Becoming global-minded scientists: The short- and long-term impacts of international exchange

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Abstract

Research on international exchange demonstrates multiple positive outcomes for participating students. Using data collected from the participants of a Youth TechCamps program, the research questions are squarely focused on how international experience impacts learners' understanding of the world and their new cultural awareness. The working hypothesis is that the experiences of working with international peers will influence students' perceptions and understanding about global matters. This article adds to the literature by showing that some changes have an influence in the short-term while others persist and

have a long-term impact. Specifically, the difference between short- and long-term impacts relates to how students integrate those changes. The former is passive (*i.e.,* I understand differences exist among people) while the latter mark intentional change (*i.e.,* I incorporate attractive components of another culture to ways of doing things). The findings are couched in research that brings together students in the U.S.A., Bolivia, Panama, and South Africa.

Keywords: international exchange, cultural awareness, cultural sensitivity, high school students

Introduction

How do our perceptions of people and different cultures impact the way we behave and treat others? This is an important question as cultural capital influences the way we think about, speak to, and engage with people of a different background. Geography education offers a strong contribution to the way we understand the world, from formal classes about the world to informal knowledge acquisition through travels or National Geographic media. At the root of geographic literacy, we consider how to understand people and places, and the differences across boundaries that separate cities, states, and countries. The future promises a society that will face complex issues as a result of continued globalization, increasing movements of a growing population, interconnections between people and places, as well as potential new cultural conflict arising from global change or decreasing resources. How prepared are students, whether in the U.S.A or abroad, to understand this landscape, let alone be at the helm to lead globally?

One measure to approach answering this question is through standardized testing of students' geography knowledge, although if this is any suggestion of students' ability to make informed decisions, it is not promising. Students in the U.S.A. perform poorly on national geography tests (National Center for Education Statistics, 2011), in international assessments (Trivedi, 2002), and young adults are equally baffled by geography in public surveys (Growth For Knowledge, 2006).

The question of student preparedness to lead was an impetus to the project *Global Connections and Exchange Program Youth TechCamps* (from heron referred to as 'Youth TechCamps'), funded by the State Department Youth Programs Division. The authors' curiosity ranges from how problem-based contexts could fulfill learning standards in geography (Solís et al., 2017) with one focus on geospatial technology and global climate change (Solís et al., 2019). Youth TechCamps was designed around an immersive 2-week international

exchange for high school learners to focus on climate change and geospatial technologies. Another critical focus of the program was to examine how cultural exchanges influence learners' perceptions of people and places in different learning situations.

The Youth TechCamps stands out because unlike many of the international exchange studies, which are between member countries of the OECD, specifically between wealthy countries, this research involved developing countries. Through this program, high school youth from the U.S.A., Bolivia, Panama, and South Africa developed deep knowledge about geospatial technologies and how to apply them in service to their communities. Participants were emerging science students applying a science and geography lens to their practice while gaining a deeper understanding about different cultures of the world.

The Youth TechCamps experience was created by following an 'overdetermined design', (Solís et al., 2019) where redundant steps in the research method increase the likelihood of having the desired results of improving students' confidence in STEM, geospatial technologies, and cultural knowledge Two instruments were used to collect in-depth answers about participants' exchange and reflections. The first instrument consisted of a 21-question survey with Likert scale options about participant perception of cultural perspectives, impact of science to society, and climate change knowledge. The second instrument, given to all participants, U.S.A. and foreign participants, at the end of their experience, was a set of open-ended questions. The research outlined here is squarely focused on how this international experience impacts students' understanding of the world and their newfound cultural awareness. The authors hypothesize that the experiences of working with international peers will influence students' perceptions and understanding about the world's people and cultures. The desired outcome is for the students to see a problem from multiple perspectives, be open to learn from those with a different approach than their own, and to be able to ask research questions that encompass diverse viewpoints. The program offered the opportunity as a qualitative experiment to observe how global-minded scientists are nurtured and what their learning process looks like when it unfolds in an international exchange context.

This paper begins by situating the research in the literature on international exchanges and their impact on learners. This is followed by a description of the data collection methods and of the participants in the program. Next, the results section provides a comparison between pre-, post-, and final-test surveys and descriptions alongside the changes (or lack thereof) in student learning as a result of this international experience. Finally, a discussion of findings is followed by a conclusion of lessons learned and a call for future research.

