RESEARCH ARTICLE

Spirituality-based environmental literacy among prospective biology teacher in Indonesia: Analysis based on gender, accreditation, and semester-level aspects

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Article history:
Received: 3 October 2023
Revised: 24 October 2023
Accepted: 6 November 2023
Published: 14 November 2023

10.22219/jpbi.v9i3.29500

p-ISSN: 2442-3750
e-ISSN: 2537-6204

How to cite:
Husamah, H., Rahardjanto, A., Hadi, S., Lestari, N., & Ummah BK., M. K. (2023). Spirituality-based environmental literacy among prospective biology teacher in Indonesia: Analysis based on gender, accreditation, and semester-level aspects. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *9*(3), 418-432. https://doi.org/10.22219/jpbi.v9i3.29500

Abstract: Spirituality-based environmental literacy (SEL) influences ecological knowledge, environmental expectations, cognitive abilities, and environmental-related behavior. In this regard, this research aims to determine SEL among prospective biology teacher throughout Indonesia. This study included a cross-sectional survey. The target respondents are students of education study programs in the field of biology who come from various institutions in Indonesia. Gender aspects, study program accreditation status, and semester-level are positioned as respondent characteristics whose impact on environmental literacy is analyzed. The sample size is 632 students. The data collection instrument used was the ELIS. The data collection process is carried out online. Data was analyzed using SPSS. We discuss the results of different tests based on gender, different tests based on accreditation, and different tests based on semester-level. This research provides unique results. Women have higher levels of SEL than men. There are significant differences between men and women in terms of environmental literacy, although references do not always support this. Accreditation status does not support differences in SEL levels. Furthermore, the semester-level (final semester) has a higher SEL, but that is only in the knowledge aspect. On that basis, we suggest several aspects to consider in future research.
Keywords: environmental literacy, environmental problem, Indonesia, prospective biology teachers.

Introduction

Environmental problems are an issue that requires a lot of attention in Indonesia (Case et al., 2007; Kurniawan & Managi, 2018). These environmental problems even harm people's lives (Fadli et al., 2019). Real examples of environmental problematic cases that occur in Indonesia include deforestation (Austin et al., 2019; Islam et al., 2016; Petrenko et al., 2016; Tacconi et al., 2019), Water pollution that occurs due to domestic waste and waste originating from industrial activities (Belinawati et al., 2018; Garg et al., 2018; Luo et al., 2019), air pollution due to vehicle exhaust and forest and land fires (EoF team, 2019; Greenstone & Fan, 2019; Kusumaningtyas & Aldrian, 2016; Madsen, 2015; WHO, 2018), Soil pollution by pesticides and a drastic decrease in soil fertility in various regions (Hartemink, 2005; Joko et al., 2017; Leimona et al., 2015; Luo et al., 2019; Savci, 2012). These environmental problems will continue to grow and develop along with decreasing human concern.
Environmental problems can be overcome, or at least reduced, by increasing public awareness of the importance of environmental quality and preservation. Public awareness of environmental quality and sustainability will be manifested in environmentally conscious behavior or environmentally friendly behavior (Hendryx et al., 2013; Hendryx & Ahern, 2008). It is hoped that environmental problems will

decrease with the spread of environmental education in various educational institutions from high schools to universities, especially with the increasing number of institutions implementing pro-environmental programs (Olsson, 2018; Schüßler et al., 2019; Steg & Vlek, 2009; Szczytko et al., 2018; Ulutas & Köksalan, 2017). Environmental education material has been included in the curriculum in almost all countries (Afandi, 2013; Hudson, 2001; Sawitri, 2016). Specifically in Indonesia, as local content in regular educational institutions or including environmental issues in subject materials (Adisendjaja & Romlah, 2008; Muhaimin, 2015; Steele et al., 2015; Sudjoko, 2014). Innovation in learning so that students' environmental literacy (EL) can be better must continue to be encouraged (Farwati et al., 2017).

EL is primarily defined as awareness, sensitivity, and concern for the environment and its various problems, as well as cognitive/knowledge, psychomotor/skills, and affective/attitudes in finding various solutions to current problems and preventing the emergence of new problems (McBride et al., 2013). EL was measured with the ELI-A instrument (Szczytko et al., 2019), which in this research adds the spirituality aspect to the dimension being assessed because it is the effect of implementing a learning model that is in line with spiritual values (Husamah et al., 2022).

