

The Impact of Science Field Courses in The Bahamas on the Personal and Professional Development of U.S. College Students, 1977-2014

Dawn M. Ford, University of Tennessee at Chattanooga

W. Hardy Eshbaugh, Miami University

R. Christopher Branson, University of California, Los Angeles¹

Abstract

Fieldwork is a component of many college science courses. Faculty at Miami University at Oxford, Ohio and the University of Tennessee at Chattanooga have facilitated fieldwork-intensive science courses in The Bahamas for many years. The study surveyed students who participated in fieldwork in The Bahamas between 1977 and 2014, measuring the perceived impact the courses had on their personal and professional development as well as their international perspective. Survey participants agreed the experience had a high impact on their personal development (97%), professional development (91%), and international perspective (89%). General Linear Model results indicated no statistically significant differences between or within groups, suggesting participants' perceived impacts are the same regardless of gender, age, institution, and field station location. Qualitative data analysis revealed several types of impact such as understanding of and appreciation for Bahamian culture, appreciation for tropical environments, development of research skills, and enhanced career opportunities. International fieldwork in The Bahamas clearly has positive long-term impacts on students and should be continued.

Introduction

Fieldwork is an integral component of many college courses and provides opportunity for knowledge, skills, and attitudes to be integrated into a hands-on experience (Garcia, Robertson, Lougheed, Tweedie, & Velasco,

2013; Rydant, Cusack, Smith, Shiplee, & Middlekauff, 2013). The student benefits of fieldwork in an international setting have been the subject of few studies and concentrated primarily on the disciplines of nursing, pre-service teacher training, and geography

¹ Dawn M. Ford, The University of Tennessee at Chattanooga, W. Hardy Eshbaugh, Miami University, Oxford, Ohio, and R. Christopher Branson, Jane and Terry Semel Research Institute for Neuroscience and Human Behavior, Los Angeles, California.

E-mail: Dawn-Ford@utc.edu

Acknowledgements: We are indebted to the many students who journeyed to The Bahamas and enriched our courses by their presence and to the people of The Bahamas welcomed us into their lives, as well as the Bahamians who took our courses. Above all, those former students who later returned to teach their own courses in The Bahamas have kept the legacy going. Thanks to the Forfar Field Station (International Field Studies) and the Gerace Research Centre for their support over the years.

APA reference: Ford, D. M., Eshbaugh, W. H., & Branson, R. C. (2017). The impact of science field courses in The Bahamas on the personal and professional development of U.S. college students, 1977-2014. *International Journal of Bahamian Studies*, 23, 15-30. <https://doi.org/10.15362/ijbs.v23i0.286>

(DeDee & Stewart, 2003; Pence & Macgillivray, 2008; Rydant, Shiplee, Smith, & Middlekauff, 2010; Willard-Holt, 2001; Zorn, Ponick, & Peck, 1995). Further, the measures of student success of fieldwork have been mostly anecdotal in nature (Rydant et al., 2010). As a result, there is “little quantifiable evidence” of the importance of scientific fieldwork on student development and future employment (Rydant et al., 2013). However, many faculty report observing that it enhances both knowledge of subject matter and understanding of scientific research (Rydant et al., 2013). Fieldwork is a form of experiential learning that links theory to practice. Experiential learning was first

described as learning by doing by Dewey (1938), and later by Kolb (1984) who described experiential learning theory, stating that experience is central to the learning process, along with perception, cognition, and behavior. The theory is connected to practice through the cycle of experience, concept, reflection, and action (Kolb, 1984).

Since 1977 at Miami University, Oxford, Ohio (MU) and 1985 at the University of Tennessee at Chattanooga (UTC), fieldwork-intensive science courses have been offered at research stations on the Bahamian Family Islands of Andros and San Salvador (Figure 1).

