Journal of Education & Learning Advancement
Volume1 Issue1 (June 2024)

Demographic Moderation in the Relationship of Environmental Awareness and Energy Literacy of Senior High School Students

Kris Maiden L. Joyosa, Ericka Danielle S. Dimaala, & Albert Andry E. Panergayo
College of Teacher Education, Laguna State Polytechnic University, San Pablo City Laguna 4000, Philippines
albertandry.panergayo@lspu.edu.ph

ABSTRACT

Energy literacy is an aggregate of adoption of energy-saving practices, basic energy knowledge, and understanding of the consequences that energy production and use have on the environment. Energy is a major concern because rising consumption causes both energy shortages and climate-damaging scenarios. This study investigated how demographic characteristics, in one public secondary high school in Laguna, moderated the relationship between senior high school students' energy literacy and environmental awareness. A cross-sectional explanatory research design was employed to collect and interpret the data gathered from 270 respondents. The adapted and content-validated instruments, Energy Literacy Survey and Environmental Awareness Questionnaire were administered through survey method. Using PROCESS v3.5, a moderation analysis was performed in accordance with Hayes (2013) framework. The findings revealed that the energy literacy and environmental awareness are both above average. The demographic factors, strand and grade level, moderate the relationship between environmental awareness and energy literacy. This indicates that the influence of environmental awareness to energy literacy may vary based on the strand and grade level of the respondents. It is recommended to highlight improving energy literacy through curriculum enhancement, educational programs and events, and instructional designing grounded on the students' environmental awareness, senior high school discipline, and academic level.

Keywords: *demographic factors, energy literacy, environmental awareness, moderation analysis*

ISSN 3028-2179

INTRODUCTION

Energy is an essential issue because of the rising consumption results in both energy shortages and greenhouse gas emissions that harm the climate. Energy production and use present a challenge that calls for understanding and behavioral changes at every level of society. Energy is essential for achieving social, economic, and development in sustainable development, and the issues can be studied as an interdisciplinary topic from the point of view of science and environmental concepts at the domestic level to a worldwide social perspective (Lee et al., 2015). Energy is essential in our daily lives and all scientific disciplines. Energy-related subjects are relevant to all branches of science as well as engineering, politics, social science, and economics. Thus, it is a necessary concept for students to learn in school.

Energy literacy is viewed as an educational initiative that paves the way for a more energy secure future by encouraging people to make wise energy-related decisions in their day-to-day lives (DeWaters & Powers, 2011). Education is a pedagogic activity that will contribute to individual awareness and both medium- and long-term shift in attitude and values from society. It enables people to participate in issues related to energy efficiency, reducing the behavioral barriers (Dias et al., 2004). Energy literacy is important because informed citizens can help design and implement intelligent, forward-thinking policies. People have misconceptions about energy, which may persist into adulthood in young students. (Yeh et al., 2017). Energy literacy is also a component of social and natural science literacy as it also necessitates a thorough understanding of common citizenship, history, economics, sociology, psychology, politics, and economics. These topics cannot be fully understood through a scientific or technological approach alone (Lee et al., 2015).

Teaching and learning energy literacy encounter pedagogical challenges as it has emerged as one of the most significant subtopics in science textbooks (Mažeikienė & Norkutė, 2021). Many textbooks failed to provide knowledge regarding energy in explicit themes and the new energy paradigm that is required for the growth of a new green economy (Yeh et al., 2017). Energy literacy should be taught in a green economy, and teachers should use various pedagogical techniques, teaching resources, and supportive learning settings to accomplish this (Yeh et al., 2017). Integrating energy literacy into curriculum fosters understanding of sustainable practices, informs decision-making, and prepare students for addressing global energy challenges effectively.

To include lessons on energy efficiency and conservation in the curriculum of Philippine schools, the Department of Energy increased the level of cooperation with the Department of Education (DepEd), the Commission on Higher Education (CHED), and the Technical Education and Skills Development Agency (TESDA) (Philippine Energy Plan 2018-2040). The National Environmental Awareness and Education Act, or Philippines Republic Act No. 9512 encouraged all school curricula to include environmental education such as energy-saving practices for sustainable development. Likewise, Republic Act (RA) 11285—also known as the "Act Institutionalizing Energy Efficiency and Conservation, Improving the Efficient Use of Energy, and Granting Incentives to Energy Efficiency and Conservation Projects"—was also passed.

ISSN 3028-2179

(Department of Energy, 2019) promote the wise and efficient use of all energy resources, increase the use of energy-efficient and renewable energy technologies, and provide a framework for adopting and institutionalizing core energy efficiency and conservation policies.