Literature review

The experience of taking part in an international exchange has resulted in multiple positive outcomes for students involved. Through immersion in another culture, students adapt to and learn to appreciate differences across cultures. This impact translates into adolescent development which results in overall wellbeing and psychological health (Lawford et al., 2012), the workplace (Crossman and Clarke, 2010; Rapoport, 2008; Duffy et al., 2005; Neander and Markle, 2005; Inkson and Myers, 2003). Its impact is long-lasting, as shown by studies that examine children or teenagers who have participated in such experiences (Peiser, 2015; Zhu et al., 2011; Zsiray et al., 2001). Bachner and Zeutschel (2009) followed a group of 14-18-year olds after their US-German exchange. The positive impacts, which include improved self-confidence and autonomy, were maintained years after the experience. Students generally found that the exchange created opportunities to build friendship and improved communication skills (Yang et al., 2013; Bishop, 2009). Generally, the literature suggests that international exchanges have positive long-term effects on student confidence, ability to accept cultural and language differences and the learners were passionate about global citizenship.

The literature also suggests that students in exchanges benefit both in the short- and long-term. Whereas such gains as developing friendships and building cultural capital are immediate measures of a successful experience, follow-up studies posit that participants gain both explicitly and implicitly weeks to a few years after the experience. Over a thirty-year period, Bachner and Zeutschel (1994) conducted follow-up studies on high school students, in Germany and U.S.A., who had travelled to the partner country. The researchers found that this experience helped students develop personal traits (*e.g.,* self-confidence, acquire resources for problem solving, self-reliance), abilities and skills (*e.g.,* research techniques, foreign language proficiency, leadership abilities, knowledge of German culture) as well as education and career choice (*e.g.,* influence their career choice, enrolment and completion of undergraduate degree, choice of specialization in graduate studies). In another longitudinal study, Paige et al. (2009) found short- (one to five years after experience) and long-term outcomes (six years and more after experience) from undergraduate students' study abroad participation. The results, derived from quantitative and qualitative data, support the notion that the international exposure played an important role in their societal engagement. The authors classified these types of engagements into five classes (civic engagement, voluntary simplicity, knowledge production, philanthropy, and social entrepreneurship) as well as educational and career choices.

The positive impact of exposure and interaction with different cultures is not limited to those found in a structured format. Travel, even if not part of an exchange program, also has similar positive improvements in being open-minded

and feeling comfortable with people of diverse backgrounds (Scarinci and Pearce, 2012; Abarbanel, 2009).

Access to cultural capital is increasingly essential in public and private sectors, to better serve 'clients' and collaborate with international and national partners. For example, cultural awareness and the ability to work with diverse stakeholders are valued in the field of research. Where national and international collaborations occur, with the latter seeing higher citation impacts (Adams, 2013) that enrich research quality and production (Martinez et al., 2015). Adams' (2013) research on international collaboration found that research with partners outside of one's home country has increased in the last 30 years. The benefit to researchers is that international co-authored papers are cited more often than purely domestic publications. In the U.S.A., papers published with at least one author from another country was cited 22% and 36% more than domestic papers in 2001 and 2011, respectively (Adams, 2013). What motivates researchers to work with colleagues across borders? Some studies point to similarities in researchers' culture and language to be a driving force for collaboration (Adams et al., 2014; Boshoff, 2010), giving value to international experiences, which are known to foster cultural awareness and language acquisition (Jokisch, 2009).

The literature provides strong evidence that international exchanges positively impact learners' sensitivity towards diversity, regardless of the age of the learner. The literature supports the notion that short study abroad experiences foster cultural awareness and the ability to reason differences (Zhu et al., 2011; Ellenwood and Snyders, 2010; Jackson, 2009). However, few research studies examine this longitudinally with exception (*e.g.,* Bachner and Zeutschel, 2009; Paige et al., 2009; Duffy et al., 2005) where much of the literature, although supporting positive impact of international exchange, is focused on immediate or short-term gains. Unfortunately, this reflects the current reality of conducting research with school-aged learners, given the increasing difficulty to access this population and to acquire ethics approval.

