Cakrawala Pendidikan
Jurnal Ilmiah Pendidikan
Vol. 41 No. 3, October 2022, pp.569-585
https://journal.uny.ac.id/index.php/cp/issue/view/2348
DOI: https://doi.org/10.21831/cp.v41i3.42407

Knowledge, Attitudes, and Behaviors of Students and Teachers towards Education for Sustainable Development

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ABSTRACT

The urgent call by UNESCO to scale up interventions for the achievement of sustainable development goals motivated this study to assess the level and association of teachers' (n =107) and students' (n = 342) knowledge, attitudes, and behaviors (KAB) regarding education for sustainable development, focusing on Pili (Canarium ovatum). This is a subset of a larger project that involves Pili to contextualize learning and instructional materials. The researchers used a descriptive cross-sectional survey approach and distributed a questionnaire through Google Forms. KAB levels were categorized into poor, moderate, and high using descriptive data analysis, and their association with one another was determined by using Pearson's Chi-square. The findings indicated that, although the associations among the KAB of teachers were distinct from those of the students, they both perceived that possessing favorable knowledge and attitudes was insufficient to generate positive behaviors. Thus, the efforts to increase teachers' and students' motivation and involvement and to help them carry out favorable behaviors toward sustainable development were imperative. Given this, identifying the barriers to converting knowledge and attitudes into behaviors and considering the factors that involved the association of KAB in promoting sustainable development, particularly in education, were recommended.

Keywords: contextualization, education for sustainable development, online survey, science education, sustainability

Article history

Received:	*Revised:*	*Accepted:*	*Published:*
29 April 2022	*29 May 2022*	*20 June 2022*	*1 October 2022*

Citation (APA Style): Funa, A. A., Gabay, R. A. E., Ibardaloza, R. T., & Limjap, A. A. (2022). Knowledge, attitudes, and behaviors of students and teachers towards education for sustainable development. *Cakrawala Pendidikan: Jurnal Ilmiah Pendidikan, 41*(3), 567-580. DOI: https://doi.org/10.21831/cp.v41i3.42407

INTRODUCTION

Years before the idea of the 17 sustainable development goals (SDGs) was created, the role of education in promoting and balancing the economy and the environment had already been apparent. Bernice Goldsmith, who was known for pioneering the integration of social and environmental concepts and practices in education, emphasized that education was integral to instilling in people their roles in the healthy future of the Earth (WCED, 1987). She furthered that schools and communities should develop and promote activities for students where they could involve themselves in making a difference in society. Concerning these ideas, the United Nations Department of Economic and Social Affairs (UN DESA) includes Quality Education as the fourth among the 17 SDGs that serves as a blueprint to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by the year 2030 (Didham & Ofei-Manu, 2018; UNDESA, 2016). The term “quality” in education is defined as a learning and teaching process that fosters creativity, knowledge, and skills including, but not limited to, literacy, numeracy, analytical, problem-solving, and high-level cognitive, interpersonal, and social skills; and

develops values and attitudes that will lead to a healthy and fulfilled lives, making informed decisions, and harnessing capabilities to address local and global challenges (WEF, 2015).

To achieve and sustain quality education, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) identified education for sustainable development (ESD) as its integral element (UNESCO, 2014, 2018). ESD aims to empower students with the capacity to make informed decisions and responsible actions to meet their necessities while balancing the four interacting complex systems (i.e., global economy, social systems, Earth systems, and political governance) and considering the welfare of the future generations (Sachs, 2015; UNESCO, 2014). Consequently, the SDG4 is relevant to the achievement of the rest of the SDGs, the same way wherein ESD is also relevant to achieving quality education. Hence, explicitly incorporating ESD to acquiring quality education at the basic level, targetting the youth as they were expected to become future leaders, is deemed important.

Teachers and students play vital roles in successfully implementing ESD. Both the teachers and their training institutions are considered as key change agents in influencing and strengthening the students to promote sustainable development (SD) at their early stages of education (McKeown & Hopkins, 2014). Students of all ages are expected to prepare and be able to face and find solutions to the problems of today and the future (UNESCO, 2018, 2020). To support and put these roles into realization, UNESCO (2020) urgently calls for action from the concerned stakeholders and authorities to scale up educational interventions, enumerating the things that need to be done. These things involve the profound understanding of knowledge, skills, values, and attitudes that empower informed decisions and responsible individuals, as well as the collective actions towards local, national, and global challenges while taking into consideration the balance among the complex systems and the welfare of the future generations (UNESCO, 2020). Given this, the assessment of knowledge, attitudes, and behaviors (KAB) of both teachers and students is imperative as it serves as a basis in the transformation and alignment of the learning environment in accordance with the principles of SD.

Various studies that assessed the KAB of teachers and students were done in the past, contextualizing them based on the targetted participants (Funa et al., 2022). To cite some examples: Borges (2019) assessed the KAB towards SD of various Portuguese preservice elementary teachers; Al-Naqbi & Alshannag (2018) assessed the KAB of United Arab Emirates University students including preservice secondary teachers towards ESD and the environment; Yang et al. (2010) assessed the values and teaching beliefs on SD of Chinese secondary teachers; Zyadin et al. (2014) assessed the KAB of secondary teachers towards SD on renewable energy in Jordan. All of these studies had teachers, preservice or in-service, as their respondents and developed their research tools or questionnaires to assess respondents in their respective contexts and cultures. Moreover, to cite some examples of studies done to assess the KAB of students at the basic level: Olsson et al. (2016) assessed the sustainability consciousness of grade six and nine students in Sweden; Michalos et al. (2015) assessed the KAB of grade 10 students in Manitoba; Ekantini & Wilujeng (2018) assessed the students' scientific literacy relevant to environmental SD in Indonesia; Amran et al. (2019) assessed the attitude and environmental awareness of senior high school (SHS) students in Indonesia. These studies only prove that various countries support the implementation of ESD and one of the various activities to do this is to examine the students and teachers' KAB towards SD. Further, investigating the teachers' and students' KAB towards SD in the Philippines context would contribute to the existing body of knowledge that would, in turn, facilitate relevant intercultural and cross-cultural research studies, among others.