There is a need to underscore energy literacy in school due to inconsistent awareness, despite widespread concern among educational leaders and policy makers. Students must be encouraged to discuss and think critically about energy in order to become energy literate, bringing it from the domain of the practical and into the domain of discussion (Attari et al., 2010). Conversely, research by Djordjevic and Cotton (2011) and Winter and Cotton (2012) suggests that contradictory or competing signals in the campus setting can undermine sustainability teaching in the formal curriculum or communication on sustainability through official channels. For instance, there are no installations that can be seen on campus, even if courses may address the possibilities of renewable energy sources like solar or wind power. These are major barriers to the growth of energy literacy in education, since a large percentage of student learning occurs outside of formal teaching and learning environments (Barth, 2013).

In view of these, researchers uncovered that there is a lack of local study about energy literacy in the Philippines. This research also raises the issue that energy literacy is not addressed in classrooms level. Likewise, the energy literacy of Filipino students appears to receive little attention from various educational institutions (Aruta, 2022). Usman and others (2020) argued that increasing energy literacy in schools for students is necessary and emphasizes research and development of energy topics. Furthermore, the curriculum does not provide many opportunities for students to increase their energy literacy (Bahrami & Mohammadi, 2021; Van Treuren & Gravagne, 2008). Consequently, there is a need for more energy-focused curriculum and instructional resources to better educate the next generation (Cotton, 2015). Research suggests that demographic profile such as households with a high income and residing in a modern home are more likely to be energy literate (Trota et al. (2017). These scenarios prompted to investigate the relation of demographic factors to environmental awareness and energy literacy. Hence, the purpose of this study is to assess the statistical connection among environmental awareness, energy literacy, and students' demographic characteristics. Furthermore, this study sought to find out the moderating role of demographic factors in the relationship between environmental awareness and energy literacy.

STATEMENT OF THE PROBLEM

This study aims to examine the demographics, environmental awareness, and energy literacy of the senior high school students in one public secondary school in Nagcarlan, Laguna. Specifically, it aims to answer the following questions:

1. How can the respondents be described in terms of:
   1.1. sex;
   1.2. grade level;
   1.3. senior high school strand; and
   1.4. socio-economic status
   1.5. Junior High School type?
2. What is the level of the environmental awareness of the students?
3. What is the level of the energy literacy of the students in terms of:

ISSN 3028-2179

3.1. cognitive/knowledge;
3.2. affective; and
3.3. behavioral domains?
4. Does environmental awareness significantly predict energy literacy?
5. Do the students' demographics significantly moderate the relationship between environmental awareness and energy literacy?

METHODOLOGY

Research Design

This study utilized quantitative cross-sectional explanatory research design. According to Hunziker and Blankenagel (2021), this research design aims to explain broad relationships between various components and conditions. Similarly, Gay (1999) claimed that this form of data collection is used to test a hypothesis or respond to inquiries about the subject's current situation. It is a type of research that tries to answer the questions of who, what, when, where and how. This research design is deemed appropriate for the purposes of the study since it seeks to uncover the underlying relationship among demographic factors, energy literacy, and environmental awareness.

Respondents of the Study

This study has been conducted at Plaridel Integrated National High School (PINHS); the school is located at Brgy. Banago Nagcarlan, Laguna. Moreover, the school offers various curricular programs such as Humanities and Social Science (HUMSS), Accountancy, Business and Management (ABM), Science, Technology, Engineering and Mathematics (STEM), and Technical-Vocational-Livelihood Strand- Home Economics (HE), Information, Communication and Technology (ICT) Strand, and Agricultural-Fishery Arts (AFA). The respondents of this study are 270 students from Grade 11 and Grade 12. This sample size was based on the sample size calculator with 95% confidence level, 5% margin of error, and 50% population proportion. This research used simple random sampling technique wherein a random sampling technique is employed by the researcher to select a representative subset of participants from an overall population. The characteristics were detailed in Table 1.

Research Instruments

This study adopted two different survey questionnaires to form part on the survey form to collect the necessary data to address the research problems. The survey form is composed of three parts: The first part aimed to collect the demographic characteristics of the respondents as to age, sex, grade level, academic strand, JHS school type, socio-economic status. The second part measures the environmental awareness of the respondents. The study adopted the Environmental Awareness Questionnaire from the work of Laso, Marban, and Ruiz (2017). It is composed of 25 items measured in four-point Likert scale from "1 - strongly disagree" to "4 - strongly agree", wherein the internal consistency of this scale was supported by a value of Cronbach Alpha of 0.87. The third part was the Energy Literacy Surveys from DeWaters and Powers (2013) composed of total items which measured three dimensions namely cognitive/knowledge, behavioral, and affective domains. The affective and behavior subscales of this questionnaire have Cronbach's alpha values that show high reliability at

ISSN 3028-2179

0.757 and 0.780 respectively, while cognitive/knowledge subscale has a Cronbach's alpha value that show moderate reliability at 0.564. The cognitive/knowledge dimension is composed of multiple-choice items that are objective in nature. There is internal consistency among the items of this instrument based on these values. The demographic characteristics were collected using survey form. The research sought permission to use the adopted instruments through electronic e-mail. The instrument and its sub-sections underwent expert validation and gained favorable outcomes.

