

Article

Comparison of the Literacy Level on Major Environmental Issues of the G.C.E. (A/L) Students of Different Disciplines in Kandy District, Sri Lanka

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Abstract: The study aims to examine the environmental literacy level of G.C.E A/L students (comparable to British Advanced Level) in the Kandy District, Sri Lanka, and to evaluate environment modules embedded into the curriculum. Furthermore, we find the relationships between environmental literacy level and socioeconomic and discipline levels. A survey with a sample of 300 students was selected randomly from four different disciplines, with 25 students in each subject (biological science, mathematics, arts, and commerce) from three different types of schools (Public, Private, and International). A piloted, self-administered, and structured questionnaire with 44 items under six sections (personal background, environmental issues, attitudes, behavior, suggestion, and mitigation) was randomly distributed among the study sample. Results showed that most respondents reside in an urban area, the education level of parents was positioned in the G.C.E. (A/L) category, and the monthly total family income was more than SLR 90,000.00. Overall, the environmental literacy (EL) was similar among students of three different types of schools. The type of permanent residence, discipline, and educational background of parents were recognized as determining factors of EL levels ($p < 0.05$). The environmental literacy knowledge of biological science students was the highest (44%), followed by mathematics (36%), art (32%), and commerce (28%). Furthermore, the EL of the biology discipline was significantly different from commerce (18%) and art (14%) students. Students acquired environmental knowledge from television and radio (44%), internet (22%), school (27%), and parents (7%). The A/L Curriculum evaluation results proved that much less environment-related components were included in the commerce, art, and mathematics subjects. Of the disciplines, geography (35%) and biological science (11%) included a higher amount of EL knowledge, comparatively. Students suggested that recycling/ reuse of waste conserves natural resources, the green building concept, and the use of public transportation to conserve the environment. This study recommends that environmental concepts should be integrated with formal G.C.E A/L syllabus with activity learning, especially for non-science disciplines, and that environment-related television and radio programs should be enhanced.

Keywords: environment literacy; school; education; subjects; G.C.E. (A/L); Kandy; Sri Lanka



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1. Introduction

Today, environmental issues are emerging on a global scale unpredictably, such as climate change, pollution, environmental degradation, biodiversity loss, and resource depletion [1,2]. The rise in environmental issues has directed attention toward environmental education. To mitigate the environmental issues, environmental education is a key factor, as the education systems provide people with the basic understandings and skills that are required for interacting and inter-relating with environment [3]. Thus, education has been suggested as the key to a transformational change in the environment [4]. The goal

of environmental education is to increase students' EL by improving their knowledge, cognitive skills, attitude, and behaviors. Environmental literacy is simply defined as awareness, knowledge, skills, and attitudes in order to make decisions about their walk of life, utilization, and lifestyle to engage in individual and collective remedies [5].

Environmental education is an integrated process involving experience, investigation, and problem-solving in natural and man-made surroundings. Environmental knowledge or literacy requires innovative teaching methods with hands-on activities, subject matter that is relevant to everyday life, and an activity learning process. It is through effective environmental education that EL is achieved [6]. The recognition of EL among school children today will provide important information for advancing environmental education tomorrow [7]. Students are expected to be future leaders in many different areas of society and will be decision-makers. Therefore, schools play a major role in mitigating environmental issues by improving the environmental literacy (knowledge, attitude, and behavior) of students [8].

The family and the school play an important role in a child's positive attitude toward the environment [9]. Human activities cause environmental problems, and a low level of anthropological feeling discourages members of individualistic societies from arranging pro-environmental behavior, resulting in an immense environmental impact. Many countries are facing challenges due to less self-control and societal benefits [10]. Eco-centric education is the fundamental value of the ecosystem environment; human living beings and habitants along with sustained development [11].

Sri Lanka provides free education for all levels of school education (primary, junior secondary, senior secondary, and advanced level) and university education. The General Certificate of Education (G.C.E.) Advanced Level (A/L) examination in Sri Lanka is similar to the British Advanced Level that is conducted annually by the Department of Examinations of Sri Lanka. The A/L exam is a main school-leaving qualification in England, Wales, Northern Ireland, and the Channel Islands [12]. Students study for two years before taking the G.C.E. (A/L) examination and then select an appropriate single field from five available major fields of studies, namely physical science, biological science, commerce, arts, and technology. In each discipline, students select three main subjects (for example, the physical science stream has combined mathematics, chemistry, and physics as subjects [13]).

Based on manipulated Z-score of results of the highly competitive A/L examination, less than 25% of eligible students can enter the 15 state universities in Sri Lanka [13]. The majority (75%) of students must find an alternative method of further education (private universities or technical colleges), or enter the semi-skilled workforce [12]. Similarly, the London A/L syllabus is conducted in international schools of Sri Lanka, mostly with two major subject disciplines: science, and commerce, and no opportunity to enter state universities. The subjects of the science streams are (i) Core Mathematics, Further Mathematics, and Physics; (ii) Core Mathematics, Chemistry, and Physics; (iii) Biology, Chemistry, and Physics. the commerce subjects are (i) Business Studies, Accounting, and Economics; Core Mathematics, Accounting, and Economics.

Despite numerous studies assessing environmental education, studies evaluating the environmental literacy knowledge in students and the socio-economic factors in Sri Lanka are still lacking. De Alwis and De Silva [14] studied the literacy of grade 12 school students in Sri Lanka. The studied students confirmed a moderate level of awareness, attitudes, and behavior toward the environment. Of the study stream, girls' and rural student's literacy levels were significantly higher; however, the family income factor was not significantly correlated. Therefore, such studies require the attention of researchers and environmentalists so that appropriate findings can be taken to minimize environmental degradation in Sri Lanka.

