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Environmental science education in a small island state: integrating theory and local experience

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ABSTRACT

The importance of education to address current sustainability challenges in small island states has been widely recognized. Environmental education may increase knowledge, while also increasing environmental awareness and motivating students to become agents of change. Student engagement in introductory environmental science courses may benefit from operationalizing abstract concepts by embedding course material and activities within this local context. Here, we describe an introductory course in environmental science that has been tailored to the local context of a small island state in the Caribbean. In addition to reaching academic course goals, pre- and post-course surveys showed that course participants' environmental awareness increased on the dimensions 'Personal Value System' and 'Willingness to Take Environmental Action'. The described course provides a template for the development of a low-cost introductory environmental science course that integrates general theory and application within the context of Caribbean island states.

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KEYWORDS

Environmental awareness; introduction course; participant survey; sustainability; willingness to take action

Introduction

The importance and urgency of quality education to address current sustainability challenges has been widely recognized. A prominent example of this notion is the United Nations' 2030 Agenda for Sustainable Development, which lists quality education prominently: Sustainable Development Goal 4 (SDG 4) is to 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'. More specifically, target 4.7 within this goal focuses on Education for Sustainable Development (ESD): 'to ensure (by 2030) that all learners acquire the knowledge and skills needed to promote sustainable development' (UN 2015). The importance of education resonates throughout the other main goals of this agenda as well, highlighting the need for education on issues such as climate change mitigation and adaptation. Furthermore, the presented vision that no one should be left behind (UN 2015) also implies that no citizen should be denied the opportunity to take ownership of the Agenda for Sustainable Development, and be empowered to become agents of change realizing its Sustainability Goals (Chin and Jacobsson 2016). In this process, education can provide the skills required to cope with complex problems inherent to sustainability challenges (Stephens et al. 2008).
Addressing sustainability challenges in a timely manner is of key importance for Small Island States (SISs). The sustainability challenges that SISs face are often directly linked to their insular geography and fragile environmental characteristics (Douglas 2006). Here, tensions may arise between socio-economic needs on the short-term and the resulting long-term impacts on the state of the natural environment (Douglas 2004; Kelman and West 2009). The need to balance short-term needs and long-term goals has also been recognized in the Small Island Developing States Accelerated Modalities of Action (SAMOA) pathway (UN 2014). For example, challenge 24 of the SAMOA pathway states: ‘in order to achieve sustained, inclusive and equitable growth with full and productive employment, social protection and the creation of decent work for all, Small Island Developing States, in partnership with the international community, will seek to increase investment in the education and training of their people’. Furthermore, governance towards sustainable development depends on active public engagement (Kemp, Parto, and Gibson 2005), which in turn may be aided by increasing environmental awareness. Again, education can play an important role here, as educating younger generations about the environment has been shown to increase their environmental awareness as well (Bradley, Waliczek, and Zajicek 1999).

Although education for sustainable development may require a holistic approach to reshape entire curricula (e.g. UNESCO 2005), the natural connection between sustainability challenges and the environmental sciences provides a promising starting point in this process (Sauvé 1996). Student engagement in introductory courses in environmental science may benefit from embedding course material and activities within the local island context. We might even conjecture that when environmental science education does not go beyond the discussion of abstract concepts in the classroom, it will only provide a limited contribution to developing a sense of ownership of current sustainability challenges. In contrast, making connections between more abstract sustainability concepts and the local island context may highlight how environmental (conservation) actions interact and influence social wellbeing on islands (e.g. Coulthard et al. 2017). Moreover, previous research shows how performing fieldwork in nearby natural areas allows students to apply theoretical knowledge to real life examples and engage emotionally with environmental issues (Ballantyne, Fien, and Packer 2001; Ballantyne and Packer 2005; Ballantyne and Uzzell 1994; Hiebert 2013). On the other hand, development of educational programs that could be transferable across SISs would need to recognize the socio-economic and logistical constraints typically experienced within challenging economies of scale (i.e. small scales of operation leading to relatively high costs per item, Bray and Packer 1993; Baldacchino and Bray 2001; Crossley and Sprague 2014). In this article, we describe an introductory academic course that aims to educate students in the environmental sciences, and to teach them how to apply this knowledge within the local context of a SIS: the island of Aruba (southern Caribbean). We will first provide a brief description of the SIS and then proceed with describing the ways in which the course integrates theory, established research methodology and local experience, while keeping the logistical and financial costs at a minimum. We will then proceed with analyzing the results of pre-course and post-course surveys, which were developed to measure the extent to which the educational program affected the course participants' environmental awareness. For both surveys, measurements were also taken for a control group of students (i.e. students who did not participate in the course).

