sustainability

MDPI

Article

# Sustainability literacy on campus and abroad: the influence of course content and type.

**Simon Ling [1,*], Adam Landon [2], Michael Tarrant [3], and Donald Rubin [4]**

[1] Warnell School of Forestry and Natural Resources, University of Georgia, Athens, United States of America; stl22004@uga.edu
[2] Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, Saint Paul, United States of America; aclandon@gmail.com
[3] Warnell School of Forestry and Natural Resources, University of Georgia, Athens, United States of America; tarrant@uga.edu
[4] Frankilin College of Arts and Sciences, University of Georgia, Athens, United States of America; drubin@uga.edu
* Correspondence: stl22004@uga.edu

Received: date; Accepted: date; Published: date

**Abstract:** As human environmental impacts have increased, so has the desirability of sustainable practices in multiple dimensions and at multiple scales. In this context, sustainability literacy has become a desirable outcome of higher education, driving the advance of sustainability as a core component of higher education institutions' missions at local, regional, and global scales. However, little is known about the efficacy of different types of higher education courses in delivering desired outcomes of sustainability education. This study employed a quasi-experimental design to explore the relative influence of different course types (study abroad/ home campus and sustainability/non-sustainability) on growth of sustainability literacy among university students. Within each course setting (study abroad or home campus) studying sustainability was associated with higher sustainability literacy scores than studying non-sustainability. However, studying non-sustainability courses abroad showed comparable growth in students' sustainability literacy scores compared to studying sustainability on home campus. These results support not only the idea that sustainability can be taught but also that study abroad, regardless of course content, may be at least as effective at increasing sustainability literacy as home campus sustainability courses.

**Keywords:** sustainability literacy; study abroad; quasi-experimental; sustainability education; higher education

## 1. Introduction

The social, economic, and environmental challenges facing humanity are global in scope [1,2]. Climate change, biodiversity loss, and water scarcity threaten the sustainability of both human and natural systems [3]. Rising to meet these challenges as a society may be facilitated by a populace informed of the global consequences of their consumer choices, as well as the role that they play within the broader system of social and economic production [4,5].

For example, with the acquisition of sustainability literacy, individuals may be better equipped to engage in environmental citizenship. While sustainability literacy and knowledge do not necessarily have a direct influence on behavior, they may augment attitudes and behavioral intentions towards related issues. Hungerford and Volk [6] suggest that environmental citizenship behaviors (pro-environmental) are a function of intent, personal empowerment variables including in-depth knowledge of issues and personal investment, and more distal dimensions of ecological knowledge, values, and worldviews. Thus, if actors are uninformed about the tenets of

sustainability, they will likely struggle to achieve it, even if they possess altruistic values and positive attitudes toward sustainability. Scholars have termed this paradox the value-action gap [7].

Sustainability education has a role to play in closing the value-action gap by providing students with the in-depth knowledge needed to act constructively on positive attitudes and intent toward issues of social, environmental, and economic concern [7,8,9]. This raises the possibility that sustainability literacy may act as a moderator in the attitude-behavior relationship [10].

Sustainability education is global in nature because environmental problems and solutions are often unrestricted by national boundaries. Thus, there is an inherent connection between global citizenship and sustainability education, i.e., the greater literacy an individual possesses with respect to sustainability, the more likely they are to possess attributes characteristic of the prototypical "global citizen". A global citizen is someone for whom the issues of justice, environment, and civic obligations are key determinants of citizenship [11]. The environmental consciousness and dedication to social justice that are found in sustainability echo these criteria for global citizenship.

The definition of sustainability literacy remains nebulous, perhaps because of the breadth of the term 'sustainability'. Stibbe and Luna's [12] broad approach regards a sustainability literate person as possessing the 'skills, attitudes, competences, dispositions, and values' required to implement a sustainable world. Parkin et al.'s [13] narrower view characterizes sustainability literacy as the 'knowledge, skills and understanding required to fashion a more sustainable future'. However, two core elements emerge from the various definitions. Firstly, sustainability literate individuals possess the knowledge and understanding to differentiate sustainable practices from the unsustainable. Secondly, they also have the skills and competencies required to implement sustainable practices [13,14]. Individuals literate in sustainability should be able to negotiate life in a manner that reduces the unsustainable impacts their decisions may have on human and non-human others in the present, in the future, and at multiple scales.

Sustainability has emerged as an important component of liberal education [15,16]. The university setting is a natural context for students to be exposed to, and gain competence in, sustainability related concepts through experience and education [17,18]. However, little is known of the influence of different modes of instruction, or different pedagogies, on students' sustainability literacy. Using a quasi-experimental design, this study tests the influence of sustainability-focused university curricula, study abroad programs, and the combination thereof on growth in students' sustainability literacy.

### *Sustainability and Sustainability Literacy*

Sustainability is defined broadly as an idealized state of human-environment interaction where the needs of present and future societies are met without eroding the natural capital that supports them, and basic human rights reman attainable by all [19,20]. This definition encompasses social, economic, and environmental dimensions – the so called "three legged stool" or "triple bottom line" [21,22]. Realizing the transition to a sustainable society requires citizens able to critically evaluate consumer, political, and development decisions in a variety of contexts with respect to impacts on these three domains and the interrelationships among them [19]. More recently, a fourth component, ethics/social justice, has led to the quadruple bottom line conceptualization of sustainability [23].