The Department of Education (DepEd) in the Philippines supports ESD by integrating it into different subjects. For instance, the science curriculum in junior high schools (JHS) has environmental literacy as the end goal; the subject Understanding Culture, Society and Politics in SHS tackles topics on global warming and climate change; and the provision of National Service Training Program and Disaster Risk Reduction Management (Apronti et al., 2015; Boakye, 2015; Onuoha et al., 2021; Valencia, 2018). The support given by the Philippines to promote SD makes the assessment of the teachers and students' KAB towards SD more imperative; for instance, to

facilitate literature reviews such as meta-synthesis and meta-analysis and profoundly understand the ESD based on the local context.

To contextualize the assessment of KAB, the researchers focused the questions on the SD of Pili (*Canarium ovatum*). The Pili plant is known for its contribution to the economy as an endemic product of the Bicol region (Region 5) in the Philippines (Coronel, 1996). The oil extracted from its pulp can be a cheap alternative to olive oil in terms of health benefits and the nuts can be made into flavored snacks and an alternative to internationally known nuts like macadamia and almonds, and the elemi is being used as a raw material for luxury fragrances (Roncero et al., 2021; Tu et al., 2021). However, although Pili offers great opportunities for economic growth, there is an alarming decline of interest among Bicolano (native or resident of the Bicol Region, Philippines) youth to farm, invest, and propagate Pili. Many of the Pili farmers' children opt to pursue white-collar jobs or work in construction or call centers, leaving their parents no choice but to sell their pili farms; hence, the labor force and land area to farm Pili diminish (Apognol, 2018; Roncero et al., 2021). Accordingly, assessing the KAB of teachers and students towards the SD of Pili is necessary to initiate studies integrating Pili in education as part of implementing ESD and promoting Pili sustainability. This study is a part of a bigger project that aims to provide opportunities for teachers and students to be explicitly involved in promoting the SD of Pili in the Bicol region, and eventually the whole country and the world.

The purpose of this study was to assess the KAB of secondary teachers and students towards the SD of Pili (*C. ovatum*). Specifically, the researchers answered the following questions: (1) What is the level of secondary science teachers' KAB towards SD of Pili? (2) What is the level of secondary students' KAB towards SD of Pili? and (3) Are there associations among the teachers' and students' knowledge, attitudes, and behaviors towards SD of Pili?

METHOD

This study was conducted in the Philippines, particularly in the Bicol region, involving secondary science teachers and students from both the junior high school (JHS) and senior high school (SHS) levels. The researchers chose the Bicol region because Pili (*C. ovatum*) is popularly known and grows endemically in this region. The methods of collecting and analyzing the data are explained below.

Research design

The researchers used the descriptive cross-sectional survey research design to assess the level of KAB among science teachers and students in the secondary level in the Bicol region, and determine the association among their knowledge, attitudes, and behaviors (Creswell & Creswell, 2018). The survey was disseminated online using Google Forms through the respondents' e-mails and social media accounts such as Facebook pages and messengers, leaving the link active in accepting responses for one month. The one-month period gave the respondents enough time to access and complete the questionnaire at their convenience. The study was conducted during the time of the COVID-19 pandemic and the online data gathering procedures ensured the respondents' health safety while answering the survey questionnaire from home (Funa & Talaue, 2021). To enhance the credibility of the obtained data online, triangulation in the form of informal interviews of seven teachers and nine students was virtually done through video communications.

Respondents

Informed The science teachers and students in both JHS and SHS levels were chosen as respondents because this study was a part of a bigger project that integrated SD in the basic level, particularly in secondary education. The assessment of KAB was necessary for the researchers to examine the current situation and informed further studies involving SD and Pili (*C. ovatum*). There were 107 science teachers and 342 secondary students from the Bicol region, the Philippines, who voluntarily participated in the study. Originally, 110 teachers voluntarily answered the questionnaire. However, three of the science teachers were removed because they did not come from the Bicol region as the study was limited to participants coming from the Bicol

region only. Table 1 shows the profile of the science teachers.

Table 1. Profile of the secondary science teachers in the study (*n* = 107)

Profile of the secondary science teachers		Frequency	Percentage
Gender	Female	74	69.2
	Male	33	30.8
Position	Teacher	93	86.9
	Master Teacher	12	11.2
	Head Teacher	2	1.9
Institution	Public	99	92.5
	Private	8	7.5
Course specialization	Biology	38	35.5
	Physics	31	29.0
	Chemistry	19	17.8
	Physical Science	7	6.5
	Earth Science	5	4.7
	General Science	5	4.7
	Biophysics	1	.9
	Environmental Science	1	.9
Grade level assignment	Junior high school	65	60.8
	9	19	17.8
	10	17	15.9
	8	16	15.0
	7	13	12.1
	Senior high school	42	39.2
	11	28	26.2
	12	14	13.1

The science teachers who voluntarily responded to the survey were generally composed of female teachers in public schools. Most of them were specialized in Biology (*n* = 38), Physics (*n* = 31), and Chemistry (*n* = 19) and assigned in JHS (*n* = 65). Further, Table 2 shows the profile of the students who voluntarily responded to the survey.

The students who voluntarily responded to the study were all in public schools and were composed mostly of females (*n* = 223) and SHS students (*n* = 215). The JHS was largely composed of Science, Technology, and Engineering (STE) students, and the SHS was primarily composed of Science, Technology, Engineering, and Mathematics (STEM) and General Academic Strand (GAS) students.

