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Review

Teaching Environmental Sustainability while Transforming Study Abroad

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Abstract: Environmental issues are of especially great importance to younger individuals, such as university students. Course-based Undergraduate Research Experiences (CUREs) are a proven methodology for transforming short-term study abroad to yield higher impact and quality student outcomes, especially as they relate to teaching environmental sustainability. This paper offers a review of tested pedagogical frameworks, provides evidence to substantiate this statement from assessment data, and offers insights on how to develop and implement an international CURE. It also shares how embedding CUREs into innovative and high-quality short-term study abroad experiences can work to positively transform the post COVID-19 era of short-term study abroad. Several case studies are presented that document how students' hands-on involvement in developing questions about real-world sustainability issues, devising and carrying out group research, and presenting their findings affect their acquisition of scientific skills and a sustainability-oriented mindset.

Keywords: biodiversity; conservation; short-term study abroad; Course-based Undergraduate Research Experiences; CUREs; environmental sustainability; Field Course Experiential Learning Model

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1. Introduction

Humanity faces this reality—the environment is broken, mostly as a result of negative human impact on the health and biodiversity of our world's ecosystems [1–5]. Human life depends on a biodiverse world. Healthy ecosystems and the myriad of life forms that define them provide us with fresh water, oxygen, pollination, soil fertility and stability, food, and medicine. Moreover, biodiversity is essential to climate change mitigation; good for the economy; and is an integral component to worldwide religious, cultural, and national identities [6].

Across the world, according to the largest assessment of nature performed on Earth to date [7], as many as 1 million plant and animal species are now at risk of extinction out of an estimated 8–9 million species that have been identified thus far. Edward O. Wilson, a renowned American biologist, naturalist, and writer, coined the acronym HIPPO to address major human threats to ecosystem biodiversity loss [8]. Habitat destruction, Invasive species, Pollution, human Population explosion, and Over-harvesting are five phenomena largely responsible for the current mass extinction event. Scientists now say HIPPO plus G to include global climate change in the list of anthropogenic causes of biodiversity decline and ecosystem collapse. Achieving environmental sustainability, the capacity of nature and human civilization to coexist, requires that we reach across national borders to work collectively to save the ecosystems that we have left and replenish those we have impoverished. Learning to work synergistically with faculty, researchers, conservationists, economists, governmental and non-governmental officials, corporate leaders, teachers and citizens both at home and abroad to teach environmental sustainability can help put students on the fast track to becoming the "game changers" our world desperately needs.

Most undergraduate study abroad experiences in the United States are short-term [9], with 60% lasting from one to eight weeks [10]. Programs vary from week-long curricula

over spring break to two- to four-week experiences conducted during winter break or the summer. More rarely, they extend over a semester. Programs can involve homestays, travel to multiple sites, service learning, or undergraduate research experiences. They can also be "embedded" into the framework of a course. The key to understanding the diversity of outcomes from short-term study abroad is the sheer diversity of programs noted by Donnelly-Smith [11]: "there is no 'average' short-term study abroad program; the variations are as numerous as the institutions that host them."

Published research has found that semester-long study abroad programs generally provide a broader array of positive learning outcomes than short-term programs because students are immersed in experiential learning for a longer time [12]. However, given the variation in both short-term and semester-long programs, when making comparisons we must look closely at which activities, critical reflection, and assimilation opportunities maximize the efficiency and productivity of student learning [13]. In other words, the *quality* of time spent can be more important than its *duration*.

This paper describes a high-impact, out-of-the-box, short-term study abroad program that has been creating learning environments wherein students unmask the anthropogenic means of broken ecosystems. It also shares how it has transitioned Course-based Undergraduate Research Experiences (CUREs) from the traditional classroom to the international arena, reviews the pedagogical frameworks that it utilizes, provides evidence for the success of its approach, and explains its potential to transform the post COVID-19 teaching of environmental sustainability through short-term study abroad.

2. History of CHANCE

Founded in 2004 by the author, Connecting Humans and Nature through Conservation Experiences (CHANCE) is a Pennsylvania State University accredited interdisciplinary and international environmental education program. Its goals are to teach environmental science and conservation biology on the front line and, in doing so, educate future scientists, teachers, engineers, politicians, leaders, and citizens about how ecosystems work, how humans have broken down their life-sustaining elements, and ways to repair and sustain the biodiverse areas we have left in order to achieve environmental sustainability. CHANCE creates short-term study abroad courses for Penn State undergraduates and Pennsylvania high school teachers who, together, tackle real-world environmental issues through field-based research often alongside foreign students and teachers. CHANCE's environmentally-centered field courses employ cutting-edge research techniques, state-of-the-art equipment, and mentorship by both American and international scientists. Over the last 16 years, CHANCE has enlisted 60 worldwide partners and numerous public and private sector funding sources to enable 712 Fellows to complete the 18 field courses in five countries (Table 1). CHANCE has resulted in 8 awards, 16 refereed publications, 7 online interactive teaching modules, and 200+ student and faculty presentations.

