Asian Journal of Interdisciplinary Research | Volume 2 | Issue 2

HIGHLIGHTED ARTICLE

The Level of Climate Change Science Literacy among Teachers in Seychelles: Implications for the Blue Economy

Raymond Ndubisi Anyanwu [a, *]

[a] Seychelles Institute of Teacher Education, Mont Fleuri, Republic of Seychelles.
*Corresponding Author Email: sir.raymondanyanwu@gmail.com ; Phone: +2482737010.
(Received: 16th March 2019; Accepted: 15th May 2019)
DOI: http://doi.org/10.34256/ajir1921

Abstract: Climate change poses a serious threat to the ocean on which the Seychelles economy depends for resources and services. To address this concern, the Seychelles National Climate Change Response Strategy recommends education about climate change in all levels of the education system to nurture young people with the capacity to address climate change impacts. This quantitative, descriptive, cross-sectional survey measures the level of climate change science literacy among teachers in Seychelles on a five-point summated scale (Extremely Low, Low, Medium, High, and Extremely High). Data was collected with a 15-item Climate Change Science Literacy Questionnaire (CCSLQ) from 572 participants representing 42.62% of the population of teachers in public schools at the time of the survey. Ethical considerations relating to access, informed consent, anonymity, and confidentiality were fulfilled. Collected data was analysed statistically with descriptive techniques (percentage, means, standard error of measurement and confidence interval) and inferential technique with the Fisher's Exact Chi-Square test. Statistical operation was performed with the Statistical Package for the Social Science (SPSS). Results indicate that the majority of the participants (37.4%, n=214) have medium literacy regarding climate change science with misconceptions on all three domains of climate change science: causes, impacts, and solutions. Educational interventions to enhance teachers' knowledge and understanding of climate change are recommended; otherwise the teachers will transfer inaccurate concepts to the learners. Without young Seychellois with the capacity to take action on climate change, it may be wearisome for Seychelles to achieve a smooth transition to a blue economy.

Key words: Climate change science literacy, teachers, blue economy.

1. Introduction

There is a consensus among climate scientists that climate change in this century is mostly the consequence of global warming [1, 2]. Going by the principles of geophysics, a warming Earth would experience sea-level rise, ocean acidification, extreme weather events, including increased ocean heat content. These changes affect society in many different ways including food insecurity, water shortage, destruction of marine environment, and loss of species. Continued warming of the oceans will exacerbate existing impacts and also create new ones, mainly in countries that have deep historic, social and economic link with the oceans [1-

6]. Oceans cover almost three quarters of the Earth's surface area and constitute the most extensive ecosystem on our planet. More than half of the oxygen in the atmosphere originates from oceanic sources. About one-third of the annual emissions of carbon dioxide produced by anthropogenic activity and over ninety per cent of global warming occurring since the 1950s are absorbed by the oceans. Economic activities such as fishing, transportation, mining and tourism rely on the oceans for resources and services. In some island and coastal communities the ocean is the main source of dietary proteins. Cognizant of these vital functions of the oceans, the United Nations has incorporated the conservation and sustainable use of oceans and marine resources, and climate change mitigation and adaptation into the list of international sustainable development goals. It is anticipated that achieving these goals will help to eradicate poverty, protect our planet, and ensure prosperity for all [6- 9].

The concept that oceans hold abundant resources that can be exploited to promote sustainable growth and development came to the fore at the United Nations Conference on Sustainable Development held in Rio de Janeiro, Brazil from 20-22 June 2012. Supporting this concept is the assumption that the modalities for land-based economy (green economy) can be adapted to the oceans to increase production of food, raw materials and services while maintaining healthy environment [10]. Ocean-based economy widely referred to as the blue economy encompasses two major economic sectors: the established productive sectors comprising captured fisheries, seafood processing, shipping, offshore oil and gas, marine manufacturing, and dredging; and, the emerging sector comprising marine aquaculture, deep and ultra-deep-water oil and gas, offshore wind energy, and marine and seabed mining. Since Rio 2012, many small island developing states including Seychelles have embraced the blue economy concept as an economic development model suited to their unique opportunities and vulnerabilities [11-17].