A National Survey on the EL of undergraduates recognized that scholars in Taiwan had a relatively low level of environmental knowledge and behavior, and a moderate level of environmental attitude [15]. Kuruppuarachchi et al. [16] surveyed university student's EL, and found it to be mainly governed by the nature school education. Therefore, it is

implied that creating a better foundation at the school level for environmental literacy is more important to create eco-friendly citizens.

Students' performances are basically influenced by personal factors, university or school factors, and the family [17], which further include English language proficiency [13], level of wealth or socio-economic status [18], parent's education level, socio-economic background [19], and type of secondary education institutions or schools [20]. Thayamathy and Elango [13] reported six factors which influenced the academic performance of science undergraduates of the eastern university of Sri Lanka (gender, mother language, obtained grades for the English language at the G.C.E. (O/L), general English at the G.C.E. (A/L) examination, stream of study of the degree, and the number of attempts at the G.C.E. (A/L) examination).

Hathella and Priyanath [21] recognized that there were significant associations between the mathematics performance on the G.C.E. (O/L) examination of Sri Lanka and demographic factors such as residence, school type, parents' educational level, and father's occupation, while the remaining factors such as gender, mother's occupation, family income, and a number of family members did not show significant relationships with mathematics performance.

This study examines the existing EL level of G.C.E. (A/L) students in different disciplines of the Kandy District of Sri Lanka. The specific objectives of the study are to compare the existing knowledge on global and local environmental issues among the different disciplines and to find out the relationships between socio-economic factors and environmental knowledge. In addition, we attempt to analyze the G.C.E. (A/L) curriculums and teacher's guides to quantify the number of environment-related components. We hypothesise that the environmental literacy levels of G.C.E. (A/L) students are influenced by the factors of socio-economic, demographic, and study discipline.

2. Materials and Methods

2.1. Selection of Study Sample

We distributed 300 questionnaires among G.C.E. (A/L) students in the Kandy District amongst four different disciplines (i.e., 25 students/discipline $\times$ 4 disciplines $\times$ 3 types of schools) without considering the total number of students registered for each discipline. Hence, the results of the study are not generalizable to the whole population. The stratified random sampling technique was adapted to select the study sample according to Wong [22]. The first population was stratified based on the availability of disciplines in government, private, and international schools. Then, a sample was selected within the selected disciplines in each type of school, with an adapted random sampling technique.

A descriptive-surveying research design was adopted to achieve the objectives with a qualitative approach for the sample study. Qualitative and quantitative data were collected through the piloted questionnaire survey [15,16,23]. The collected data from the study were used to analyze the frequency tabulation, cross-tabulation, and multiple comparisons using the SPSS computer package [24–26]. All of the variables related to EL in each item of the questionnaire were translated into a dichotomous scale (1 for sufficient environmental literacy and 0 for insufficient environmental literacy, and items with two answers were divided as 0 and 1). Then, sum of the variables was used to obtain the frequency % of the literacy level [27].

In addition, data were used for descriptive explanation and represented in graphical and tabulated form. The multiple comparison Uncorrected Fisher's LSD method was used in ANOVA to create confidence intervals for all pairwise differences between factor level means while controlling the individual error rate to a significance level [28]. All of the assumptions of ANOVA were tested using residual plots.

2.2. Questionnaire Survey

The study was based on the surveying method and used a prepared and piloted questionnaire [16,22,29–31]. The draft questionnaire was validated using a preliminary

survey [32], which included a total of 32 randomly selected students from each subject discipline. We calculated the answering frequency percentages for each item of the questionnaire. The questionnaire's minimum respondent items were rearranged in a reader-friendly manner. Furthermore, open-ended responses were scrutinized, and items with similar types of repetition were removed and rearranged based on advice from experts on the subject.

The items of the piloted questionnaire covered various aspects of current environmental issues at the global and local levels. The questionnaire consisted of six sections. The instrument developed in this study consisted of multiple-choice questions, an agree or disagree response section, and a response writing section. The questionnaire was prepared using seven criteria (Table 1) and the coding or scoring methods are illustrated in the supplementary document (File S1). The questions are composed of numerous scales such as Likert, Dichotomous, and open-ended. Likert scaling or absolute number ratings have been proposed for content validity.

Table 1. Questionnaire criteria and the number of questions in each criterion, and the scale that is assigned to each criterion.

Criterion & Questions in Parenthesis	Scale (Assessing Reliability and Validity)
A. Background information (11)	Likert (8), Dichotomous (1), Raking (2)
B. Knowledge on environmental issues (12)	Open ended (4), Likert (7), Ranking (1)
C. Attitudes towards the environment (3)	Likert
D. Behavior towards the environment (6)	Likert
E. Suggestions and policies (10)	Likert (6), Open ended (4)
F. Mitigation methods (2)	Open ended

The open-ended component included six (6) items under two main headings, i.e., four items (items 39–42) for global and local environmental issues and remedial measures, respectively. The last two items (43 and 44) evaluated the knowledge of waste management and proposed solutions. The perceived answers for the open-ended components were subjected to quantification by calculating the frequency percentages of responses, as in Kuruppuarachchi and Karunanayake [33].

2.3. Assessment of the Representativeness of Sampling

We assessed the representativeness of the sample using the Chi-squared goodness-of-fit test. Several questions from various parts of the questionnaire in terms of environmental issues, behaviour, policies, and opinions were used for a one-sample chi-square test that allowed for examining whether the proportions of the sample students in each discipline (biological science, mathematics, arts, and commerce) were similar to, or significantly different from, the hypothesized proportions.

2.4. Quantitative Questionnaire Validity and Reliability Analysis

We performed reliability analysis using the analysis tool in SPSS software. We selected 33 items from the Likert scale and open-ended questions about knowledge on major environmental issues, attitudes towards the environment, behavior towards the environment, local/international environmental protection policies, and preventative measures for testing validity and reliability.