Table 1. Some of the environmental issues addressed in Connecting Humans and Nature through Conservation Experiences (CHANCE) courses.

Species Extinction	Tropical Rainforests, Costa Rica
Deforestation	Tropical Rainforests, Costa Rica
Global Climate	Tropical Rainforests, Panama
Habitat Destruction	Coral Reefs and Mangroves, Cuba
Pollution	Yangtze River and its Watershed, China
Micro-algal Blooms	Lake Tai, China
Macro-algal Blooms	Great Barrier Reef, Australia

3. Pedagogical Framework

Faculty seeking to create effective international, field-based, short-term, scientific learning experiences have few pedagogical frameworks to assist them. During the early years of CHANCE programming (early 2000s), an integrated embedded field course model

(Figure 1A), the "Field Course Experiential Learning Model" [14–16], was developed. It featured three steps: (1) pre-trip assignments to provide essential background knowledge, (2) an international trip focused on "structured" inquiry-based research [17] and hands-on conservation activities, and (3) a post-trip assignment to evaluate the key concepts and global perspectives absorbed and to allow for personal reflection. The model was heavily grounded in constructivist learning theory [18,19] and pragmatism [20,21] as well as repeated assessments of student learning. It relied on evidence-based teaching practices and experiential learning—all geared to augment learners' engagement, critical thinking, and memory retention and, importantly, to add "utility" to their lives. Using this approach, three cohorts of undergraduates (62 participants total, 3 field courses held during consecutive summers in Costa Rica) showed significant cognitive and affective learning gains in all evaluated areas, which included conceptual knowledge in conservation biology and ecology, scientific research skills, and environmental advocacy—all through a global lens [16,20,21].

After years of real-world application and reflection, CHANCE revised the "Field Course Experiential Learning Model" to include a CURE as the key pedagogical method for its field research component (Figure 1B). CUREs are learning experiences in which a whole class of students address a research question with unknown outcomes [22] and whose findings are of interest to stakeholders outside the classroom. The fact that they are a part of a credit-bearing course has benefits for students [23], as evidenced by multiple research studies: enhanced self-confidence in scientific thinking and the development of scientific process skills [24], increased inclusivity in science for unrepresented populations [25], and improved retention in science and medicine [26]. This step, adding a CURE, was initiated after the author spent over a decade developing and implementing novel CUREs focused on pressing issues that face society for students enrolled in her, and several of her research colleagues', traditional American biology major laboratories (Table 2). There was a need to bring a similar level of rigorous and relevant research scholarship to the forefront of the CHANCE field courses. Pre-trip, trip, and post-trip components were changed to pre-field, field, and post-field to emphasize the importance of the field research in this program, i.e., it is more than a trip.

CHANCE international CUREs utilize a proven "Four-Step CURE Pedagogical Framework" (Figure 2). The framework is simple and flexible, designed to orient and guide any instructor through the process of designing and implementing a CURE. As in traditional labs, in an effective CURE students work in small groups to learn research techniques; ask novel questions grounded in scientific literature; design their own experiments; and test their hypotheses using the scientific method, iteration, and the reflective process of progressive problem solving [27]. Additionally, in a CURE, students interpret their data and disseminate their work in a professional scientific manner by means of poster presentations, oral academic talks, or scientific papers. To achieve this, students receive individualized mentorship, which is essential to knowledge integration [28].