Data Collection

The data were gathered using a survey method in a span of one week. The researchers asked permission to conduct the study in the research site to the school head. Upon approval, the endorsements channeled to key personnel involved such as head teacher, master teacher, research coordinator, and subject teacher in the research site directly related to the target respondents. The research instruments were administered in face-to-face setting to ensure the high-response rate. In observance of proper research protocols, the instrument came with an informed consent form stating the rationale, objectives, and procedures of the study. It also stated that their participation is entirely voluntary and they may opt to withdraw their participation without explanation. The researcher ensured the high response rate by directly coordination with the research coordinator.

Data Analysis

The data that had been collected were treated using statistical analysis to answer the research problems. Descriptive statistics such as frequency, percentage, mean, and standard deviation with corresponding verbal interpretations were used to describe the demographic characteristics, environmental awareness, and energy literacy of the respondents. Inferential statistics such as Pearson correlation r, linear regression, and moderation analysis were initiated to examine the relationship among the aforementioned variables. Correlation analysis using Pearson correlation coefficient was performed to determine the association among the study variables prior to regression and moderation analysis. To determine the direct effect of environmental awareness to energy literacy, linear regression was employed. Moderation analysis was performed based on the procedure of Hayes (2014) using the PROCESS v3.5. Separate moderation analysis was conducted for each demographic moderators based on Haye's (2014) model 1, a simple moderation model.

RESULTS AND DISCUSSION

The study examined the demographic moderation in the relationship between environmental awareness and energy literacy of senior high school students in one public secondary high school. It also investigated the direct effect of environmental awareness to energy literacy. It further described the demographic characteristics, environmental awareness, and energy literacy.

The demographic characteristics profiled included age, sex, grade level, strand, junior high school type, and socio-economic status. The details of these demographic characteristics are presented in Table 7. Out of the 270 responses that were eligible for the study, 54.4% were identified as male and 45.6% were identified as female.

ISSN 3028-2179

Table 1. Distribution of Students' Demographic Characteristics (n=270)

Profile		f	%
Age (Years old)	16	36	13.3
	17	107	39.6
	18	94	34.8
	19	21	7.8
	20	7	2.6
	21	2	0.7
	22	1	0.4
	23	2	0.7
Sex	Female	123	45.6
	Male	147	54.4
Grade Level	Grade 11	150	55.6
	Grade 12	120	44.4
Strand	ABM	30	11.1
	AFA	60	22.2
	HE	32	11.9
	HUMSS	30	11.1
	ICT	58	21.5
	STEM	60	22.2
Type of JHS School	Private	8	3.0
	Public	262	97
Socio-economic Status	Poor	176	65.2
	Low-income class (but not poor)	65	24.1
	Lower middle-income class	19	7.0
	Middle middle-income class	7	2.6
	Upper middle-income class	2	0.7
	Upper-income class (but not rich)	0	0
	Rich	1	0.4

The study found that 55.6% of participants were at the grade 11 level, while the remaining 44.4% were at the grade 12 level. The strand that encompasses Science, Technology, Engineering, and Mathematics (STEM) is reported to have a similar percentage of 22.2% as the Agricultural-Fishery Arts strand. The majority of participants in the study were classified as having a low socioeconomic status, with 65.2% of the sample falling into this category.

Table 2. Descriptive Statistics of the Dimensions and Sub-dimensions of Energy Literacy of Senior high School Students

Dimensions and Sub-dimensions	Mean	SD	Interpretation
Cognitive/Knowledge[a]	59	3.63	Did not meet Expectations
Scientific Basic Facts	68	1.81	Did not meet Expectations
Issues	62	1.64	Did not meet Expectations
Impacts	61	1.67	Did not meet Expectations
Self-assessment	2.61	0.93	Somewhat informed
Affective[b]	3.66	0.46	Agree
Self-Efficacy			
Internally empowered	3.58	0.70	Agree
Externally Empowered	3.15	0.79	Neutral
Attitudes & Values			
Awareness	4.34	0.53	Strongly Agree
Values	3.56	0.59	Agree
Behavior[b]	3.57	0.81	Agree
Personal Behavior			
Behavioral Frequencies	4.27	2.37	Strongly Agree
Willingness	3.69	0.87	Agree
Energy Use Assessment	2.83	1.05	Neutral
Family Behavior			
Family Frequencies	3.61	2.13	Agree

Legend: *"90 -100 (Outstanding); 85-19 (Very Satisfactory); 80-74 (Satisfactory); 75-79 (Fairly Satisfactory); Below 75 (Did not meet Expectations); b4.20-above (Strongly Agree); 3.40-4.19 (Agree); 2.60-3.39 (Neutral); 1.80-2.59 (Disagree); 1.00-1.79 (Strongly Disagree)*