We calculated the convergent validity (CV) using SPSS and Excel statistical packages. Convergent validity refers to items measuring the same latent trait being treated as belonging to the same dimension, and indicates there is a high correlation between the values of each item [34]. First, the Factor Analysis for each item was calculated using the Dimension Reduction tool in SPSS. Then, the average explained variance (AVE) was calculated based on the value obtained from factor analysis. AVE is a common assessment method which determines how much of the variance revealed by the underlying factor comes from measurement error [35].

The AVE is obtained by dividing the sum of squares of the covariance loadings of the expressions related to the factor by the number of expressions.

$$AVE = \frac{\left[\sum_1^k \lambda_i\right]^2}{K} \quad (1)$$

where k = number of observed variables; λ_i = the factor loading of item i onto a single common factor.

Composite Reliability (CR), the level of reliability of the relationship between observed variables and latent variables, is calculated using the following equation [36]:

$$CR = \frac{\left[\sum_{i=1}^k \lambda_i\right]^2}{\left[\sum_{i=1}^k \lambda_i\right]^2 + \left[\sum_{i=1}^k 1 - \lambda_i^2\right]} \quad (2)$$

In order to provide convergent validity, AVE values must be less than the CR, and each AVE value must be greater than 0.5. If the CR value is greater than the lower threshold of 0.7, this indicates that the scale is reliable [37].

We calculated Cronbach's alpha coefficient to determine the internal consistency of the scale using the SPSS reliability tool [38].

The formula for calculation of Cronbach's alpha is given below.

$$\alpha = \left[\frac{N}{N-1} \right] \left[\frac{S_x^2 - \sum S_1^2}{S_x^2} \right] \quad (3)$$

N = number of items in the measuring instrument; S_1^2 = variance of each item; S_x^2 = sum of variance points of each item in the measuring instrument.

2.5. Quantification of Amount of Environmental Related Components Included in the G.C.E. (A/L) Curriculum

The G.C.E. (A/L) curriculum of Sri Lanka is categorized into Arts (33 subjects), Commerce (04 subjects), Biological Science (06 subjects), Physical Science/Mathematics (04 subjects), and Technological Stream (05 subjects). The National Institute of Education (NIE) is the authorized institution for the formulation of curricula for the school level in Sri Lanka and provides the required syllabi and teacher guides. This section of the study evaluated the subject-wise extended teachers guides and calculated the amount of environment-related areas included as percentages [33].

$$\text{Percentage of environmental related areas in the subject} = (A \div B) \times 100 \quad (4)$$

A = total periods included for environment-related areas, B = total periods allocated for the subject.

For this study, each subject curriculum was selected for evaluation based on the subject selection preference of students. i.e., Biology, Combined Mathematics, Chemistry, Physics, Accounting, Business Studies, Economics, Agricultural Science, Geography, Buddhist Civilization, Bushism, Political Science, Sinhala, Science for Technology, Engineering Technology, and Biosystem Technology.

3. Results

3.1. Socio Economic Status of the Study Sample

The overall results relevant to socio-economic status showed that the majority of students reside in urban areas, and monthly family income was greater than SLR 90,000, parents are G.C.E. (A/L)-qualified and permanently living in urban areas with 10–20 perch land. The results of this study showed that the type of permanent residence ($p < 0.05$),

discipline ($p < 0.01$), and educational qualification of parents ($p < 0.05$) were factors which were associated with the environmental knowledge of the students.

Most of the students reside in urban (50.4%) and suburban (33.3%) areas, and only 16.3% of the students were from rural areas (Table 2). The environmental knowledge of the students from urban ($38.15 \pm 13.26\%$) and suburban ($34.2 \pm 11.69\%$) areas was higher compared to those from rural ($20.3 \pm 10.82\%$) areas. The sample included an approximately equal number of male (48%) and female (52%) students. The highest educational qualifications of any family member were graduate or higher (5%), and G.C.E. A/L (66%). A small number were reported as having a qualification under G.C.E. O/L (6%). It was found that the environmental knowledge of students whose parent's education status was Bachelor or above ($51.92 \pm 11.10\%$) and G.C.E. (A/L) ($36.46 \pm 12.24\%$) was higher than those of others such as parents having G.C.E O/L ($31.84 \pm 11.42\%$) and below ($25.42 \pm 13.19\%$) qualification.

Table 2. Comparison of environment literacy level with socio-economic and demographic factors.

Category	No of Students (%)	Frequency % of Score and Std.	<i>p</i> -Value
Gender			
Male	144 (48)	35.9 ± 11.99	0.924
Female	156 (52)	35.1 ± 13.78	
Residence			
Urban	151 (50.4)	41.3 ± 9.73	0.027 *
Sub urban	100 (33.3)	34.2 ± 11.69	
Rural	49 (16.3)	20.3 ± 10.82	
School Type			
Government	100	38.15 ± 13.26	0.885
Private	100	35.36 ± 14.58	
International	100	34.00 ± 10.32	
Discipline			
Biological Science	75	44.36 ± 12.26	0.002 *
Mathematics	75	36.20 ± 12.09	
Arts	75	32.48 ± 13.43	
Commerce	75	28.97 ± 9.51	
Family Income (SLR)			
<20,000	21 (7)	37.09 ± 13.68	0.994
20,000–50,000	37 (12.4)	35.46 ± 12.67	
50,000–70,000	43 (14.3)	37.63 ± 12.53	
70,000–90,000	79 (26.3)	34.1 ± 12.08	
$\geq 90,000$	120(40.0)	35.4 ± 13.64	
Qualification of Parents			
Graduate or More	15 (5)	51.92 ± 11.10	0.014 *
G.C.E A/L	198 (66)	36.46 ± 12.24	
G.CE.O/L	69 (23)	31.84 ± 11.42	
Lower than O/L	18 (6)	25.42 ± 13.19	
Extent of house land (perch)			
<10	103 (34)	34.83 ± 13.36	0.972
$10 \leq 20$	111 (37)	34.64 ± 13.38	
$20 \leq 30$	72 (24)	37.33 ± 11.24	
≥ 30	14 (5)	37.87 ± 14.50	
No. of. family members			
3	58 (19.3)	37.25 ± 12.71	0.996
4	61 (20.3)	35.82 ± 12.70	
5	64 (21.3)	35.80 ± 13.10	
6	58 (19.3)	34.53 ± 12.50	
>6	59 (19.8)	34.10 ± 13.81	

* The mean difference is significant at 0.05 level.