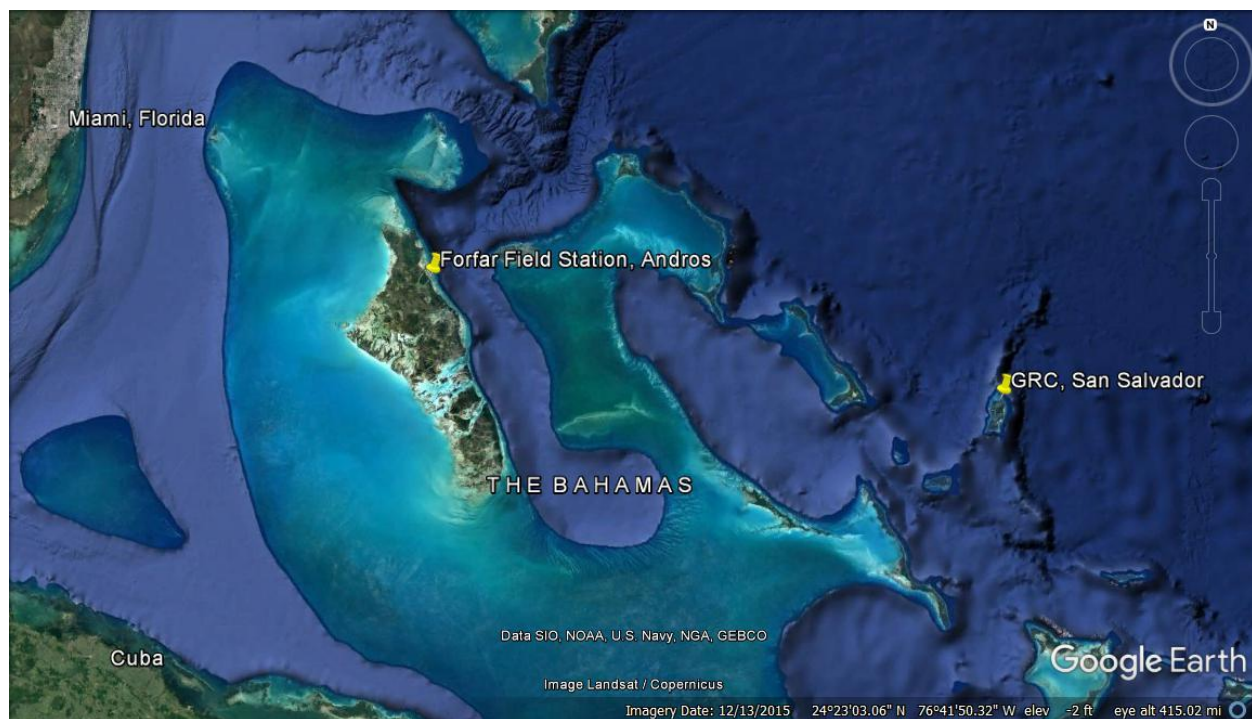


Figure 1: Field station locations in The Bahamas: Forfar Field Station on Andros Island and the Gerace Research Centre on San Salvador Island.

Andros, the largest of the Bahamian islands, is approximately 150 miles southeast of Miami, Florida (National Oceanic and Atmospheric Administration, 2017). Forfar Field Station, formerly a dive resort and named after founder Archie Forfar, was established on

Andros in 1970 by International Field Studies (2016). Forfar’s buildings of Caribbean pine and limestone provide cabin-style housing for up to 56 occupants overlooking the beach in Blanket Sound. Forfar’s lodge has a dining hall, classroom, research lab, and dive shop

(International Field Studies, 2016). The housing comprising little more than bunk beds, ceiling fans, and shared bathrooms, provides students with living arrangements to which they are generally not accustomed. However, the ocean is just 75 feet away and the gentle waves serenade residents to sleep at night with a good breeze to keep the mosquitoes at bay. Little has changed at Forfar over the years, but the rustic appeal and variety of opportunities available to the many groups visiting annually.

A more remote island, San Salvador Island is approximately 375 miles southeast of Miami (National Oceanic and Atmospheric Administration, 2017). The Gerace Research Centre (GRC)², formerly known as the Bahamian Field Station, was established in 1971 by Don Gerace on a former United States naval base (Gerace, 2014). A centre for the study of archaeology, biology, geology, and the marine sciences, the GRC is the largest facility of its kind in the Caribbean and is affiliated with the University of The Bahamas (Gerace, 2014). In contrast to Forfar, the GRC's campus has concrete-block buildings including dormitories for students, faculty housing, multiple laboratories, a conference room, computer lab, library, dive shop, and cafeteria, with the ability to support over 200 students at one time (Troy Dexter, personal communication, 2017). Situated on the northern end of the island, the GRC is across the road from Graham's Harbour, the perfect place for inexperienced students to snorkel for the first time. There have been improvements to the GRC facilities over the years, including the addition of air conditioning in faculty housing, solar-powered security lights, and a student computer lab with Internet services.

² <http://www.geraceresearchcentre.com/>

Why study science in The Bahamas?

Science field courses can be taught anywhere, but The Bahamas, particularly the Family Islands, provides unique and near pristine subtropical environments in which to study. From a geological perspective, the Bahama Banks represent a current carbonate sedimentation environment that is rarely found in the world today (Kornicker, 1963). Additionally, there are unique karst features on the islands such as banana holes, blue holes, and caves, and there is a well-exposed rock record of carbonate sequences (Carew & Mylroie, 1994). Biologically, the islands are one of the world's biodiversity hotspots and the diverse habitats—terrestrial, aquatic, and marine—are relatively easy to access and provide an abundance of opportunities for study and research.

Andros Island and San Salvador Island are quite different from one another in terms of terrestrial habitat and species diversity. Andros has about 60% of the plant species of The Bahamas with more than 800 species (Eshbaugh & Wilson, 1996; Eshbaugh, 2014). There are 10 plant communities identified on Andros: beach/strand, coastal rock, coastal coppice, interior coppice, pineland, savanna, scrub, freshwater marsh, saltwater marsh, and mangrove (Nickrent, Eshbaugh, & Wilson, 2008). Each of these communities has a distinct group of flora and fauna. San Salvador, on the other hand, is generally considered a scrubland with just over 500 species of vascular plants and an endemism rate of 6-8% (Smith, 1993). There are seven plant communities present on San Salvador: beach/strand, coastal rock, coastal coppice, mangrove, freshwater formations, whitelands, and interior coppice—the most extensive plant community on the island (Smith, 1993).

Both islands have many inland ponds and lakes that range from freshwater to hypersaline. In these water bodies—often lined by mangroves—are a host of macroalgae,

invertebrates, and fish, some of which are very specialized species. For example, there are two pupfish species of the genus *Cyprinodon* that were recently discovered and occur only on San Salvador in some interior ponds (Martin & Wainwright, 2013). These fish show some of the fastest rates of evolution ever recorded and provide “a powerful case study for understanding remarkably localized adaptive radiation and the evolution of ecological novelty” (Martin & Wainwright, 2013, p. 239). Also on San Salvador are coastal ponds filled with stromatolitic beds such as those in Storr’s Lake (Dupraz, Tobias, & Visscher, 2013). On Andros, there is a famous blue hole called Uncle Charlie’s Blue Hole that was once explored by Jacques Cousteau. It is an inland blue hole that contains a population of the blind Bahamian cave fish, *Lucifuga spelaeotes* (Farr & Palmer, 1984).