Sustainability literacy can be defined as 'competence in and knowledge of' sustainability concepts [24]. Therefore, when attempting to measure sustainability literacy care should be taken to ensure that measures do not include assessment of values, attitudes and behaviors, which may be related, but should be considered independently [24]. Coyle [25] argues that 'literacy' should be 'distinct from simple awareness… because of its depth of information'. Due to the integrative nature of sustainability as a concept, assessing literacy according to these criteria is not a simple task. Measures of sustainability literacy must assess sustainability knowledge, interrelationships of sustainability domains, and the depth of information integration. As such, sustainability literacy measures can be complex, lengthy and face difficulty assessing skills and competence through simple formats such as multiple choice. On the other hand, a primary criticism levelled at many

existing instruments has been the lack of equal assessment of all dimensions in the triple bottom line and the interrelationships among them [24]. Balancing these factors is a significant challenge.

One of the most comprehensive instruments for the assessment of sustainability literacy is the ASK (Assessment of Sustainability Knowledge) [26]. The final version of the ASK retained the sixteen most discriminating questions but has received criticism for lacking questions that integrate all three elements of the triple bottom line [24]. Researchers at the University of North Carolina (UNC) also developed an instrument for the assessment of sustainability literacy. Shorter than the ASK, with thirteen questions focused on sustainability literacy, it incorporates questions requiring integration of knowledge from social, environmental, and economic domains at some depth [27]. However, the psychometric properties of the UNC measure have not been reported.

*Course Content*

Although many authorities suggest that sustainability literacy can be inculcated via direct instruction (see [28,29,30,31,32]), few studies have tested that supposition quasi-experimentally. College major has a mixed relationship with sustainability literacy [26]. Horvath and colleagues [33] found the number of sustainability related courses a student reported completing had a non-linear relationship with sustainability literacy using a measure of their own making. These authors reported a threshold effect. Students who completed 1-2 sustainability related courses were not significantly more knowledgeable than those who completed no sustainability courses, while students who completed 3 or more sustainability related courses were more knowledgeable than students in either of the other categories.

Fisher and McAdams [34] looked at the influence of sustainability coursework type and number of sustainability courses on how students conceptualized sustainability along four indices; ecosystems and nature, eco-efficiency, community and well-being, and systemic change and innovation. They found course content influenced the way students conceptualized sustainability within these indices, rather than the number of sustainability courses. For example, taking natural science subjects was related to higher scores on the ecosystems and nature index. However, it should be noted this study examines the relative importance students assign to aspects of sustainability rather than sustainability literacy per se. It is mentioned here to add context to Horvath et al.'s [33] findings.

*Mode of Delivery*

Literature examining the impact of study abroad on sustainability literacy is limited. However, there is evidence that participation in international education may positively influence students' understanding of the interconnections among social, economic, and ecological systems; topics germane to sustainability education [35,36,37,38,39]. For example, consider the interdisciplinary concept of global citizenship as a demonstrated outcome of study abroad programs focused on studies of society and the environment [40,41,42,43,44]. Reysen and Katzarska-Miller [45] define global citizenship as 'awareness, caring, and embracing cultural diversity while promoting social justice and sustainability, coupled with a sense of responsibility to act'. Sustainability is thus regarded as a subset of global citizenship and the relationship between the two depends on the context of all other subsets.

Educational travel abroad where faculty guide students through learning experiences in the field, as opposed to studying abroad in traditional classroom settings, is regarded as having strong potential to deliver transformational learning experiences for students [46,47], as is experiential learning in and of itself [48]. This may be an influential approach in situations where sustainability education challenges a student to significantly alter their conceptualization of the balance between social, environmental, and economic facets of life. Bell et al. [47] looked at 150 US university students that had completed highly experiential programs in the South Pacific. Using qualitative analysis of reflective responses to open-ended questions, they identified four themes associated with sustainability and transformative learning:

1. A new socio-cultural understanding,

2. A new connection with the natural world,
3. Economic considerations,
4. And making changes.

The first three themes resonate strongly with the tenets of sustainability and the triple-bottom line, while the fourth is arguably a function of the recognition of the response social justice/ethics demands once understanding of the first three themes is acquired.

A number of studies have found an association between participation in study abroad and learning outcomes related to sustainability literacy, such as sustainability education in tourism [41,43], ethics [49], and global citizenship [50,51]. However, quantitative research solely focused on sustainability literacy and its relationship to instructional design is scarce, despite many universities having offered formal certification in sustainability for some time. More explicit research on outcomes in these programs, as in may lead to targeted interventions that significantly improve educational goal achievement.