The findings indicate that the participants did not attain the anticipated level of proficiency in the cognitive domain. The findings show that the cognitive domain is absent among students, emphasizing the need for improvement in this area as it is a crucial aspect of energy literacy. The respondents' self-assessment falls under the "somewhat informed" category, as evidenced by their low level of knowledge (M=12.99, SD=3.63). The

ISSN 3028-2179

data shows the highest mean value in affective is the Awareness (M=4.34, SD=0.53). This means that the respondents are aware about the importance of energy and it should be part of every school's curriculum. In addition, the respondents agree that every Filipino should conserve more energy. On the other hand, the lowest mean value in Affective is Externally Empowered (M=3.15, SD=0.79). The data indicates that the participants exhibit a self-reliant approach towards energy conservation, without relying on external factors or individuals. The research findings suggest that an individual's attitude towards energy should begin with self-reflection and personal responsibility.

In the behavioral dimension, the highest mean value is the Behavioral Frequencies (M=4.27, SD= 2.37). It concludes that all decisions should be affected by the thoughts on energy use, such as turning off the light when you are leaving or turning off the television when it is not using. However, the lowest mean value is the Energy Use Assessment (M=2.83, SD= 1.05). This concludes that when it comes to energy use, the respondents should try to save energy. Since energy-saving behaviors are when people are willing to do more things to save energy, like using less electricity, because they are concerned about the environment. The Affective and Behavioral dimension result shows that the senior high school students are aware of problems regarding energy (Affective: M=3.66, SD=0.46). In addition, the respondents are willing to contribute to solve energy problems by making more of the electricity from renewable energy. Such as more wind farms should be built to generate electricity (Behavior: M=3.57, SD= 0.81).

Table 3. Descriptive Statistics of Environmental Awareness of Senior high School Students

Indicators	Mean	SD	Interpretation
Behavioral			
1. Reuse used paper	3.01	1.27	Agree
2. Provide a second use of different materials for classroom work	2.78	1.17	Agree
3. Promote activities in the natural environment	2.60	1.28	Agree
4. Include environmental issues as a basic component in the training of my students	3.13	1.32	Agree
5. Participate as a volunteer in school environmental conservation campaigns	2.38	1.17	Agree
6. Choose subjects that deal with environmental issues because I feel I do not know enough	2.53	1.20	Agree
Concern to Environmental Problem			
7. Contamination of the atmosphere	2.73	1.19	Agree
8. Contamination of the oceans	2.72	1.37	Agree
9. Decrease of the ozone layer	2.58	1.06	Agree
10. Climate change and global warming	2.78	1.02	Agree
11. Extinction of animal and plant species	2.56	1.40	Agree
12. Discharges of industrial waste	3.03	1.36	Agree
13. Desertification and soil erosion	2.91	1.33	Agree
14. Discharges to inland water bodies	2.77	1.43	Agree
Affirmations to Environmental Awareness			
15. Plants and animals have as much right as humans to exist	2.97	1.25	Agree
16. If things continue on their present course, we will soon experience a major ecological catastrophe	2.40	1.28	Disagree
17. The balance of nature is very delicate and easily upset	2.86	1.31	Agree

ISSN 3028-2179

Indicators	Mean	SD	Interpretation
18. Humans are severely abusing the environment	2.78	1.24	Agree
19. In order to achieve sustainable development, a balanced economic situation is needed in which economic growth is controlled	2.83	1.27	Agree
20. When humans interfere with nature it often produces disastrous consequences	2.53	1.28	Agree
21. There are more important things to do in life than protecting the environment	3.01	1.24	Agree
22. There are more important things to do in the classroom than to teach to protect the environment	2.36	1.29	Disagree
23. The degree of environmental commitment of the teacher influences his students	3.01	1.26	Agree
24. I consider it interesting to receive environmental training	2.69	1.33	Agree
25. The university should include more field activities because they help to better understand the subject	2.62	1.21	Agree
Overall Mean	3.20	0.34	Agree

Legend: 3.25-4.0 (Strongly Agree); 2.5-3.25 (Agree); 1.75-2.5 (Disagree); 1.0-1.75 (Strongly Disagree)

The table depicts that the indicator 4 has the highest mean value of 3.13. It concludes that environmental issues should be integrated in the training of the students. When teachers educate about the environment in education, children learn environmental literacy, which helps them protect the environment at home, at work, and in their community through their responsible decisions. Awareness of environmental issues, as well as the connection between this awareness and activities performed within the classroom or community to lessen the environmental impact of their operations. The findings imply that a comprehensive approach to teaching is necessary for students to gain an in-depth awareness of various environmental concepts and knowledge.