The natural habitats of Andros and San Salvador provide opportunities for students to gain first-hand experience with both endangered species and invasive ones. Each island has its own subspecies of endemic iguana, for example. On Andros Island, the Andros rock iguana (*Cyclura cyclura cyclura*) uses termite mounds for nesting, which is a very unique nesting strategy (Knapp, 2015). On San Salvador, populations of the endangered San Salvador Rock Iguana, *Cyclura rileyi rileyi*, are benefitting from an iguana headstart incubation program and educational facility at the GRC (Hayes et al., 2016). In the marine environment, endangered sea turtles occur just offshore of both islands. The green sea turtle, *Chelonia mydas*, is listed as endangered on the IUCN Red List of Endangered Species (Bahamas National Trust, n.d.). There is currently a population of green sea turtles that live just off the beach in Graham’s Harbour, San Salvador. Off the coast of Andros, there have been sightings of the critically endangered Hawksbill turtle,

Eretmochelys imbricata near Small Hope Bay Lodge (Small Hope Bay Lodge, 2012).

Islands are susceptible to invasion of non-native plant species, and according to Smith (2010), The Bahamas is “overrun with alien invasive plants” (p. 2). Because of the abundance of invasive species, it is an ideal environment for presenting case studies in the field to students. While there are hundreds of invasive species in The Bahamas, species-specific response plans have been developed for only two species: melaleuca (*Melaleuca quinquenervia*), also called paperbark, and lionfish (*Pterois miles*, *Pterois volitans*). Many more species response plans are needed (Moultrie, 2013). Lionfish are a relatively new invader to The Bahamas and are often seen in Pigeon Creek and around reefs and artificial structures on San Salvador (Pimiento, Nifong, Hunter, Monaco, & Silliman, 2013). Local divers are known to spear lionfish and feed them to sharks. Also an invasive species, *Casuarina*, is a tree native to Australia with a distribution pattern that is associated with human habitation (Rodgers, 2005), making it an easy tree for students to examine on both islands

The islands are also vulnerable to tropical storms, hurricanes, and sea level rise due to climate change. The study of changes to coastlines, coral reefs (coral bleaching), plant distribution, and mangrove communities are among the many research topics that students can focus upon in The Bahamas. For example, there has been much research on the geological and biological impacts of Hurricanes Joaquin in 2015 and Matthew in 2016 on the islands. During the most recent Joint Symposium on the Natural History and Geology of The Bahamas in 2017, scientists, faculty and students shared research findings on trends in flowering intensity, impacts on interior pond macroalgae and invertebrates, and coastal erosion and boulder movement due to hurricanes, for example (Gerace

Research Centre, 2017).

While the primary purpose of these field courses is to study science, the Bahama islands have an intriguing history and rich culture, which also offer many opportunities for research. The first inhabitants of the islands were the Lucayans (Berman & Gnivecki, 1995; Keegan, 1985). They were established on San Salvador by the A.D. 800s (Berman, Gnivecki, & Pateman, 2013). These people, who originated from South America, were a fishing and horticultural society, and left behind many artifacts such as food items (bones of grouper and parrotfish, mollusk shells), pottery fragments, beads, and charcoal, that have been studied for many decades (Berman, et al., 2013; Blick, 2007; Rose, 1987; Rouse, 1992).

Columbus made landfall in 1492 on San Salvador (then called Guanahani by the natives). The Spanish colonized the islands briefly, capturing the Lucayans and selling them as slaves. The Lucayan population in the Caribbean suffered from European disease, starvation, and ill-treatment (Craton, 1986; Rose, 1987). According to radiocarbon data, Lucayan sites may have been active through the mid-1500s after which, it seems they were depopulated (Berman, et al., 2013). The islands were virtually uninhabited except for pirates until 1629 when Great Britain claimed The Bahamas (Palmer, 1994). The Bahamas became a British Crown colony in 1717 (Craton, 1986).

Most of the early population of the islands were slaves of primarily African descent (Palmer, 1994). The Loyalists came to the islands in the 1800s, bringing slaves with them and establishing plantations. Emancipation came in 1838 but there was ongoing discrimination (Palmer, 1994). After 325 years of British rule, on July 10, 1973, The Bahamas became a free and sovereign country, replacing a minority rule with a

democratically elected government.

Students are exposed to some elements of the history of the Bahamas during the time on the islands. Lucayan artifacts are available for viewing in the repository at the GRC. There is a Columbus Monument on the west side of San Salvador that is a frequent stop during field courses. There are stories of pirates hiding their bounty in caves, such as Lighthouse Cave on San Salvador and Morgan's Bluff on Andros. There are ruins of plantation houses to explore. Because The Bahamas is a former British colony, students are exposed to other remnants of that legacy such as road names (Queen's Highway) and driving rules (driving on the left side of the road).

The Courses

During the one- and two-week university field courses at Forfar and the GRC, MU and UTC students, both undergraduate and graduate, have been exposed to Bahamian culture, hands-on field research, and a variety of ecosystems in rugged and remote subtropical environments. Most days are spent in the field, and field station trucks are used for transportation to specific field sites such as the savannah grasslands on Andros and the mangrove-lined Pigeon Creek on San Salvador. Field sites are often short distances from home base, but travel times are frequently long because of poor road conditions, and mechanical issues with trucks. Once at the field sites, students are actively engaged in observing, sampling, taking notes, collecting data, and reflecting upon what they are doing, the implications, and the explanations (or conclusions). Days are busy and may involve strenuous activities such as hiking, snorkeling, caving, and swimming for extended periods of time, so students learn to prepare themselves appropriately for these activities. For example, students may need to wear pants and boots in the morning to walk through the sawgrass marsh for a botany

lesson and a swimsuit in the afternoon to explore one of the many blue holes. Groups head back to the field station in the late afternoon where dinner, typically with a Bahamian flair, is a welcome meal. After dinner, time is spent in the laboratory or classroom attending evening lectures, working on independent research projects, and finishing the day's work.