EL is the main goal of environmental education (Szczytko et al., 2019), where this aspect needs to be improved among prospective science/biology teachers (Mashfufah et al., 2018; Pe'er et al., 2007). The important role of teachers' EL in realizing the goals of environmental education and the ability to develop students' environmental literacy is very much needed (Altmeyer, 2021; Kidman & Casinader, 2019).

It is very important to encourage the application of EL, aimed at reducing environmental impacts and moving towards a more sustainable future (Silveira & Munford, 2020; Wardani et al., 2018). Universities play an important role in training professionals who have an important role in protecting the environment in the future (Heyl et al., 2013). Environmental awareness is an important requirement for the study of environmental pollution prevention and environmentally friendly attitudes (Akkor & Gündüz, 2018). Higher education institutions must not forget their educational/formative goals. In this context, it is necessary to pay attention to how to view the environment to achieve changes in attitudes in students (Ibáñez et al., 2020).

Educational institutions need to carry out their roles efficiently, especially for the benefit of students (Sousa et al., 2021). In this research, we propose to study aspects of environmental literacy of students in higher education. We also aimed to analyze whether students' demographic characteristics influence these variables. Correspondingly, individuals' environmental attitudes, as well as their academic background knowledge, are potential factors that can help overcome these environmental challenges (Arshad et al., 2020)

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have the strength of religious spirituality, self-control, personality, intelligence, noble morals, and skills needed by themselves, society, and nation (Siregar, 2015). Thus, environmental literacy cannot be separated from religious values or in a broader context called spirituality and religiosity (Clugston, 2016; Ezeh, 2015; Maheshwari, 2016; Onovughe & Mordi, 2017; Ramli *et al*., 2022), so it is called spirituality-based environmental literacy (SEL). Even though the concepts of spirituality and religiosity are different, in this study the researchers consider them to be the same terms (Bertella, 2022; Ulluwishewa, 2017). Many scientists argue that mainstreaming spirituality holds the key to winning the ultimate challenge in sustainable development (Banerji & Prasad, 2018).

There are many interpretations of the word spirituality (Krempl, 2014). Today, people usually refer to spirituality as combination of humanistic psychology with mystical, esoteric traditions and eastern religions aimed at personal well-being and development (Georgiou, 2013). Spirituality involves the search for meaning and purpose in human life (Hyman & Handal, 2006; Rudolfsson *et al*., 2014; Rudolfsson *et al*., 2015;). Spirituality arises rationally (Erenchinova & Proudchenko, 2018). Spirituality in a general sense is the quality or state of being spiritual or attached to questions and values related to religion (Hussain, 2020). Research on SEL is still rarely done. In the United States in particular, there is debate over the interpretation of Christians regarding their religious teachings as to whether this causes EL to be lower or higher (Murdoch, 2012).

Other research shows the need for the important role of EL for teachers in realizing the goals of environmental education and the importance of ability, to determine the level of EL in their students. The measuring instrument was applied to a sample of teachers. Analysis of the results revealed that the instrument meets the necessary psychometric requirements and can be considered a valid and reliable instrument for measuring teachers' environmental literacy levels. This research also revealed interesting results regarding the relationship between teachers' EL levels and their educational areas, accompanying learning area engagement, and environmental education training in general (An et al., 2022; Cincera et al., 2021). In this regard, an Environmental Literacy Instrument based on Spirituality (ELIS) has been developed (Husamah et al., 2022), in the Indonesian context. Therefore, this instrument has potency to be used.

Based on these studies, we conclude that research focused on student teachers is still rarely conducted, especially in Indonesia (as a whole). So far, there have been several studies that have

focused on prospective biology teachers but on the scale of one campus/university or do not describe the environmental literacy of prospective biology teachers throughout Indonesia. In this regard, this research aimed to determine the SEL of prospective biology teachers throughout Indonesia. We review it from the aspects of gender, study program accreditation status, and semester-level.