The total monthly family income of the study sample was distributed as SLR 20,000 (7%), SLR 21,000–50,000 range (12.4%), SLR 51,000–70,000 (14.3%), and Rs. 71,000–90,000 (26.3%), while more than SLR 90,000 included 40% of students. The total number of family members included three family members (19.3%), four (20.3%), five (21.3%), and six (19.3%), while more than six family members included only 9.8%. Finally, the extent of house land of the study population shows less than 10 perch (34%), 10–20 perch (37%), and 20–30 perch (24%), while more than 30 perch was 5% only.

3.2. Existing Knowledge on Conservation of Global Environmental Hazards

The study recognized that the students at government schools (25%), private schools (23%), and international schools (21%) showed somewhat similar knowledge of the conservation of global environmental hazards. In general, students in all disciplines were exposed to a low level of knowledge (23%) on the conservation of global environmental hazards (Figure 1).

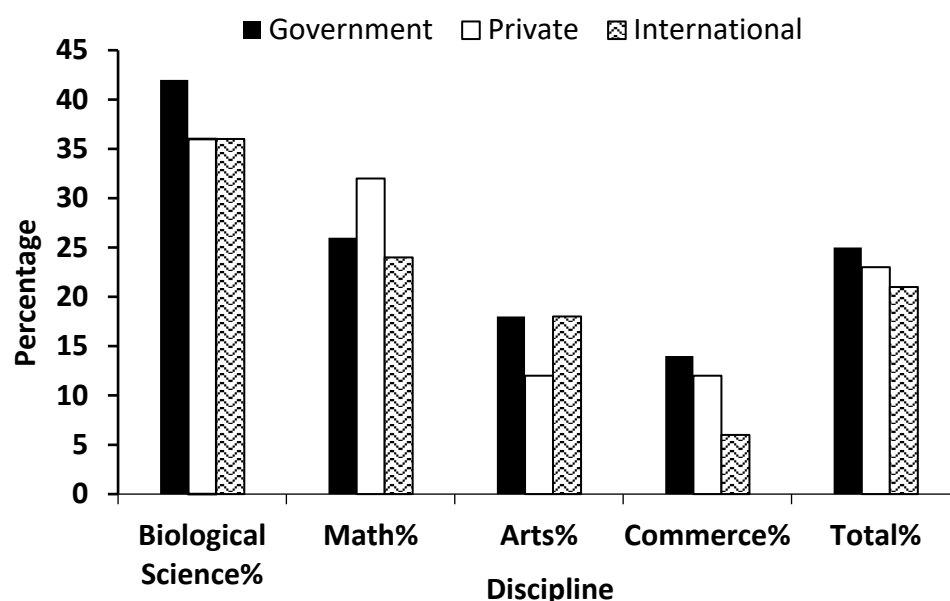


Figure 1. Identification of existing knowledge on conservation of global environmental hazards.

3.3. Source of Acquired the Environmental Knowledge

According to Figure 2, the majority of the respondents (44%) said that television and radio were the main source of their environmental awareness, whereas 22% said internet, 27% mentioned the course curriculum, and only 7% of student acquired knowledge from parents.

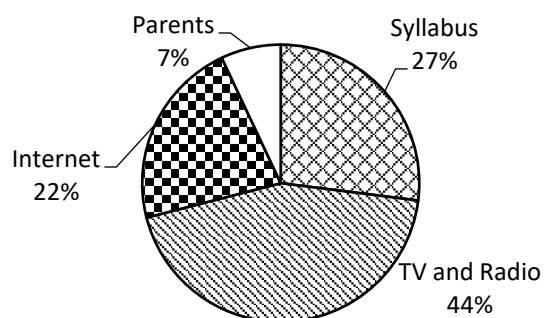


Figure 2. Various sources of knowledge acquired by students.

3.4. Comparison of Existing Environmental Knowledge on Global Environmental Issues among Different Disciplines

The discipline of the student's study was found as the key factor which showed influence on environmental knowledge compared to the other socio-economic and demographic factors. Biological science obtained the highest ($44.36 \pm 12.26\%$) score and commerce scheme students scored $28.97 \pm 9.51\%$, the lowest, respectively, in environmental knowledge. Then, Mathematics and Arts scheme students scored $36.20 \pm 12.09\%$ and $32.48 \pm 13.43\%$, respectively.

The unprotected Fisher's LSD test is essentially a set of t-tests, without any correction for multiple comparisons. The results of multiple comparisons of existing environmental knowledge on global environmental issues among different disciplines carried out by the Uncorrected Fisher's LSD method are summarized in Table 3. It was found that the bio-science scheme showed a significant ($p < 0.05$) mean different from all of the other schemes. Bio-science scheme students had more environmental literacy levels as compared to the commerce scheme. There was no significant ($p > 0.05$) mean different between arts and commerce schemes among schools. In government and private schools, there was a significance mean difference ($p < 0.05$) between mathematics and commerce schemes (Table 3).