The connection between ocean and climate is such that any disruption on one affects the other. This connection poses a serious challenge for creating the conditions for growth and investments that are needed to realize a full transition to a blue economy. One of the enablers to address this challenge is education and capacity building [14]. Taking into account that climate change is a life or death concern for Seychelles, the Seychelles National Climate Change Response Strategy recommends education about climate change in all levels of the education system with the intention of developing people with the capacity to initiate appropriate action on climate change impacts [18]. However, this kind of education requires teachers who are climate change science literate, so that they can provide appropriate information to learners [19-22]. Against this backdrop it is pertinent to investigate the level of climate change science literacy among teachers in Seychelles in order to determine the possibility of sustaining the Blue Economy in this era of visible impacts of climate change on the oceans.

A survey of literature reveals there is a growing interest on research in teacher knowledge and understanding of climate change in developed and developing countries, as climate change affects everyone anywhere in the world [23] used Florida (United States) and Puerto Rico to investigate secondary science teachers' knowledge and teaching of climate change science and the

result show that the majority of the teachers hold misconceptions about climate change. This finding corroborates [24] involving samples from the United States; [25] involving samples from India; [26] involving samples from Australia; and [27] involving samples from Turkey. Research has shown that misconception, once formed, is resistant to change and pose a serious barrier to construction of knowledge [28].

Many different scales are used to measure level of knowledge in education. Large-point scales have an advantage over small-point scales in that they provide a variety of options thereby raising the probability of meeting the objective reality of sample [29]. A three-point Likert scale comprising Low, Medium, and High was employed by [30] to measure the level of knowledge about climate change among primary school teachers in Kisumu district, Kenya and the result shows that the majority of the teachers have medium awareness of climate change with some gaps in their understanding of climate change. On the other hand, [31] employed a five-point Likert scale with categories as Extremely Low, Low, Medium, High and Extremely High to measure the level of literacy about climate change science among geography teachers in the Western Cape, South Africa. The result shows that the majority of the teachers demonstrated high literacy in climate change science, though with lower scores on climate change impacts and climate change solutions respectively than on processes/causes of climate change. A related study by [32] found that Omani teachers demonstrated awareness of the measures humans can take to mitigate and adapt to climate change. Although most of the empirical studies cited here were conducted in developing countries; none involved samples from Small Island Developing States in the Indian Ocean; and, none involved 'climate change science literacy' as a construct.

The main purpose of this study was to measure the level of climate change science literacy among teachers in Seychelles. For the purpose of this study, climate change science comprises climatic processes and causes of climate change, climate change impacts, and climate change solutions [31, 33]. In addition, level of literacy is measured on five-point summated scale with the following categories: Extremely Low (0-20), Low (21-40), Medium (41-60), High (61-80), and Extremely High (81-100), based on [31]. This scale is appropriate in situations where the number of participants in different score categories is needed to get an idea of the level of knowledge/performance of a sample of individuals on a test [29, 34]. For the purpose of this survey, the category with the highest frequency represents the level of literacy of the teachers. The main research question is: To what extent are the teachers in Seychelles literate regarding climate change science? To answer this question, this study will find out whether the observed scores (actual scores) from the test and the expected scores (theoretical scores) differ significantly, or not.

2. Materials and Methods

2.1 The Research Context

Seychelles is one of Africa's small island states situated in the Indian Ocean. It is an archipelago comprising over 115 islands including the three main inhabited islands, namely Mahe, Praslin and La Digue. Mahe is the main island and also the most populated. Seychelles' capital city, Victoria situated on Mahe, is the smallest capital city on the African continent. The population of Seychelles stood at 95821 as at December

2017 and is mostly youthful. The main economic activities are tourism and fishing-related businesses. Literacy rate and life expectancy are high owing to public investment in education and capacity building, health and social protection. Seychelles consist of six geographical regions, namely East, West, North, South, Central and Inner Islands. Each region has at least three primary schools and one secondary school, though depending on the size of the region. As at the time of this survey there were 25 public primary schools with 724 teachers; and, 11 public secondary schools with 618 teachers. In total, there were 1342 teachers in 36 public schools in Seychelles [11, 35]. Presently, there are nine essential learning areas of the national curriculum: Languages; Mathematics; Arts; Sciences; Technology and Vocational Education; Social Sciences; Personal, Social and Citizenship Education; Health and Physical Education; and Information and Communication Technology. Although climate change science is not taught as a separate school subject in public primary and secondary schools in Seychelles; some topics/concepts relating to climate change are integrated into some of the learning areas, mostly Science, Social Sciences, and Technical and Vocational Education [36].