The instrument

The researchers adopted an instrument called the Online Survey Instrument on SD of Pili (OSISDeP) by Funa et al. (2022) to assess the KAB of teachers and students. It is a 24-item 4-point Likert scale questionnaire composed of three main parts: Knowledge, Attitudes, and Behaviors. Included in the instrument was the declaration of the Philippines data privacy act of 2012 and the agreement on voluntary participation in the study. Further, it obtained a Cronbach's alpha estimate of 0.835 for science teachers, signifying that the instrument was reliable (Funa et al., 2022; Taber, 2018). Evaluating the suitability of the instrument to the respondents' characteristics is an important process before implementation and dissemination (Funa & Ricafort, 2019). Thus, to determine the suitability of the instrument for students, three evaluators composed of master teachers in science, who were from the Bicol region and knowledgeable on Pili (*C. ovatum*), evaluated the content and face value of the OSISDeP. Using the Online kappa

calculator by Randolph (2008), the instrument gained a very good Fleiss's kappa estimate (κ = 1.00, 95% *CI*, -1.00 to 1.00), signifying that the instrument was valid for assessing students KAB towards the SD of Pili (*C. ovatum*).

Table 2. Profile of the secondary students in the study (*n* = 342)

Profile of the secondary students		Frequency	Percentage
Gender	Female	223	65.2
	Male	119	34.8
Grade level	Junior high school	127	37.2
	8	66	19.3
	9	28	8.2
	7	17	5.0
	10	16	4.7
	Senior high school	215	62.8
	11	140	40.9
	12	75	21.9
Strand (JHS)	Science, Technology, Engineering (STE)	87	25.4
	General Curriculum	40	11.7
Strand (SHS)	Science, Technology, Engineering, and Mathematics (STEM)	86	25.1
	General Academic Strand (GAS)	56	16.4
	Humanities and Social Sciences (HUMSS)	30	8.8
	Technology, Vocational, and Livelihood (TVL)	25	7.3
	Accountancy, Business, and Management (ABM)	18	5.3

Data collection

The researchers disseminated the OSISDeP online through Google Forms. Together with the instrument was a downloadable consent form for the students to download, fill out, sign by their parent/guardian, and submit back through the given upload button in the same form before they could continue answering the main parts of the survey. The data gathering procedure was done during the COVID-19 pandemic; hence, to prevent the transmission of the COVID-19 virus, the collection of responses was done in a full online mode. The link was opened to accept responses for a period of one month to give the participants enough time to complete the survey form

Data analysis

To quantitatively analyze the level of teachers and students' KAB towards SD, the researchers obtained the frequency and percentage in each item of the questionnaire. On one hand, the total individual scores were then classified by percentage as follows: (a) scores less than 60%: poor KAB, (b) scores between 60% to 80%: moderate KAB, and (c) scores more than 80% to 100%: high KAB. On the other hand, to determine the association among the KAB, the researchers used Pearson's Chi-square test.

FINDING AND DISCUSSION

The presentation and discussion of the results follow the order of the abovementioned problem statements. The first part includes the level of secondary science teachers' KAB towards SD of Pili (*C. ovatum*), the second part involves the level of secondary students' KAB towards SD of Pili (*C. ovatum*), and the third part discusses the association among the KAB of both the teachers and the students. Moreover, the discussion highlights the items with high and low percentage agreement to determine the specific KAB that needs improvement.

Finding

Level of secondary science teachers' KAB towards SD of Pili

The majority of the secondary science teachers in the Bicol region strongly agreed on all the items provided in the knowledge dimension of the questionnaire. Table 3 shows that the teachers strongly agreed that the SD of Pili contributed to a better climate system (K4 = 89.7%), supported different cultural values in the Bicol region (K5 = 79.4%), and improved understanding of people about Pili (K8 = 77.6%). These results indicated that the teachers strongly believed that the SD of Pili contributed to changes in the atmosphere and climate systems, preserving cultural values, and improving people's understanding. Further, these results are in line with the study of Al-Naqbi & Alshannag (2018) wherein preservice teachers in UAE strongly agreed that education, environmental protection, and human contributions to climate systems are important aspects of SD.

Table 3. KAB od secondary science teachers towards SD of Pili (*n* = 107)

Dimension	Items	SA	A	D	SD
		n (%)	*n* (%)	*n* (%)	*n* (%)
Knowledge	K1	75 (70.1)	31 (29.0)	1 (0.9)	0 (0.0)
	K2	69 (64.5)	38 (35.5)	0 (0.0)	0 (0.0)
	K3	82 (76.6)	24 (22.4)	1 (0.9)	0 (0.0)
	K4	96 (89.7)	11 (10.3)	0 (0.0)	0 (0.0)
	K5	85 (79.4)	21 (19.6)	1 (0.9)	0 (0.0)
	K6	76 (71.0)	31 (29.0)	0 (0.0)	0 (0.0)
	K7	81 (75.7)	26 (24.3)	0 (0.0)	0 (0.0)
	K8	83 (77.6)	24 (22.4)	0 (0.0)	0 (0.0)
Attitudes	A1	98 (91.6)	9 (08.4)	0 (0.0)	0 (0.0)
	A2	59 (55.1)	43 (40.2)	5 (4.7)	0 (0.0)
	A3	68 (63.6)	33 (30.8)	6 (5.6)	0 (0.0)
	A4	85 (79.4)	22 (20.6)	0 (0.0)	0 (0.0)
	A5	91 (85.0)	16 (15.0)	0 (0.0)	0 (0.0)
	A6	70 (65.4)	32 (29.9)	5 (4.7)	0 (0.0)
	A7	90 (84.1)	17 (15.9)	0 (0.0)	0 (0.0)
	A8	73 (68.2)	31 (29.0)	3 (2.8)	0 (0.0)
Behaviors	B1	14 (13.1)	40 (37.4)	50 (46.7)	3 (2.8)
	B2	52 (48.6)	46 (43.0)	9 (8.4)	0 (0.0)
	B3	4 (3.7)	19 (17.8)	52 (48.6)	32 (29.9)
	B4	11 (10.3)	23 (21.5)	60 (56.1)	13 (12.1)
	B5	30 (28.0)	51 (47.7)	25 (23.4)	1 (0.9)
	B6	10 (9.3)	20 (18.7)	52 (48.6)	25 (23.4)
	B7	17 (15.9)	34 (31.8)	47 (43.9)	9 (8.4)
	B8	7 (6.5)	20 (18.7)	49 (45.8)	31 (29.0)