Furthermore, the finding of the highest mean value provides evidence that contradicts the claim made by the student that there exist greater priorities to pay attention to in the classroom than educating students on environmental protection. Research suggests that students are more likely to develop a strong understanding of environmental awareness when they receive adequate education and have opportunities to observe positive attitudes towards environmental awareness. However, the findings of this study also indicate that a large majority of the participants do not support the view that constant damage to the environment will result in significant ecological catastrophes (M=2.40, SD=1.28). According to the respondents' perception, there appears to be a belief that the current status of the environment has no significant impact on the environment. The findings suggest that the respondents perceived a low level of risk associated with potential environmental damage and disasters.

Most of the respondents agree upon doing a positive behavior relative to the Environment and it is important to teach on how to protect the environment (M=3.20, SD=0.34). Given the attitudes and behavior of young people towards the environment are so important for environmental conservation, it is necessary to understand the factors

ISSN 3028-2179

that facilitate these attitudes and behaviors. The empowerment of young people to participate actively in the improvement of their surroundings by cultivating positive attitudes and behaviors might result from the promotion of positive development among young people. According to Lualhati (2019), including the students in environmental education is essential to developing a sense of awareness and engagement in them as well as educating them on ecological principles that strive to maintain a balance between the wellbeing of the individual, society, and environment. Since, including students will help in developing their knowledge of the environment as well as their capabilities and awareness of how to deal with global issues. It has the potential to bring about profound changes in both individuals and society. It does both informing and inspiring work. It has an effect on people's attitudes. It inspires one to take action

Table 4. Correlation Analysis of Students' Demographics, Environmental Awareness, and Energy Literacy

Variables	1	2	3	4	5	6	7
1. Sex							
2. Grade Level	0.040						
3. Strand	0.157	0.104					
4. Type of School	-0.028	-0.063	-0.061				
5. Socio-economic Status	-0.001	0.109	0.058	-0.023			
6. Environmental Awareness	-0.071	0.076	0.119	-0.012	-0.002		
7. Energy Literacy	-0.093	-0.084	0.138**	-0.017	-0.035	0.159**	

Legend: **=p <.05; **=p <.01; ***=p <.*

This study demonstrates the only variables to emerge are the strand and energy literacy and environmental awareness and energy literacy. This study demonstrates a statistically significant positive correlation between strand and energy literacy ($r=0.138$, $p<0.01$). In addition, the findings suggest that environmental awareness and energy literacy ($r=0.159$, $p<0.01$) share a positive correlation with one another. According to the study of Dwyer (2011) that energy literacy, which is a part of environmental education and contributes to the process of establishing a sense of environmental responsibility, continuously grows. It suggests that as individual engage in learning about energy-related concepts, they not only acquire knowledge but also play a significant role in fostering improved sense of environmental responsibility.

The findings indicate a positive correlation between environmental awareness and energy literacy, suggesting that an increase in environmental awareness is associated with a corresponding increase in energy literacy. This implies that as the students become more environmentally conscious, there is a concurrent rise in their understanding of energy-related matters. To address interconnected global concerns like climate change, loss of biodiversity, unsustainable use of resources, and inequality, learning about energy and the environment awareness should be a process that continues throughout one's life and is an essential component of an education that is of excellent quality.

ISSN 3028-2179

Energy education naturally incorporates scientific courses, which can improve overall scientific, technological, or environmental literacy of the students (DeWaters & Powers, 2011).

Furthermore, the chosen strand has a positive relationship with Energy Literacy. This suggests that the strand has an important role in the energy literacy of an individual. Each strand has a specialized subject, this concludes the specialized are helpful in discussing energy. Studies have shown that those with more information about environmental issues and their consequences, as well as those who hold pro-environmental attitudes, beliefs, values, and self-transcendent goals and motives, are more likely to execute energy conservation at home (Arnon & Orion, 2015).

Table 5. Direct Effect of Environmental Awareness to Energy Literacy R^2=0.025, Adj. R^2 = 0.022

	Unstandardized Coefficient			95% Confidence Interval
	β	SE	t	p
constant	4.848	0.719	6.745	0.000
Environmental Awareness	0.591	0.224	2.644	0.009

Table 5 presents the finding from the linear regression analysis to explain the direct effect of environmental awareness to energy literacy. Based on the table, environmental awareness merged to be a significant predictor of energy literacy based on the β-coefficient and p- value ($\beta=0.591$, $p<0.05$) at 95% confidence interval. This suggests that the variation in the energy literacy of the respondents can be explained by their environmental awareness. Based on the statistical analysis, there is a significant relationship between the respondents' level of environmental awareness and their energy literacy. Energy literacy is most likely part of environmental awareness this is supported by the measured p-value Specifically, an increase in environmental awareness is associated with a corresponding increase in energy literacy. This further indicates that a one-unit change in energy literacy can institute a 0.591-unit change in energy literacy, assuming other factors are held constant. Hence, the first alternative hypothesis stating that environmental awareness significantly predicts energy literacy is supported. based on the computed p-value at 95% confidence interval.