While field courses in The Bahamas have changed over the years, varying in content and activities, these courses have always required students to keep a field journal. The field journal is where students record notes, summarize daily activities, interpret information, and critically reflect on their learning; it is central to the learning process. According to the constructivist learning theory, learning is more about interpreting information than recording it (McLaughlin & Johnson, 2006). Further, field journals give students the opportunity to synthesize information from different perspectives including cultural and personal ones (McLaughlin & Johnson, 2006). As a result of using a constructivist approach, students learn science by doing science through an active social process (Seimears, Graves, Schroyer, & Staver, 2013). Students are actively engaged in real-world problems and learn by bringing their prior knowledge and constructing new meaning from multiple perspectives (Park, Jang, Chen, & Jung 2011; Seimears et al., 2013).

Although students often comment about the importance of these field courses immediately upon completion, the long-term impacts on students have been largely unknown and undocumented, except for their published works that may result from students' time at the field station. MU's Botany Department contributions alone include at least 114 publications (Eshbaugh, 2014). Publications are important and easily demonstrate the contribution of a student to his or her

discipline, but many students do not have publications related to their work in The Bahamas. The purpose of this study was to measure the impact of Bahamas field courses on students, in terms of their professional and personal development, their international experience and their awareness of cultural differences.

Methods

To measure the impact of The Bahamas field courses on former students, a Qualtrics™ survey of 25 questions was developed and administered online between November 2015 and January 2016. The survey responses were confidential and not tied to any identifiable information.

Of the 25 survey questions, nine questions asked participants about the specific course they took (institution, year, duration, location, etc.). Four questions asked participants to report their level of agreement using a 7-point Likert scale about the course's impact. Three questions were open-ended and asked participants to describe the top three personal and professional benefits of the course, skills they developed during the course, and any other comments about course impact they would like to make. Three questions asked about participation in other field courses and any publications they had authored, related to their work at the field station. Lastly, there was a set of standard demographic questions.

In the survey, definitions were provided to the respondents for personal development, professional development, and international perspective. Personal development was defined as "personal growth by expanding self-awareness and knowledge and improving skills". Professional development was defined as "ability to do well in the discipline, the workplace, and/or graduate school". International perspective was defined as "ability to view issues from the point of view of people living in other countries".

Former students of The Bahamas field courses at MU (Botany Department) and UTC (Biology, Environmental Science, Geology) were asked to complete the survey, representing the years 1977-2014. A total of 455 former students were contacted (350 MU, 115 UTC). Contact information for students was obtained from the Registrar and Alumni Affairs offices at the institutions. Students were either emailed or mailed a letter, depending upon the contact information available. If contact information was found to be out of date, attempts were made to contact via social media such as Facebook™ and LinkedIn™.

Quantitative analyses were conducted using IBM SPSS statistical software package version 22. Due to the number of independent variables, a General Linear Model was used to compare differences between groups and within groups as well as the main effects and interactions of gender, institution, and age on student ratings of personal impact and professional impact of their Bahamas course. This research was approved by the UTC Institutional Review Board (IRB 15-105).

Results

A total of 152 survey responses were received, representing a 34% response rate. Student responses represented all the years the course was offered at the institutions, 1977-2014. Because some respondents did not answer all 25 questions, incomplete surveys were removed from analysis, resulting in 133 survey responses being included in the study.

Sixty-five percent of respondents took the course at MU and 35% took the course at UTC; 42% were male and 58% were female (Table 1). The largest group of respondents was between the ages of 35 and 44. A possible explanation for this age distribution is that MU’s botany course in The Bahamas was last offered in 2008.

Table 1
Survey participant characteristics.

Characteristic	Frequency (%)
Male	56 (42%)
Female	77 (58%)
Current age (years)	
18-24	8 (6%)
25-34	17 (13%)
35-44	65 (49%)
45-54	27 (20%)
55-64	14 (10%)
65-74	2 (2%)
75 or older	0 (0%)
Former undergraduate student	99 (74%)
Former graduate student	34 (26%)
MU student	87 (65%)
UTC student	46 (35%)
First time to travel abroad	
Yes	43 (32%)
No	89 (67%)
Don't remember	1 (1%)

Most respondents were undergraduates when they participated in the course and had travelled abroad before (Table 1). Twenty-four percent of respondents reported that the field course led to other experiences at the field station such as undergraduate or graduate research, and 15% indicated they had publications related to their time at the field station. The General Linear Model results indicated that there were no statistically significant differences between groups or within groups, and no main effects or interactions. This suggests that participants’ perceived impacts of the course on their development and perspective are the same for both institutions, both field stations, males and females, and do not vary with the current age of former students. There were no differences linked to age; this can be interpreted as no change over time because most students took these courses as young adults.

The vast majority of respondents, no matter the year in which they participated or the

institution from which they took the course, agreed (responded “somewhat agree,” “agree,” or “strongly agree”, Figure 2) that the course had a high impact on their personal development (97%), professional

development (91%), and international perspective (89%). Further, 97% of respondents agreed that an international field course is very important component of the college experience.