Table 3. Multiple comparisons of existing environmental knowledge on global environmental issues among different disciplines.

Comparison	Mean Diff	SE	Sig.	95% CI Lower	95% CI Upper
Government					
Sci-Mat	7.515 *	3.255	0.0216	1.109	13.92
Sci-Art	13.4 ****	3.255	<0.0001	7.534	20.35
Sci-Com	19.39 ****	3.255	<0.0001	12.99	25.8
Mat-Art	6.42224 *	3.255	0.0493	0.0186	12.83
Mat-Com	11.88 ***	3.255	0.0003	5.473	18.28
Art-Com	5.455	3.255	0.0948	−0.9511	11.86
Private					
Sci-Mat	9.818 **	3.255	0.0028	3.412	16.22
Sci-Art	13.82 ****	3.255	<0.0001	7.412	20.22
Sci-Com	17.82 ****	3.255	<0.0001	11.41	24.22
Mat-Art	4.00	3.255	0.2201	−2.406	10.41
Mat-Com	8.000 *	3.255	0.0146	1.594	14.41
Art-Com	4.00	3.255	0.2201	−2.406	10.41
International					
Sci-Mat	7.152 *	3.255	0.0288	0.7458	13.56
Sci-Art	7.879 *	3.255	0.0161	1.473	14.28
Sci-Com	8.970 **	3.255	0.0062	2.564	15.38
Mat-Art	0.7273	3.255	0.8233	−5.678	7.133
Mat-Com	1.818	3.255	0.5768	−4.588	8.224
Art-Com	1.091	3.255	0.7377	−5.315	7.497

* The mean difference is significant at 0.05 level (**** highly significant, *** moderately significant, ** significant, * merely significant) (Sci = Biological Science, Mat = Mathematics, Art = Arts, Com = Commerce).

3.5. Overall Environment Literacy Level of Students

The overall environmental literacy level of the study sample was noted as 34.41%, indicating that there was a low level of environmental literacy among the selected school students. The environmental literacy among schools is more or less similar among disciplines (Figure 3).

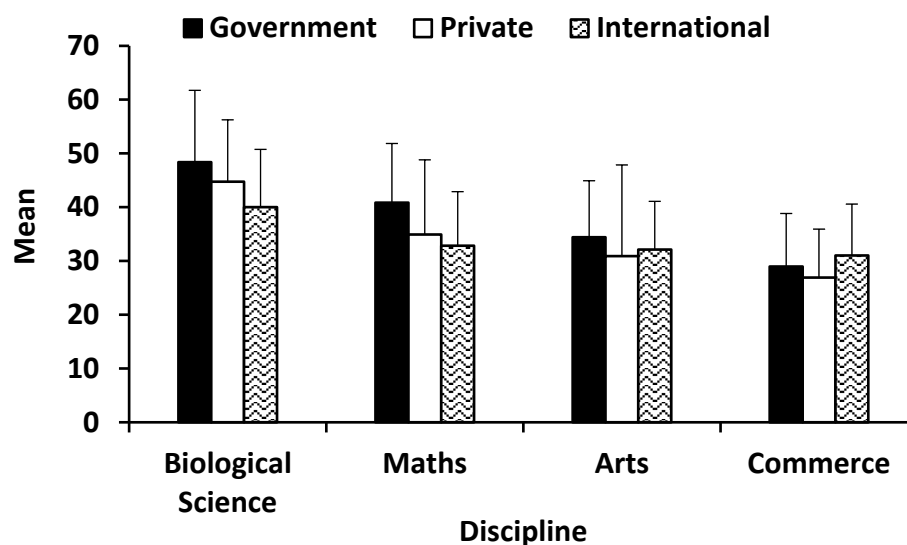


Figure 3. Overall environmental literacy level of students for three schools.

3.6. Evaluation of Pursued Solutions

Some of the valuable suggestions made by students to improve the environmental literacy levels of school children are summarized as follows. Twenty-five percent (25%) of the students suggested the environment-related subjects from grade six to G.C.E. (A/L) as a compulsory component with possible outdoor activities inculcated with the intergraded activity learning methodologies. In addition, a few (5%) preferred to have competitions based on environmental education topics. Most of the students (35%) insisted on practical sessions on waste disposal management and environment-based projects. Some students proposed (25%) ideas to mitigate environmental hazards such as replacing disposal items with reusable items, recycling waste to conserve natural resources, green buildings, and the use of the public modes of transportation. Some of the arts scheme students (10%) also suggested environmental studies programs in schools to improve their knowledge about the environment.

3.7. Representativeness of a Sample

Table 4 presents the statistical results from the chi-square test. Of the parameters tested, several questions from various parts of the questionnaire such as environmental issues, behaviour, policies, and opinions showed a significant difference, $p < 0.01$, $p < 0.05$, and $p < 0.001$, which means that our samples are representative among the four disciplines of Biological Science, Mathematics, Arts, and Commerce.

Table 4. Assessment of representativeness of environmental education among four disciplines, Science, Math, Arts, and Commerce, among three schools.

Part of the Questionnaire and Question Number (Q#)	Chi-Square (χ^2) Value	Asymptotic Significance
Part B Knowledge on Major Environmental Issues		
(Q 15) Secondary pollutants in the atmosphere	13.895	$p < 0.01$
(Q 16) Acid rain	12.183	$p < 0.01$
(Q 23) Global warming	7.887	$p < 0.05$
Part D Behavior towards the Environment		
(Q 29) Reducing the waste	8.05	$p < 0.05$
(Q 30) Environment offences	12.067	$p < 0.01$
(Q 31) Disposing the garbage	20.835	$p < 0.001$
(Q 32) Bins to dispose the garbage	16.173	$p < 0.001$
Part E Knowledge on Local/International Environmental Protection Policies		
(Q 36) Establishing Central Environmental Authority	14.131	$p < 0.005$
F Write your own opinion		
(Q 39) Environmental issues in the world	7.723	$p < 0.05$
(Q 40) Reducing the environmental issues	7.897	$p < 0.06$

NB: Please refer the questionnaire for the details of Likert scale questions.