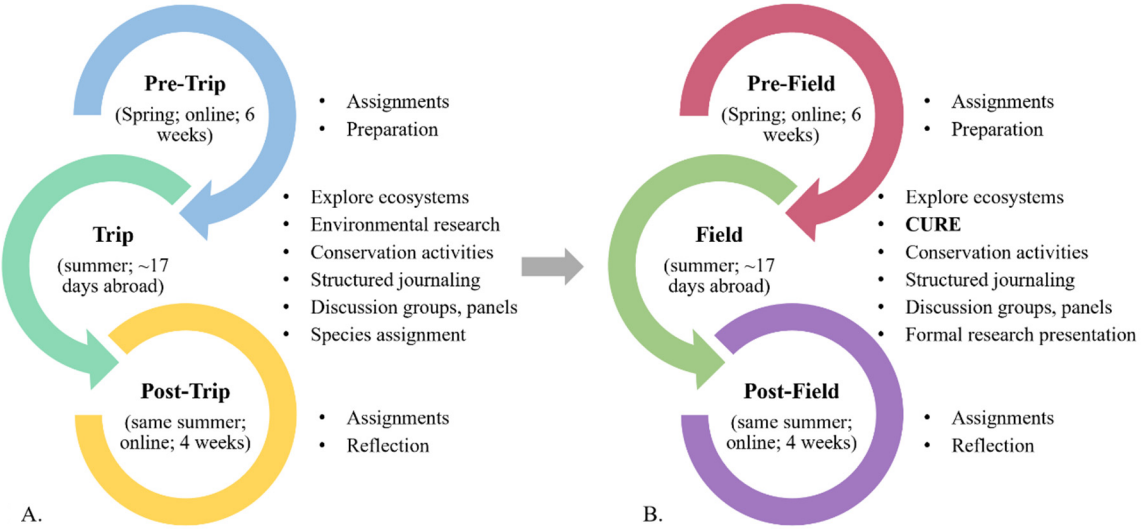


Figure 1. The CHANCE "Field Course Experiential Learning Model" (**A**) evolved to include a Course-based Undergraduate Research Experience (CURE) (**B**).

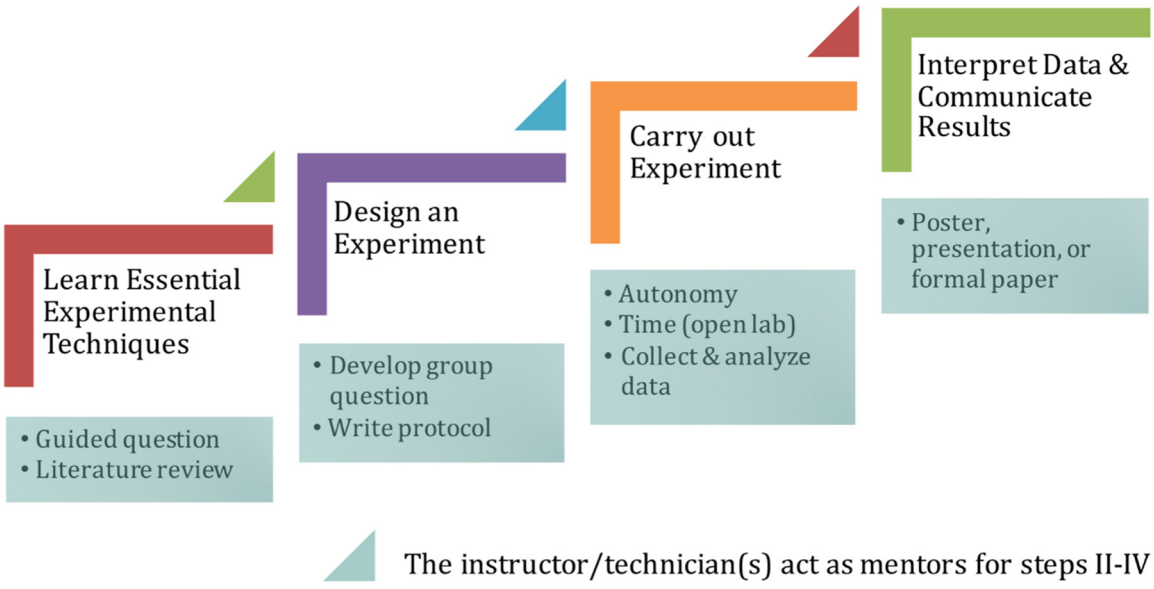


Figure 2. The "Four-step CURE Pedagogical Framework" used to develop and implement CUREs in CHANCE field courses. Created by McLaughlin and Coyle [29] and evaluated by McLaughlin et al. [30].

Table 2. Some successful transformations of biology laboratories using the "Four-step CURE Pedagogical Framework".