Overall, research on international exchange suggests that learners' post-experience has a positive shift in their personal as well as professional spheres. What is less often discussed in these studies is how these gains might influence their engagement with geographic understanding of people and places over time. Within the geography education literature, few studies delineate which are the short- and long-term gains from exposure to cultural differences. This article addresses these paucities directly, especially in a geographic context, while calling for more research and better methods to answer questions about the potential gains from international exchange experiences.

Methodology

This study used a mixed-methods approach. The first instrument consisted of a 21-question survey with Likert scale options about participant perception of cultural perspectives, impact of science to society, and climate change knowledge. Two statistical operations, Wilcoxon signed-rank test and Friedman test, were used to determine significance in the results. Only results of the cultural perspectives survey will be discussed here.

The second instrument, given to all participants, U.S.A. and foreign participants, at the end of their experience, was a set of open-ended questions. These were used to collect in-depth answers about their exchange and reflections.

This section begins with a description of how quantitative data were collected and analyzed. This includes an overview of the surveys and its dissemination timeline, followed by the hypotheses tested in the research. Next, a discussion details how the qualitative data were collected and analyzed. Finally, a profile of the participants is summarized.

Quantitative data collection

The 21-question survey borrows questions from a cultural sensitivity questionnaire developed by Olson and Kroeger (2001). The selected questions were specifically about responders' perceptions of culture. In total, surveys from three different time points were collected from U.S.A. participants, with response rates ranging from 100% (pre-test) to 50% (post-test) to 80% (final-test). Due to the extreme lack of time during orientation for international students and the challenges connecting to some students via digital communication, they did not complete a pre-survey. However, they participated in a post-survey that was released at the same time as that for U.S.A. students. For this reason, the quantitative analyses are focused on the U.S.A. students who provided pre-, post-test data for comparison.

A pre-test and two post-evaluations were conducted to measure participants' experiences abroad. All U.S.A. students responded to the online pre-survey (100% response rate) during an allotted period at the orientation, prior to departure. Of the sample, 69% of the respondents were female (n=22) while 31% were males (n=9). These students were generally well travelled outside of their home state, with a median of three trips per year. Reported international travel ranged from 1 to 5 per year but just over half had never left the country prior to this trip (55%) while 69% of respondents had a passport prior to the Youth TechCamps.

Approximately 6 weeks after returning from the program, U.S.A. students were surveyed again (referred to as 'post-test' from hereon). Fifteen survey responses were collected from five male and 10 female participants (50% response rate).

Nine months after their return, the same post-survey was sent out (referred to as 'final- test' from hereon). Twenty-four complete surveys were collected from 7 male and 17 female participants (80% response rate).

The authors sought to measure whether the Youth TechCamps participation had any impact on a shift in U.S.A. students' perception, understanding, and action towards international matters. The dataset includes all responses from complete surveys collected at three time periods: before departure, six weeks after return, and nine months upon return. The hypotheses and statistical tests are elaborated below.

Test 1: To identify whether the intervention (*i.e.,* Youth TechCamps) had any immediate impact on student perception and interaction with peers of different culture(s). The tests examined whether statistical differences exist between responses provided in the pre-test and post-test questions. The non-parametric Wilcoxon signed-rank test was used to compare paired responses, between 12 students who answered both the pre-test and post-test, as it enabled us to conduct paired comparisons in a context in which the sample size was small and data could not be assumed to follow a normal distribution (Howell, 2008; Siegel and Castellan, 1988).

The hypothesis is that the intervention would produce an increase in overall respondent confidence in their understanding of differences and similarities across cultures. A one-tailed method was used. Twelve students completed both pre-test and post-test. Gender differences on this particular topic were not considered, as a separate test showed no statistical difference between female and male responses. Furthermore, the number of female respondents (n=8) was much higher than that of males (n=4).

Test 2: To identify whether the intervention (*i.e.,* Youth TechCamps) had any long-term impact on students in general, whether it be personal worldview or way of being. The tests examined whether statistical differences exist between responses provided in the pre-test and final-test questions, the latter that was conducted 9 months, labelled as 'final- test', after students returned from the trip. The non-parametric Friedman test was used to compare paired responses, between 11 students who answered the pre-test and post-test and final-test. The Friedman test was selected because it enables conducting repeated measure analysis when normality of data cannot be assumed or when sample size is small (Howell, 2008; Siegel and Castellan, 1988).

