. Readability is a metric for measuring the success of information delivered to a large population of people trying to access [8]. In 2017, a research was conducted on the readability level of renewable energies using textbooks, however, this study uses online information to improve understanding of biomass energy technology [9]. The readability level is basically determined in two ways which include, through a formula and through the reader’s response. In addition to these, it is used to predict difficulties associated in understanding textbooks. It is difficult to obtain the readability score based on words, due to its number in a sentence, and the arrangement of paragraphs.

Method

This study was conducted at the Vocational High School in Surakarta City, Central Java Province in the field of technology and engineering. The research was carried out from November to April 2019, with its location chosen because it is closest to the development of geothermal energy and future energy users. This study used three written information in the textbook as research materials. Data was obtained

from literature studies through a quantitative approach and by using scientific methods. The study was also fact-based, free from prejudice, using analytical principles, hypotheses, objective measures and quantitative data.

3. Results and discussion

The distributed questionnaire asked for respondents' opinions on the 6 parameters of the textbooks. These include (1) attitude towards the number of informational sentences on geothermal renewable energy information in textbooks, (2) ease of reading and following texts, (3) difficulties associated with the words and phrases used in the text (4) more general opinions on words and phrases will make the text easier to understand, (5) opinions of others, (6) the benefits obtained from the text.

Respondents were asked to indicate if each text on geothermal renewable energy information in textbooks was too little, enough, or too much. Table 2 (a), illustrates that more than 50% of the respondents indicate that text no. 1 contains too much writing. Text No. 2 is rated as one with enough writing (more than 80%), while the third is rated with too little text (more than 60%).

Respondents were also asked to demonstrate the ease of reading following the text of renewable energy from geothermal sources. The ease of perception is shown using four linkert scale levels, from easy to very difficult. As shown in Table 2 (b), majority of the respondents indicated that almost all texts were easy (level 2 of the scale) and very easy (level 1 of the scale). Furthermore, some considered text no. 1 difficult (more than 20%). and text no. 2 very difficult (0%). Respondents also rated longer texts more difficult to understand.

Tabel 2. Respondent's attitude towards the amount of text from each geothermal renewable energy information in the textbook (a), and the ease of reading and following the text (b).

Text's designated number	(a)			(b)			
	Too little (%)	Enough (%)	Too much (%)	Very easy (%)	Easy (%)	Difficult (%)	Very difficult (%)
Text No. 1	1.6	46.9	51.5	5.1	71.7	20.6	2.6
Text No. 2	13.5	81.4	5.1	19.6	74.6	5.8	0
Text No. 3	64.3	32.5	3.2	49.2	45	4.5	1.3

They were also asked whether the words and phrases in the text were easy or difficult to understand. Majority of respondents stated were of the opinion that it was easy to understand as illustrated in Table 3 (a). Text no. 1 which had the highest percentage of texts and phrases was considered difficult to understand due to its length. More than half (above 50%) of the text material are considered easy to understand by respondents using more general words and phrases. As shown in Table 3 (b), text no. 1 has the highest percentage above 70% of the total respondents. This is due to the fact that majority suggested that words and phrases in text no. 1 be made more general for easy understanding considering the long amount of text.

Respondents were also asked to indicate attitudes towards understanding geothermal renewable energy information by others, and if it is understood by everyone, most people, or just a few numbers. Majority of the respondents considered almost all texts understandable. In Table 4 (a), text No. 3 is considered to be understood by everyone with a percentage of more than 50%. This is due to the short nature of the texts which tends to be more general and easier for respondents to understand. Table 4 (a) illustrates that the majority of respondents were of the opinion that almost all texts were useful (more than 50%). Given the importance of students' understanding of renewable energy from geothermal sources for the future.

Table 3. Respondent's attitude towards words and phrases used by geothermal renewable energy information in textbooks (a), and whether more general words and phrases will make text easier to understand (b).

Text's designated number	(a)			(b)	
	Easy to understand (%)	Could understand with some difficulty (%)	Difficult to understand (%)	Held view: yes, easier to understand (%)	Held view: no, not easier to understand (%)
Text No. 1	28.6	65.9	5.5	74.6	25.4
Text No. 2	61.1	37.3	1.6	52.7	47.3
Text No. 3	73.6	22.2	4.2	57.2	42.8

Table 4. Respondent's attitude towards understanding geothermal renewable energy information by others (a), and how much benefit is obtained from the text (b).

Text's designated number	(a)			(b)			
	Understood by everyone (%)	Understood by most people (%)	Understood by few people (%)	Very helpful (%)	Helpful (%)	Ordinary (%)	Not so useful (%)
Text No. 1	32.8	45.7	21.5	28	61.7	9.3	1
Text No. 2	49.9	45.3	4.8	28	63.3	8.7	0
Text No. 3	61.4	31.5	7.1	32.1	48	16.1	3.8

4. Conclusions

This study aims to illustrate the need for improving information on renewable energy from geothermal sources in vocational high school textbooks, in an effort to support and increase student's knowledge and understanding, which tends to affect future development. Beside focusing on content as the preparation of information, we also need to consider that the information is friendly to student's reading ability. A similar study in India also revealed some barriers in the implementation of renewable energy which are related to its information, such as the lack of a formal information channel on renewable energy for small and medium-scale enterprises, poor access to renewable energy information compared with the access to conventional energy technologies, lack of easy access to information about the latest renewable energy technologies, and also the preference of general public to take their friend's advice rather than to obtain information from experts [10]. The concern on student readability of renewable energy from geothermal sources in Vocational High School textbooks would not only encourage student involvement in the use of geothermal energy, but the use of renewable energy materials from geothermal sources can also attract students to be involved more as an important factor to be successful implementation geothermal energy in Indonesia.

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