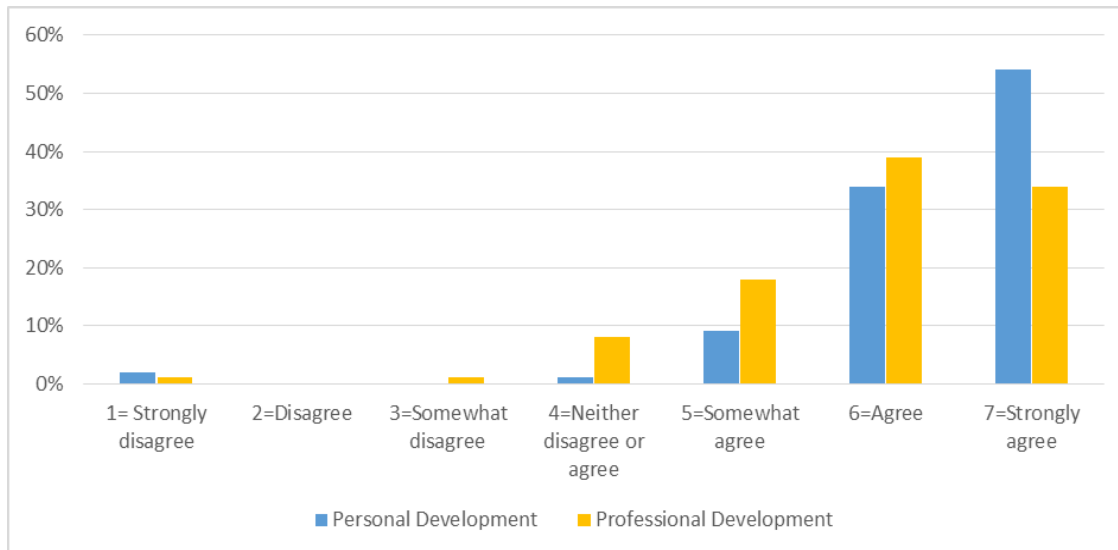


Figure 2: Participant level of agreement on 7-point Likert scale (1= strongly disagree...7= strongly agree) on high impact of course on their personal development and professional development.

Survey respondents were asked to list their top three personal benefits and top three professional benefits of the experience. For each response, if more than three benefits were listed, only the first three were analyzed.

The qualitative analysis revealed major themes in these open-ended responses related to the personal development impact and professional development impacts (Table 2)

Table 2
Themes in open-ended responses for top personal & professional benefits of the field experience, in ranked order.

Personal Impact Themes	Frequency	Professional Impact Themes	Frequency
Exposure to/immersion in Bahamian culture	55	Hands-on experience/field research	48
Building of relationships with peers, faculty, and others	46	Developing knowledge of and appreciation for tropical environment	41
Developing knowledge about/appreciation for tropical environment	35	Working on a team	29
Hands-on experience/field research	31	Professional contacts/networking	18
International travel experience	27	Field notebook/journaling experience	15
Working on a team	20	International experience	10
Being adaptable/outside comfort zone	19		
International perspective, such as exposure to poverty	18		
Developing independence	11		
Developing confidence	11		

Additional personal benefits mentioned, but with a frequency of less than 10, included enjoyment, snorkelling, SCUBA, problem solving, critical thinking, learning about oneself, facing fears, being self-disciplined, and managing one's time. Other professional benefits mentioned included critical thinking, problem solving, learning educational techniques, being adaptable, having endurance, development of work ethic, leadership development, independent thinking, and writing for publication.

One question asked respondents to list any specific skills they learned during the course that they have applied elsewhere. There was significant overlap with the themes listed in Table 2, but unique skills reported were technical writing, oral communication, observation, data analysis, sampling strategies, and plant identification and description.

Discussion

The findings of this study suggest that scientific fieldwork in an international setting is an important aspect of the college experience and has long-term impacts on the personal and professional development and international perspective of learners. While DeDee and Stewart (2003) found that there was a decline in perceived impacts over time in student participants, this research found that there was no change over time. This was one of the few studies of its kind that includes both qualitative and quantitative data to evaluate student impact. While the quantitative data are very helpful in analyzing differences between groups, the qualitative data tell the story more descriptively.

Respondents commented on the both personal and professional benefits of the experience of working on a student team, working independently, collecting and interpreting data, communicating scientific information, being flexible and adaptable, problem solving,

among many other skills and benefits. These are what define fieldwork (Rydant et al., 2013), and are the types of skills which employers and graduate schools are seeking in applicants (National Association of Colleges and Employers, 2016). Eyler (2009) suggests that experiential learning activities such as fieldwork, helps students transition more smoothly from college to work because of the skills and perspectives they develop as they actively participate.

Some student responses very clearly explain the importance of the international exposure and provide evidence of the impact on their personal and professional lives. Three samples are included here:

The experience me [*sic*] and my fellow students had was so valuable for many reasons. As young scientists, it is very important to get out and experience different environments and field experiences, so that new knowledge and connections can be formed and perspective can be expanded and challenged...both scientists and non-scientists can gain so much from international field experiences, such as greater appreciation and love for the world and the organisms and human cultures in it and a desire to help preserve them.

Hands-on learning can't be replicated in a classroom setting. The people, culture, and environment immersion allows for a high quality learning that is unforgettable. It made me hungry for travel and to see other parts of the world and be humbled and thankful for all that we have/are able to do. I feel very lucky and fortunate every day! Andros Island is near and dear to my heart, and it takes unique individuals who love what they do to lead a field course year in and year out. I'm very grateful to have experienced the

Flora of The Bahamas course in so many ways – Thank you!

The field course introduce [*sic*] me to the possibility of conducting research in another country. It allowed me to get to know The Bahamas, see various locations of interest, and learn more about ecology and biology of the islands. I chose this location for my dissertation research and my continued scientific research. As a professor, I have also developed my own Tropical Ecology course which I have taught 5 times in The Bahamas, most recently with a co-instructor from my college. Several undergraduate research projects have come out of my field course.

While some qualitative themes related to the benefits of fieldwork in general, other themes were specific to working in The Bahamas. Students commented on the impact of learning about the Bahamian subtropical environment such as the flora and marine life, even listing specific plant families that they learned about. A number of respondents are educators, K-12 teachers and college professors, and commented on using information they learned in the course with students in their own classes. At least 9 former students take university groups of their own to the Bahamas (Eshbaugh, 2014). Many students mentioned that the research in The Bahamas was impactful on their career direction. Because research is a required component of these courses, much research has been published by these students over the years, contributing greatly to the scientific literature concerning / based on The Bahamas. Students at UTC are required to present their work at either the annual UTC Research Dialogues event or the Tennessee Academy of Sciences annual meeting, and this activity helps develop data analysis, interpretation, and presentation skills in students and promotes their work across campus and

throughout the state. As mentioned previously, there have been numerous master's theses and doctoral dissertations at MU based on research conducted in The Bahamas and resulting in publications.