2.2 Design, Methods and Procedure

This survey adopted the quantitative, descriptive, cross-sectional design. This design is appropriate for collecting data from a large sample without influencing it in any way. Since it was not feasible to collect data from all the teachers in public schools in Seychelles owing to economic and ethical reasons, a design that would allow for generalization of results based on observation from a representative sample of the population was employed. In addition, the chosen design allows for collecting data from the sample at single point in time. These choices were made to achieve a high response rate in the survey [37, 38]. The sample for this survey was selected using clustered sampling technique, described by [39] as a suitable strategy for capturing the heterogeneity of population. Capturing the homogeneity of the population is crucial in this survey because of the diversity of the population. A list of all the public primary and secondary schools in Seychelles including the number of teachers in each school was obtained from the Schools Division in the Ministry of Education. The schools were categorised into clusters consistent with the geographical regions in Seychelles: east, west, north, south, central, and inner islands. From each cluster at least two primary schools and one secondary school were selected, depending on the number of schools in each region. All the teachers in the schools selected were to participate in the survey. The teachers vary in terms of region where school is located, gender, age, qualification, specialization, experience, nationality, level of learners taught, and main source of information about climate change, but this study will not be concerned with investigating the influence of these variables rather the focus will be on the level of literacy of the participants at the time of this survey.

This survey was conducted with a 15-item criterion-referenced, multiple-choice Climate Change Science Literacy Questionnaire (CCSLQ). The instrument was originally developed by [40]. It has a reliability coefficient of 0.74 based on internal consistent measured with the Guttman's split-half test. However, a slight adaptation was made on the CCSLQ by replacing Item 15 with a question on the link between climate change and the Blue Economy in order to reflect the reality of Seychelles. With this adjustment the reliability (internal consistency) of the CCSLQ dropped

from 0.74 to 0.6. Apart from this adjustment, the rest of the items where retained as originally designed. The CCSLQ consists of three sections. Each section represents a domain of climate change science with five items. The items were derived from content topics from approved school textbooks and other publications by the Intergovernmental Panel on Climate Change; United Nations Educational, Scientific and Cultural Organisation; United Nations Framework Convention on Climate, and National Ocean and Atmospheric Administration. Topics on climate processes and probable causes of climate change include the Earth's climate systems, global warming, natural/anthropogenic causes of climate change, global CO_2 emissions and future climates and the nature of climate science. Topics on climate change impacts include the evidence of climate change in natural and human systems, climate change and water availability, vulnerability of sub-Saharan Africa, effect of climate change in developing countries and global effects of climate change. Content topics on climate change solutions include stabilisation of global carbon production, rural people and their adaptation to climate change, implementation of climate change policies mitigation and adaptation options for developing countries, and climate change response in the small island developing countries. Each item has four options lettered A to D. General instructions and sectional instructions were provided to guide the participants through the items. The test is weighted 100. The maximum time allowed to complete the questionnaire was 45 minutes.

Prior to data collection the investigator obtained a written approval to conduct the survey from the Office of the Principal Secretary, Ministry of Education. The CCSQL was completed by the participants during one of their regular professional development meetings in Term 2 (June), 2018. Prior to the survey, participants were asked to give consent to participate in it by voluntarily completing a consent form attached to the questionnaire. Only those who completed the consent form participated in the survey. Completed questionnaire was collected for marking, data capture and analysis.

2.3 Techniques of data analysis

A participant's score on each section of the CCSLQ was derived by obtaining the number of correct responses and converting it into a percentage of the total. In this way, a participants' score on the three domains of climate change science was obtained. The scores were first captured with SPSS, with columns showing the number of participants responding correctly to each item and those that gave wrong (inaccurate) answers, for each domain. Descriptive analysis involving frequency, percentage, standard error and mean score was employed to determine the pattern of responses in order to identify areas of misconceptions and the mean score for each domain. A five-point Likert-type summated scale comprising Extremely Low (0-20), Low (21-40), Medium (41-60), High (61-80) and Extremely High (81-100) was used to derive the number of participants in each score category in an effort to determine the category with the highest frequency. The category where the highest number of participants congregates represents the literacy level for the majority of the participants. Since the score continuum contains some individual counts (frequencies) that are less than 1, it is appropriate to employ the Fisher's Exact Chi Square test rather than Pearson Chi Square test. This test (Fisher's Exact Chi Square test) us used to determine whether the observed score frequencies in the