### *Purpose and Hypotheses*

There has been little experimental exploration of the relationships between study abroad pedagogy, sustainability content, and sustainability literacy in the literature to date. With this gap in mind, our purpose in conducting this study was to test the influence of content (sustainability) and delivery mode (study abroad) commonly employed in the university setting to convey sustainability concepts using a quasi-experimental, pre-test/post-test design. Specifically, we hypothesize that:

1. Students engaged in study abroad programs in non-sustainability-focused courses will show greater growth in sustainability literacy from pre-test to post-test than students completing non-sustainability courses on home campus during the same term.
2. Students engaged in studying sustainability-focused courses on home campus will show greater growth in sustainability literacy from pre-test to post-test than students engaged in non-sustainability-focused courses, whether through study abroad or on home campus, in the same term.
3. Students engaged in educational travel in sustainability-focused courses will show greater growth in sustainability literacy from pre-test to post-test than students studying in all other courses combined (home campus sustainability, home campus non-sustainability, and study abroad non-sustainability courses) during the same term.

## 2. Materials and Methods

### *Data Collection and Sample Demographics*

The study took place at the University of Georgia, a large public university in the southeastern United States. Surveys were administered to students enrolled in Sustainability Educational Travel courses (SETss; N=769), Sustainability Home Campus courses (SHC; N=175), Non-Sustainability Study Abroad courses (NSSA; N=236), and Non-Sustainability-Focused Home Campus courses (NSHC; N=523) settings during the spring and summer terms of 2014, 2015, and 2016. Courses considered "sustainability-focused" were listed on the university Office of Sustainability website as applicable to a certificate in sustainability (26 classes over the period 2014-2016), i.e. pertained primarily to sustainability topics. Sustainability courses included topics in ecology, public health, sustainable development, and marine sciences among others, conducted both on campus, in traditional classroom study abroad settings, and field-based educational travel study abroad settings. The educational travel study abroad programs surveyed included at least three credit hours of Field Studies in Natural Resources and were all delivered using a modular experiential educational travel pedagogy that moves students through multiple locations exploring relationships between societies and the environment.

Non-sustainability courses included topics in sociology, law, language, and history; again, including both on campus and study abroad courses (24 classes over the period 2014-2016). Surveys

were administered in a pretest/posttest design commencing on the first and last day of the class. Participants provided informed consent and generated a unique identifier used to anonymously match pretest and posttest instruments. 68.4% of participants identified as female. Participants varied in class standing with 10.9% first year students, 28.2% sophomores, 35.3% juniors, 23.2% seniors, and 2.4% graduate students.

*Measures*

The measure of sustainability literacy was a knowledge test. Items measured were drawn from sustainability literacy scales previously administered at the University of North Carolina at Chapel Hill [27] and Ohio State University [26]. For the purpose of this study, three questions in each of the three dimensions of sustainability (environmental, economic, and social) were selected from these studies for inclusion in the sustainability literacy scale. The questions were selected to reflect sustainability concepts that inform individual choices about human-environment interactions, and to include questions requiring synthesis of knowledge, concepts, and processes.

Questions were presented in a multiple-choice format, for which there were five answer choices, including "Don't Know." Each item had a single correct answer. The score on this test was the number of correct answers selected, giving a range of scores from 0-9.

*Sustainability Literacy Scale Validation*

The psychometric properties of the proposed sustainability literacy scale were explored using confirmatory factor analysis. Measurement models were tested in the lavaan package [52] for the R statistical software v3.3.1 [53]. We hypothesized that the sustainability literacy scale measures a single latent construct reflected by the nine items described earlier (Appendix A). Since the data are dichotomous (correct or incorrect), and therefore do not conform to the normality assumptions of maximum likelihood, we used the diagonally weighted least squares (DWLS) estimator with the asymptotic covariance matrix to estimate model parameters. Acceptable model fit was assessed following the recommendations of Hu and Bentler [54] (Root Mean Square Error of Approximation RMSEA < 0.08; Non-Normed Fit Index NNFI, and Comparative Fit Index CFI > 0.95). Convergent validity [55] was assessed via Composite Reliability (≥.7) and the Average Variance Explained (≥.5), at cutoffs recommended by Fornell and Larker [56], and Rykov [57]. Measurement models were tested independently at both pretest and posttest.

*Hypothesis Testing*

Hypotheses were tested using a factorial repeated measures analysis of variance (ANOVA). Participants were nested in combinations of context (home campus versus abroad) and subject matter (+/-sustainability) and crossed with the repeated measure, time of testing (pretest versus posttest). ANOVA models were estimated using the statistical software SPSS version 25.0 [58]. Planned Helmert contrasts were implemented to test a priori hypotheses. Post-hoc Bonferroni pairwise comparisons were carried out to further explore results.

## 3. Results

*Scale Validation: Construct Validity, Model Fit, and Reliability.*

An initial test of the measurement model (at pretest) demonstrated an adequate fit for the data. However, upon inspection of item factor loadings and modification indices, the item SL2 (Appendix A) failed to load adequately ($\lambda \leq .3$) on the factor and was subsequently dropped from the analysis [56].