Level	Lab	Topic	Location	Reference
Freshmen Sophomore	Introductory Cell Biology for Majors	Growth Kinetics of Yeast	4-year college	Goudsouzian, McLaughlin, and Slee 2017 [31]
Freshmen Sophomore	Introductory Cell Biology for Majors	Cancer Cell Transformation	4-year college	McLaughlin and Coyle 2016 [29]
Honors	Introductory Biology for Nonmajors	Microalgae as a Source of Biofuel	2-year college	Goedhart and McLaughlin 2016 [32]
Sophomore	Developmental Biology for Majors	Drug Induced Arrhymia in the Developing Vertebrate Heart	4-year college	McLaughlin and Patel 2017 [33]

The rigor and effectiveness of CUREs presented in Table 2 is evidenced by undergraduate-authored, peer-reviewed publications in undergraduate research journals. Examples of specific experiments that utilized the CURE framework can be reviewed in Hussain et al. 2020 [34]; Gonzalez, Afzal, and Mclaughlin 2015 [35]; and Adams et al. 2015 [36]. Examples of experiments designed and carried out by CHANCE participants who were enrolled in an international CURE through a CHANCE field-based course (short-term program) are highlighted in the next sections.

4. Developing an International CURE—An Example from China

Jiangsu Province, especially the southern portion of the province, has long been China's most populated, affluent, and educated region. Since the establishment of the port of Shanghai, it has also been China's most heavily industrialized region, responsible for a disproportionate percentage of China's industrial production. This province was selected as the main site for CHANCE programming because it is home to Lake Tai (Taihu), China's third largest freshwater lake, whose catastrophic environmental reality made headlines around the world in 2007. Effluents—phosphorus and nitrogen, nutrients, heavy metals from an estimated 1300 nearby factories, and raw sewage from millions of people—resulted in a major algal outbreak that contaminated the drinking water and killed numerous species [37–39].

In 2008, the author envisioned a CHANCE embedded field course that translated the revised field course model to China. This cross-cultural course would emphasize the link between China's booming economy and its deteriorating environment. This CURE would allow students to understand and critically think about one of China's most dire environmental realities: its polluted water [40]. Preparation for the course included the author touring several provinces in China to witness environmental realities and visiting several institutions of higher education to establish key partners. Collaboratively with the identified partners, the specific CURE topic, course content, and format were established as well as non-academic collaborators, research facilities, and research mentors.

In 2010, a binational pilot, *Global Environmental Sustainability: A Field Study in China*, was offered with 4 Penn State and 15 Jiangnan University undergraduates. This was followed in 2011 by a full-fledged program wherein 13 Penn State students from varied disciplines and 3 faculty performed hands-on research alongside Chinese researchers, governmental and non-governmental agency leaders, and more importantly, 15 Chinese students and 5 faculty. The 28 students worked in binational groups of four or five students each. The CURE component of both courses occurred at Jiangnan University in Wuxi, Jiangsu Province at established field sites along Lake Tai, tributaries of the

Yangtze River, and in the laboratories of Jiangnan University, School of Environmental and Civil Engineering.

For the 2011 course, eight faculty mentors were trained in using the CURE four-step framework, then charged with implementing the specific CURE they worked over two years to develop. This CURE challenged the student groups to develop a novel research question and design an experiment that addressed the effects of industrial, municipal, and urban development (waste) affecting the water quality within the Lake Tai basin. Students then carried out experiments which focused on the chemical, biological, and/or physical characteristics of the lake's water to diagnose its aquatic health and stability. All students evaluated the past and present water purification technologies utilized at Lake Tai to assist in its remediation through field trips to factories, wastewater treatment facilities, and university-based research facilities. Importantly, to push students to the level of understanding the broader impacts of their research, they were also asked to brainstorm and submit strategic solutions for the lake's restoration to the Chinese government. Several groups also added a study on land use around Lake Tai via interviews of local residents.

To conclude their experience, students followed the CURE pedagogical framework and delivered group-based oral presentations to faculty and students from Jiangnan University and neighboring universities, governmental and non-governmental officials, and local citizens. Students recommended more and immediate waste and industrial water treatment facilities, enhanced ecological restoration, environmental education of the citizenry, and revised local and national water pollution standards. They also critiqued the effectiveness of the restoration efforts and emphasized the need for more transparent and longitudinal data on restoration than were in place at the time. This course and its CURE were again replicated in 2015, adding Nanjing University as another key partner, due to effective and long-lasting relationships and the CHANCE program's reputation.

Following the 2011 CURE experience in China, a modified Student Assessment of Learning Gains (SALG) survey (https://salgsite.net/) was utilized to generate data on students' perceptions of conceptual knowledge gains in environmental science and conservation biology, specific scientific skills in water assessment and basic research, and advocacy in the fields of environmental science and conservation biology. Collective results revealed that both American and Chinese students demonstrated not only an understanding of core concepts and research skills but also felt motivated to carry out future actions as environmental stewards with essential intercultural knowledge and awareness [41].

