

PERCEPTIONS OF BIOENERGY: IS THERE A NEED TO IMPROVE THEM AMONG INSTRUCTORS AND YOUNG LEARNERS?

¹PRADIPTA HALDER, ²JANNE PIETARINEN, ³SARI HAVU-NUUTINEN, ⁴SINIKKA POLLANEN, ⁵PAAVO PELKONEN

^{1,5}School of Forest Sciences, University of Eastern Finland, Finland

^{2,3,4}School of Applied Educational Science and Teacher Education, University of Eastern Finland, Finland

Email: ¹pradipta.halder@uef.fi, ²janne.pietarinen@uef.fi, ³sari.havu-nuutinen@uef.fi, ⁴sinikka.pollanen@uef.fi,

⁵paavo.pelkonen@uef.fi

Abstract- Bioenergy is the oldest and most widely used source of renewable energy in the world. However, the share of modern biomass-based technologies in global energy production is negligible. There exist both positive and negative perceptions of bioenergy among public. The study explored bioenergy related perceptions among school students and science teachers in Finland and India in order to find out the current status of public perceptions of bioenergy from a cross-country perspective. The students in both the countries demonstrated quite positive perceptions of bioenergy. However, they were also concerned over the perceived negative impacts of increasing use of bioenergy on the earth's biological resources. Likewise, the science teachers from both the countries also appeared to be very positive about the usefulness of bioenergy. Their perceptions of bioenergy were more uniform in the two countries compared with the students' perceptions. The study recommends stronger emphasis by teachers on environmental and energy related education in schools to increase their awareness of bioenergy and other renewable energy technologies.

Keywords- Bioenergy, Perceptions, Students, Teachers

I. INTRODUCTION

Climate change and growing energy demand are two intertwined and immediate policy challenges for which solutions need to be developed and implemented urgently [1]. Renewable energy (RE) technologies are considered as the most promising alternatives to fossil fuels as they can contribute to environmental, economic, and social developments. Bioenergy is the oldest and most widely used RE source in the world. However, the share of modern bioenergy technologies in global energy production is negligible. It indicates that the diffusion of modern bioenergy technologies has remained sluggish in both developed and developing countries. Although there are various social, environmental and economic benefits of using modern bioenergy technologies, there are also serious concerns among public over the increasing use of bioenergy [2-3]. Therefore, a sound understanding of public perceptions of the new and emerging RE technologies such as bioenergy is crucial for implementing them successfully in our society. In this context, the emergence of innovative, informed and motivated young students is paramount in all countries as they are the key to build a sustainable future [4]. Simultaneously, the role of school teachers are also crucial as their perceptions and attitudes concerning bioenergy technologies could have an impact on the students' psychological dimensions related to bioenergy.

The study aimed to investigate bioenergy related perceptions among school students and science teachers in Finland and India. The results are expected to generate a new body of knowledge in understanding the psychological dimensions of young

generations and school instructors regarding bioenergy.

II. METHODOLOGY

In India, a questionnaire-based survey was conducted among 28 science teachers and 183 high school students from four schools located in Delhi and Bengaluru. The Finnish survey was conducted among 22 science teachers and 402 high school students from six schools located in Joensuu and Savonlinna. About 52% and 51% of the Finnish and Indian students were male, respectively. Among the science teachers who participated from India, 80% were female and the mean age of the science teachers was 35 years (SD=7.75). About 55% of the Finnish science teachers were female and the mean age was 47 years (SD=2.1). The language of the survey was English in India as the schools followed English as their medium of instruction. However, the English version of the questionnaire was translated into Finnish for the survey participants in Finland.

The questionnaire consisted of sections of which the first section included questions related to the respondents' socio-demographic profiles. The second section consisted of items in statement forms to measure the respondents' knowledge of bioenergy on a True-False scale. The third section included items on a seven-point Likert-type scale (strongly agree to strongly disagree) that intended to measure the respondents' behavioral intentions to use bioenergy. The fourth section was made up with items to measure the respondents' environmental concerns. This fifth section also included questions to explore the respondents' viewpoints about the possibility of

teaching and learning about bioenergy in schools. For this paper, only the items measured respondents' perceptions of bioenergy will be reported. The detailed results of all sections will be reported in a number of scientific articles elsewhere.