Results indicated that the hypothesized scale was valid and reliable when measured at both pretest ($\chi 2 = 33.49$, df = 20, p = 0.03; RMSEA = 0.02; CFI = 0.99; NNFI = 0.98) and posttest ($\chi 2 = 33.25$, df = 20, p = 0.03; RMSEA = 0.02; CFI = 0.99; NNFI = 0.99). The eight-item sustainability literacy scale demonstrated acceptable reliability (Composite Reliability = 0.87pre/0.91post) [57]. However, the average variance explained by the latent factor was slightly lower than is recommended, with values of 0.33 and 0.41 at pretest and posttest respectively. A complete summary of model fit can be found in Table 1.

Table 1. Summary of Model Fit and Reliability for Sustainability Literacy Scale

| Model | $\chi^2$ | df | *p*-value | C.R. | AVE | RMSEA | CFI | NNFI |
|---|---|---|---|---|---|---|---|---|
| Pretest | 33.49 | 20 | 0.03 | 0.87 | 0.33 | 0.02 | 0.99 | 0.98 |
| Posttest | 33.25 | 20 | 0.03 | 0.91 | 0.41 | 0.02 | 0.99 | 0.99 |

C.R. = Composite Reliability; AVE = Average Variance Explained; RMSEA = Root Square Mean Error of Approximation; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; df = Degrees of Freedom

*ANOVA Models*

Cell means for sustainability literacy by Time (pre-test, and post-test) and Context (Sustainability Educational Travel, Sustainability Home Campus, Non-Sustainability Study Abroad , and Non-Sustainability Home Campus) are presented in Table 2. Results of the ANOVA model reveal a significant within subjects effect for Time x Context but with a small effect size (F = 9.162, df = 3, p <0.01, ◎2=0.016).

Table 2. Mean and Standard Deviation for Sustainability Literacy at Pretest and Posttest

| Condition | Pretest *M* | *S.D.* | Posttest *M* | *S.D.* | *N* |
|---|---|---|---|---|---|
| Educational Travel Sustainability | 7.02 | 1.40 | 7.56 | 1.26 | 769 |
| Home Campus Sustainability | 6.25 | 1.94 | 6.50 | 1.99 | 175 |
| Study Abroad Non-Sustainability | 6.13 | 1.76 | 6.23 | 1.92 | 236 |
| Home Campus Non-Sustainability | 5.92 | 1.91 | 6.10 | 2.00 | 523 |

Planned contrasts show no significant difference for gain in sustainability literacy score between NSSA and NSHC (Difference estimate = 0.17, S.E. = 0.12, p>.05), and we find no support for H1 on that basis. SHC students showed greater gains in sustainability literacy score compared to NSSA and NSHC students combined (Difference estimate = 0.28, S. E. =0.13, p<.05), supporting H2. SETss students showed greater gains in sustainability literacy score compared to SHC, NSSA, and NSHC students combined (Difference Estimate = 1.1, S.E.=0.08, p<.001), supporting H3. These results support the hypotheses that participation in sustainability-focused coursework will yield greater growth in sustainability literacy than participation in non-sustainability coursework (Figure 1), and that participation in educational travel focused on sustainability will yield greater growth in sustainability literacy than all other modes of instruction examined in this study (Figure 1).

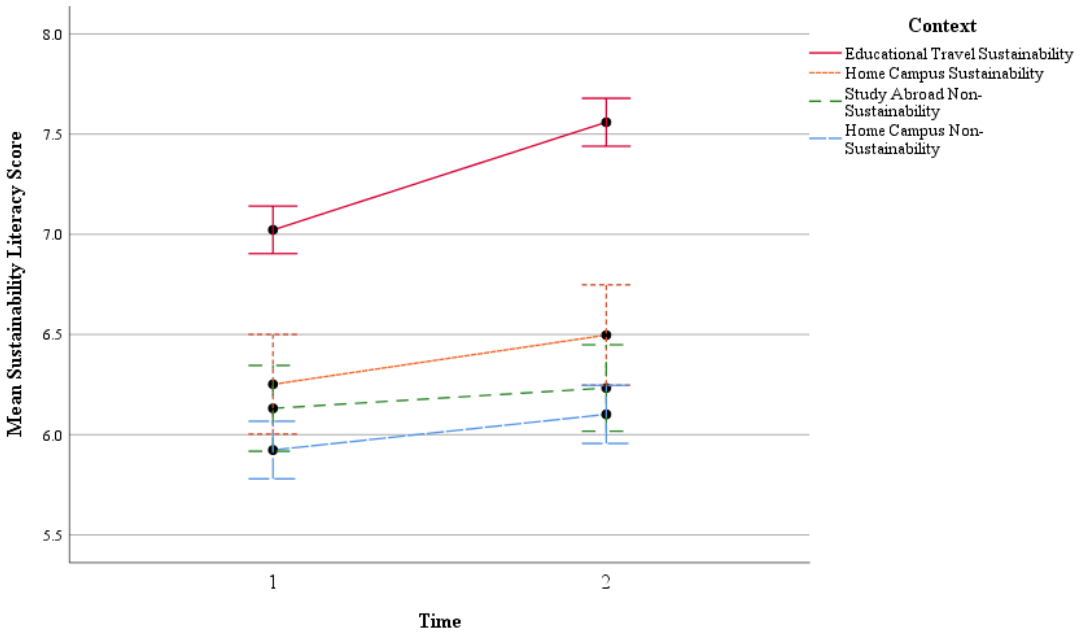


Figure 1. Mean Sustainability Literacy Scores at Pretest and Posttest by Context (error bars represent 95% C.I.).