Some respondents commented that they would have appreciated more interaction with the Bahamian people and culture. Immersion in Bahamian culture is the highest ranked theme of personal impact. Throughout their experience, students learn about and reflect upon the food, religion, work, healthcare, education, and recreation of the people of the Family Islands. For example, the islands rely heavily on imported goods, and this is often attributed to the history of colonialism (Palmer, 1994; Sealey, 1990). Students are surprised by the cost of food and other supplies in local stores, and this helps them realize that imported goods come at a cost and that, as compared to the United States, a larger proportion of income on the islands goes toward meeting basic needs. Because Bahamians cook the meals at the field stations, students are introduced to some traditional foods such as pigeon-peas and rice, Johnny cake, baked macaroni and cheese, freshly baked bread, and stewed meats, as well as some local fruits including sapodilla, wild dilly, pigeon-plum, passion fruit, sugar-apple, and tamarind. Students sometimes have the opportunity to attend church services and take part in recreational activities such as rake-n-scrape, which gives them a deeper connection with the Bahamian people.

The importance of tourism as a leading industry is easily seen on the Family Islands. On San Salvador, many Bahamians work at Club Med, and on Andros, there are quite a few resorts and lodges. On Andros, a visit to the batik factory and dinner at a local restaurant provide student exposure to local people and their work. Often, resident craftsmen from Red Bays on the northwest side of Andros visit Forfar in the evening to

sell students their unique baskets made from silver-top palm as well as wood carvings made from native tree species, mahogany or horseflesh. The baskets are a lesson in culture because they are “born from two distinct cultures, Seminole and Black slave descendants that established and settled in the community in the 1800s” (Eshbaugh, 2014, p. 191). Likewise, local craftsmen on San Salvador visit the GRC around dinnertime to sell their goods such as wood carvings and handmade jewelry (Figure 3).



Figure 3: Local wood carver, Kenny Whitfield, at his home in Sugar Loaf, San Salvador.

The limited availability of healthcare on these islands is impressed upon students before travel. While a basic health clinic is available, serious health issues and emergencies require a flight to Nassau. This can lead to a discussion of traditional and natural remedies. One of the most memorable exchanges on Andros that many MU students commented about in the survey was a visit with a local bush medicine practitioner, Mrs. Amelia Marshall, who is now deceased. Students would talk with her about the plants she utilized to treat common illnesses and gain incredible insight from her ethnobotanical experience.

To learn more about the Bahamian educational system, UTC courses have incorporated a visit to San Salvador High

School over the past few years. The visit usually happens during the science fair when junior high and high school students present their science research projects. UTC students often comment on the San Salvadorian students’ resourcefulness in using common household items to conduct research experiments, and the lack of current technology and basic school supplies is impressed upon them.

While Andros and San Salvador are very different islands, there are enough similarities to produce no statistically significant difference in how students responded about their experiences. Students equally rated the personal impacts, professional impacts, and international perspective, no matter which island they visited. In the open-ended questions, students visiting Andros tended to comment more about the tropical flora of the island and students visiting San Salvador tended to comment more about the marine environment, and this seems to be related to the focus of each course. MU’s botany course was held on Andros most years, while UTC’s tropical ecology course was held on San Salvador.

The current study provides further evidence of the importance of experiential learning during the college experience. Active engagement outside of the classroom can provide a learning experience that is powerful and helps students achieve intellectual goals (Eyler, 2009; Younes & Asay, 2003). According to Perrin (2014), successful experiential learning programs have three components: learner autonomy, accountability / real-world implications, and peer support. In these field courses, students have autonomy in making decisions about independent and/or team research projects, they are accountable for their work such as the “tedious” field notebooks, and they are involved in team projects during which they give and receive peer feedback. The scope of these components

was evident in the student responses to the survey. Moreover, these field courses include critical reflection, which is integral to the learning process in experiential learning activities (Kolb, 1984).

Considering rising costs and liability issues, these findings about long-term course impacts on student participants should prove useful for university administrators in decision-making related to supporting similar programs. International field courses can be very expensive for students, especially those who are supporting themselves. While both field stations—Forfar and the GRC—have kept their costs reasonably low for student room and board, travel expenses have greatly increased over the past several years, making it a challenge for students; it is no surprise that cost is an important factor that students give serious consideration to when contemplating international study (Zhai & Scheer, 2002). MU historically allowed graduate students to take Bahamian field courses at a reasonable cost with tuition waivers; however, the funding model changed in 2006, which made it difficult to run a low enrolment course in a way that covered its costs, while keeping expenses low for graduate students (Eshbaugh, 2014). MU's Tropical Flora of The Bahamas course was last offered in 2008 because of this challenge; however it is planned to be taught again in January 2018.

At UTC, the current Bahamian field course—a blend of biology, environmental science, and geology—has recently been offered through the Honors Program and this program has assisted students by paying for flights, while also supporting faculty pay and travel. Starting in 2016 at UTC, an international fee has been assessed to students and some of these monies will be used to provide student assistance for international travel courses based on financial need.

While much was learned from this study, there were limitations. Contact information was not available for all former students, resulting in a smaller group of potential respondents. The survey was administered online only (no paper surveys or interviews) so some potential respondents may not have been able to complete the survey. The survey could be completed on a computer or mobile device, so more brief answers may have been given to open-ended questions when completing on a mobile device. To obtain more granular data such as specific information about what was learned about Bahamian culture, focus groups or one-on-one interviews could be done in a future study. While hundreds of students have participated in the Bahamian field courses over the years, it is our hope that even more students will be able to experience this life-changing experience.

References

Bahamas National Trust. (n.d.). Green turtle.