Three items that fall under the least prevalent among the items in the knowledge dimension are the following: the SD of Pili promotes the use of renewable energy (K6 = 71.0%); promotes Pili business in the community that helps the poor (K1 = 70.1%); and involves minimizing wastes (K2 = 64.5%). Nevertheless, most of the teachers still strongly agreed with these items. These results show that the teachers believed that the SD of Pili involved the use of renewable energy. This is in parallel to the results obtained by Zyadin et al. (2014) wherein teachers in Jordan had a low level of knowledge on renewable energy including the reuse of bio-waste. Their study recommended the strengthening of the role of education to create environmentally literate and

energy-conscious generations. Moreover, with the conducted informal interview with the teachers, they believed that the promotion of the Pili business had the capacity to help the poor communities in the Bicol region. However, the reports and campaigns relevant to this aspect were rarely visible and felt. This factor contributes to the placement of item K1 in the least prevalent items. Nonetheless, the secondary science teachers had a high level of knowledge of the SD of Pili as shown in Table 4.

Table 4. Level of teachers' KAB towards SD of Pili

Dimension	Level	Frequency	Percentage
Knowledge	Poor	0	0
	Moderate	8	7.5
	High	99	92.5
Attitudes	Poor	0	0
	Moderate	9	8.4
	High	98	91.6
Behaviors	Poor	59	55.1
	Moderate	34	31.8
	High	14	13.1

The high level of secondary science teachers' agreement on the knowledge dimension shows that they were knowledgeable on the relevance of environmental, social, economic, and political aspects to the SD of Pili in the Bicol region. Favorable results in the adults' knowledge dimension towards SD were parallel to the results obtained by Borges (2019) and Michalos et al. (2011). The knowledge and beliefs of teachers may be considered as factors to manifest positive attitudes and behaviors towards SD.

Like in the knowledge dimension, the teachers obtained a high level of attitudes as shown in Table 4. The three most prevalent secondary science teachers' attitudes towards the SD of Pili are the following: the teachers were happy to see people understand the importance of Pili sustainability in preserving the culture of their community (A1 = 91.6%); admired people who invested in Pili to lessen poverty (A5 = 85.0%); were glad to hear news about the government encouraging the use of renewable energy in Pili production (A7 = 84.1%). The most prevalent item in the attitude dimension was the A1 tackling the relevance of the SD of Pili in the culture of Bicol which was the same theme as the most prevalent item in the knowledge dimension. These results signify that the Pili is not only a plant that is important for economic and environmental purposes but also an important part of the Bicol culture. Due to the geographic location and physical environment, the Philippines is one of the most disaster-prone countries in the world and the Bicol region is one of the areas often visited by natural hazards such as typhoons and floods (Mascariñas et al., 2013). Over time, the Pili tree has proven its resiliency and adaptability to the erratic climatic condition of the Bicol region withstanding strong typhoons and floods. As a result of these characteristics, the local communities dubbed Pili as "the tree of hope", believing that it plays a significant role in their culture (Philippines Department of Agriculture, 2011).

Further, although the least items for knowledge included the relevance of SD of Pili to helping the poor (K1) and promoting the use of renewable energy (K6), the teachers were happy to see people investing in Pili to lessen poverty and using renewable energy for Pili production. Based on the interview with the teachers, they believed that Pili had been an important part of being a Bicolano. Whenever they had visitors from other provinces or countries, they usually introduced and owned Pili as one of Bicol's signature local delicacies. However, they perceived that the movements that promoted the Pili industry as one of the means to alleviate poverty and the use of renewable energy for its production were limited. Nevertheless, they felt happy for the efforts in the Pili industry to help the poor and use safe and renewable energy in the future.

However, 65.4% of the teachers got mad at people exploiting Pili resources (A6); 63.6% were annoyed when people ignored threats to Pili conservation (A3); 55.1% got angry when Pili

manufacturers did not encourage zero-waste Pili production (A2). These three items showing negative attitudes towards undesirable activities on the SD of Pili fell under the least items in the attitude dimension. These results signify that among the items in the attitude dimension, the teachers have leaned more on showing positive attitudes rather than negative ones. Overall, the attitudes of teachers towards the SD of Pili were favorable as shown in Table 4. These favorable attitudes towards the SD were parallel to the results obtained by Al-Naqbi & Alshannag (2018) wherein preservice teachers showed positive attitudes in protecting the environment, Zyadin et al. (2014) wherein teachers supported the use of renewable energy, and Borges (2019) wherein teachers obtained moderate scores for the attitudes dimension.

Concerning the behavior dimension, the majority of the teachers agreed that they bought Pili products from the local producers (B2 = 48.6%); thought about saving Pili from environmental deterioration (B5 = 28.0%); read studies on converting Pili wastes into useful products (B7 = 15.9%). These results suggested that teachers supported the local Pili businesses and gave importance to Pili by wanting to participate in saving and promoting it. Based on the interview with them, the different Pili products were rampant wherever they visited the Bicol provinces. However, although they thought about saving Pili and using its wastes to make new useful materials, the activities, seminars, and workshops on the SD of Pili and ways to effectively incorporate it into teaching and learning processes were lacking. According to them, there might be efforts to promote Pili products, but the visibility of such efforts was not proactive enough in the education sector, most especially at the secondary level. As a result, they disagreed on the following items: that they coordinated with the government to plant Pili trees (B6 = 9.3%); volunteered to work for organizations involving Pili sustainability (B8 = 6.5%); and attended seminars on the SD of Pili (B3 = 3.7%). In this regard, the intensification of programs and activities for the SD of Pili and its integration to the basic education level was imperative. These items reflect the results as shown in Table 4 wherein teachers yielded poor behaviors towards the SD of Pili.