Description of the SIS

The course was developed and taught in Aruba, a semi-autonomous island state that is part of the Kingdom of the Netherlands and located in the southern Caribbean. The island’s land area is 180 km² and located 24 km north of the Venezuelan coast. Since the island received its semi-autonomous status in 1986, its population has grown from 62,644 to 111,350 in 2018 (CBS Aruba
The island has also seen a more than five-fold increase in the number of visiting tourists: from around 185,000 in 1986 to more than one million in 2015 (CBS Aruba 2015). Recent estimates suggest that more than 88% of the island’s Gross Domestic Product (GDP) currently originates from travel and tourism (Taylor 2018). To accommodate the tourists, substantial parts of the western coastline have been transformed into holiday resorts and accommodations. The increased development related to both tourism and residential growth tends to put stress on coastal and marine resources, on the availability of energy, food and water resources, and it also poses a challenge for appropriate waste management (UN-OHRLLS 2009; de Scisciolo et al. 2016).

Description and rationale of the education program

The course ‘Introduction to Earth and Environment’ is offered as an elective within the curriculum of the Academic Foundation Year (AFY), which is organized by the University of Aruba since 2016. The AFY program is a one-year certificate program that equips motivated students with the skills, tools and capabilities to seek successful entry into higher education. It has been designed for students who have recently graduated from high school, and who are exploring opportunities and aiming to strengthen their competencies for higher education. The establishment of the AFY program was supported by the Aruban government on the basis of the fact that high school students frequently experience difficulties when transitioning to studies in higher education and frequently changing study choice, dropping out of higher education or experiencing considerable delays in their progress (Government of Aruba 2013).

The age of students participating in the program ranges between 17 and 26 years (average around 19 years) and all students have completed a secondary education program that complies with university degree entry requirements. The majority of students considers Papiamentu their first language, with a smaller proportion of students considering English, Spanish, or Dutch their first language.

The program does not only aim to improve academic competencies of the students, but also aims to guide and coach the students towards a motivated study choice. Apart from that, the program offers all students the opportunity to participate in the design, execution, and analysis of research in the context of the island, an experience that is meant to enhance the embeddedness of the students’ future academic development in the sustainable development of the island state. The AFY courses are designed following an experiential learning approach, with a focus on developing awareness of the need to be motivated in class in order for teaching to be successful (Itin 1999). The experiential learning approach also emphasizes the value of reflection, the further development of analytical skills to conceptualize experiences and the development of confidence and problem-solving skills in order to use the new ideas gained from experiences.

The course ‘Introduction to Earth and Environment’ is a 5-credit course (representing 140 hours of work), with 8 contact hours per week during a 10-week period. The course consists of three parts (Figure 1): (1) basic theory on the functioning of the earth system and its biosphere; (2) environmental research methods and application of these methods within the local context; (3) integration of application and theory.