continuum vary significantly from the expected score frequencies [41]. All statistical analysis was performed with the SPSS. The null hypothesis which states that no significant difference existed between the observed and expected frequencies was tested at 0.05 level of confidence. Hypothesis is rejected if the observed (calculated) p-value is greater than the critical p-value; otherwise, it is upheld.

3. Results

Data on Table 1 shows that the majority of the participants responded correctly to four out of the fifteen items testing literacy of climate change science. Among the five items on the causes of climate change, the majority of the participants gave correct answers on two and incorrect answers on three of the five items.

The two items where the majority of the participants gave correct answers are Item 3 (63.81%, n = 365) and Item 4 (71.5%, n = 409). Items where the majority of participants gave incorrect answers are Item 1 (92.21%, n = 528), Item 2 (52.8%, n = 302) and Item 5 (70.45%, n = 403). Among the items testing literacy of climate change impacts, the majority of the participants gave correct answers to Item 6 (62.24%, n = 356) and incorrect answers to Items 7 (29.9%, n = 171); Item 8 (47.55%, n = 272); Item 9 (13.64%, n = 78); and Item 10 (34.44%, n = 197). Pertaining to literacy of climate change solutions, Table 1 shows that the majority of the participants gave correct answers to Item 15 (69.76%, n = 399) whereas their answers to Item 11 (22.38%, n = 128); Item 12 (20.63%, n = 118); Item 13 (48.6%, n = 278) and Item 14 (47.38%, n = 271) were incorrect.

Table 1 Results of analysis of participants' responses to CCSL items

Domains of climate change science	Item ID	Correct Responses		Incorrect Responses	
		n	%	n	%
Processes and causes of climate change	1	44	7.69	528	92.31
	2	270	47.2	302	52.8
	3	365	63.81	207	36.19
	4	409	71.5	163	28.5
	5	169	29.55	403	70.45
Impacts of climate change	6	356	62.24	216	37.77
	7	171	29.9	401	70.11
	8	272	47.55	300	52.45
	9	78	13.64	494	86.36
	10	197	34.44	375	65.56
Solutions of climate change	11	128	22.38	444	77.62
	12	118	20.63	454	79.37
	13	278	48.6	294	51.4
	14	271	47.38	301	52.62
	15	399	69.76	173	30.24

Table 2 Mean scores on the three domains of climate change science

Domains of climate change science	Mean	SD	SEM	95% Confidence Interval		Min	Max
				Upper Bound	Lower Bound		
Climatic processes/causes of climate change	43.95	22.31	0.93	42.89	45.84	0	100
Impacts of climate change	37.48	22.78	0.95	35.63	39.11	0	100
Solutions of climate change	41.75	23.49	0.98	39.9	43.5	0	100
All domains	**41.06**	**16.99**	**0.71**	**39.61**	**42.32**	**0**	**80**

Table 3 Distribution of respondents by level of literacy about climate change science

Domains of climate change science	0-20 Extremely Low		21-40 Low		41.60 Medium		61-80 High		81-100 Extremely High	
	N	%	N	%	n	%	n	%	n	%
Climatic processes/ causes of climate change	157	27.4	168	29.4	183	32	61	10.7	3	0.53
Impacts of climate change	221	38.6	179	31.3	128	22.4	41	7.2	3	0.52
Solutions of climate change	179	31.3	181	31.6	140	24.5	67	11.7	4	0.7
All domains	**89**	**15.6**	**212**	**37.1**	**214**	**37.4**	**57**	**10**	**0**	**0**

Table 4 Results of Fisher's Exact Chi Square test of the difference between the observed and expected score frequencies

Level of Literacy	Range	n	%	x^2	*df*	Fisher's Exact Sig.
Extremely Low	0-20	89	15.6	140.66	3	0.000
Low	21-40	212	37.1			
Medium	41-60	214	37.4			
High	61-80	57	10			
Extremely High	81-100	0	0			

Table 2 shows that the mean score for the entire test (climate change science) is 41.06; with the mean for causes of climate change (43.95) higher than mean for impacts of climate change (37.48) and mean for solutions of climate change (41.75). Standard error of measurement (SEM) for all three sections of the test and on the entire test vary as follows: Processes/causes of climate change (0.93), Impacts of climate change (0.95), solutions of climate change (0.98), and climate change science (0.71). The true means lie between the lower and upper bound at 95% confidence interval. The minimum and maximum scores show that none of the participants scored 100 on the entire test; while some did on the individual sections of the test.