Method

Research Design and Participants

This research includes a cross-sectional survey. Data collection activities were carried out in August 2023. The target respondents were Department of Biology Education students from various universities throughout Indonesia. The characteristics of the respondents whose impact on the environmental literacy of student teachers analyzed in this research were gender, study program accreditation status, and semester-level. Accreditation is seen as describing quality more than other aspects, for example the graduates' grade point average (GPA). GPA is mostly determined internally; Meanwhile, accreditation is carried out by external institutions with comprehensive criteria.

The target population size for this survey is 650 people. Therefore, based on the Krejcie and Morgan Table, the minimum sample size with a confidence level of 95% and a margin of error of 5% (Kharuddin et al., 2020; Krejcie & Morgan, 1970) is a minimum of 620 students. Based on the screening process carried out, there were 632 students involved. We set inclusion criteria referring to previous research, i.e that respondents were students who were prospective biology teachers (from the Faculty of Teacher Training and Education, College of Teacher Training and Education, Faculty of Education, or Faculty of Mathematics and Natural Sciences), come from universities in Indonesia, are Indonesian citizens, are still active students, and are willing and aware to be involved as respondents. We also set exclusion criteria, i.e students from diploma, vocational, and postgraduate programs; not from an education study program, dropped out, and not completely fill in the requested data (Rahardjanto et al., 2022).

Data Collection Instruments and Procedures

The data collection instrument used in this research was Environmental Literacy based on Spirituality (ELIS); consists of 26 items with acceptable validity and internal consistency. This instrument consists of four dimensions: ecological knowledge (five items), environmental expectations (seven items), cognitive skills (eight items), and behavior (six items). ELIS is recommended as a spirituality-based environmental literacy development measure for prospective biology teachers. The development and testing of this instrument involved a fairly large sample, so this has implications for statistical power. Cronbach's alpha coefficient was more significant than 0.80 for all items and most domains (total 0.96). The analysis results of internal consistency reveal that the value of CR is 0.73- 0.94 and Cronbach's alpha is 0.72-0.94 or ≥0.7 (meets the criteria). The AVE value of 0.52-0.65 or ≥0.5 (meets the criteria) (Husamah et al., 2022). The target respondents were very large and broad, covering all of Indonesia, so based on these conditions, the survey process was carried out online. Therefore, ELIS was transformed into an online questionnaire via Google form.

Data Processing and Analysis

Survey data was downloaded in comma-separated-value (csv) format and checked and labeled by the authors using Microsoft Excel before analysis was carried out. After checking and labeling the data was completed, data was analyzed using SPSS software. Data on respondent characteristics were analyzed using frequencies and percentages. The mean and standard deviation of scores were calculated for each item. Comparisons of two groups of students were analyzed using the Mann-Whitney U Test, while comparisons of more than two groups used the Kruskal-Wallis H Test. The alpha value set in this study was 5%.

Results and Discussion

Information on the demographic distribution of respondents is presented in Table 1. Based on Table 1, it can be seen that the majority of respondents were female (83.07%), came from study programs accredited B (53.16%), semester VII/VIII (30.47%), and came from Java (35.60%). Descriptive Statistics EL are presented in Table 2.

The number of female teachers and prospective teachers in Indonesia tends to be greater. This is due to social tradition factors which tend to view women as more appropriate as educators (Lefkowitz et al., 2014; Määttä & Uusiautti, 2020; Paul Halpern & Perry-Jenkins, 2016; Tašner et al., 2017; Yu, 2021), increasingly open access to higher education for women (Augustus, 2021; Brommesson et al., 2022; Ding, 2021; Moore, 1987; Parvazian et al., 2017), and historical factors that tend to see women being

more painstaking in their teaching or teaching careers (Abdulahi, 2020; Ortan et al., 2021). Apart from that, this fact is supported by individual interests and skills, which women have. In Indonesia, the figure of male teachers is very low (de Gomes, 2018; Ho & Lam, 2014; Indriyany et al., 2021; Pancaningrum & Pasiningsih, 2023). These data are in line with international trends that men are generally less likely to work as teachers than women (Han et al., 2020). Globally, women now have excellent participation in education and employment. Current higher education policies have opened up educational and employment opportunities for women including individual and social mobility (for all groups) (David, 2015).