Available at

<http://bnt.bs/wildlife/reptiles/turtles/green-turtle/>

Berman, M. J., & Gnivecki, P. L. (1995). The colonization of the Bahama archipelago: A reappraisal. *World Archaeology*, 26(3), 421-441.

<https://doi.org/10.1080/00438243.1995.99>

[80285](https://doi.org/10.1080/00438243.1995.99)

Berman, M. J., Gnivecki, P. L., & Pateman, M. P. (2013). The Bahama archipelago. In W. F. Keegan, C. L. Hofman, & R. Rodriguez Ramon (Eds.), *The Oxford handbook of Caribbean archaeology* (pp. 264-280). New York: Oxford University Press.

<https://doi.org/10.1093/oxfordhb/9780195392302.013.0085>

- Blick, J. P. (2007). Pre-Columbian impact on terrestrial, intertidal, and marine resources, San Salvador, Bahamas, A.D. 950-1500. *Journal for Nature Conservation*, 15, 174-183. <https://doi.org/10.1016/j.jnc.2007.04.004>
- Carew, J. L., & Mylroie, J. E. (1995). *Geology and karst of San Salvador Island Bahamas: A field trip guidebook*. San Salvador, Bahamas: Gerace Research Center.
- Craton, M. (1986). *A history of The Bahamas*. (3rd ed.). Waterloo, Ontario: San Salvador Press.
- DeDee, L. S., & Stewart, S. (2003). The effect of student participation in international study. *Journal of Professional Nursing*, 19(4), 237-242. [https://doi.org/10.1016/s8755-7223\(03\)00086-3](https://doi.org/10.1016/s8755-7223(03)00086-3)
- Dewey, J. (1938). *Experience and education*. New York: Macmillan.
- Dupraz, C., Fowler, A., Tobias, C., & Visscher, P. T. (2013). Stromatolitic knobs in Storr's Lake (San Salvador, Bahamas): A model system for formation and alteration of laminae. *Geobiology*, 11, 527-548. <https://doi.org/10.1111/gbi.12063>
- Eshbaugh, W. H. (2014). The flora of the Bahamas, Donovan Correll, and the Miami University connection. *Botanical Review*, 80, 184-203. <https://doi.org/10.1007/s12229-014-9141-3>
- Eshbaugh, W. H., & Wilson, T. K. (1996). On the need to conserve Bahamian floral diversity. In N. B. Elliott, D. C. Edwards, & P. J. Godfrey (Eds.), *Proceedings of the Sixth Symposium on the Natural History of the Bahamas* (pp. 77-82). San Salvador, Bahamas: Bahamian Field Station. Retrieved from http://www.geraceresearchcentre.com/pdfs/6thNatHist/163_Deyrup_6thNatHist.pdf
- Eyler, J. (2009). The power of experiential education. *Liberal Education*, 95(4), 24-31. Retrieved from <http://files.eric.ed.gov/fulltext/EJ871318.pdf>
- Farr, M., & Palmer, R. (1984). The blue holes: Description and structure. *Cave Science*, 11(1), 9-22.
- Garcia, C. V., Robertson, W. H., Lougheed, V., Tweedie, C., & Velasco, A. (2013). Journey to the end of the Earth: Academic and professional benefits for students participating in a field-based research program in Antarctica. *Journal of College Science Teaching*, 42(4), 72-81. Retrieved from <http://www.jstor.org/stable/43631925>
- Gerace Research Centre. (2017, June). The 2nd Joint Symposium on the Natural History and Geology of the Bahamas: Abstracts and programs. Retrieved from <http://geraceresearchcentre.com/pdfs/2017JSNHGProgram.pdf>
- Gerace, D. T. (2014). The Gerace Research Center, San Salvador, Bahamas, 1971-2007. *International Journal of Bahamian Studies*, 20(1), III 34-40. <https://doi.org/10.15362/ijbs.v20i2.218>
- Hayes, W. K., Cyril, S., Crutchfield, T., Wasilewski, J. A., Rothfus, T. A., & Carter, R. L. (2016). Conservation of the endangered San Salvador rock iguanas (*Cyclura rileyi rileyi*): Population estimation, invasive species control, translocation, and headstarting. *Herpetological Conservation and Biology*, 11 (Monograph 6), 90-105. Retrieved from http://www.herpconbio.org/Volume_11/Monograph_6/7-Hayes_et_al_SanSalvador_2016.pdf