N = 572

Table 3 shows that most participants (32%, n = 183) demonstrated medium literacy regarding the processes/causes of climate change; most participants (38.6%, n = 221) demonstrated Extremely Low Literacy regarding the impacts of climate change; and most participants (31.6%, n = 181) demonstrated Low Literacy regarding climate change solutions. In general, the majority of the participants (37.4%; n = 214) demonstrated Medium literacy regarding climate change science.

Table 4 shows that 15.6% of the participants (n=89) fell in the Extremely Low literacy level; 37.1% (n = 212) fell in the Low literacy level; 37.4% (n = 214) fell in the Medium literacy level; 10% (n = 57) fell in the High literacy level; and none fell in the Extremely High literacy level. This distribution implies that the majority of the participants of this survey demonstrated Medium literacy about climate change science. With x^2 (3, n = 5) = 140.66, $p < 0.05$; the observed (calculated) p-value is less than critical p-value. Hence Ho which states that no difference exists between the expected and the observed score frequencies of the five performance levels is rejected. It is therefore upheld that a significant difference exists between the expected and the observed score frequencies of the five performance levels on literacy about climate change science.

4. Discussion

The purpose of this quantitative cross-sectional survey was to understand the extent teachers in Seychelles are climate change science literate; that is; how far they are knowledgeable regarding climatic processes/causes, impacts, and solutions of climate change. Reference to CCSLQ, Items 1 to 5 focused on the climatic processes/causes of climate change, Items 6 to 10 focused on impacts of climate change, and Items 11 to 15 focused on solutions of climate change. Results of descriptive analysis of participants' performance on the test presented on Table 1 indicate that the participants did well on four items only, namely Items 3, 4, 6, 15 and did poorly on eleven items, namely Items 1, 2, 5, 7, 8, 9, 10, 11, 12, 13, 14. Coming from the positive side of the coin, the majority of the participants know that emission of industrial greenhouse gases into the lower atmosphere is an anthropogenic cause of climate change (63.81%, n = 365); they know that given the amount of CO_2 currently in the Earth's atmosphere global warming will continue for many centuries (71.5%, n = 409); they know that global warming could result to melting of ice sheets (62.24%; n = 356); and also they know that the main advocates of the Blue Economy are Small Island Developing States (69.76%, n = 399). These observations indicate that the participants did well on two out of five items testing literacy about climatic processes/causes of climate change; one out

of the five items testing literacy about impacts of climate change; and one out of the five items testing literacy about solutions of climate change.

On the other side of the coin, it was found that the majority of the participants did not know that: water vapour is the most abundant greenhouse gas and also the most important contributor to natural greenhouse effect in the atmosphere (92.31%; n = 528); the term *global warming* refers to increase in the average temperature of the Earth's atmosphere (52.8%, n=302); climate change science is characterised by uncertainty (70.45%, n = 403); subtracting atmospheric demand for moisture in an area from atmospheric supply of moisture in that area gives an indication of droughts (70.11%, n = 401); and, most sub-Saharan African countries are vulnerable to climate change as a result of low/poor capacity to adapt to climate changes (52.45%, n = 300). Furthermore, the majority did not also know that: climate change is not the cause of low outbreak of diseases in less developed countries (86.36%, n = 494); high temperature associated with increase in greenhouse warming may have more negative effects on people in the northern hemisphere than people in the southern hemisphere because the northern hemisphere is more populated than the southern hemisphere; carbon sequestration is the removal of CO_2 from the atmosphere and depositing it in reservoirs (77.62%, n = 444); implementing guidelines to achieve carbon emission reduction targets is not a community-based adaptation to climate change (79.37%, n = 454); leaving the responsibility of formulating climate change policies to experts alone may jeopardise the implementation of new policies on climate change (51.4%; n = 294); and, implement programmes that will reduce the harmful effect of climate change is the best option for developing countries, since climate change may not stop anytime soon (52.62%; n = 301). This observation reveals that most of the participants have misconceptions about climate change science. This finding corroborates [23-25, 27, 31] who observed that most teachers hold inaccurate conceptions about climate change.