Most prospective biology teachers in Indonesia are on the island of Java or choose to carry out their education on the island of Java. This is supported by several factors. There are many universities and biology education study programs on the island of Java, providing a variety of choices for students. Many leading and reputable teaching universities have opened biology education study programs (Abbas, 2023). The interesting thing is that job opportunities after graduation tend to be greater on the island of Java because of the large number of schools, facilities, salaries, and making it a strong attraction for prospective teachers (Alifia & Pramana, 2021; Kominfo, 2023; Sabon et al., 2018; Sucahyo, 2023). Development on the island of Java is more advanced so that educational facilities and resources are more abundant, complete, and better (Arifianto, 2010; Khasanah, 2014).

Table 1. Distribution of respondents' demographics

Group		Frequency	Percentage (%)
Gender	Male	107	16.93
	Female	525	83.07
Accreditation	A/Superior	236	37.34
	B/Very good	336	53.16
	C/Good	60	9.50
Study period / Semester-level	I/II	87	13.81
	III/IV	158	25.08
	V/VI	167	26.51
	VII/VIII	192	30.47
	≥IX	26	4,13
Place of Origin	Java	225	35.60
	Bali/Nusa Tenggara	121	19.15
	Kalimantan	91	14.10
	Sumatera	145	22.94
	Sulawesi	30	4.75
	Maluku/Papua	20	3.16

Table 2. Descriptive Statistics

Component	N	Mean	Std. Deviation	Minimum	Maximum
Knowledge	632	21.6703	3.57190	5.00	25.00
Hope	632	30.6230	4.77634	4.00	35.00
Cognitive	632	33.9259	6.06749	.00	40.00
Behavior	632	25.0931	4.34883	.00	30.00
Total	632	111.3123	16.65419	10.00	130.00

Based on the results of descriptive statistics as presented in Table 2, the average Knowledge score is 21.67 out of a maximum score of 25.00 (classified as high). Judging from the Hope component, the student score was an average score of 30.62 out of a maximum score of 35.00 (classified as high). Meanwhile, cognitive ability is calculated at a score of 33.93 out of a maximum score of 40 (classified as high). Finally, based on the behavioral aspect, students' abilities are classified as high with an average score of 25.09 out of 30.00. In total, students' environmental literacy skills are at a high level with a score of 111.31 out of a maximum score of 130.00. Judging from the standard deviation of all components (knowledge = 3.57; Hope = 4.77; Cognitive = 6.07; Behavior = 4.34) and the total (16.65), it shows below 0.25SD, meaning that student scores are less diverse/less varied (tend to be uniform) and are more accurate with the mean. A low standard deviation shows that the data tends to be close to the mean with low variation/slightly less diversity. A high standard deviation means that the data is spread out from the mean value. This means that the scores are more variable or diverse (Ramachandran & Tsokos, 2021; A. F. Siegel, 2012).

Differences by gender

Tests for different aspects of gender were carried out using the Mann-Whitney Test. The results of the Mann-Whitney Test for gender aspects are presented in Table 3 (Ranks) followed by Table 4 Test Statistics to determine the U and W values.

Table 3. Mann-Whitney Test (Ranks) gender aspect

Ranks				
Component	Gender	N	Mean Rank	Sum of Ranks
Knowledge	Male	107	296.17	31690.50
	Female	525	320.64	168337.50
	Total	632		
Hope	Male	107	270.57	28951.50
	Female	525	325.86	171076.50
	Total	632		
Cognitive	Male	107	291.46	31186.50
	Female	525	321.60	168841.50
	Total	632		
Behavior	Male	107	292.99	31349.50
	Female	525	321.29	168678.50
	Total	632		
Total	Male	107	283.74	30360.00
	Female	525	323.18	169668.00
	Total	632		

Based on Table 3, it can be explained that (1) Knowledge: The average ranking of the female group (320.64) is higher than that of the male group (296.17); (2) Hope: the average ranking of the female group (325.86) is higher than that of the male group (270.57); (3) Cognitive: the average rating of the female group (321.60) is higher than that of men (291.60); (4) Behavior: the average rating of the female group (321.29) is higher than that of men (292.99). Thus, in total the average ranking of the female group (323.18) is higher than that of men (283.74) in the SEL aspect.