3.8. Validity and Reliability Analysis

The confirmatory factor analysis (CFA) results showed that the factor loadings of each item were >0.5 , indicating that each latent variable was highly representative of the questions from Part B to Part E of the questionnaire. Our results showed that the AVE value is greater than the lower threshold value of 0.5 (AVE = 0.617), and the CR value (CR = 0.953) is greater than the AVE value. The Cronbach's Alpha (CA) Coefficient for the variables is 0.646.

3.9. Quantification of the Amount of Environmental Related Components Included into the G.C.E. (A/L) Curriculum

The G.C.E (A/L) Curriculum evaluation results showed that the Geography (35%), Biology (11%), Engineering Technology (8%), Biosystem Technology (7%), Science for Technology (7%), Buddhist civilization (9%), and Agricultural Science (5%) subject areas processed a comparatively higher amount of environment-related components (Table 5).

Table 5. Comparing the amount of environment-related periods with the total periods for the subjects.

Subject	Total Periods for the Subject (1 Period = 40 min)	Environment Related Periods	Total Percentage (%)
Biology *	591	63	10.66
Chemistry *	495	16	3.23
Physics *	598	-	-
Combined * Mathematics	589	-	-
Agricultural * Science	507	24	4.73
Accounting **	464	-	-
Economics **	548	10	1.82
Business ** Studies	535	12	2.24
Geography ***	629	220	35
Buddhist civilization ***	586	51	8.7
Buddhism ***	600	20	3.33
Political Science ***	593	-	-
Sinhala ***	600	-	-
Science for Technology *#	552	37	6.7
Engineering Technology *#	593	48	8.09
Biosystem Technology *#	561	41	7.3

* Science Subjects, ** Commerce Subjects, *** Arts Subjects, *# Technology subjects.

4. Discussion

Environmental literacy has become one of the best tools to minimize man-made environmental issues [39]. Comparatively, schools play a major role in minimizing environmental degradation by upgrading environmental knowledge, attitudes, and behavior among students [40]. Assessing the extent of environmental literacy of students with regard to socio-economic status would provide a better picture of the sustainable environmental policy-making process [16,41].

4.1. Socio Economic Status versus Environmental Literacy

The present study recognized (Table 2) that socio-economic factors such as gender, school type, and family income were found as factors that do not have significance with regard to environmental knowledge, as shown by Bozoglu et al. [42] and Denae et al. [43]. Former studies highlighted diverse results on the influential factors for environmental literacy levels. For example, “Extracurricular activities” is the determinant that had the most significant positive impact on environmental literacy among students in Singapore, Estonia, and Germany [34]. There is a significant effect of gender on students’ environmental literacy regarding environmental concern, in favor of girls, parents’ educational level, and mothers’ work status; however, there was not a significant effect of source of information about the environment on students’ environmental literacy [44]. The sociodemographic variables of gender, age, and environmental experience had a significant effect on EL, and mass media served as the main source of environmental information for undergraduates in Iran [45]. Mazumdar [46] identified that economic growth has a significant impact on the initial

level of adult literacy. Similarly, Kuruppuarachchi et al. [16] found that factors such as family income, family educational background, and nature of school education significantly influenced university students' environmental literacy level. Clark et al. [47] recognized that the physical nature of the living area positively influences the environmental literacy level of the resident. That is, persons living in areas with higher canopy cover have higher levels of environmental literacy and higher educational attainment. However, the present study found no significant difference between environmental knowledge and the physical extent of house land. Similarly, the results of this study are comparable with Kuruppuarachchi et al. [16] except for the family income of students.

It is clear that many of the previous studies emphasise family income, family educational background, and parent educational level as affecting environmental literacy and behavior. There are not enough studies to strongly support that urban and rural students have different environmental opinions [48].

Many previous studies have revealed that students who come from urban areas have better environmental knowledge than those from rural areas. The study done by Tuncer et al. [49] in Turkey in 2004 examined urban and rural students and recognized that urban students showed more knowledge and better attitudes regarding the environment. The results of this study are also comparable with the findings of Herdiansyah and Ningrum [50], Behera and Samal [51], and Tuncer et al. [49]. Living in rural areas has been described as a driver for behaving in a pro-environmental way, mainly due to the more frequent contact with nature that people from rural areas have [52]. A study that was carried out by Duron-Ramos et al. [52] revealed that rural children hold a stronger sense of connection to nature and behave in a more pro-environmental way than urban children. If the urban students are provided with more hands-on experience with the environment and rural students are provided with more knowledge on basic concepts of the environment, the teaching–learning process will enhance and balance the disparity between rural and urban.

Several studies have proved that the status of “Family” and its socio-economic nature are the main factors which influence student achievement and literacy [21,53]. Apart from the education given in school, it seems that parents have an active role in the success of the student's performances [34]. Earlier studies [16,18,19,21,54,55] have also shown that the educational background of parents was positively correlated with the environmental knowledge and attitudes of students. Generally, in Sri Lankan culture, school students mostly depend on their parents for education. Comparatively, students with higher socio-economic backgrounds have opportunities for utilizing more physical, psychological, and education-related facilities. Therefore, parents' socio-economic backgrounds, and the concept of “Family,” are highly influenced by students' environmental literacy levels. These results are comparable with the study of Hathella and Priyanath [21] on the performance of the mathematics subject of G.C.E (O/L) students of Sri Lanka.