In summary, the results showed that the secondary science teachers had favorable knowledge and attitudes towards the SD of Pili. However, the lack of opportunities for them to express their knowledge and attitudes has led to difficulty manifesting those qualities into behaviors. To investigate further, the researchers analyzed the KAB of students that were presented in the next part of this paper.

Level of secondary students' KAB towards SD of Pili

As shown in Table 5, the majority of the students strongly agreed that the SD of Pili contributed to a better climate system (K4 = 71.1%); supported different cultural values in the Bicol region (K5 = 62.9%); helped the poor through the promotion of businesses in Pili (K1 = 50.6%). The first two items in the knowledge dimension of secondary students were also the first two items in the knowledge dimension of teachers. These results signify that the perception of both the students and the teachers was that the SD of Pili was closely associated with environmental protection and cultural promotion. These results were in parallel with the findings of Al-Naqbi & Alshannag (2018) and Michalos et al. (2015). In addition, the students believed that the SD of Pili played an important role in promoting businesses in Pili which in turn would help the poor in their community.

However, some of the students believed that the SD of Pili promoted the use of renewable energy in manufacturing Pili products (K6 = 41.2%); allotted part of the Pili business's income for services that cared for the environment (K7 = 36.5%); involved minimizing wastes (K2 = 33.0%). These items were the least prevalent items among the knowledge dimension as perceived by the students. These items were comparable with the least items in the knowledge dimension of the teachers, namely K6 and K2. Although the students and teachers believed that the SD of Pili promoted renewable energy and involved minimizing waste, there were reservations for strongly agreeing with these items. Based on the interview with the students, although they agreed to the idea that the SD of Pili promoted renewable energy and involved minimizing waste, they did not often see projects with those areas in the school that explicitly involved Pili. They might

be familiar with the efforts conducted in renewable energy and recycling wastes, but involving Pili was rare.

Table 5. KAB of secondary students towards SD of Pili (*n* = 342)

Dimension	Items	SA	A	D	SD
		n (%)	*n* (%)	*n* (%)	*n* (%)
Knowledge	K1	173 (50.6)	167 (48.8)	0 (0.0)	2 (0.6)
	K2	113 (33.0)	209 (61.1)	18 (5.3)	2 (0.6)
	K3	153 (44.7)	175 (51.2)	10 (2.9)	4 (1.2)
	K4	243 (71.1)	97 (28.4)	0 (0.0)	2 (0.6)
	K5	215 (62.9)	119 (34.8)	6 (1.8)	2 (0.6)
	K6	141 (41.2)	195 (57.0)	4 (1.2)	2 (0.6)
	K7	125 (36.5)	209 (61.1)	6 (1.8)	2 (0.6)
	K8	171 (50.0)	167 (48.8)	2 (0.6)	2 (0.6)
Attitudes	A1	225 (65.8)	117 (34.2)	0 (0.0)	0 (0.0)
	A2	82 (24.0)	210 (61.4)	48 (14.0)	2 (0.6)
	A3	98 (28.7)	201 (58.8)	43 (12.6)	0 (0.0)
	A4	182 (53.2)	156 (45.6)	4 (1.2)	0 (0.0)
	A5	173 (50.6)	163 (47.7)	6 (1.8)	0 (0.0)
	A6	108 (31.6)	186 (54.4)	42 (12.3)	6 (1.8)
	A7	162 (47.4)	178 (52.0)	2 (0.6)	0 (0.0)
	A8	158 (46.2)	164 (48.0)	18 (5.3)	2 (0.6)
Behaviors	B1	28 (8.2)	90 (26.3)	176 (51.5)	48 (14.0)
	B2	108 (31.6)	127 (37.1)	99 (28.9)	8 (2.3)
	B3	16 (4.7)	50 (14.6)	121 (35.4)	155 (45.3)
	B4	44 (12.9)	86 (25.1)	146 (42.7)	66 (19.3)
	B5	80 (23.4)	125 (36.5)	123 (36.0)	14 (4.1)
	B6	42 (12.3)	80 (23.4)	120 (35.1)	100 (29.2)
	B7	68 (19.9)	108 (31.6)	130 (38.0)	36 (10.5)
	B8	107 (31.3)	122 (35.7)	73 (21.3)	40 (11.7)

Table 6. Level of students' KAB

Dimension	Level	Frequency	Percentage
Knowledge	Poor	2	0.6
	Moderate	81	23.7
	High	259	75.7
Attitudes	Poor	1	0.3
	Moderate	123	36.0
	High	218	63.7
Behaviors	Poor	194	56.8
	Moderate	115	33.6
	High	33	9.6

Thus, the recommendation of Zyadin et al. (2014) in their study to promote environmentally literate and energy consciousness was important not only for teachers but for students as well. However, this time, the involvement of Pili must be explicit. Further, although students believed that the SD of Pili promoted Pili businesses, some of them were skeptical that part of the income in these businesses was allotted to the services that cared for the environment.

The interview with the students revealed that they would see Pili businesses grow and businesspeople gain their profit. However, they did not know of any programs led by these businesspeople that cared for the environment in general. These results indicate that more efforts are needed to promote the programs and projects of businesses that care for the sustainability of Pili, mostly those that would involve students. Nevertheless, Table 6 shows that the students have a high level of knowledge of the SD of Pili.