Table 4. Results of the Mann-Whitney Test (Test Statistics) on gender aspects

Test Statistics[a]					
	Knowledge	Hope	Cognitive	Behavior	Total
Mann-Whitney U	25912.500	23173.500	25408.500	25571.500	24582.000
Wilcoxon W	31690.500	28951.500	31186.500	31349.500	30360.000
Z	-1.285	-2.886	-1.570	-1.469	-2.038
Asymp. Sig. (2-tailed)	.199	.004	.116	.142	.042

a. Grouping Variable: Gender

Judging from Knowledge Table 4, it shows that the U value is 25912 and the W value is 31690. If converted to the Z value, the value is -1.285. The Sig value or P value is 0.199 > 0.05. If the p-value is > the critical limit of 0.05 then there is no significant difference between men and women. From Hope's side, Table 4 shows the U value is 23173 and the W value is 28951. If converted to the Z value, the value is -2,886. The Sig value or P value is 0.004 < 0.05. If the p value is < the critical limit of 0.05 then there is a significant difference between men and women. From the Cognitive component, Table 4 shows a U value of 25408 and a W value of 31186. If converted to a Z value, the value is -1,570. The Sig value or P value is 0.116 > 0.05. If the p value is > the critical limit of 0.05 then there is no significant difference between men and women. From the Behavior component, Table 4 shows a U value of 25571 and a W value of 31349. If converted to a Z value, the value is -1,469. The Sig value or P value is 0.142 > 0.05. If the p-value is <the critical limit of 0.05, then there is no significant difference between men and women. Thus, in total Table 4 shows a U value of 24582 and a W value of 30360. If converted to a Z value, the value is -2.038. The Sig value or P value is 0.042 < 0.05. If the p value is <the critical limit of 0.05, then there is a significant difference SEL between men and women.

We cannot conclude that women have better SEL than men. This is because the level of SEL tends to vary between individuals. Anyone can have good SEL, regardless of gender (Ha et al., 2023; Lloyd-Strovas et al., 2018; Mardiani et al., 2021; Örs, 2022; Parwati et al., 2021; Putra et al., 2021). Several things such as educational factors and environmental awareness are related to strengthening one's SEL (Aminrad et al., 2013; Debrah et al., 2021; Edsand & Broich, 2020; Flavian, 2016; Ha et al., 2022; Kuthe et al., 2020). However, several previous studies have empirically shown that women tend to care

more about environmental issues and sustainable development issues (Hunt, 2020; Li et al., 2022; Santoso, 2022; Shinbrot et al., 2019; Zhao et al., 2021). The most likely reason is that there are social, cultural and traditional role/task factors that cause women to be more involved in household tasks, this is often related to the environment (Li et al., 2022; Schueman, 2023; Zhao et al., 2021).

Differences based on accreditation

Tests for different aspects of accreditation are carried out using the Kruskal-Wallis Test. The results of the Kruskal-Wallis Test for accreditation aspects are presented in Table 5 (Ranks) followed by Table 6 Test Statistics to determine the H value.

Table 5. Results of the Kruskal-Wallis Test (Ranks) for accreditation aspects

Ranks

	Accreditation	N	Mean Rank of Knowledge	Mean Rank of Hope	Mean Rank of Cognitive	Mean Rank of Behavior	Mean Rank of Total
Knowledge	A/Superior	236	314.70	316.79	316.41	297.75	311.74
	B/Very good	336	321.24	318.45	318.61	323.63	320.80
	C/Good	60	297.05	304.44	305.01	350.33	311.13
	Total	632					

Table 6. Results of the Kruskal-Wallis Test (Test Statistics) on aspects of accreditation

Test Statistics[a,b]