III. RESULTS

3.1. Students' perceptions of bioenergy

Students' perceptions of bioenergy were measured on a seven-point Likert-type scale consisting of six statements. The first statement was Use of bioenergy can reduce the threat of global climate change and the majority of the students (Finland-75%; India-84%) showed their agreements with it. The second statement was Domestically produced bioenergy in my country can reduce the dependency on importing energy from other countries. In this case, about 62% of the Finnish and 80% of the Indian students showed their agreements with it. Over 70% of the students in both the countries also perceived positively the third statement Use of bioenergy as a fuel in motor vehicles can reduce the use of petrol and diesel. Differences appeared between the Finnish and Indian students related to their agreements with the fourth statement Energy production from biological materials is necessary for the progress of human society. About 46% of the Finnish students and 73% of the Indian students agreed with that statement.

However, notable difference appeared between the students in the two countries related to their perceptions of the fifth statement Use of biological materials for energy production could reduce their availability for other uses. In this case, about 51% of the Finnish students appeared to be neutral whereas about 70% of the Indian students were in agreement with that statement. For the sixth statement Use of biological materials for energy production could destroy biological resources on earth, it emerged that the majority of the Finnish students (about 54%) had neutral stand whereas no such clear stand appeared among the Indian students. It also appeared that the Finnish students showed more neutral stand against the six statements than their Indian counterparts. Statistically significant differences (Mann Whitney U-Test, $p < .01$) appeared among the Finnish and Indian students' perceptions related to all the statements. In one hand, the Indian students were more positive than the Finnish students towards the usefulness of bioenergy. On the other hand, the Indian students were also more concerned than the Finnish students over the perceived negative impacts of increasing use of bioenergy. No statistically significant gender differences appeared among the Indian students related to their perceptions of bioenergy. However, statistically significant gender difference emerged among the Finnish students only related to the first statement. The Finnish female students appeared to be more positive than their male

counterparts towards the relevance of bioenergy for reducing the threat of global climate change.

3.2. 3.2 Teachers' perceptions of bioenergy

Teachers' perceptions of bioenergy were measured by the same six statements that measured students' perceptions of bioenergy. More than 80% of the respondents from the both countries were positive about the perceived usefulness of bioenergy such as its importance in reducing the threat of global climate change, decreasing the dependency on imported energy sources, and reducing the use of petrol and diesel in motor vehicles. Over 75% of the respondents in both the countries were in agreement with the fourth statement that Energy production from biological materials is necessary for the progress of human society.

About 59% of the Finnish and 56% of the Indian teachers perceived that the use of biological materials for energy production could reduce their availability for other uses; however, about one-third of the teachers in both the countries showed disagreements with that notion. The majority of the Finnish and Indian teachers also appeared to be in disagreement with the proposition that Use of biological materials for energy production could destroy biological resources on earth. Statistically significant differences (Mann Whitney U-Test, $p < .05$) appeared between the teachers in the two countries only related to the first item-statement Use of bioenergy can reduce the threat of global climate change where the Indian instructors were more positive than their Finnish counterparts.

CONCLUSIONS

The study aimed to explore perceptions of bioenergy among school students and science teachers in Finland and India in order to find out how public perceptions are forming in these two countries regarding an emerging RE technology. Although the study findings cannot be generalized due to its small sample size, yet it provides some new information on bioenergy related public perceptions among students and their instructors in Finland and India. The students in both the countries showed quite positive perceptions towards the proclaimed benefits of using bioenergy. However, it appeared that they were also concerned over the probable negative impacts of the increasing use of bioenergy on earth's biological resources. In addition, a substantial portion of them were unsure concerning the impacts of bioenergy.

In comparison to the students, the teachers from both the countries appeared to be very positive about bioenergy. In other words, teachers' perceptions of bioenergy appeared to be more uniform in the two countries compared to the students' perceptions, which were significantly different. Gender did not appear to play a major role in determining students'

perceptions of bioenergy in both the countries. These findings indicate that bioenergy related perceptions among young generations such as school students could be quite different in different countries and that could result from various factors such as the socio-economic status of the country, level of bioenergy development in the country, media coverage of bioenergy and students' access to media, and also students' formal and informal learning environments. Based on these findings it can be said that there are opportunities for increasing interactions between students and teachers in both the countries to discuss modern RE related topics such as bioenergy that could increase their awareness of bioenergy and remove some of the apprehensions about it from their minds. Such opportunities should be explored by introducing new teaching and learning methods in science education.

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