The first part of the course focuses on theory and utilizes an active learning approach. Each active learning session comprises four hours. Typically, the first hour of the session comprises an interactive lecture, in which the theory is introduced using a combination of slides, blackboard, and discussions with and among course participants. Students then spend an hour to read the accompanying lecture notes (Figure 1(a)). The third hour is typically spent on answering more in-depth questions about the lecture notes, which are then discussed in class during the last hour of each session. Students write their own report answering all questions about the course material, which is then graded by a course instructor. Thus, the first part of the session is mainly
Figure 1. Illustration of the three parts comprising the course Introduction to Earth and Environment, which is part of the Academic Foundation Year of the University of Aruba. One ecosystem that is studied in the course is mangrove. (A) basic theory on the functioning of this ecosystem; (B) fieldwork in the Spanish Lagoon, the second-largest and most pristine mangrove complex on the island of Aruba; (C) presentation of the research findings at a public symposium at the headquarters of the nature conservation NGO Parke Arikok. Photo credits: M. Adriaanse and T. de Scisciolo.
focused on conveying information to the students through one-way communication (Monroe, Andrews, and Biedenweg 2008). In contrast, the second part of the session aims at building understanding and improving skills through two-way communication (Monroe, Andrews, and Biedenweg 2008). Importantly, inclusion of elements of two-way communication in course design may increase the likelihood of reaching the educational objectives (Monroe, Andrews, and Biedenweg 2008). Three basic theory sessions are taught, which focuses on the earth system, biodiversity, and the climate system. All lecture notes for this course were written by the course developers, which yields two advantages. First, utilizing a variety of sources on earth science, environmental science, ecology, climate science, and sustainability, the lecture notes spanned a much broader range of topics than typically found in a single textbook. Second, the course material could be offered freely to the course participants. A central theme throughout these topics is the understanding of how human activities affect and alter the global environment. This part of the course is concluded by means of a written exam.

In the second part of the course, the course participants learn about different research methodologies and how these methods can be applied at different locations on the island of Aruba (Figure 1b)). This second part contains three practical fieldwork exercises, which all follow the same structure. First, a theoretical research methodology session is taught, which is based on an established, low-cost field method for one of the (eco)systems that can be found on the island. More specifically, these sessions introduce methods to assess marine beach pollution (based on de Scisciolo et al. 2016), to assess the landscape functions of xeric ecosystems (based on Tongway and Hindley 2004) and to assess carbon storage within mangrove ecosystems (based on Kauffman and Donato 2012). The choice was made to include fieldwork prominently in the course, as first-hand field experience promotes a more in-depth learning and it can help students in developing a sense of responsibility and connection to their local environment (Manzanal, Barreiro, and Jimenez 1999; Pearson, Honeywood, and O'Toole 2005; Scott et al. 2012). Through exposing students to this type of learning outside of the traditional classroom setting, we aimed to encourage pro-active behaviour of the students in further developing their connection to their island states’ environment.

The first fieldwork, on marine beach pollution, takes place on a beach on the most easterly coast of the island, where most pollution originates from distal marine sources (de Scisciolo et al. 2016). The second fieldwork on xeric ecosystem functioning takes place in a National Park, which is managed by the NGO Parke Arikok. This NGO also manages the mangrove complex where the third fieldwork is executed. In line with the philosophy of experiential learning (Itin 1999), the specific choices made for these fieldwork locations are an important starting point of the intended learning process. Specifically, the first fieldwork exposes the students to possible teleconnections between human activities (in this case: disposal of litter into the Atlantic Ocean) and environmental impacts (in this case: deposition on Aruban beaches after long-distance transport through the Caribbean current, de Scisciolo et al. 2016). The second fieldwork exposes the students to a scientific way of looking at an ecosystem that they encounter on a near-daily basis. In contrast, the third fieldwork introduces the students to a natural environment that is present on this island, yet relatively unknown because of its inaccessibility. Performing fieldwork in these locations, under the relatively challenging conditions inherent to a sub-tropical climate, the students may experience success, adventure, and the challenges involved in performing environmental research (Itin 1999). As noted above, both the second and third fieldwork are performed in close collaboration with the NGO. These fieldworks are (partly) supervised by the managers and rangers employed at the NGO. Apart from supervision, the managers and the rangers also provide additional information about the field sites and the management and conservation activities undertaken by the NGO in these sites. The interactive nature of these latter activities, fuelled by inquiries made by the course participants themselves, is an example of how the course aims to combine formal and non-formal learning elements (Barth et al. 2007). Also, within the context of the goals of the AFY, the managers and the rangers also inform students about their
educational background and their career trajectory leading to environmental conservation. This part of the course is also concluded by means of a written exam.