The hypothesis is that the intervention would influence some element of their personal view or interaction with different cultures. A one-tailed method was used. Data from eleven students who completed all three surveys were used. Gender differences were not considered on this particular topic as a separate test showed no statistical difference between female-male responses. Furthermore, the number of female respondents (n=8) was much higher than that of males (n=3).

There are two limitations in this study, both related to the data collection process. First, not all participants completed the three surveys. Second, post-test participation was lower compared to the pre-test, although the final-test response rates returned to a high level. Thus, not all views were represented over the mid-term comparison. Nevertheless, sufficient responses were generated across the groups to permit descriptive quantitative assessment and qualitative interpretation of results.

Qualitative data collection

The post-survey for all participants included nine open-ended questions, which were developed for the Youth TechCamps program. Specifically, the questions were designed to solicit feedback on student's experience working with peers of different cultures, immediate gains from the program, and any impact to future plans. The questions were sent 6 weeks after the conclusion of the Youth TechCamps, yielding a 50% response rate from U.S.A. students (15 received from 30 participants). Twenty-nine responses were received from international students (33% response rate), almost half from Panama (n=15 out of 29), followed by Bolivia (n=7 out of 30), and South Africa (n=6 out of 27).

Responses from all participants were compiled, by question, resulting in a rich set of qualitative data. The analysis was performed by a single researcher who combed through the data using the grounded theory approach (Charmaz, 2006). The process was iterative and refined by the emergence of words and ideas that repeatedly popped up in the data. The researcher looked at overall common themes from all participants and also took note of differences, if any, between USA and international participants. The selection of qualitative themes was informed by author participation in national level geographic research agendas to discover a road map for establishing disciplinary learning progressions (Huynh et al., 2015).

The themes were brought to two colleagues for discussion: Principal Investigator (PI) of the project and lead project evaluator. Due to their intimate knowledge of the program and close communication with the participants, the PI was able to validate the interpretations with respect to conformity to the implementation framework and vet that the surfaced themes were comparable to those observed and heard from participants during the Youth TechCamps. Finally, the lead evaluator, who is removed from the operation of the project, provided a neutral space to discuss ambiguous responses and how to group findings, particularly in ways that inform the current literature gap.

Participants

Participants from the U.S.A were outstanding high school students who were selected to team up with counterparts in Bolivia, Panama or South Africa. They collaborated online and in person at one of the three rounds of training

events to address the theme of *Geotechnologies for Climate Change & Environment*.

A total of 116 students participated, with 30 from the U.S.A, 30 from Bolivia, 29 from Panama and 27 from South Africa. While the international students participated in their own country, 10 U.S.A. students went to one of the three host countries (Table 1). Of the U.S.A. group, 63% (n= 19) were female, while this number was 55% (n=47) for the International students. Their ages range between 15-18 years old. Participants were competitively selected for this program from across the country, attendees primarily coming from the east and central U.S.A. compared to the south and west. Residence of students from Bolivia, Panama, and South Africa was clustered around the large cities.

Table 1. Number of student participation, by country

Participants	***Host Country***		
	Bolivia	*Panama*	*South Africa*
U.S.A.	10	10	10
Bolivia	30	-	-
Panama	-	29	-
South Africa	-	-	27
Total participants	***40***	***39***	***37***

Results

Comparison of pre-, post-, and final-tests of U.S.A. participants

Table 2 compares the responses between two timeframes: 1) pre-and post-tests and 2) pre- and final-tests. The second column ['Immediate impact of intervention (Pre-test to Post-test)'] shows statistically significant differences that were found in 3 survey questions, with scores increasing from the pre-test to post-test, namely questions 3, 5, and 10. The third column ['Long-term impact of intervention (Pre-test to Final-test)'] shows statistically significant differences in 3 survey questions, detected by the Friedman test. This means that differences were found across the pre-test, post-test and final-test in survey questions 4, 6, and 8. It is important to note that none of these 3 survey questions, from the post-test and final-test scores, dropped to the pre-test level.