Bonferroni post-hoc analysis offers greater resolution on the relationship between individual context categories. SETss students show significantly greater gain in sustainability literacy scores than any other category (Table 3). The relationship between SHC, NSSA and NSHC is also

illuminated. SHC students show significantly greater gain in sustainability literacy score than NSHC students, but not in comparison to NSSA students (Table 3).

Table 2.3. Pairwise Comparisons for Differences in Mean Sustainability Literacy Score Gain.

Note: differences = Column-Row; *$p$<.05 after Bonferroni adjustment; SETss = Sustainability Educational Travel *sensu stricto*; SHC = Sustainability Home Campus; NSSA = Non-sustainability Study Abroad; NSHC = Non-sustainability Home Campus.

| SETss | SETss | SHC | NSSA | NSHC |
|---|---|---|---|---|
| SHC | 0 | 0.92* | 1.11* | 1.28* |
| NSSA | -0.92* | 0 | 0.19 | 0.36* |
| NSHC | -1.11* | -0.19 | 0 | 0.17 |
| | | | | |

## 4. Discussion

Our results demonstrate that educational travel focused on sustainability is an effective means of promoting growth in students' sustainability literacy over and above non-study abroad sustainability and non-sustainability education. Students studying abroad in the field and undertaking coursework recognized as contributing to campus sustainability initiatives demonstrated significantly greater growth in sustainability literacy compared to contemporaries engaged in more traditional courses of study. These results reflect the growth potential in a single term of studying sustainability abroad and are, thus, a lower bound estimate in assessing the efficacy of potential sustainability education efforts on campus. It remains to be seen what longer exposure to sustainability focused educational travel may yield.

The link between educational travel and support for environmental policies has already been established [59,36]. The acquisition of sustainability knowledge through experiential learning on study abroad programs has already been investigated to some degree [47]. While post-program evaluations of experiential learning programs report qualitative themes of sustainability, scales such as the one employed here will allow us to acquire quantitative evidence for increases related to so-called transformational programs. In addition, it is of interest whether aspects of the educational travel model, e.g. experiential learning or reflective practices, are as effective at increasing sustainability literacy if integrated into other curricula.

This research suggests studying abroad in the absence of sustainability-focused pedagogy may provide similar benefits in terms of gains in sustainability literacy as studying sustainability on home campus, although the differences are relatively small. It is plausible that this may be the results of exposure to differing worldviews, to relationships formed within and with other cultures, or to the experience of negotiating the complexities of unfamiliar societies. This result begs further investigation within the context of sustainability education.

### *Limitations*

Although we feel that the results are promising, several limitations should be noted. First, the sustainability literacy scale was comprised of a relatively low number of items. This was a deliberate action in order to aid in the administration of the instrument (and correspondingly in the speed of assessment delivery). A larger scale may enable better discrimination of scores and may improve the overall ability of the scale to judge sustainability literacy. However, a tradeoff exists in item number and cognitive burden in survey administration.

Second, we sampled only one type of sustainability study abroad program. Results from similar research on other sustainability study abroad approaches may differ from those presented here. Third, our sample consisted of undergraduate students at a southeastern university that may not be representative of the university population at large. Certainly, for study abroad programs, self-selection is always a concern with regards to randomization. Furthermore, the observation that SETss students started programs with sustainability literacy scores above other groups, and demonstrated greater gains, may be evidence for self-selected SETss students being pre-disposed to the subject matter of the course and thus more influenced by it.

Fourth, there is wide variability in the amount of sustainability-related material taught in the courses involved in this study. Quantification of the degree of program fidelity, and of the types and ratios of teaching/learning occurring in each course (e.g. experiential versus reflective), would increase the resolution of conclusions. Fourth, and intimately related to the previous point, instructor bias is a confounding variable whose effects are unknown.

## 5. Conclusions

As the world's population has increased, and competition for scarce resources has become more salient, sustainability has moved to the forefront of international and domestic discourse. It is now incumbent on higher education institutions to prepare graduates that can follow, understand, and meaningfully participate in that discourse. Many are making significant moves in that direction in curricula and in on-campus policy.

Institutions dedicated to sustainability education, and sustainability itself, can benefit from the ability to identify what type of content and pedagogy best deliver desired learning outcomes. In assessing students' functional knowledge regarding the social, economic, and environmental dimensions (Triple Bottom Line) of sustainability, this study provides some context for designing instructional programs that optimize or promote sustainability literacy (as a specific learning outcome). For example, study abroad programs are increasingly incorporating reflective exercises to promote engagement – designing programs that encourage student reflection with sustainability topics that have been learned/addressed in the field/overseas could yield promising functional knowledge outcomes.

However, education is only the tip of the sustainability iceberg. Giving students the required literacy, knowledge, and tools to engage with in the sustainability discourse is a small, but important step on the path to a populace capable of making wise decisions regarding the sustainability of the choices they make in their personal, and professional, lives.