5. Recent International CURE in Cuba

The revised field course model and the CURE pedagogical framework were also used in Cuba for a 2017 ten-day program, *Environmental Protection, Conservation, and the Sustainability of Cuban Ecosystems*, that included a CURE in environmental policy and economic development. It involved 15 Penn State undergraduates and PA teachers who traveled from Havana to Western Cuba. They engaged in Cuba's 21st century conservation, economic, societal, and political realities as well as its rich cultural heritage through pre-field assignments and by interacting with local experts, faculty scholars, conservationists, teachers, and citizens. Students learned about how relations between the United States and Cuba were reawakening (at the time) and how, due to the investment interest, Cuba was at a crossroads in defining the sustainability of its economic development. Would Cuba's tropical coastlines soon be home to towering cruise ships and sprawling resorts, endangering its pristine coral reefs and mangroves? Cuba's approach to conservation and environmental protection could be a model for other Caribbean nations, if implemented correctly. A novel CURE which asked students to research and unmask the anthropogenic phenomena that were negatively affecting a specific environmental problem of their choosing, e.g., coral bleaching, was implemented. Students developed their own scholarly research agenda (Table 3) geared toward devising a sustainable solution to their chosen Cuban-based environmental issue and devised ways to balance economic development with best practices in

conservation in light of this issue. Students carried out steps 3 and 4 of their CURE upon return to the U.S. and most of their literature review using the Penn State libraries. Students presented their results in the form of a group-based poster presentation at the annual Penn State Undergraduate Research Exhibition in fall, 2018. CHANCE partners who helped build this field course, which will hopefully be replicated when international travel to Cuba resumes, include CubaMar, Guanahacabibes National Park, and Holbrook Travel.

Table 3. CURE group-based research topics from two recent programs.

2017 CURE projects in Cuba under *Environmental Protection, Conservation, and the Sustainability of Cuban Ecosystems*
Implementing Urban Green Agriculture to Increase Food Production and Reduce Fossil Fuel Dependency
Exploring the Economic Utilization of Invasive Species to Improve the Health of Select Ecosystems *
Developing Effective Foreign and International Policies for Conserving Mangrove Forests in Cuba
Coral Reef Preservation in the United States and Cuba: Solidarity versus Alliance
An Organic Agritourism Network for the Sustainability of Cuban Agriculture and Tourism
2018 CURE projects in Costa Rica and Panama under *Conservation Biology and Sustainability of Select Tropical Ecosystems*
Atta cephalotes (leaf-cutter ants) Ecosystem Re-Engineering
Shifts in Microclimates and Bromeliad Faunal Diversity Due to Global Climate Change
Foraging Behavior and Spatial Memory in *Phaethornis longirostris* (long-billed hermit) in the Altering Tropical Forest
The Biodiversity of Tropical *Chironomidae* (non-biting midges, Diptera)
The Function of Stilt Roots in the Growth Strategy of *Socratea exorrhiz* (walking palm) in the Face of Global Climate Change

* 2018 Penn State Undergraduate Research Exhibition Gerard A. Hauser Award for Best Overall Exhibit Presentation.

To elicit additional context from the CHANCE CURE experiences, an interdisciplinary panel of expert Penn State faculty and graduate students in biology, conservation biology, and environmental policy were gathered to observe and analyze the content and delivery of students' 2018 post-field poster presentations (eight months after traveling to Cuba). They employed modified Association of American Colleges and Universities (AAC&U) Value Rubrics (www.aacu.org/value/rubrics) developed to assess students in the areas of critical thinking in environmental science, conservation biology, and international policy; oral communication; global learning; and intercultural knowledge and competence. The data (not previously published) showed that participants benefited substantially in all areas and, importantly, retained these outcomes post CURE (Figure 3).

In addition, student writing artifacts (post-field assignments and journals) were independently ranked by three experts. Results indicate that students also benefited in the areas assessed using the AAC&U Written Communication Value Rubric (Figure 4). An indirect piece of evidence of student tangible gains is that the group that presented *Exploring the Economic Utilization of Invasive Species to Improve the Health of Select Ecosystems in Cuba* at the 2018 Penn State Undergraduate Research Exhibition took home the top prize.