For the attitude dimension, Table 5 shows that the students strongly agreed that they felt happy when they saw people who understood the importance of Pili sustainability in preserving the culture of their region (A1 = 65.8%); heard the news about stricter laws that protected Pili trees (A4 = 53.2%); got to know people who invested in Pili to lessen poverty (A5 = 50.6%). Items A1 and A5 matched the most prevalent items chosen by teachers in the attitude dimension. As the students' knowledge of the SD of Pili was associated most likely with environmental protection and cultural promotion, their attitudes were also the same. These results strengthened the idea that Pili had a great influence on the culture of the people in the Bicol region (Mascariñas et al., 2013). Further, students believed and were hopeful that the Pili industry had the potential to help the poor and lessen the poverty in their community.

However, the students got annoyed when people ignored the threats to Pili conservation (A3 = 28.7%), were mad at people exploiting Pili resources (A6 = 31.6%) and were angry when Pili manufacturers did not encourage zero-waste Pili production (A2 = 24.0%). These three least items for students were also the same least items in the teachers' attitude dimension. Like the teachers, the students have chosen positive attitudes rather than negative attitudes towards the SD of Pili. Nonetheless, they still agreed that they would feel and react negatively to the negligence and abuse of the Pili resources. As shown in Table 6, the students had a high level of attitudes towards the SD of Pili in the Bicol region.

For the behavior dimension, some students agreed that they bought Pili products from the local producers (B2 = 31.6%), volunteered to work for organizations involving Pili sustainability (B8 = 31.3%); and thought about saving Pili from environmental deterioration (B5 = 23.4%). These results show that the students supported the Pili industry by patronizing local Pili products. At an early age, some of them were already aware and thinking of the possible ways to preserve the Pili in the Bicol region including the conversion of Pili wastes into useful materials (B7 = 19.9%). Based on the conducted interview with the students, if given the chance to be part of a program or activity that would elevate the Pili industry not only in the Bicol region but also in the entire country, they were willing to participate. In some cases, some students have included Pili as their capstone projects in school, but some proposals did not materialize because of the lack of laboratory and technical resources.

On the other hand, the students disagreed that they coordinated with the government to plant Pili trees (B6 = 12.3%); used Pili as an example in their classroom discourse (B1 = 8.2%); and attended seminars on the SD of Pili (B3 = 4.7%). From the previous results in the knowledge and attitude dimensions, the willingness of students to participate in the activities involving the SD of Pili in the Bicol region was present. However, the results in the behavior dimension suggest that the availability of such activities that would prompt students to coordinate with authorities, plant trees, attend seminars, and contribute as a volunteer for Pili projects were limited. This result was confirmed with the interview of students. They did not often see activities on the SD, especially involving Pili, which were available for them to attend. Hence, the development and implementation of such activities that would explicitly show the relevance to the SD of Pili were imperative to increase students' involvement in promoting SD, focusing on Pili sustainability.

In summary, the students' KAB towards the SD of Pili is not at par with the KAB of their teachers. Both of them have favorable knowledge and attitudes towards the SD of Pili. These qualities are important but not sufficient to manifest positive behaviors toward the SD (Al-Naqbi & Alshannag, 2018). Therefore, opportunities that would enable teachers and students to be directly and explicitly involved in the SD of Pili are important so they can transform their favorable levels of knowledge and attitudes into observable manifestations of behaviors toward SD (Amran et al., 2019; Borges, 2019). Moreover, in the next section of this paper, the researchers explored further

whether there are associations among the knowledge, attitudes, and behaviors towards the SD of Pili of both the teachers and the students

Association among the teachers' and students' knowledge, attitudes, and behaviors

The Pearson's Chi-square statistics results as shown in Table 7 depict that the teachers with high knowledge of SD of Pili tend to have a high level of attitudes as well. On the other hand, those with high knowledge and attitudes tend to show poor behaviors towards the SD of Pili. Moreover, Table 7 shows that there is an association between the teachers' knowledge and attitudes ($p < 0.05$). In contrast, the behavior is not associated with the teachers' knowledge and attitudes ($p > 0.05$). These results may explain why even though the teachers have a high level of knowledge and attitudes, they still tend to have poor behaviors toward the SD of Pili. This strengthens the claim of Al-Naqbi & Alshannag (2018) and Funa et al. (2022) that knowledge and attitudes, although important, are not sufficient to elicit positive behaviors. In view of this, the activities on the SD of Pili for teachers need to focus not only on honing their knowledge and attitudes but also on developing their behaviors. Hence, activities, where secondary science teachers can directly manifest a positive behavior towards the SD of Pili, are important.

Table 7. Pearson's chi-square test for independence among knowledge, attitude, and behaviors of teachers

				Behaviors	
		Count	Poor	Moderate	High
Knowledge	Poor	0	0	0	0
	Moderate	8	6	2	0
	High	**99**	**53 (53.5%)**	**32 (32.3%)**	**14 (14.1%)**
Attitudes	Poor	0	0	0	0
	Moderate	9	6	3	0
	High	**98**	**53 (54.1%)**	**31 (31.6%)**	**14 (14.3)**
				Attitudes	
Knowledge	Poor	0	0	0	0
	Moderate	8	0	4	4
	High	**99**	**0 (0.0%)**	**5 (5.1%)**	**94 (94.9%)**

These findings are inconsistent with the study of Borges (2019) where the elementary teachers' KAB are significantly associated with one another. However, their results support the findings of this study that the association between the knowledge and attitudes dimension is stronger, the association between knowledge and behaviors is slightly weaker, and the association between the attitudes and behaviors is the weakest (Borges, 2019). The poor association of behaviors to knowledge and attitudes may be due to the lack of motivation among teachers to turn that knowledge and attitudes into actual behaviors (Moh & Abd Manaf, 2014). As a result, the activities that would motivate teachers to be involved and manifest behaviors towards the SD of Pili would be helpful.