	Knowledge	Hope	Cognitive	Behavior	Total
Kruskal-Wallis H	.961	.307	.288	5.112	.399
df	2	2	2	2	2
Asymp. Sig.	.618	.858	.866	.078	.819

a. Kruskal Wallis Test
b. Grouping Variable: Acreditation

Table 5 shows that from the Knowledge component, the average ranking for accreditation group B (321) is higher than A (314) and C (297). Based on the Hope component, the average rating for accreditation group B (318) is higher than A (316) and C (304). From the Cognitive component, the average ranking for accreditation group B (318) is higher than A (316) and C (305). Meanwhile, for the Behavior component, the average rating for accreditation group C (350) is higher than A (297) and B (323). In total, the average ranking for accreditation group B (320) is higher than A (311) and C (311). Furthermore, Table 6 provides information that in this case, the p-value is 0.618 (knowledge), 0.858 (hope), cognitive (0.886), behavior (0.078), and total (0.819). This value is more than the critical limit of 0.05, which means there is no difference between groups A, B, and C.

The accreditation status of a campus or study program is considered to provide a good basis for strengthening all aspects of student literacy (Adiyaman & Ozmantar, 2021; Rachmatullah et al., 2016; Saunders, 2008). Accreditation status is related to the quality of learning, access to resources, the quality of the implemented curriculum, and quality assurance, monitoring, and evaluation (Abdullah et al., 2012; Benbassat et al., 2022; Darojat, 2018; Kis, 2005; Machumu et al., 2014; Randahn & Niedermeier, 2017). However, we need to realize that literacy - including environmental literacy in this case - is also more influenced by factors originating from each individual, such as motivation, interest, hard work and personal commitment to developing abilities and competencies (Chen, 2015; Randahn & Niedermeier, 2017). Someone who has a high dedication to developing their literacy may achieve a better or higher level of literacy even though they come from a campus or study program with low accreditation status (good or very good or not yet superior status). Likewise, vice versa, even though a student comes from a superior accredited campus or study program but they does not have a strong commitment to learning or developing skills and competencies, he may not achieve a better or higher level of literacy.

Differences based on semester-level

Tests of different semester-level aspects were carried out using the Kruskal-Wallis Test. The results of the Kruskal-Wallis Test for semester-level aspects are presented in Table 7 (Ranks) followed by Table 8 Test Statistics to determine the H value.

Table 7. Results of the Kruskal-Wallis Test (Ranks) for semester-level aspects

Ranks

	Year	N	Mean Rank of Knowledge	Mean Rank of Hope	Mean Rank of Cognitive	Mean Rank of Behavior	Mean Rank of Total
Knowledge	I/II	87	348.31	310.48	305.80	323.64	318.73
	III/IV	158	283.09	296.84	298.01	294.69	290.72
	V/VI	167	313.86	317.91	310.10	325.43	315.99
	VII/VIII	192	321.48	325.99	332.62	316.63	327.60
	≥IX	26	368.98	352.83	362.52	342.62	362.83
	Total	630					

Table 8. Results of the Kruskal-Wallis Test (Test Statistics) for semester-level aspects

Test Statistics[a,b]

	Knowledge	Hope	Cognitive	Behavior	Total
Kruskal-Wallis H	10.647	3.564	5.377	3.357	5.572
df	4	4	4	4	4
Asymp. Sig.	.031	.468	.251	.500	.233

a. Kruskal Wallis Test
b. Grouping Variable: Year

Table 7 shows that in the Knowledge component the average ranking of the group with semester-level ≥IX is higher than the other four groups. In terms of the Hope component, the average ranking of the group with semester-level ≥IX is higher than the other four groups. The Cognitive component shows that the average rank of the group with semester-level ≥IX is higher compared to the other four groups. Meanwhile, the Behavior component shows that the average ranking of the group with semester-level ≥IX is higher compared to the other four groups. Based on totals, Table 7 shows that the average rank of the group with semester level ≥IX is higher compared to the other four groups. Furthermore, Table 8 shows that in this case, the p-value is 0.031 (knowledge), 0.468 (hope), cognitive (0.251) behavior (0.500), and total (0.233) where only knowledge is less than <0.05. This means that there are only significant differences between groups in the knowledge aspect.