It is obvious that a higher educational background of parents influences a higher level of psychological support for their children through environments that encourage the development of skills necessary for success at school. Kuruppuarachchi and Sayakkara [31] indicated that students with graduate parents possess more information about the relative weight of grades, core courses, electives, and academically relevant information. Hence, students with a higher educational background in the family have tended to enter highly demanding professional university degrees after taking the G.C.E. (A/L) competitive exams in Sri Lanka. Artun and Ozsevec [56] underlined that educated parents with sufficient knowledge about the environment transfer this information and experiences to their children, and they could develop positive environmental attitudes as a result. Students that had a higher environmental awareness score (Damerell et al. [57]) revealed that environmental education can be transferred between generations and indirectly induce targeted behavioral changes.

4.2. Environmental Knowledge among Different Disciplines

This study found significant differences in the environmental knowledge among different disciplines of G.C.E (A/L) students (Table 3). The reason behind this is that only the biological science and mathematics scheme curriculums incorporate topics that are related to environmental study [58]. The present study revealed that the A/L mathematics curriculum of Sri Lanka does not emphasize environment-related areas. However, Biology, Geography, Agricultural Science, and three subjects of newly introduced technological disciplines were comparatively higher in environment-related components. This study found that TV and the internet are considerable knowledge-gathering sources. Mathematics is a science-based discipline, students of which, due to the inner curiosity, would gain developed EL levels through such media and would be able to maintain comparatively high EL levels.

Mishra [59] also found that the environmental knowledge of science students was comparatively higher than commerce and art students, and that science students were more aware of environmental problems in comparison to art students. Kuruppuarachchi et al. [16] recognized that there were significant differences among the disciplines and that the Science, Engineering, and Law disciplines provided more environmental literacy for Sri Lankan university students. Janmaimool and Khajohnmanee [60] highlighted the comparable results for university students in Thailand. The results of the curriculum evaluation of the present study (Table 4) indicated that few environmental components have been included in the G.C.E. (A/L) curriculum except for in the Geography, Biology, Engineering Technology, Biosystem Technology, Science for Technology, Buddhist Civilization, and Agricultural Science subjects. Furthermore, both public and private schools process significant differences in the environmental literacy levels of biological science versus art, and biological science versus commerce subject streams. (Table 3). Further, there is not much difference in environmental knowledge among different subject areas at international schools.

4.3. Source of Acquired the Environmental Knowledge

The number of channels on television and FM radio has increased significantly in the last decade in Sri Lanka. As well, television coverage of environmental problems has increased dramatically in the last few decades. Therefore, while Sri Lanka appears to be performing well in terms of environmental indices, it still has a long way to go [61]. It is possible to learn about environmental problems and their solutions without learning much about the environmental concept in subject matters. According to Kow [62], television is the primary source of environmental information. Pawlowski [63] studied the perception of environmental problems by young people in Poland and found that the main source of environmental information for participating students was TV (television). Said et al. [64] also found similar results among secondary school students in Malaysia. Chan [65] recognized that television and school were cited as major sources of environmental information and described mass media as more important than personal media in the dissemination of environmental information, similar to this study. In addition, Kuruppuarachchi et al. [16] found that school education, printed materials, and TV/radio-influenced factors are important for upgrading the environmental literacy levels of undergraduate students.

4.4. Overall Environment Literacy Level of Students

The present study recognized that the overall environmental literacy levels of study samples are comparatively low (less than 40%) compared to global scenarios. Some of the similar studies in globally recognized EL awareness levels of students reported 70% [39], 61.5% [66], 60.2% [67], and 69% [68]. Even though a higher percentage of EL awareness levels were reported around the world than in the current study, it is hard to compare EL levels due to the high diversity among methodologies and research tools adopted by different studies. The low EL knowledge could be attributed to a lack of attention to environmental topics in Sri Lankan school curricula, as well as a lack of emphasis on environmental topics in social and electronic media. A few studies are available to deter-

mine how electronic and printed media influence EL. Similarly, studies by Kaplowitz and Levine [69], Johannsdottir [70], and Lillah [71] recognized low-level environmental literacy among students. Diverse methodologies were adopted by these studies to determine the literacy level; hence, comparison would not provide the correct picture. However, most studies recommended the integration of environmental concepts into the formal curriculum to develop literacy levels, which could lead to promoting interest and action towards environmental activities [14,72]. The low level of environmental literacy among school students indicates that the current curriculum and other information providers had failed to achieve the required goals for the environmental knowledge of school children. An increased level of environmental literacy leads to the development of positive attitudes. Attitudes toward pro-environmental behavior have a role in mediating the relationship between environmental knowledge and environmental concerns [73]. Because of their interconnected nature, positive behavioral changes in school students' interactions with the environment can be developed by increasing their environmental literacy level.

4.5. Pursued Solutions Made by the Students

Students proposed inculcating environment-related subjects into normal curricula from grade six to G.C.E. (A/L) as a compulsory component with possible outdoor activities. This type of intergrading teaching–learning methodologies was recommended by different educationists even for the university level [74], as well as for schools, as outdoor activities [75]. Developing and implementing projects and activities on environment and technology at the school level was highlighted by Gündüz and Erdoğan [76] for Cyprus schools. Murat Genc [77] emphasized the importance of project-based activity learning works in the teaching–learning process and found that project-based learning had a positive effect on students' environmental attitudes as well as that is beneficial, enhancing creativity, encouraging research, and providing permanent learning. Similarly, in the present study, most of the students insisted that practical sessions, especially for waste management and environment-based projects, would be beneficial. Ecofriendly behaviors such as the usage of reusable items, recycling waste to conserve natural resources, green building, and the use of the public modes of transportation were suggested by students to conserve nature and showed their positive attitudes toward the environment. Results from the present study can be used to conclude that, although students show a low level of environmental literacy, their approaches to conserving the environment are at a higher level, as shown by Özgürler and Cansaran [41] for undergraduate students. On the other hand, Laor et al. [78] recognized that university students' knowledge of solid waste management is high; however, the levels of attitude and practice are neutral and moderate. Akadiri et al. [79] highlighted the importance of designing eco-friendly buildings for future sustainability.