Looking at the association of students' KAB, Table 8 shows that students with a high level of knowledge of the SD of Pili tend to have a high level of attitudes. However, students with a high level of knowledge and attitudes tend to show poor behaviors. Both the teachers and students obtained the same results in the level of association. However, in the case of students, the *p*-values from the statistical test show that there are a significant association between knowledge, attitudes, and behaviors ($p < 0.05$). These findings are consistent with Ahamad & Ariffin (2018) in which the KAB on sustainable consumption of Malaysian students were associated with one another. In this regard, the improvement of students' knowledge of the SD of Pili can result in changes in their attitudes and behaviors. The attempts to improve one dimension of KAB might affect the other dimensions as well. This indicates that the activities on the SD of Pili for students can be

made holistic, comprising the development and improvement of knowledge, attitudes, and behaviors together.

Table 8. Pearson's chi-square test for the independence among knowledge, attitudes, and behaviors of students

			Behaviors			
		Count	Poor	Moderate	High	*p*-value
Knowledge	Poor	2	0	2	0	.036
	Moderate	81	56	19	6	
	High	**259**	**138 (53.3%)**	**94 (36.3%)**	**27 (10.4%)**	
Attitudes	Poor	1	0	1	0	.000
	Moderate	123	91	22	10	
	High	**218**	**103 (47.2%)**	**92 (42.2%)**	**23 (10.6%)**	
				Attitudes		
Knowledge	Poor	2	1	1	0	.000
	Moderate	81	0	67	14	
	High	**259**	**0 (0.0%)**	**55 (21.2%)**	**204 (78.8%)**	

The level of association among the KAB of teachers and students is similar. However, the significance of these associations varies among the teachers and students. Therefore, with the given results supported by various researchers, considering the characteristics of the respondents, whether they are categorized as students or teachers, is imperative in determining the suitability of methods, approaches, and techniques for developing and promoting KAB towards SD.

Discussion

UNESCO (2020) calls for interventions to scale up actions in achieving the 17 SDGs before 2030 ends, which includes quality education. Quality education considers ESD as a vital element for its achievement (McKeown & Hopkins, 2014; Sachs, 2015; UNESCO, 2020); hence, the present researchers investigated ESD in basic education, focusing on the evaluation of teachers' and students' KAB towards SD. The researchers contextualized further by involving Pili (*C. ovatum*), a plant that is although known for its economic and cultural contributions to the Philippines, particularly in the Bicol region (Coronel, 1996), has been losing the local youth's interest in the farm and invest . Specifically, the researchers determined the level of teachers' and students' KAB towards SD of Pili (*C. ovatum*) and their association with one another.

The findings show that the teachers' level of knowledge of SD of Pili (*C. ovatum*) was high. The most prevalent items for the knowledge dimension pertain to the contributions of SD of Pili to the climate system, culture, and environmental understanding. These results are in parallel to the study of Al-Naqbi & Alshannag (2018) wherein three aspects of SD prevailed among the preservice teachers in UAE (i.e., education, environmental protection, and human contribution to climate systems). In addition, the teachers associated Pili (*C. ovatum*) with their culture. As mentioned, the Philippines is one of the most disaster-prone countries in the world due to its geographical location and physical environment, and the Bicol region is one of the areas frequently visited by natural hazards such as typhoons and floods (Mascariñas et al., 2013). Pili (*C. ovatum*) tree has proven its resiliency and adaptability to the erratic climatic conditions of the Bicol region, withstanding strong typhoons and floods (Philippines Department of Agriculture, 2011). As a result, the teachers perceived the SD of Pili as having important role in their local culture. However, the least prevalent items for the knowledge dimension pertained to contributions of SD of Pili to renewable energy, waste management, and poverty reduction. Although these items were the least prevalent, they obtained high scores which indicates that teachers strongly agreed with these items. These results support the study of Zyadin et al. (2014) that teachers had a low level of knowledge of renewable energy which might lead to difficulty fostering environmentally literate and energy-conscious generations.

The teachers obtained a high level of attitude toward the SD of Pili. The most prevalent items referred to favorable attitudes toward the roles of SD of Pili in cultural preservation, poverty reduction, and renewable energy. In the knowledge domain, poverty reduction and renewable energy were among the least prevalent items. These results may suggest that teachers were least aware of the roles of SD in poverty reduction and renewable energy; hence, they supported the efforts for SD focused on these items (Zyadin et al., 2014). In contrast, the least prevalent items of the attitude domain referred to the negative attitudes when people were ignoring the threats to Pili conservation, zero-waste Pili production, and Pili resources exploitation. The overall results for the knowledge and attitude domains were both favorable and are in parallel to the results obtained by Borges (2019), Al Naqbi & Alshannag (2018), and Zyadin et al. (2014).

However, the teachers' level of behavior towards the SD of Pili was poor. The prevalent items included the following behaviors toward SD of Pili: buying Pili products from the local producers, thinking about saving Pili from environmental degradation and reading studies on transforming Pili wastes into valuable products. On the contrary, they disagreed that they volunteer with the government, volunteer to work for organizations, and attend seminars relevant to SD of Pili.

The students gained a high level of knowledge on the SD of Pili. On one hand, the roles of the SD of Pili to a better climate system, different cultural values, and helping the poor through local business were among the most prevalent items in the knowledge domains. These results support the results of the study of Al Naqbi & Alshannag (2018) and Michalos et al. (2015) that students believed that SD played an important role in environmental protection and cultural promotion. On the other hand, the contributions of the SD of Pili to promoting renewable energy, collaborating with businesses for environmental protection, and minimizing wastes were among the least items for the knowledge domain. Both the students and their teachers are aware of renewable energy but did not often see projects on renewable energy relevant to the SD of Pili. Zyadin et al. (2014) recommend that promoting energy consciousness among teachers and students is important; hence, the teachers need to involve renewable energy in teaching and learning processes relevant to SD. Moreover, the students believed that SD of Pili involved helping the poor through local businesses but did not agree that local businesses allotted part of their income to care for the environment. Hence, the projects of the various businesses that profited from Pili products to protect the environment needed to be more visible to the students.