**Author Contributions:** For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, M. Tarrant and S. Ling.; methodology, M. Tarrant; validation, S. Ling and A. Landon; formal analysis, S. Ling, A. Landon.; investigation, S. Ling..; data curation, S. Ling and A. Landon; writing—original draft preparation, S. Ling.; writing—review and editing, S. Ling, A. Landon, M. Tarrant, and D. Rubin.;. All authors have read and agreed to the published version of the manuscript

**Funding:** This research received no external funding"

**Conflicts of Interest:** The authors declare no conflict of interest

## Appendix A

Survey instrument – Correct answers in bold, origin of question in parentheses (OSU=Ohio State University, UNC=University of North Carolina).

---

Select the best answer from the following questions. Please check only one box.

---

SL1. What is meant by the term "carbon footprint"? (UNC)

☐ The age of an item found at an archeological site
☐ The carbon left on the ground each time you take a step
☐ The size of the carbon chain in a given quantity of gasoline
☐ **The greenhouse gasses released by burning fossil fuels**
☐ Don't know

SL2. What is the term used for the technique to assess environmental impacts associated with all stages of a product's life from cradle to grave (resource extraction through usage and disposal or reuse)? (UNC)

☐ An energy audit
☐ A cost-benefit analysis
☐ **A life-cycle assessment**
☐ A thermal system analysis
☐ Don't know

SL3. Which of the following is an example of sustainable forest management? (OSU)

☐ Setting aside forests to be off limits to the public
☐ **Never harvesting more than what the forest produces in new growth**
☐ Producing lumber for nearby communities to build affordable housing
☐ Putting the local communities in charge of forest resources
☐ Don't know

SL4. Which of the following is the most commonly used definition of sustainable development? (OSU)

☐ Creating a government funded system that ensures universal access to education, healthcare, and social services
☐ Setting aside resources for preservation, never to be used
☐ **Meeting the needs of the present without compromising the ability of future generations to meet their own needs**
☐ Building a neighborhood that is both socio-demographically and economically diverse
☐ Don't know

SL5. Workers around the world face a variety of social injustices, including low wages, poor working conditions, and lack of access to education. Of the following, what is the best way to help improve conditions for these workers? (OSU)

☐ Purchase products from companies that do not allow workers to join labor unions
☐ Buy the newest products to keep factories around the world open
☐ **Learn about how companies conduct business prior to purchasing their products**
☐ Support large corporations because they generally have more money to pay their workers
☐ Don't know

SL6. Of the following, which would be considered living in the most environmentally sustainable

way? (OSU)

- ☐ Recycling all recyclable packaging
- ☐ **Reducing consumption of all products**
- ☐ Buying products labeled "eco" or "green"
- ☐ Buying the newest products available
- ☐ Don't know

SL7. Which of the following is the most commonly used definition of economic sustainability? (OSU)

- ☐ Maximizing the share price of a company's stock
- ☐ **Long term profitability**
- ☐ When costs equal revenue
- ☐ Continually expanding market share
- ☐ Don't know

SL8. What is included when corporations report their triple bottom line? (UNC)

- ☐ Three forms of financial reporting
- ☐ **Environmental, social, and financial performance**
- ☐ Offering health, dental, and vision care to employees
- ☐ Incorporating community, labor, and government representatives on the board of directors
- ☐ Don't know

SL9. In order to support a local economy, which of the following is the best place to purchase goods? (OSU)

- ☐ At large chain stores that may employ workers from the local community
- ☐ Online from discount retailers
- ☐ **From stores that sell locally-produced goods**
- ☐ From second-hand/thrift stores
- ☐ Don't know

## References

References must be numbered in order of appearance in the text (including citations in tables and legends) and listed individually at the end of the manuscript. We recommend preparing the references with a bibliography software package, such as EndNote, ReferenceManager or Zotero to avoid typing mistakes and duplicated references. Include the digital object identifier (DOI) for all references where available.

Citations and References in Supplementary files are permitted provided that they also appear in the reference list here.

In the text, reference numbers should be placed in square brackets [ ], and placed before the punctuation; for example [1], [1–3] or [1,3]. For embedded citations in the text with pagination, use both parentheses and brackets to indicate the reference number and page numbers; for example [5] (p. 10), or [6] (pp. 101–105).