Table 6. Moderating Effect of Students' Demographics in the Influence of Environmental Awareness to Energy Literacy

	β	SE	t	p	LLCI	ULCI
Sex	.2383	.4653	.5121	.6090	-.6778	1.1544
	R=.1819, R^2=.0331, MSE=1.5564, F= (3.0344), p=.5175					
Grade	-1.1758	.4579	-2.5678	.0108	-2.0773	-.2742
	R=.2411, R^2=.0581, MSE= 1.5161, F= (5.4703), p=.0012					
Academic Strand	-.3153	.1216	-2.5916	.0101	-.5548	-.0757
	R= .2518, R^2= .0634, MSE= 1.5079, F= (6.0028), p=.0006					
SSE	-.2015	.2369	-.8505	.3958	-.6680	.2650

ISSN 3028-2179

	β	SE	t	p	LLCI	ULCI
		R= .1711, R^2=.0293, MSE= 1.5625, F= (2.6738), p=.0477				
JHS Type	1.0156	1.1077	.9169	.3600	-1.1652	3.1965
		R= .1694, R^2= .0287, MSE=, F= (2.6205), p=.0512				

Legend: *Significant if p<0.05; Not Significant if p>0.05*

The study aimed to investigate the potential moderating effect of sex on the relationship between environmental awareness and energy literacy. Female and male are the terms used to describe sex roles. The Statistical analysis revealed that the model had no significant overall effect, with a R=.1819, a F (3,266) = 3.0344, and a p-value of .5175. The findings indicate that there is no statistically significant interaction between environmental awareness and sex (β = -.9716, t (266) = -.6481, p= .5175). The data presented in this study provides evidence to support the significance of the model. Meaning there is a relationship between energy literacy and environmental awareness. However, it does not provide enough evidence to support the significance of any particular sex that moderate the relationship.

The study aimed to investigate the potential moderating effect of Grade on the relationship between Environmental Awareness and Energy Literacy. Specifically, Grade 11 and Grade 12 levels are used to define their grade. The Statistical analysis revealed that the model has a significant overall effect, with a R=.2411, a F (3,266) = 5.4703 and a p-value of .0012. The findings indicate that there is a statistically significant interaction between environmental awareness and grade (b= 3.5241, t (266) = 2.3878, p=.0176). The effect of environmental awareness on energy literacy can be predicted by the grade level. In that case, grade level is said to be a moderator of environmental awareness' effect on energy literacy. According to the the findings, the grade 11 level has a significant effect on environmental awareness and energy literacy, as evidenced by the coordinator effect value of 1.055 and significant interaction with a p-value of 0.0002. However, the findings indicate that grade 12 has no significant interaction with the p-value of .7401 and the coordinator effect value of -.120 the grade 12 energy literacy, which in turn predicts the environmental awareness of grade 12. Given the data, it appears that grade 12 students possess a significant level of energy knowledge, likely due to their knowledge that they have already engaged with this subject matter in their specialized classes.

In the next regression analysis, the variable strand was based on the six categories such as STEM, HUMSS, ABM, ICT, and AFA. The results indicated that the overall model was significant R (.2518), F (3,266) = 6.0028, p = .0006. There was also a significant interaction for environmental awareness and strand (β = 1.1072, t (266) = .7957, p = .0059. This suggests that strand acts as a moderator of the relationship between environmental awareness and energy literacy. The effect of environmental awareness on energy literacy can be predicted by the academic strand. In that case, strand is said to be a moderator of environmental awareness' effect on energy literacy. According to the findings that in strand of Agricultural-Fishery Arts (AFA) that has a significant effect on

ISSN 3028-2179

environmental awareness and energy literacy, as evidenced by the coordinator effect value of 1.0538 and significant interaction with a p-value of 0.0005. However, the findings indicate that Humanities and Social Sciences (HUMSS) that have coordinator effect value of .4233 has no significant interaction with a p-value of .0621 and Science, Technology, Engineering, and Mathematics (STEM) that have coordinator effect value of -.2072 has no significant interaction with p-value of .5686. It appears that students in STEM fields have an advanced level of understanding regarding energy, as they are subjected to a wider range of sp energy.

The study aimed to investigate the potential moderating effect of socioeconomic status on the relationship between environmental awareness and energy. Specifically, the monthly income of participants' parents was utilized as a measure of socioeconomic status. The statistical analysis revealed that the model had a significant overall effect, with a R= .1694, a F (3,266) =2.6738 and a p-value of 0.0477. The findings indicate that there is no statistically significant interaction between environmental awareness and socioeconomic status (β =.5911, t = 0.7779, p =.4373). The sample data presented in this study provides evidence to support the significance of the model. However, it does not provide enough evidence to support the significance of any particular socioeconomic status.