The students' level of attitudes towards the SD of Pili was high. The students strongly agreed that they felt happy when people preserved culture, implemented laws for environmental protection, and invested in Pili to lessen poverty. Both the teachers and the students had favorable attitudes when it came to environmental protection and the cultural relevance of Pili. These results strengthened the idea that Pili significantly contributed to the culture of the people in the Bicol region (Roncero et al., 2021; Tu et al., 2021). Thus, the integration of Pili in future environmental projects and programs in schools in the Bicol region was essential. Like teachers, the students negatively reacted to people ignoring threats to Pili conservation, exploiting Pili resources, and disregarding zero-waste Pili production.

The level of students' behaviors toward the SD of Pili was low. Like teachers, the most prevalent items for behaviors pertained to buying Pili products from local producers and thinking about saving Pili from environmental deterioration. In contrast, the least prevalent items pertained to coordinating with the government and attending seminars on SD of Pili. In addition, the students disagreed that they used Pili as examples in their classroom discourse. Nevertheless, if given the opportunity to be involved in a project relevant to Pili, the students showed a willingness to participate.

Both the students and their teachers obtained a high level of knowledge and attitudes, but a poor level of behavior toward SD of Pili. According to Al-Naqbi & Alshannag (2018), favorable knowledge and attitudes are critical but not sufficient to manifest positive behaviors. Exploring various opportunities for teachers and students to transform their knowledge and attitudes into behaviors is important (Amran et al., 2019; Borges, 2019).

The knowledge and the attitudes domains of teachers towards the SD of Pili were significantly associated with each other. However, the behaviors domain was not significantly

associated with the knowledge and attitudes domains. The weak relationship between the knowledge and the attitudes to the behavior domain might be attributed to the teachers' lack of motivation to transform their knowledge and attitudes into favorable behaviors (Moh & Abd Manaf, 2014). Hence, the researchers recommend separate activities that are designed to hone teachers' motivation in converting their knowledge and attitudes into positive behaviors towards SD of Pili.

In contrast, although the levels of students' KAB were similar to teachers' (high levels in the knowledge and attitudes domain and poor levels in the behavior domain), these three domains were significantly associated with one another. These results are consistent with the results of the study of Ahamad & Ariffin (2018) that the KAB on SD among Malaysian college students is significantly related to one another. Thus, the improvement of the knowledge and attitudes domains may affect the behavior domains among students.

Given the findings of the study, the levels of KAB between teachers and students might be similar, but the associations among the domains were different. Hence, the researchers recommend that the approaches to transform favorable knowledge and attitudes into positive behaviors between teachers and students may also be different. Further studies are needed to determine the factors that hinder the conversion of knowledge and attitudes into behaviors and the effective approaches to convert knowledge and attitudes into behaviors.

CONCLUSION

UNESCO has released an urgent call to scale up actions aimed at achieving the 2030 SDGs. Given this, the researchers evaluated the KAB of teachers and students as bases to assess the current situation and define the areas that need improvement. In addition, the Pili (*C. ovatum*), being one of the anticipated economic drivers in the Bicol region, diminished its influence on the locals' labor force and farming interests. This prompted the researchers to investigate and contextualize the assessment of KAB towards the SD of Pili. Specifically, they assessed the KAB towards the SD of Pili of science teachers and students in the secondary level and investigated the association among these three dimensions. The findings of this research signify that both the teachers and the students had high levels of knowledge and attitudes but poor behaviors towards the SD of Pili. These findings show that favorable levels of knowledge and attitudes were not the bases of positive behaviors. With the same level of KAB, the associations among the KAB of teachers and students were different. For the teachers, their knowledge and attitudes were not significantly associated with their behaviors. However, students' KAB were significantly associated with one other. These findings demonstrated the critical importance of providing opportunities and motivation for teachers and students to generate positive behaviors toward the SD of Pili. However, the strategy required of teachers might differ from that required of students. Thus, it was crucial to assess a range of approaches for motivating and engaging teachers and students in promoting SD. Further, the researchers found that teachers and students did not only consider Pili as a plant that played a role in the environment and climate change and as a commodity for economic growth, but also as a significant part of the culture of the Bicol region. With this kind of importance given to Pili, the authorities and stakeholders might find the ease in enjoining participation from both the teachers and the students. Thus, the inclusion of Pili in the future environmental activities in schools in the Bicol region was recommended. This study assessed the current situation of SD of Pili in the Bicol region as part of a bigger research project that aimed to integrate Pili in contextualizing the educational materials at the secondary level. The findings of this research were crucial in providing better insights for the authorities and stakeholders in their development and implementation of training, programs, curricula, and instructional materials to primarily promote SD and Pili industry. Moreover, it is recommended that future studies investigate the factors that hinder the manifestation of favorable behaviors despite the positive knowledge and attitudes; use variables other than Pili to examine KAB towards SD; apply these findings in implementing various forms of pedagogy and andragogy and creating programs and instructional materials. Thus, identifying and considering the factors that involve the different associations of KAB among the teachers and students is recommended in

order to provide proper interventions in promoting SD. The findings of this study are limited to the science teachers and students at the secondary level in the Bicol region who participated in this study. Findings may therefore not be generalizable outside the Bicol region and to respondents with different profiles and characteristics but may be useful for comparing other groups of respondents such as intercultural and cross-cultural studies, among others.

ACKNOWLEDGEMENT

Special thanks are hereby given to the Department of Science and Technology – Science Education Institute (DOST-SEI) through the Capacity Building Program in Science and Mathematics Education (CBPSME) and the National Research Council of the Philippines (NRCP) for the support given to the authors.

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