1. Steffen, W., & Crutzen, P.J., & McNeill, J. R. (2007). The anthropocene: are humans now overwhelming the great forces of nature? Ambio, 36(8): 614-621.
2. Röckstrom, J., Steffen, W., Noone, K., Persson, A., Chapin, F. Stuart III., Lambin, E., Lenton, T.M., Scheffer, M., Folke, Schellenhuber, H.J., Nkvist, B., de Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U., Fallkenmark., M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., & Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. Ecology & Society, 14(2): 32.
3. Millennium Ecosystem Assessment (MEA). (2005). Ecosystems and Human Well-Being: Synthesis. Island Press: Washington D.C.
4. Nassauer, J.I. (2011). Care and stewardship: From home to planet. Landscape and Urban Planning, doi:10.1016/j.landurbplan.2011.02.022.
5. Schultz, P.W. (2011). Conservation means behavior. Conservation Biology, 25(6): 1080-1083.
6. Hungerford, H.R., and Volk, T.L. (1990). Changing learner behavior through environmental education. The Journal of Environmental Education, 21(3), 8-21.
7. Kollmus, A., and Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior. Environmental Education Research, 8(3), 239-260.
8. Chaplin, G. and Wyton, P. (2014). Student engagement with sustainability: understanding the value–action gap. International Journal of Sustainability in Higher Education, 15(4): 404 – 417.
9. Hungerford, H.R., Peyton, R.B., and Wilke, R.J. (1980). Goals for curriculum development in environmental education. Journal of Environmental Education, 11(3), 42-46.
10. Fishbein, M. and Ajzen, I. (2010). Predicting and changing behavior: The reasoned action approach. Psychology Press, New York.
11. Dobson, A. (2003). Citizenship and the environment. Oxford: Oxford University Press.
12. Stibbe, A. and Luna, H. (2009). Introduction. In The Handbook of Sustainability Literacy: Skills for a Changing World. Dartington, UK: Green Books Ltd.
13. Parkin, S., Johnston, A., Buckland, H., Brookes, F., and White, E. (2004). Learning and Skills for Sustainable Development: Developing a Sustainability Literate Society. Guiding for Higher Education Institutions' (Forum for the Future).
14. Winter, J. and Cotton, D. (2012). Making the hidden curriculum visible: Sustainability literacy in higher education. Environmental Education Research, 18(6): 783-96.
15. Warburton, K. (2003), Deep learning and education for sustainability, International Journal of Sustainability in Higher Education, Vol. 4, Issue 1, pp. 44-56.
16. Cortese, A.D., and Hattan, A.S. (2010). Research and solutions: Education for sustainability as the mission of higher education. Sustainability: The Journal of Record, 3(1): doi.org/10.1089/SUS.2009.9802
17. Bowers, C.A. (2001). Challenges in educating for ecologically sustainable communities. Educational Philosophy and Theory, 33(2), 257-265.
18. Bowers, C.A. (2002). Toward an eco-justice pedagogy. Environmental Education Research, 8(1), 21-34.
19. World Commission on Environment and Development. (1987). Our Common Future. Oxford, . Retrieved from http://mom.gov.af/Content/files/Bruntland_Report.pdf
20. Solow, R.M. (1991). Sustainability: An Economists Perspective. In R.N. Stavins, Economics of the Environment (pp. 131- 138). New York, W.W. Norton and Company.
21. Elkington, J. (1994). Towards the sustainable corporation: win win win business strategies for sustainable development. California Management Review, 36(2): 90-100.
22. Dawe, N.K. and Ryan, K.L. (2003). The faulty three-legged-stool model of sustainable development. Conservation Biology, 17(5): 1458-1460.
23. Inayatullah, S. (2005). Spirituality as the fourth bottom line? Futures, 37(6), 573-579 https:/doi.org/10.1016/j.futures.2004.10.015.
24. Barnes, N. (2014). Institutional Attempts To Measure Student Sustainability Knowledge. Sustainability: The Journal of Record, 7(2), 104–108.
25. Coyle, K. (2005). Environmental literacy in America: what ten years of NEEFT/Roper research and related studies say about environmental literacy in the U.S. The National Environmental Education and Training Foundation, 1–152. Washington, DC.