For the next regression analysis, junior high type of school was analyzed as a binary moderator variable, using public and private scores with the average scores of the energy literacy used as the dependent variable, and the average scores of the environmental awareness as the independent variable. The results indicate that the overall model was not significant R (.1694), F (3,266) = 2.6205, p = .0512. There was also no significant interaction for environmental awareness and junior high type of school (β = -3.3796, t (266) = -.9404, p = .3478), indicating that type of school does not moderate the relationship between environmental awareness and energy literacy. This suggests that whether in public or private educational institutions, the observed positive correlation between environmental awareness and energy literacy remains consistent.

The study revealed that the variable "strand" demonstrated a significant moderating effect on the relationship between environmental awareness and energy literacy. The frequency of STEM and AFA as the most prominent fields suggests a focus on Environmental Awareness and Energy Literacy within these areas of study. This implies that the connection between environmental awareness and energy literacy is influenced by the specific academic discipline of the individuals involved. Environmental awareness is a crucial aspect of scientific education for the students. Science students should be well-versed in environmental concepts and should possess a deep understanding of environmental issues and problems (Rogayan & Nebrida, 2019).

The summary of the interpretation is that the alternative hypotheses stating that environmental awareness significantly predicts energy literacy moderated by age, sex, socioeconomic status, JHS type are all rejected are based on the computed p-value at 95% confidence interval.

ISSN 3028-2179

On the other hand, the alternative hypothesis stating that grade level and academic stand significant moderates the relationship between environmental awareness are accepted. Therefore, the alternative hypothesis2 stating that environmental awareness significantly pre predicts energy literacy moderated by strand and grade level is accepted based on the computed p-value at 95% confidence interval.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study is to assess the statistical connection exists among environmental awareness, energy literacy, and students' demographic characteristics. Furthermore, this study sought to find out the moderating role of demographic factors in the relationship between environmental awareness and energy literacy. Based on the findings, the following conclusions were made: The senior high school students generally reported themselves as relatively above average environmental awareness and energy literacy. Furthermore, environmental awareness has a significant direct and positive effect to energy literacy. This implies that environmental awareness can explains the variation of energy literacy among the respondents. In addition to this, the relationship between environmental awareness and energy literacy is not significantly moderated by the students' demographic characteristics as to sex, age, socioeconomic status, and junior high type of school. On the other hand, the academic strand and grade level demonstrated significant moderating effects in the relationship between environmental awareness and energy literacy. This suggests that the effect of environmental awareness to energy literacy differs based on the academic level and strand of the students.

This study recommends the following based on the salient findings of the study: The inclusion of energy concepts and principles to the curriculum, education programs and events, and school administrations to provide more opportunity to improve the energy literacy of the students, especially in the cognitive domain. For teachers, educators must prioritize the instruction of energy and environmental awareness-related subjects as fundamental components of students' learning. Exploring alternative and stimulating activities related to energy and the environment may contribute to enhancing students' literacy and awareness. Furthermore, integrating real-world examples, hands-on experiments, and case studies into the curriculum can provide students with practical insights into the application of energy and environment concepts. Through designing an interactive learning environment, educators can encourage students' interest and facilitate more profound connection to the material. Furthermore, fostering open discussions and encouraging critical thinking about the current environmental challenges can empower the students to develop sense of responsibility in addressing these issues.

For students, researchers suggest that increased student involvement in community or school activities related to energy can lead to enhanced energy literacy and environmental awareness. Attending seminars focused on energy education may also be beneficial for students seeking to enhance their knowledge in this field. This study suggests that active engagement can enhance students' understanding of energy literacy and environmental awareness.

These experiential learning activities not only deepen their

ISSN 3028-2179

understanding in energy-related matters but also instills behavioral change to act for the environment. Through active immersion, the students can develop a comprehensive set of skills and mindset conducive in addressing the challenges of sustainable energy and environmental conservation.

For future works, it is imperative to undertake parallel study involving a larger and more diverse participants. Expanding the scope by including students and non-students can provide a more comprehensive understanding of energy literacy across different demographics. Additionally, the study recommends to examine alternative antecedents aside from environmental awareness predicting energy literacy. This approach can uncover additional factors that may influence or contribute to the individual's proficiency in energy-related matters, enriching the existing knowledge base and offering a more nuanced perspective on the determinants of energy literacy. The study further suggests to investigate the long-term impact of enhancing energy literacy on sustainable behavior, measuring whether increased awareness translates into environmental-friendly practices over time. Exploring innovative teaching strategies may also provide insights into optimizing energy education for diverse group of students. Lastly, conducting cross-cultural studies to examine how cultural context influence perceptions of energy literacy and environmental awareness could contribute to developing tailored educational strategies for a given group of students.

Acknowledgement

The authors extend their deepest gratitude to Laguna State Polytechnic University for the unwavering support to this research undertaking.