Final semester students tend to have higher knowledge in the field of students with fewer semesters due to several reasons, for example, the accumulation of a lot of learning material (learning experience), specialization (they study a specific topic), final assignment (requires the application of existing knowledge). focus and depth, which encourages a stronger understanding of something), intense guidance from lecturers (gaining deeper insight), as well as motivation and dedication (career goals and application of goals) (Adams & Blair, 2019; Giang et al., 2015; Okubai et al., 2023; Tadese et al., 2022). However, it should be noted that knowledge - especially related to SEL - does not always increase automatically with semester-level. This is because individual student factors in taking advantage of existing learning opportunities, how hard they study, and the strength of their interest in something have a greater influence on literacy levels. (Dunlosky et al., 2013; Harackiewicz et al., 2016; Kuh et al., 2006; Liu et al., 2022; Meşe & Sevilen, 2021; Rugutt & Chemosit, 2005; Tong et al., 2022).

This research is novel in terms of revealing facts about the condition of Spirituality-based environmental literacy (SEL) among prospective biology teacher students in Indonesia. There is not much research that links environmental literacy as a target that must be achieved in environmental education with aspects of spirituality. In fact, it is well recognized that a better understanding of the spirituality-sustainability relationship will enable more effective, sustainable, just, ethical and culturally acceptable development programs (Luetz et al., 2023). It takes the view that spirituality and sustainability are vitally linked and that there is no sustainability without spirituality (Dhiman, 2016). Spiritually based sustainable living is an endless path of reason and faith. Reason without faith gives way to pride, arrogance, and all that comes with it, while faith without reason denies humanity, denying who we are as human beings. Sustainability without paying attention to spirituality is a dead end, because it ignores the essence of oneself (Carroll, 2004).

Environmental education based on spirituality is a form of idea that integrates spirituality and pedagogical practice (Molodychenko et al., 2021). This is a theocentric worldview that centers on a religious-spiritual relationship with God to be included as part of environmental education (Muhamad et al., 2021). Religious traditions have always played a central role in supporting society to survive and be sustainable both at the individual and community levels (Freston, 2019). This integration is very natural considering that around 85% of the world's population is religious. In a broader sense, a philosophy of life, or stance on life, is important for each person to have a fundamental vision of the good life and a motivation to act. After all, people do not act from an empty place, but walk with a certain outlook on life (Jansen et al., 2019).

In an effort to strengthen this culture, it is necessary to design learning conditions that enable students to learn and develop their competencies and realize the importance of spirituality. In this condition the role of educators is very vital. Educators must always consistently instill in students that aspects of spirituality and sustainability are part of the competencies that must become a way of life and culture (Alika et al., 2023; Amalia et al., 2023; Fitri et al., 2023; Maruti et al., 2023; Musa & Kamal, 2023; Zulfa et al., 2023).

Conclusion

This research provides unique results. Women have higher levels of SEL than men. There are significant differences between men and women in terms of environmental literacy, although references do not always support this. Next, accreditation status does not support differences in SEL levels among students. Furthermore, the semester-level (final semester) has a higher SEL, but that is only in the knowledge aspect.

This research does not analyze based on grade point average (GPA), university origin, college accreditation, age, initial capital (from school when they were in high school), the status of lecturers who teach environmental science courses (educational status: master, doctor, professor; certification status: certified and not certified; teaching experience: less than five years and more than five years), and learning pattern (mode: online, offline, blended; strategy: student-centered learning or not). Some of these things are very likely to influence SEL levels so they are very worthy of consideration in further research.

This research has future implications. Data or information regarding the SEL level of prospective biology teachers in Indonesia can be a basis for implementing environmental education in teacher colleges. The gender aspect needs special attention, as well as the hope that the higher the semester level will show the accumulation of student competence. Even though the study program accreditation aspect does not affect SEL, as an effort to guarantee the quality of educational provision, this aspect must be ensured to be at a superior level. It could be that this aspect of accreditation is related to other aspects that have not been analyzed or explored in this research.

Acknowledgment

Respectful appreciation be upon the Dean of Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang who has facilitated the research through the Blockgrant Research Scheme (Funding in 2023).

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

H.Husamah: conducting the research, collecting data, writing original article, and revision **A. Rahardjanto:** methodology, review and revison; **S. Hadi:** collecting data and review**; N. Lestari:** collecting dat and review; **M. K. Ummah BK:** collecting data and review.

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