In the third part of the course, participants write a scientific report that integrates the empirical results of the fieldwork, the theory discussed in part 1 and the implications of the research findings within the local context of Aruba. Participants work in groups of 4–5 students, with each group analyzing the data collected during one of the fieldworks. Data analyses are limited to visualizations of the data, to provisionally answer posed research questions; formal statistical analyses are beyond the scope of the course. Through a lecture and computer-based tutorial, participants are getting acquainted with data visualization (using SPSS; this program is available at the University of Aruba) using a publicly available dataset of Caribbean coral reef growth (Perry, Spencer, and Kench 2008). In addition, each group prepares a poster presentation, which is rehearsed in the class. This part of the course is concluded with all groups giving their poster presentation during a final public symposium (Figure 1(c)). The symposium is organized at the visitor center of Parke Arikok, the NGO participating in the fieldwork. The staff of Parke Arikok, as well as course participants’ family, friends and other community members are invited to attend this final symposium. In line with the philosophy of experiential learning, this component of the course aims to help the students in critically analyzing, synthesizing, and reflecting on the results gained from the offered experiences (Kolb 1984; Itin 1999). Through this process, the students start to understand the value of their research for the Aruban community as well as the responsibility they can take as researchers for the Aruban society.

Measuring impact on participants’ environmental awareness

The grades that participants obtained during the course (for the written exams, their participation and the quality of the scientific report and presentations) reflect the extent to which the formal learning goals of the course were achieved. These formal learning goals focus on acquiring knowledge about the earth system and the biosphere, as well as the skills needed in environmental research. Following the Dutch education system, course grades were given on a 10-point scale. The average final grade for the course was 7.9 (n = 23 students, standard deviation: 0.7), which would correspond to an A- in the letter grade system (UCU 2018). The fact that the average final grade was relatively high provides a strong indicator that the formal learning goals of the course were reached to a very satisfactory degree. In addition, we performed surveys to assess the impact of the course on participants’ environmental awareness.

Our survey was based on the survey performed by Hassan, Noordin, and Sulaiman (2010), who investigated environmental awareness among secondary school students. In our modified survey, we distinguished three dimensions of environmental awareness: (1) Personal Value System; (2) Consumption of Natural Resources; (3) Willingness to take Environmental Action. Following Hassan, Noordin, and Sulaiman (2010), each of these dimensions was operationalized by means of three indicator questions (Table 1). All questions (except one) used a five-point scale, with higher scores indicating higher environmental awareness (Table 1). For one question, in which students selected the three topics, they considered most important in the recent parliamentary elections, a six-point scale was used in order to accurately distinguish all the different answers that could be given to this question (Table 1). Together, the answers to the indicator questions yielded a total score on the three dimensions, ranging between 2 and 16 (for the dimension Personal Value System, Table 1) or between 3 and 15 (for the dimensions Consumption of Natural Resources and Willingness to take Environmental Action, Table 1).

The impact of the course on participants’ environmental awareness was measured using a two-group pre-test and post-test design. Since the course Introduction to Earth and Environment
Table 1. Details of the survey, which was taken from all Academic Foundation Year (AFY) students in the first week of the study period (pretest) and after the course ‘Introduction to Earth and Environment’ had finished (post-test).