REFERENCES

Ali, M., Irfan, M., Öztürk, İ., & Rauf, A. (2022). Modeling public acceptance of renewable energy deployment: a pathway towards green revolution. *Ekonomska Istrazivanja-economic Research*, *36*(3). https://doi.org/10.1080/1331677x.2022.2159849

Aruta, J. J. B. R. (2022). Science literacy promotes energy conservation behaviors in Filipino youth via climate change knowledge efficacy: Evidence from PISA 2018. *Australian Journal of Environmental Education*, *39*(1), 55–66. https://doi.org/10.1017/aee.2022.10

Barth, J., Münder, T., Nüesch, E., Trelle, S., Znoj, H., Jüni, P., & Cuijpers, P. (2013). Comparative Efficacy of Seven Psychotherapeutic Interventions for Patients with Depression: A Network Meta-Analysis. *PLOS Medicine*, *10*(5), e1001454. https://doi.org/10.1371/journal.pmed.1001454

Bahrami, S., & Mohammadi, Y. (2021). Assessing energy literacy of Iranian ninth-grade students. *Journal of Turkish Science Education, 18*(4), 707-731. https://doi.org/10.36681/tused.2021.99

Bélaïd, F., & Joumni, H. (2020). Behavioral attitudes towards energy saving: Empirical evidence from France. *Energy Policy*, *140*, 111406. https://doi.org/10.1016/j.enpol.2020.111406

Carmi, N., Arnon, S., & Orion, N. (2015). Transforming environmental knowledge into behavior: the mediating role of environmental emotions. *The Journal of Environmental Education*, *46*(3), 183–201.

ISSN 3028-2179

https://doi.org/10.1080/00958964.2015.1028517

Cotton, D., Miller, W., Winter, J., Bailey, I., & Sterling, S. (2015). Developing students' energy literacy in higher education. *International Journal of Sustainability in Higher Education*, *16*(4), 456–473. https://doi.org/10.1108/ijshe-12-2013-0166

Department of Energy. (2018). The Philippine Energy Plan (PEP) 2018-2040. https://policy.asiapacificenergy.org/node/4299#:~:text=The%20Philippine%20Energy%20Plan%20(PEP,Consumer%20Empowerment%3B%20and%2C%20IV.

DeWaters, J., & Powers, S. E. (2011). Energy literacy of secondary students in New York State (USA): A measure of knowledge, affect, and behavior. *Energy Policy*, *39*(3), 1699–1710. https://doi.org/10.1016/j.enpol.2010.12.049

DeWaters, J., Qaqish, B., Graham, M., & Powers, S. E. (2013). Designing an energy Literacy questionnaire for middle and high school youth. *The Journal of Environmental Education*, *44*(1), 56–78. https://doi.org/10.1080/00958964.2012.682615

Dietz, T. (2010). Narrowing the US energy efficiency gap. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(37), 16007–16008. https://doi.org/10.1073/pnas.1010651107

Djordjevic, A., & Cotton, D. (2011). Communicating the sustainability message in higher education institutions. *International Journal of Sustainability in Higher Education*, *12*(4), 381–394. https://doi.org/10.1108/14676371111168296

Lee, L. S., Lee, Y. F., Altschuld, J. W., & Pan, Y. (2015). Energy literacy: Evaluating knowledge, affect, and behavior of students in Taiwan. *Energy Policy*, *76*, 98–106. https://doi.org/10.1016/j.enpol.2014.11.012

Lualhati, G. P. (2019). Environmental awareness and participation of Filipino pre-service teachers. *Jurnal Pendidikan Biologi Indonesia*, *5*(2), 345–352. https://doi.org/10.22219/jpbi.v5i2.8524

Özgelen, S. (2012). Students' Science Process Skills within a Cognitive Domain Framework. *Eurasia Journal of Mathematics, Science and Technology Education*, *8*(4). https://doi.org/10.12973/eurasia.2012.846a

Schwartz, S. J., Unger, J. B., Zamboanga, B. L., & Szapocznik, J. (2010). Rethinking the concept of acculturation: Implications for theory and research. *American Psychologist*, *65*(4), 237–251. https://doi.org/10.1037/a0019330

Winter, J., & Cotton, D. (2012). Making the hidden curriculum visible: sustainability literacy in higher education. *Environmental Education Research*, *18*(6), 783–796. https://doi.org/10.1080/13504622.2012.670207

Yeh, S., Huang, J., & Yu, H. (2017). Analysis of energy literacy and misconceptions of junior high students in Taiwan. *Sustainability*, *9*(3), 423. https://doi.org/10.3390/su9030423

Van Treuren, K. W., & Gravagne, I. A. (2008). Raising community energy awareness: Building an energy display at the Mayborn museum. In *Proceedings of the 2008 ASEE Gulf-Southwest Annual Conference* (pp. 1-11).

ISSN 3028-2179