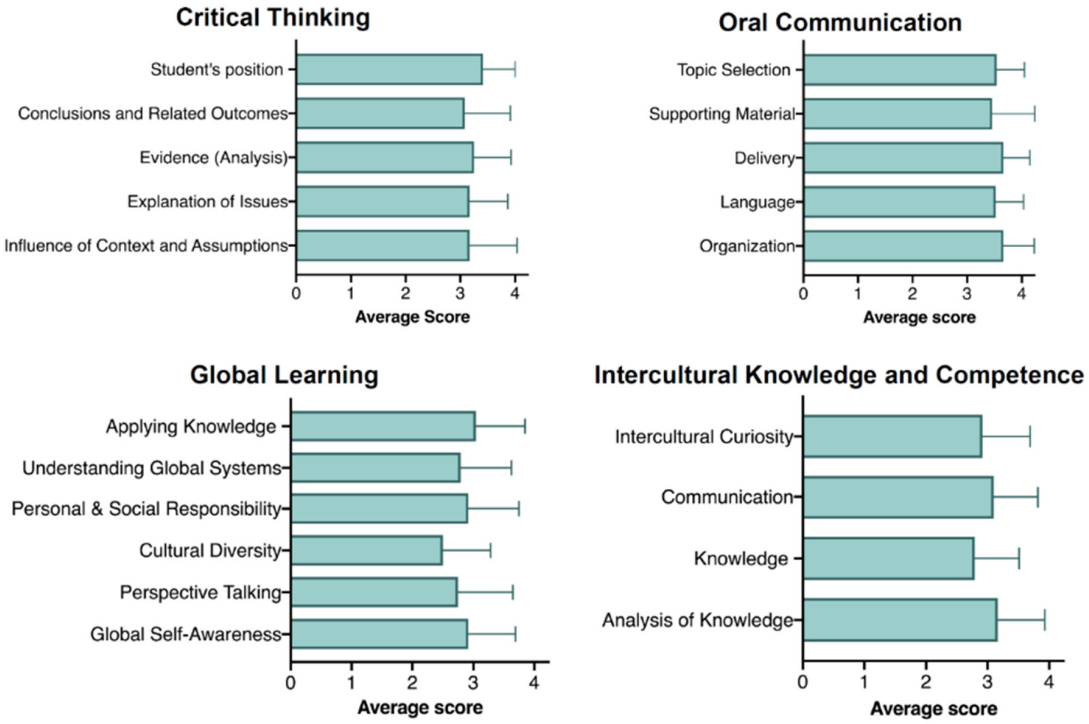


Figure 3. Average scores for each evaluated component of four separate AAC&U Value Rubrics used to assess five separate post-field group presentations from the 2011 CHANCE Cuba program. Each group presentation was evaluated by four independent expert raters using the —rubric scale 1—benchmark, 2—3 milestone, 4—capstone. The error bars represent the SD of the mean.