- International Field Studies. (2016). Forfar Field Station. Retrieved from <http://www.intlfieldstudies.org/forfar-field-station/>
- Keegan, W. (1985). *Dynamic horticulturalists: population expansion in the prehistoric Bahamas*. (Unpublished doctoral dissertation) University of California, Los Angeles.
- Knapp, C. R. (2015). Staying high and dry: A unique nesting strategy for an insular iguana. *Frontiers in Ecology and the Environment*, 13(2), 114-115. <https://doi.org/10.1890/1540-9295-13.2.114>
- Kolb, D. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
- Kornicker, L. S. (1963). The Bahama Banks: A "living" fossil-environment. *Journal of Geological Education*, 11(1), 17-25. <https://doi.org/10.5408/0022-1368-11.1.17>
- Martin, C. H., & Wainwright, P. C. (2013). A remarkable species flock of Cyprinodon pupfishes endemic to San Salvador Island Bahamas. *Bulletin of the Peabody Museum of Natural History*, 54(2), 231-240. <https://doi.org/10.3374/014.054.0201>
- McLaughlin, J. S., & Johnson, D. K. (2006). Assessing the field course experiential learning model: Transforming collegiate short-term study abroad experiences into rich learning environments. *Frontiers: The Interdisciplinary Journal of Study Abroad*, 13, 65-85. Retrieved from <http://files.eric.ed.gov/fulltext/EJ891485.pdf>
- Moultrie, S. (2013). The Bahamas national invasive species strategy 2013. Nassau: Department of Marine Resources. Retrieved from <http://www.friendsoftheenvironment.org/wp-content/uploads/2012/08/Bahamas-Revised-NISS-2013-FINAL.pdf>
- National Association of Colleges and Employers. (2016). Job outlook 2016: The attributes employers want to see on new college graduate resumes. Retrieved from <http://www.naceweb.org/career-development/trends-and-predictions/job-outlook-2016-attributes-employers-want-to-see-on-new-college-graduates-resumes/>
- National Oceanic and Atmospheric Administration. (2017). National Hurricane Center latitude/longitude distance calculator. Retrieved from <http://www.nhc.noaa.gov/gccalc.shtml>
- Nickrent, D. L., Eshbaugh, W. H., & Wilson, T. K. (2008). Vascular flora of Andros Island, Bahamas. Retrieved from <http://nickrentlab.siu.edu/NickrentPDFs/AndrosFloraSm.pdf>
- Palmer, C. A. (1994). Tourism and colonialism: The experience of the Bahamas. *Annals of Tourism Research*, 21(4), 792-811. [https://doi.org/10.1016/0160-7383\(94\)90084-1](https://doi.org/10.1016/0160-7383(94)90084-1)
- Park, S., Jang, J. Y., Chen, Y. C., & Jung, J. (2011). Is pedagogical content knowledge (PCK) necessary for reformed science teaching? Evidence from an empirical study. *Research in Science Education*, 41(2), 245-260. <https://doi.org/10.1007/s11165-009-9163-8>
- Pence, H. M., & Macgillivray, I. K. (2008). The impact of an international field experience on preservice teachers. *Teaching and Teacher Education*, 24(1), 14-25. <https://doi.org/10.1016/j.tate.2007.01.003>

- Perrin, J. (2014). Features of engaging and empowering experiential learning programs for college students. *Journal of University Teaching and Learning Practice*, 11(2), 1-12. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1040736.pdf>
- Pimiento, C., Nifong, J. C., Hunter, M. E., Monaco, E., & Silliman, B. R. (2015). Habitat use patterns of the invasive red lionfish *Pterois volitans*: A comparison between mangrove and reef systems in San Salvador, Bahamas. *Marine Ecology*, 36(1), 28-37. <https://doi.org/10.1111/maec.12114>
- Rodgers, J. S. (2005). The distribution of Casuarinas on San Salvador, The Bahamas. *Southeastern Geographer*, 45(2), 222-238. <https://doi.org/10.1353/sgo.2005.0031>
- Rose, R. (1987). Lucayan lifeways at the time of Columbus. In *Proceedings of the First San Salvador Conference* (pp. 321-339). San Salvador, Bahamas: College Center of the Finger Lakes, Bahamian Field Station. Retrieved from http://www.geracerearchcentre.com/pdfs/1stColumbus/321_RoseR_1stColumbus.pdf
- Rouse, I. (1992). *The Tainos: Rise and decline of the people who greeted Columbus*. New Haven, CT: Yale University Press.
- Rydant, A. L., Cusack, C., Smith, J. P., Shiplee, B. A., & Middlekauff, B. (2013). Student perceptions of fieldwork utility across three international field courses. *Review of International Geographical Education Online*, 3(2). Retrieved from <http://dergipark.ulakbim.gov.tr/rigeo/article/view/5000041494/5000039024>
- Rydant, A. L., Shiplee, B. A., Smith, J. P., & Middlekauff, B. D. (2010). Applying sequential fieldwork skills across two international field courses. *Journal of Geography*, 109(6), 221-232. <https://dx.doi.org/10.1080/00221341.2010.502945>
- Sealey, N. E. (1990). *The Bahamas today: An introduction to the human and economic geography of The Bahamas*. London: Macmillan Educational.
- Seimears, C. M., Graves, E., Schroyer, M. G., & Staver, J. (2012). How constructivist-based teaching influences students learning science. *The Educational Forum*, 76(2), 265-271. <https://doi.org/10.1080/00131725.2011.653092>
- Small Hope Bay Lodge. (2012). Hawksbill turtles in The Bahamas. Available at <http://smallhopebay.blogspot.com/2012/12/hawksbill-turtles-in-bahamas.html>
- Smith, R. L. (2010). Invasive alien plant species of The Bahamas and biodiversity management. (Unpublished master's thesis) Miami University, Ohio. Retrieved from https://etd.ohiolink.edu/!etd.send_file?accession=miami1275062320&disposition=inline
- Smith, R. R. (1993). *Field guide to the vegetation of San Salvador Island, The Bahamas*. (2nd ed.). San Salvador, Bahamas: Bahamian Field Station. Retrieved from http://geracerearchcentre.com/pdfs/VegetationGuideSanSal_RRSmith.pdf
- Willard-Holt, C. (2001). The impact of a short-term international experience for preservice teachers. *Teaching and Teacher Education*, 17(4), 505-517. [https://doi.org/10.1016/s0742-051x\(01\)00009-9](https://doi.org/10.1016/s0742-051x(01)00009-9)

- Younes, M. N., & Asay, S. M. (2003). The world as a classroom: The impact of international study experiences on college students. *College Teaching*, 51(4), 141-147. <https://doi.org/10.1080/87567550309596429>
- Zhai, L., & Scheer, S. D. (2002). Influence of international study abroad programs on agricultural college students. *Journal of International Agricultural and Extension Education*, 9(3), 23-29. Retrieved from <https://www.aiaee.org/attachments/article/267/Vol-9.3.pdf#page=25>
- Zorn, C. R., Ponick, D. A., & Peck, S. D. (1995). An analysis of the impact of participation in an international study program on the cognitive development of senior baccalaureate nursing students. *Journal of Nursing Education*, 34(2), 67-70. <https://doi.org/10.3928/0148-4834-19950201->