Researchers in the present study evaluated official teachers' curriculum guidebooks for different disciplines of G.C.E. (A/L), newly formulated by the National Institute of Education (NIE) of Sri Lanka. Basically, the commerce, arts, and mathematics disciplines had curricula based on knowledge, concepts, and theoretical development. However, the newly-developed Technology discipline, as well as former agricultural science and biological science subjects, comparatively highlighted some of the practical aspects. The overall G.C.E. (A/L) curriculum of Sri Lanka is focused mainly on upcoming university education. Unfortunately, only 25% of eligible students would be able to enter state universities. Therefore, we highly recommend to our policymakers and education planners that they diversify the curriculum from knowledge-based to skill- and attitude-based, integrating environmental concepts. In addition, arts (except geography), commerce, and mathematics require that more attention be paid to environmental concepts.

4.6. Validity and Reliability

Fornell et al. [80] suggested that AVE greater than 0.5 indicates a good convergent validity (CV). A higher CR indicated a greater degree of association among the items in that group and a higher degree of agreement among the measured potential factors. According

to Janssen [37], a CR value that is greater than the lower threshold of 0.7 indicates that the scale is reliable. The CA value for this study has proximity to 0.7, meaning the internal consistency of the scale is acceptable (Sürücü & Maslakçı [81]). The results in this study of AVE and CR values of >0.6 indicate that the scale has a good CV [82].

4.7. Environmental Related Components Associated with G.C.E. (A/L) Curriculum

A curriculum refers to the lessons and academic content taught in a school, together with the guidelines for teaching the learning process in a particular course or program. In the policy documents and curricula, teachers in the subject areas of science, social science, and language are encouraged to collaborate on cross-curricular issues such as sustainable development in many counties. Policymakers have shown diverse views on sustainability implementation [83]. The environment-integrated school curriculum, especially for the primary level, has a long history. In Great Britain, from the 1940s onwards, various ideas and initiatives came into the 'roots' of environmental education, involving a mixture of history, geography, and nature study in the school locality, 'field studies' such as residential visits, wildlife gardening, earth education, a greater focus on the ecology of urban areas, and the development of 'city farms'. Then, EE became a cross-curricular theme in the 1990s' (alongside health education, education for citizenship, careers, guidance, and economic and industrial understanding). The theme encompassed both the built and natural environments through the following topics: climate, water, energy, plants and animals, soil, rocks, minerals, buildings, industrialization and waste, and people and communities. Then, the curriculum was reviewed in 1994, and cross-curricular environmental education themes in the curriculum were eliminated. Education for Sustainable Development (ESD) was introduced as a non-statutory element of the curriculum in 2000. Then, the Government's Sustainable Schools Strategy (S3) was launched in 2006, which encouraged schools to follow the eight 'doorways' (buildings and grounds, energy and water, travel and traffic, food and drink, purchasing and waste, local well-being, inclusion and participation, and global dimension) in order to become a completely sustainable school by 2020. However, this system was removed in 2010. In 2006, the government launched the Learning Outside the Classroom Manifesto. The manifesto highlighted the values of hands-on, experiential learning as a method of enhancing and supporting work in the classroom [84].

Several studies emphasize the quantification of environment-related areas into the formal curriculum at the school level [85]. Gopal and Anand [86] highlighted different main topics that were included in the school curriculum from grades 1 to 12 as an exploration of science, the variety of life, the process of life, human influence on earth, types and uses of materials explaining how materials behave, earth and atmosphere, energy, and natural resources and conservation. Westover [87] evaluated the possibility of combining the concepts of environmental education with community service learning to create a new method of curriculum integration; environmental community service learning has been recognized as a successful teaching-learning process. Local environmental knowledge could play an important role in environmental education and integration with historical experiences, with environmental resources recommended to include formal curricula for the sustainability of environmental education for Junior secondary schools of Botswana [88]. Effective school-community partnerships are pivotal to improving the integration of environmental education. Introducing new areas of environmental education to the formal school curriculum is essential, although practically difficult, and requires the involvement of responsible whole sectors. In Sri Lanka, no proper investigations have been carried out on the effects of the school curriculum on the environmental literacy level of school children. Hence, these initiatives would facilitate new dimensions for imparting higher EL levels in school children of Sri Lanka.

5. Conclusions

In brief, it was found that the nature of permanent residence, the educational qualifications of parents, and the discipline of study were socioeconomic factors that influenced the environmental knowledge of students. Students from urban and sub-urban areas showed more environmental knowledge compared to students from rural areas. The environmental knowledge of students increases parallel to the level of education of parents. Students who belong to the science scheme showed the highest environmental knowledge compared to other disciplines. Gender, school type, and family income were not correlated with environmental knowledge. Low levels of overall environmental knowledge among school students indicated that the schools' current curriculum had failed to achieve the goal of education. The suggested future environmental knowledge research among students of various grade levels (from primary to advanced) includes a post- and pre-test, followed by environmental programs or lectures. Further, it may be advisable to develop a qualitative follow-up study to evaluate the top-performing schools in this study to find out why and how their students performed so well on the environmental literacy survey.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su15053968/s1>, File S1: Questionnaire from the student opinion survey concerning environment literacy on issues, local/international agreements, attitudes, behavior, and policies. The wording of the questions was formulated using predefined scales of answers (source: authors' research).

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