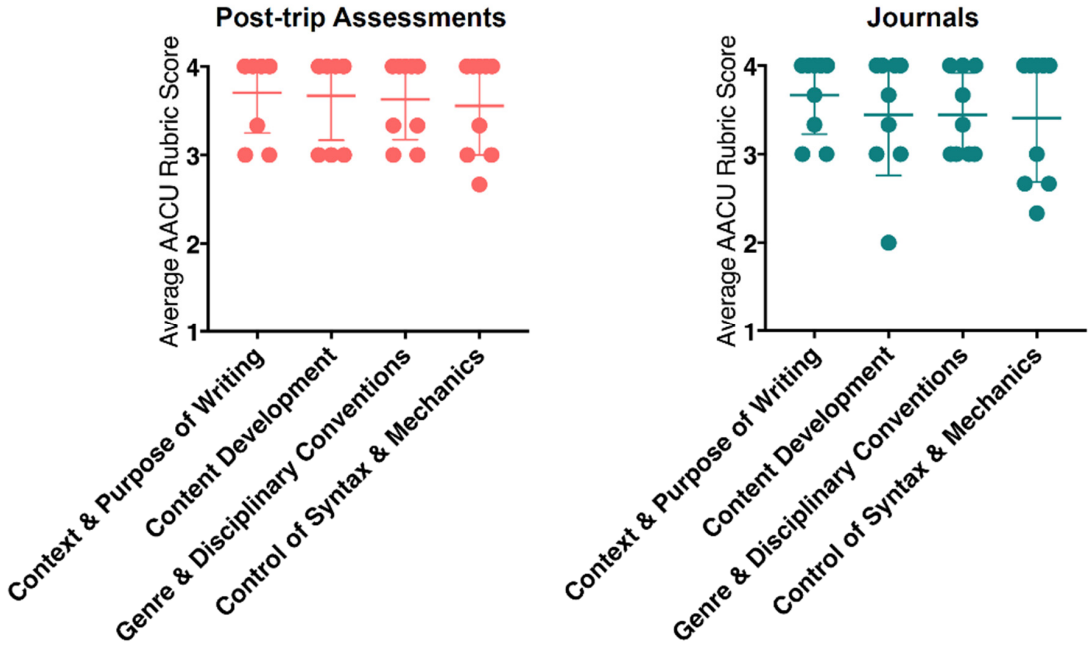


Figure 4. AAC&U Written Communication Value Rubric scores of the post-trip assignments and journals from 15 individual student participants from the 2011 CHANCE Cuba program. Each artifact was evaluated by three independent expert raters using the rubric scale 1—benchmark, 2—3 milestone, 4—capstone. The error bars (shorter line) represent the SD of the mean (longer line).

Alarmingly, fewer than 10% of undergraduate pedagogical research studies validate self-reports (e.g., SALGs) with analysis of research products (such as presentations or culminating reports), direct measures of content gains, longitudinal evidence of persistence, or observations of student activities [28]. The results of this study also shed light on the benefits of the international CURE experience on students' personal growth into environmental advocates and informed citizens. Globally minded citizens understand the interdependency of the world and its inhabitants and the connective links that exist between all living things [42]. It is generally accepted that global citizenship includes three key dimensions: social responsibility (a concern for humanity and the environment), global awareness (alertness and responsiveness to issues that are global in nature), and civic engagement (active, informed participation in local, national, and global affairs) [43–45]. Post-field assignments and research presentations showed that students who participated in the Cuba program grasped these three dimensions. The majority shared a viewpoint that reflects a global sense of belonging to an interconnected living planet, a responsibility to protect and sustain biodiversity, and a desire to alleviate the degradation of nature in their lifetimes.

6. Additional Evidence for International CURE Success

In 2018, students' perceptions (54 participants; 3 field courses) of their scientific skills and knowledge in ecology and conservation biology following a short-term embedded field course, *Conservation Biology and Sustainability of Select Tropical Ecosystems in Costa Rica and Panama,* was published [46]. This program comprised a CURE focused on biodiversity loss of the tropical rainforest due to global climate change within the confines of the Organization of Tropical Studies/La Selva Biological Field Station (OTS/La Selva), Costa Rica (example research topics are shown in Table 3). Student groups presented their research findings to the OTS/La Selva scientific community. Students reported *significant* to *very significant* gains in specific scientific hard and soft skills deemed essential by the National Research Council (NRC) and knowledge benchmarks in the fields of ecology and conservation biology following their CURE experience. Additionally, they showed high interest in doing further research in the field of ecology and conservation biology, and the majority shared a sense of belonging to an interconnected living planet, a responsibility to sustain biodiversity, and a desire to alleviate the degradation of nature.

The CURE aspect of a CHANCE field course is ambitious in its goals, packing a lot of information and experiences in a concise period. Indeed, the pedagogical framework usually spans 8–10 weeks in a traditional biology lab. Student assessment of 64 participants in the CHANCE Costa Rica and Panama field course revealed the need for time spent with scientific mentors pre-field to enhance understanding of the literature (especially data analyses and interpretation), essential scientific concepts, and broader impacts before partaking in field work. They also stressed the need for more time in the field to learn research methods more adequately [46]. These issues are presently being addressed in the upcoming CHANCE Romania pilot field course through pre-field, field, and post-field components.

7. The Role of Partnerships

Working together with international partners—be they institutions of higher education, biological field stations, government and non-government organizations, or ecotourism providers—to build short-term field courses with a CURE component takes time, typically years, but has numerous benefits: (1) They aid in finding an environmental problem to address and in developing a CURE to resolve it. (2) They allow the co-construction of international, cross-cultural, and multidisciplinary curricular elements. (3) They advance the international scope of the involved faculty, research scientists, and conservationists through their professional development in experiential field-based pedagogy and CURE implementation. (4) They create long-term relationships that benefit future programming through action research and program assessment. (5) They assist with navigating inter-

national travel logistics and risk management. (6) They foster sharing costs and in-kind contributions. Solid and numerous partnerships build up the pillars of curricular scholarship, bring rigor and authenticity to CURE work, allow for synergistic outlooks and visions, and increase the quality of time spent in the field by short-term participants. While there is no simple recipe for success, an initial seed will steadily grow over time on the basis of successful programs and sustained effort (Table 4 and CHANCE Partners).