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Indicator Item</th>
<th>Scoring system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student identification</strong></td>
<td>What is your name?</td>
<td>Open question, responses were anonymized after students’ pretest and posttests surveys were coupled in the dataset</td>
</tr>
<tr>
<td></td>
<td>Which courses do you follow this period?</td>
<td>Open question, used to assign student to ‘participant group’ if courses include ‘An Introduction to Earth and Environment’</td>
</tr>
<tr>
<td><strong>Personal value system</strong></td>
<td>During the past elections for the Aruban parliament, the different political parties expressed their views on many topics. Below is a list of a subset of these topics. From this subset, indicate which three topics you consider most important (1 = most important, 2 = 2nd most important, 3 = 3rd most important).</td>
<td>Topics not directly related to environmental sustainability:</td>
</tr>
<tr>
<td></td>
<td>Topics directly related to environmental sustainability:</td>
<td>Topics directly related to environmental sustainability:</td>
</tr>
<tr>
<td></td>
<td>I appreciate Aruba’s biodiversity, the diversity among and within plant and animal species in Aruba. I hope that in the coming 10 years:</td>
<td>I appreciate Aruba’s biodiversity, the diversity among and within plant and animal species in Aruba. I hope that in the coming 10 years:</td>
</tr>
<tr>
<td><strong>Personal actions to reduce natural resource use</strong></td>
<td>I actively try to reduce the amount of waste I produce (e.g. by limiting the use of disposable plastic and styrofoam items)</td>
<td>5-point Likert-scale</td>
</tr>
</tbody>
</table>

(continued)
is an elective within AFY, we could distinguish an experimental group (‘participants’, i.e. the students who followed the elective) and a control group (‘other AFY students’, i.e. students who did not follow the elective). Both groups of students took the survey in the first week of the course period (November 2017), and took the survey again in the week after the final symposium (January 2018). The test was taken through a free online survey tool (surveymonkey.com), from which the results were manually extracted. The pre-test was taken by 46 of the 59 AFY students ($n_{\text{total}} = 46$, $n_{\text{experimental}} = 28$, $n_{\text{control}} = 18$). The post-test was taken by 32 of the 42 AFY students that were still participating in the program at that time ($n_{\text{total}} = 32$, $n_{\text{experimental}} = 19$, $n_{\text{control}} = 13$). To maximize comparability between pre-test and post-test results, we focused our analysis on the students that had filled out both the pre-test and the post-test ($n_{\text{total}} = 28$, $n_{\text{experimental}} = 19$, $n_{\text{control}} = 12$). Of the students participating in the survey, the majority was female (21 out of 28 students). Within the sub-group of surveyed students that followed the course, a similar proportion was female (11 out of 16 students), meaning that there were no significant gender differences between the surveyed experimental group and the control group (chi-square test: $X_1 = 0.78$, $p = .38$). All the student surveys that were analyzed for this study had been filled out completely, except one pre-test survey from the control population, in which questions regarding the Personal Value System were left unanswered.

We used two-sample $t$-tests to identify differences in pre-test scores between the experimental and control group. Scores on the three dimensions were tested for normality (using a Shapiro-Wilk test) and homogeneity of variances (using a Levene test). In cases where the assumption of normality was violated, we used a non-parametric Mann–Whitney $U$ test. Differences between pre-test and post-test scores were analyzed by paired sample $t$-tests, and by calculating gain scores for each dimension (e.g. Dimitrov and Rumrill 2003). More specifically, gain scores were calculated as the difference in a student’s post-test and pre-test score. Differences in gain scores between the two groups were then tested with two-sample $t$-tests. Average gain scores of the control group are hypothesized to be zero and the gain scores of the

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Indicator item</th>
<th>Scoring system</th>
</tr>
</thead>
<tbody>
<tr>
<td>I actively try to reduce my use of electric energy at home</td>
<td>5-point Likert-scale</td>
<td></td>
</tr>
<tr>
<td>I actively try to reduce my use of water at home</td>
<td>5-point Likert-scale</td>
<td></td>
</tr>
<tr>
<td>I read about environmental issues in the (mass) media</td>
<td>Never (1 point) Rarely, once a year (2 points) Sometimes, at least a few times per year (3 points) Often, at least a few times per month (4 points) Very often, a few times per week (5 points)</td>
<td></td>
</tr>
<tr>
<td>I discuss environmental issues with my friends and family</td>
<td>Never (1 point) Rarely, once a year (2 points) Sometimes, at least a few times per year (3 points) Often, at least a few times per month (4 points) Very often, a few times per week (5 points)</td>
<td></td>
</tr>
<tr>
<td>I have participated in environmental conservation actions on Aruba</td>
<td>Never, and I have no interest in doing so (1 point) I have never participated, but I intend to do so in the future (2 points) I have participated in such an action once (3 points) I have participated in such an action multiple times (4 points) I have participated multiple times, and I have also organized such actions myself (5 points)</td>
<td></td>
</tr>
</tbody>
</table>
course participant would reflect the effect of the intervention (Dimitrov and Rumrill 2003). All data analyses were performed in SPSS (version 24, IBM Corporation, 2016).