The figures shown on Table 2 corroborate those on Table 1. Data on Table 2 show that the mean scores for the three domain of climate change science vary as follows: 43.95 for processes/causes of climate change; 37.48 for impacts of climate change; and 41.75 for solutions of climate change. In total, the mean score for climate change science (the three domains combined) is 41.06. These figures reveal poor performance on all sections of the test was poor. With a Standard Error of Measurement (SEM) of 0.93 for climatic processes/causes of climate change, 0.95 for impacts of climate change, 0.98 for solutions of climate change, and 0.71 for the entire test, indicate that the true means for the three domains vary, with true mean for Domain 1 falling between 43.02 and 44.88; true mean for Domain 2 falling between 36.53 and 39.45; and true mean for Domain 3 falling between 40.77 and 42.73. The true mean for the entire test (the three domains combined) lies between 40.35 and 41.77. In each case the estimates (true means) approximate their upper and lower bounds at 95% confidence interval, an indication that the observed (sample) means are dependable estimates of the population means.

The number and percentage of participants in the different score categories (levels) for the three domains of climate change science vary as shown on Table 3. The majority of the participants showed medium literacy regarding the processes/causes of

climate change (32%, n=183); extremely low literacy on impacts of climate change (38.6%, n = 221); low literacy on solutions of climate change (31.6%, n = 181). For climate change science as a whole (the entire test), most of the participants fall between extremely low and medium category, with the majority (37.4%, n=214) clustering on the medium category. No participant fell in the extremely high literacy category. This result validates [30] who found that primary teachers in Kisumu district in Kenya have medium awareness of climate change, with some gaps in their understanding of climate change. However, the result contradicts [31] who observed that geography teachers in Western Cape Province of South Africa have high literacy regarding climate change science, even though the present survey did not focus specifically on geography teachers. Results of Fisher's Exact Chi Square test (see Table 4) give statistical credence to the results on Table 3 by confirming that a significant difference exists between the observed and expected score frequencies of the five literacy categories about climate change science literacy; since x^2 (3, n = 5) =140.66, $p < 0.05$. In other words, the difference between the observed and the expected score frequencies in the distribution could not be due to chance, following that the observed p-value (0.00) is less than critical p-value (0.05). This difference may be due to the influence of variables other than teacher knowledge and understanding of climate change; however, those variables fall outside the scope and purpose of this survey.

5. Conclusions

For a small island developing country like Seychelles that is among the most vulnerable in the world to climate change, and one that hopes to make a full transition to a blue (ocean) economy; education about climate change offers the best strategy to develop people's capacity to take action on climate change impacts. Observing that most of the teachers in public schools in the country have medium literacy regarding climate change science with misconceptions on all its three domains casts doubt on the possibility of a transition to a blue economy in the near future. This is because teachers who understand the link between the ocean, climate change and sustainable development have the capacity to develop young people with the capacity to create the conditions for growth and investments that are needed to maintain a blue economy. Therefore, professional development intervention programmes to enhance teachers' knowledge and understanding of climate change are recommended; or else these teachers will not be able to provide accurate information on climate change to the learners. Since there was no empirical study on the topic of this survey with samples from Seychelles, the outcomes of this survey make a unique and significant contribution to knowledge and research on the topic.

References

[1] The Royal Society. 2019. Climate change: evidence and causes. Available at: https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/

[2] Intergovernmental Panel on Climate Change, 2018. Special Report: Global Warming of 1.5 ºc. Available at: https://www.ipcc.ch/sr15/

[3] [3] Natural Resources Defense Council. 2019, Are the Effects of Global Warming Really that Bad? Available at: https://www.nrdc.org/stories/are-effects-global-warming-really-bad.