Table 4. Examples of some CHANCE partners, illustrating their breadth.

Role	Organization
Financial Support	DOW
	Pennsylvania Dept. of Education
	Sanofi
	Various families
Collaborators	American Institute of Biological Sciences
	Smithsonian Tropical Research Institute
	World Wildlife Fund
	James Cook University, Australia

8. Future Plans

CHANCE's next initiative, set for post-COVID-19 programming, is a pilot program and will immerse 12 Penn State students and 12 Romanian students working in binational groups on a select CURE focused on an environmental issue confronting the Danube River, the second largest river in Europe, which runs from Budapest to the Black Sea. After decades of pollution during the Communist era, the Danube is facing new threats from microplastics, pesticides, and pharmaceutical waste [47]. Efforts to restore the health and sustainability of the Danube River are so important that the European Union recently created the International Center for Advanced Studies on River-Delta-Sea Systems (Danubius Research Infrastructure (RI); http://www.danubius-ri.eu/) to spearhead an international effort.

Working with new partners in Romania (U.S. Embassy in Bucharest; Romanian Ministry of Education and Research; University of Bucharest; Danubius RI; Politehnica University, Bucharest), CHANCE and its partners are developing six new, separate CUREs involving top research scientists in Romania. These CUREs focus on specific water issues facing the delta of the Danube River (overharvesting of species, algal blooms, pollution, microplastics, invasive species, and global climate change), address three United Nation's Sustainable Development Goals (SDG) (SDG 6—Clean Water and Sanitation; SDG 13—Global Climate Change; SDG 14—Life Below Water), and will be the foundation for future, more numerous and student-enrolled, CURE-based CHANCE embedded field courses in this area of the world. As with all CHANCE field research, students will not only be tasked to research these issues but will also devise and recommend sustainable answers, in this case, effective conservation efforts, economic and environmental policies, or entrepreneurial efforts. Penn State and Romanian undergraduates and scientists will be working side by side. However, this time American and Romanian faculty and scientific mentors will co-create the pre-field and field curricula, and Romanian students will take part in all pre-field online elements as well as earn course credits at their home institution.

The post-COVID-19 key objectives of these new, multidisciplinary, and binational field courses will include enhancing student career trajectories in environmentally related STEM jobs. Both online and real-life platforms for career guidance and mobility will be created. Students will be professionally mentored on potential career path possibilities, both while in the field and post-field. Other collaborative goals include developing an open-access online database to store longitudinal (year-to-year) field research data, student presentations and

publications, and information to guide Danubius RI in its work to advise the European Union on environmental policy directives.

9. Conclusions

The landscape of higher education has been unquestionably disrupted by the COVID-19 pandemic. Leaders in study abroad are challenged with devising new ways to internationalize their institutions, curricula, and study abroad programs with bold ideas that stop "defending the old and familiar" [48] and "open our minds to a world of new ways to help people (worldwide) get what they really need and value" [49].

International CUREs offer a proven methodology for transforming short-term study abroad to yield higher impact and quality student outcomes. Other insights that can aid in international CUREs success include engaging students in global scientific activities and exchanges that are relevant, state-of-the-art, and based on relationships with real people from all sectors of society, not just academia. Additionally, solid teaching and research collaborations between faculty and scientists must transcend single nations, with institutions working together across borders to reimagine and share in creating teaching and learning experiences. Cross-cultural and binational (stressing we bring our students and teachers together) teaching and learning brings students together to solve not just local and national but also international problems. Additionally, students gain a stronger understanding of the scientific process, which allows them to discover how science can better their societies, environments, and our shared world.

When it comes to conserving our natural resources and biodiversity, it is important to recognize that internationally we are all in this together—the biomes of the Earth are interconnected. Thus, in order for nations, regions, and local communities to implement effective policies that support conservation and sustainability, educators worldwide must band together and encourage their students, the citizens of the world, to develop levels of understanding of core environmental science, ecological, and economic concepts that allow them to comprehend the negative impact and consequences of any broken ecosystem—be it a polluted river, an overharvested forest, or a bleached coral reef overtaken by an invasive species. The CHANCE program presents educators with unique pedagogical opportunities to do just that—by blending research on international environmental realities together with short-term study abroad (SDG 17: Global Partnerships for Sustainable Development). In summary, higher education can catalyze what Edward O. Wilson describes as a much needed "moonshot of global conservation" [50].

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