Results

Pre-course differences in environmental awareness

Participants in the course Introduction to Earth and Environment had similar pre-test scores as the other AFY students on all three dimensions: Personal Value System (Mann–Whitney U test, $U = 50, p = .057$), Consumption of Natural Resources (two sample t-test: $t_{26}=1.53, p = .14$) and Willingness to take Environmental Action (two sample t-test: $t_{26}= 0.56, p = .58$). Although it could be expected that students who choose an environmental science elective are more environmentally aware than students not choosing this elective, these results suggest that such differences between the groups were not present at the start of the course (Figure 2).

Post-course differences in environmental awareness

The strongest effect was observed for the dimension ‘Willingness to take Environmental Action’, as scores of course participants significantly increased for this dimension (Figure 3; paired-sample t-test: $t_{15}=2.59, p = .02$), whereas non-participant scores significantly decreased (paired-sample t-test: $t_{11}=3.0, p = .012$) over the same time period. The gain scores for non-participants on the other two dimensions were, as expected, close to zero (Figure 3; Personal Value System: $0.09 \pm 0.81$; Consumption of Natural Resources: $0.00 \pm 0.59$). For course participants, the gain score on the dimension Personal Value System was positive ($1.50 \pm 1.16$). Although the difference in gain scores between non-participants and participants on this dimension were not significantly different (Mann–Whitney U test: $U = 72, p = .41$), the difference was large enough to create a significant difference in post-test scores between participants and non-participants on this
dimension (Figure 3; two-sample t-test: $t_{26}=2.25, p = .033$). For the dimension Consumption for Natural Resources, however, the gain score for participants was relatively close to zero (-0.63 ± 0.60), meaning that course participants and non-participants scored similarly on this dimension, both before and after the course Introduction to Earth and Environment (Figures 2 and 3; two sample t-test: $t_{26}=0.72, p = .48$).

**Discussion**

We described an introductory course in environmental science that integrates the study of general scientific theory with practical application within the context of a small island state. Although this course focuses entirely on learning knowledge and skills, we observed that the willingness of course participants to take environmental action and their appreciation of the environment increased during the process as well (Figure 3). The observed effect size could be interpreted as modest, but these results are in line with previous findings that fieldwork in the local environment may enhance students’ environmental learning as well as facilitating a future role as agents of change (Ballantyne et al. 2001; Ballantyne and Packer 2005).

Through our survey, we aimed to obtain a first estimate of the broader impacts of the course on its participants. Now that the likelihood of such impacts has been established (Figure 3), it is interesting to consider additional research efforts focusing on measuring these impacts in greater detail. Specifically, in-depth interviews could provide a powerful complementary approach to assess the relative contribution of the different course elements (e.g. theory, fieldwork, collaboration with an NGO) to these overall impacts. Excerpts from student reflections that were written shortly after the final fieldwork session provide anecdotal evidence for a range of different learning experiences (Box 1). For example, the excerpts highlight how personal experience created a
sense of achievement and satisfaction, and the importance of collaboration to reach the set goals for a particular fieldwork (Box 1). Interestingly, students also noted that the theory previously encountered in the first part of the course became better understood while being out in the field (Box 1). Finally, some students indicated that participation of the fieldwork led to an increased appreciation of the nature on the island of Aruba (Box 1). Together with experiences of the authors from various other environmental awareness projects in Aruba over the past 20 years, these observations provide a promising starting point for future studies.