[4] United Nations Development Programme. 2019. Small Island nations at the frontline of climate action. Available at: http://www.undp.org/content/undp/en/home/presscenter/pressreleases/2017/09/18/small-island-nations-at-the-frontline-of-climate-action-.html

[5] I. Kelman, Islandness within climate change narratives of Small Island Developing States (SIDS). *Island Studies Journal*, 13 (2018) 149-166.

[6] C. Betzold, Adapting to climate change in small island developing states. *Climatic Change*, 133 (2015) 1-9.

[7] United Nations, 2017. The Sustainable Development Goals Report 2017. New York: United Nations. Available at: https://sdgactioncampaign.org/wp-content/uploads/2017/07/TheSustainableDevelopmentGoalsReport2017.pdf

[8] United States Environmental Protection Agency. 2017. Effects of Ocean and Coastal Acidification on Marine Life. Available at: https://www.epa.gov/ocean-acidification/effects-ocean-and-coastal-acidification-marine-life

[9] A.J. Berry, Sustainable resource use and the problem of declining shoreline resilience to sea level rise: a Seychelles case study, *Island Studies* (2015) 20-26.

[10] United Nations, 2012. Why value the oceans. A discussion Paper. Available at: http://www.teebweb.org/media/2013/10/2013-Why-Value-the-Oceans-Discussion-Paper.pdf

[11] Economic Commission for Africa, 2018, Country Profile 2017: Seychelles. Addis Ababa, Ethiopia. Economic Commission for Africa. In: http://www.uneca.org/sites/default/files/uploaded-douments/CountryProfiles/2018/Seychelles_cp_2017_en.pdf

[12] Organisation for Economic Co-operation and Development, 2018, The Ocean Economy in 2030. Available at: http://www.oecd.org/environment/the-ocean-economy-in-2030-9789264251724-en.htm

[13] A. Bari, Our Oceans and the Blue Economy: Opportunities and Challenges, *Procedia Engineering*, 194 (2017) 5-11.

[14] Commonwealth Secretariat, 2016, The Blue Economy and Small States Commonwealth Blue Economy Series, No. 1. London: Commonwealth Secretariat. Available at: http://www.cpahq.org/cpahq/Cpadocs/The%20Blue%20Economy%20and%20Small%20States.pdf

[15] United Nations, 2017. The Sustainable Development Goals Report 2017. New York: United Nations. Available at: https://sdgactioncampaign.org/wp-content/uploads/2017/07/TheSustainableDevelopmentGoalsReport2017.pdf

[16] United Nations, 2014. The Oceans Economy: Opportunities and Challenges for Small Island Developing States. Available at: https://unctad.org/en/PublicationsLibrary/ditcted2014d5_en.pdf

[17] L. Greenhill, A. Hughes, J.G. Day, M. S. Stanley, Developing Knowledge to Transition to a Blue Economy: A Strategic Approach. *Island Studies* (2015) 6-10.

[18] Government of Seychelles, 2016, Seychelles Climate Change Strategy and Priorities. Available at: http://commissionoceanindien.org/fileadmin/resources/Acclimate/09Seychelles_COI_GCF%202016.pdf

[19] United Nations Educational, Scientific and Cultural Organisation, 2018. Global Action Programme on Education for Sustainable Development. Available at: https://en.unesco.org/gap/priority-action-areas. Accessed 26 November 2018.

[20] R. B. Stevenson, J. Nicholls, H. L. Whitehouse, What Is Climate Change Education? *Curriculum Perspectives,* 37 (2017) 1-5.

[21] H. Boon, Teachers and the communication of climate change science: a critical partnership in Australia. *Procedia - Social and Behavioral Sciences,* 116 (2014) 1006–1010.

[22] A. Anderson, Climate Change Education for Mitigation and Adaptation. *Journal of Education for Sustainable Development*. 6 (2012) 191-206.

[23] B.C. Herman, A. Feldman, V. Vernaza-Hernandez, Florida and Puerto Rico Secondary Science Teachers' Knowledge and Teaching of Climate Change Science. *International Journal of Science and Mathematics Education*, 15 (2017) 451-471.

[24] [24] E. Plutzer, M. McCaffrey, A. L. Hannah, J. Rosenau, M. Berbeco, A. H. Reid, 2016. Climate confusion among U.S teachers, *Science*, 351 (6274) 664-665.