26. Zwickle, A., Koontz, T.M., Slagle, K.M., and Bruskotter, J.T. (2014). Assessing sustainability knowledge in the environmental, economic, and social domains. International Journal of Sustainability in Higher Education, 15(4): 375-389.
27. University of North Carolina. (2012). Sustainability Literacy Assessment Report. Retrieved from: https://sustainability.unc.edu/files/2015/12/Sustainability-Literacy-Assessment-Report-Nov2012.pdf
28. Armstrong, C. M. (2011). Implementing education for sustainable development: the potential use of time-honored pedagogical practice from the Progressive Era of Education. Journal of Sustainability Education, 2.
29. Burns, H. (2013) Meaningful sustainability learning: a study of sustainability pedagogy in two university courses. International Journal of Teaching and Learning in Higher Education. 25(2): 166-175.
30. Burns, H. (2015) Transformative sustainability pedagogy: learning from ecological systems and indigenous wisdom. Journal of Transformative Education. 13(3): 259-276.
31. Howlett, C., Ferreira, J. L., and Blomfield, J. M. (2016) Teaching sustainable development in higher education: building critical, reflective thinkers through an interdisciplinary approach. International Journal of Sustainability in Higher Education. 17(3), 1-17.
32. Segalàs, J., Mulder, K. F., Ferrer-Balas, D. (2012). What do EESD "experts" think sustainability is? Which pedagogy is suitable to learn it?: results from interviews and Cmaps analysis gathered at EESD 2008. International Journal of Sustainability in Higher Education. 13(3), 293-304.
33. Horvath, N., Steward, M., Shea, M. (2013). Toward instruments of assessing sustainability knowledge: Assessment development, process, and results from a pilot survey at the University of Maryland. Journal of Sustainability Education, 5(2013).
34. Fisher, P.B. and McAdams, E. (2015). Gaps in sustainability education: the impacts of higher education coursework on perceptions of sustainability. International Journal of Sustainability in Higher Education, 16(4): 407-423.
35. Myers, D.N., Hill, M., and Harwood, S.A. (2005). Cross-Cultural Learning and Study Abroad: Transforming Pedagogical Outcomes. Landscape Journal, 24(2): 172-184.
36. Cusick, J. (2009). Study abroad in support of education for sustainability: a New Zealand case study. Environment, Development and Sustainability, 11(4): 801-813.
37. Tarrant, M. A. (2010). A Conceptual Framework for Exploring the Role of Studies Abroad in Nurturing Global Citizenship. Journal of Studies in International Education, 14(5), 433–451. http://doi.org/10.1177/1028315309348737
38. Lee, Y.S., and Schottenfeld, M.A. (2012). Internationalising Experiential Learning for Sustainable Development Education. Journal of Education for Sustainable Development, 6(2): 341-354.
39. Reilly, A.H., McGrath, M.A. and Reilly, K. (2016). Beyond 'Innocents Abroad': Reflecting on Sustainability Issues During International Study Trips. Journal of Technological Management and Innovation, 11(4): 29-37.
40. Tarrant, M., and Lyons, K. (2012). The effect of short-term educational travel programs on environmental citizenship. Environmental Education Research, 18(3), pp. 403-416.
41. Tarrant, M., Rubin, D., and Stoner, L. (2015). The effects of studying abroad and studying sustainability on students' global perspectives. Frontiers: The Interdisciplinary Journal of Study Abroad, 26(1): 68-82.
42. Tarrant, M.A., Stoner, L., Tessman, K., Gleason, M., Lyons, K., and Wearing, S. (2015). Global programs in sustainability: A case study of techniques, tools, and teaching strategies for sustainability education in tourism. In G. Moscardo and P. Benckendorff (Eds), Education for sustainability in tourism: A handbook of processes, resources, and strategies. (pp. 229-237). New York, NY: Springer.
43. Wearing, S., Tarrant, M.A., Schweinsberg, S., Lyons, K., and Stoner, K. (2015) Exploring the Global in Student Assessment and Feedback for Sustainable Tourism Education. In: Moscardo, G., Benckendorff, P. (eds) Education for Sustainability in Tourism. CSR, Sustainability, Ethics and Governance. Springer, Berlin, Heidelberg.
44. Landon, A.C., Tarrant, M.A., Rubin, D.A., and Stoner, L. (2017). Beyond "Just Do It": Fostering higher-order learning outcomes in short-term study abroad. AERA Open, 3(1): 1-7.
45. Reysen, S, and Katzarska-Miller, I. (2013). A model of global citizenship: Antecedents and outcomes. International Journal of Psychology, 48 (5): 858-870.
46. Ritchie, M.A. (2013). Sustainability Education, Experiential Learning, and Social Justice: Designing Community Based Courses in the Global South. Journal of Sustainability Education, 5:216-227.

47. Bell, H. L., Gibson, H. J., Tarrant, M. a., Perry, L. G., & Stoner, L. (2014). Transformational learning through study abroad: US students' reflections on learning about sustainability in the South Pacific. Leisure Studies, 4367(October), 1–17.
48. Owens, C., Sotoudehnia, M. and Erickson-McGee, P. (2015). Reflections on teaching and learning for sustainability from the Cascadia Sustainability Field School. Journal of Geography in Higher Education, 39(3): 313-327.
49. Parmentier, M.J. and Moore, S. (2016). 'The Camels are Unsustainable': Using Study Abroad as a Pedagogical Tool for Teaching Ethics and Sustainable Development. Teaching Ethics, 16(2): 207-221.
50. Tarrant, M.A., Lyons, K., Stoner, L., Kyle, G.T., Wearing, S. and Poudyal, N. (2014). Global Citizenry, educational travel and sustainable tourism: evidence from Australia and New Zealand. Journal of Sustainable Tourism, 22(3): 403-420.
51. Tarrant, M.A., Rubin, D.L., and Stoner, L. (2014). The added value of study abroad: Fostering a global citizenry. Journal of Studies in International Education. 26:68-82.
52. Rossel, Y. (2012). lavaan: An R package for structural equation modeling. Journal of Statistical Software, 48(2): 1-36.
53. R Development Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.
54. Hu, L., and Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1-55.
55. Netemeyer, R.G., Bearden, W.O., and Sharma, S. (2003). Scaling procedures: Issues and applications. Thousand Oaks, CA: Sage.
56. Fornell, C., and Larker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 18(1), 39-50.
57. Rykov, T. (1997). Estimation of composite reliability for congeneric measures. Applied Psychological Measurement. 21(2), 173-184.
58. IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.
59. Tarrant, M., Stoner, L., Borrie, W.T., Kyle, G., Moore, R.L., and Moore, A. (2011). Educational travel and global citizenship. Journal of Leisure Research, 43(3): 403-426.