Previous studies have highlighted the importance of education as a means to raising environmental awareness (Stephens et al. 2008; Zelezny 1999). Importantly, a so-called multiplier effect (e.g. Kuijper 2003), may be generated if the education program is inclusive and reaches out to and involves the community and stakeholders. The growth of the awareness of the relation between well-being and environmental awareness and nature conservation increases the island states’ resilience in sustainable development. The design of the module as an ‘unapologetic Caribbean’ (Davis Kahina 2016) program connects the growth of that environmental awareness with a sense of ownership that leads to pro-active engagement of the students. In this context, it is relevant to note, in addition to the results described, that a sub-group of course participants founded an environmental action committee (Making Aruba a Greener Environment Club, or M.A.G.E.C.) while the course was being taught. It is interesting to note how this sub-group of students created an informal learning environment that emerged as an extension of the formal learning environment (cf, Barth et al. 2007) initially offered through the course structure. Meanwhile, this committee has already developed multiple initiatives that impact the local community, such as a beach cleanup event and the initiation of a plastic collection and recycling program for the entire University of Aruba (Figure 4). The committee keeps family and friends informed about their activities via social media and also the larger community is reached via articles in newspapers and items on television (Figure 4; Baumann 2018; Lodewijks 2018). The committee has also started to actively participate in events organized at the island level (Figure 4).

In this study, we assessed the impact of the course on participants’ environmental awareness by taking a survey comprised of closed questions before and after the course (Table 1). Although these results could be compared to a control group, it should also be noted that the design limits the

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**Box 1. Excerpts from student reflections on the fieldwork performed in the course ‘Introduction to Earth and Environment’**

“Even though beach cleanups temporarily clean the beach, I would like to participate in more of them. Because after I finished, despite my exhaustion, I felt great knowing I helped the environment with something valuable, and knowing that our data will also be used valuably.”

“I got to experience actual fieldwork instead of just reading about it in books. By doing actual fieldwork, I can now be sure about the choices I make regarding what I will study in the future.”

“We learned how to measure everything precisely and write it down. I learned how to work in a group and finally I also discovered more about the nature of Aruba.”

“When reflecting back on the fieldwork we have done, I must say that I am proud of myself. Especially at the mangroves. I had to get out of my comfort zone and I am glad I did. […] Overall I have enjoyed the fieldwork and of course the snacks. It has made me appreciate our nature more.”

“Personally I have learned that fieldwork is a lot of work especially when the surrounding environment is not easy to walk through, but have also learned that through practice the material becomes easier to understand. Also that teamwork during a fieldwork is crucial: if you do not work together, you don’t cover as much ground. I also find that once you do it, you start to understand the theory better. Once you have seen it in person you understand how it happens and why it happens.”

“I think everyone found out how much we can do to help and not just complaining. The environment is strong and so are we to be able to make a change.”

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The level of detail of the information that is obtained. For example, the only dimension for which course participants did not score significantly higher at the end of the course was 'Consumption of Natural Resources' (Figures 2 and 3). In fact, the scores that course participants gave themselves seemed to have slightly decreased after following the course. Although this could mean that student had reduced their efforts to try to limit use of natural resources, it could also mean that following the course had made them more critical of their own resource consumption. It would be interesting in future studies to complement the survey approach used in this study with alternative means of data collection, such as in-depth interviews including open questions.

Education in Small Island States (SISs) often needs to be developed under relatively strong financial constraints. It is, therefore, relevant to point out that the active fieldwork component of
the described course can be executed at a relatively low cost. This was achieved by focusing the
different fieldwork exercises around methods that are both low-cost and scientifically established
(de Scisciolo et al. 2016; Kauffman and Donato 2012; Tongway and Hindley 2004). Other compo-
nents of the program could be further adapted to reduce costs if needed (e.g., the use of SPSS
could be replaced by using freely available software programs such as Google Forms and/or R).
Hence, we believe that the developed course can be readily transferred to other small island
states within the Caribbean. Especially when offered in an early stage of higher education, this
type of education may help students in developing a sense of ownership of their relationship
with the local environment. Increased ownership can lead to deeper understanding of the
importance of the studies they will pursue for the sustainable development of their SISs.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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