[25] [25] S. S. Hegde, N . S. Murthy, C. N Shalini, K. R. Sandeep, Awareness of global warming among school teachers in coastal Karnataka, *Indian Journal of Preventive and Social Medicine,* 43 (2012) 383-388.

[26] H. Boon, Climate change? Who knows? A comparison of secondary students and pre-service teachers. *Australian Journal of Teacher Education*, 35 (2010) 104-120.

[27] A. E. Bozdoğan, A Collection of Studies Conducted in Education about 'Global Warming' Problem. *Educational Sciences: Theory and Practice*, 11 (2011) 1618–1624.

[28] National Academy of Sciences, 2019, Misconceptions as Barriers to Understanding Science, Available at: https://www.nap.edu/read/5287/chapter/5

[29] A. Josh, S. Kale, S. Chandel, D. K. Pal, Likert Scale: Explored and Explained. *British Journal of Applied Science & Technology*, 7 (2015) 398-403.

[30] M. A. Ochieng, J. Koske, The level of climate change awareness and perception among primary school teachers in Kisumu municipality, Kenya. *International Journal of Humanities and Social Science*, 3 (2013) 174-179.

[31] R. Anyanwu, L. Le Grange, P. Beets, Climate change science literacy of Geography teachers in the Western Cape Province, South Africa. *South African Journal of Education*, 35 (2015) 1-9.

[32] A. Ambusaidi, E. Boyes, M. Stanisstreet, N. Taylor, Omani pre-service science teachers' views about global warming: Beliefs about action and willingness to act. *International Journal of Environment & Science Education*, 7 (2012) 233-251.

[33] R. N. Anyanwu, L. Le Grange, The nature of climate science:Challenges for the development of climate change science literacy in education. Africa International Journal of Multidisciplinary Research, 2 (2018) 24-34.

[34] R. Johns, Likert Items and Scales. Survey Question Bank: Methods Fact Sheet 1 (March 2010). Available at: https://ukdataservice.ac.uk/media/262829/discover_likertfactsheet.pdf

[35] Ministry of Education, 2019. Schools. Mont Fleuri, Seychelles: Ministry of Education. Available at: www.education.gov.sc/pages/school/aspx. Accessed 31/1/2019

[36] Government of Seychelles, 2013. The Seychelles National Curriculum Framework. Ministry of Education: Mont Fleuri, Mahe.

[37] T. Mathiyazhagan, D. Nandan, 2010, Survey research method. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.464.5585&rep=rep1&type=pdf

[38] R. R. Rindfuss, M. K. Choe, N. O. Tsuya, L. L. Bumpass, E. Tamaki, Do low survey response rates bias results? Evidence from Japan. *Demographic Research*, 32 (2015) 798-827.

[39] [39] M. H. Alvi, 2016, A Manual for Selecting Sampling Techniques in Research. Available at: https://mpra.ub.uni-muenchen.de/70218/1/MPRA_paper_70218.pdf

[40] R. N. Anyanwu, 2015. An assessment of climate change literacy and climate change pedagogical literacy of Geography teachers in the Western Cape, South Africa. PhD Dissertation. Stellenbosch University, South Africa. Available at: *scholar.sun.ac.za/handle/10019.1/96831*

[41] J. M. Gran, 2011. Analyzing tables Chi-squared, Exact and Monte Carlo tests. Available at: http://folk.uio.no/jonmic/Statkurs/12%20-%20Table%20analysis.pdf

Acknowledgments:

The investigator seizes this opportunity to express profound gratitude to the Principal Secretary, Ministry of Education, Seychelles for giving him authorization to conduct this survey in public primary and secondary schools in Seychelles; and to the Head-teachers for encouraging their teachers to participate in it.

Funding: NIL

Conflict of Interest: NIL

About The License

Asian Journal of Interdisciplinary Research, Vol. 2, Issue 2, pp. 1-13, Online ISSN 2581-8430. Copyright © IOR Press 2019. This work is licensed under a Creative Commons Attribution 4.0 International License. This Article is freely available to download, save, reproduce, and transmit for noncommercial, scholarly, and educational purposes. Reproduction and transmission of journal content for the above purposes should credit the author and original source. Use, reproduction, or distribution of journal content for commercial purposes requires additional permissions from the IOR Press; please contact support@iorpress.org