Within the first six weeks of returning from the trip, the quantitative data suggests that the most immediate impactful influence was on their perception of people from different cultures. The essence is that people are the same, regardless of the outward appearance or lived culture, and that friendships are forged (Questions 3, 5, and 10). The second set of data collected 9 months after the return suggest that students practice personal reflection about one's views which have

the power to bring upon action such as questioning personal prejudices or incorporating aspects of a culture into one's life (Questions 4 and 6). Question 8 is statistically significant and suggests that students recognize the value or cultural importance to be fluent in a language other than their mother tongue.

Table 2. Comparison of responses between pre-, post-, and final-tests

Survey questions	**Immediate impact of intervention (Pre- to Post-tests)**[1] **(n=12)**	**Long-term impact of intervention (Pre-Post-Final-tests)**[2] **(n=11)**
1. I am aware of ways that I could raise awareness about my involvement in this program in my home city or		
2. I am able to temporarily give up my own worldview to participate in another worldview		
3. I understand that differences exist but believe that we should focus on similarities. We are all human	*(p = 0.0078; W = *28*)	
4. I question my own prejudices as well as all national and cultural stereotypes		*(p =0.0283; FS = 7.103)
5. I have long-term friendships with several people from other cultures	*(p = 0.0313; W = *19*)	
6. I incorporate the attractive aspects of other cultures into my own way of doing things		*(p =0.0213; FS = 7.517)
7. I have substantive knowledge about at least one other culture outside of the United States		

8. I am linguistically competent in a language other than my native language	*(p =0.0237; FS = 7.583)
9. I want to continue to learn about the world's peoples, cultures, and issues	
10. People are the same despite outward differences in appearance	*(p = 0.0098; W = *45*)

[1]Wilcoxon signed-rank test, One-tailed <0.05
[2]Friedman test, Two-tailed <0.05

Open-ended questions collected from all participants

Qualitative data are complementary to the quantitative data in Table 2 to enhance the understanding of the immediate and long-term impacts. Qualitative analyses, using grounded theory, were applied to the open-ended responses in the post-tests. Table 3 summarizes the survey questions posed followed by an expanded understanding of each theme based on aggregated student responses. The emerging themes include cultural awareness, outreach to peers and community, research and collaboration. Direct quotes are taken from surveys to illustrate students' thinking; no attempt has been made to correct grammar so as to preserve the participant's original writing.

Table 3. Themes from participant feedback

Theme	**Open-ended question(s)**
Cultural awareness	1. Having now worked with students from another country, how have your reactions or views to different cultures changed, if at all? 2. Describe your experience working within a team of diverse peers in the Youth TechCamps.
Peer education and community outreach	3. Please describe any specific action or activity you plan to do or have done as a result of your experience with the program? Are there any actions you have taken up or planned to do now that you are home? 4. What experiences or tools or skills that you developed during the Youth TechCamps do you plan to share or have you shared with friends or classmates?
Research and collaboration	5. Describe your experience working within a team of diverse peers in the Youth TechCamps.

Theme 1: Cultural awareness

The majority of participants described the Youth TechCamps experience as pivotal to their cultural sensitivity, expanded perspectives of other cultures, and more confidence engaging with different cultures. The international participants mentioned a number of interesting discoveries and enjoyed learning about such topics as U.S.A. dance, music, meals, fashion, school system, and climate.

The increased sensitivity to culture stems directly from interaction. International students admitted their biases and stereotypes about students in the U.S.A., but these were soon dispelled, and they quickly learned that there were many similarities. An international participant recalls their change in perception: "*At first I thought that Americans were all self-centered as they portray them in movies but opposite is the case the TechCamp helped me to see that we are all people with common goals in life*".

A second form of cultural sensitivity comes from the participants' reflection of past interaction with peers from different cultures and making a connection between geography, culture and behavior. A participant explained in their middle school, "*African students that were ostracized pretty badly because of how boisterous and playful they were. None of us Americans understood it, but after actually being in South Africa and seeing the difference in culture, I see it*."

Regardless of the participants' home country, many explained that they saw their peers as people, with similar dreams, hopes, and fears, despite the physical distance. It was also clear to them that despite economic differences among countries, peers are very similar. A representative quote is "*Everyone around me had similar plans for the future and ideas in general and it opened my eyes to the fact that there are people all around the world who want the same things for this planet that I do. I feel that there is a lot of potential power in that."*

Similar to developing sensitivity to cultural differences, participants have overwhelmingly noted that they have "*a new perspective on the lives of others around the world*." Since interacting with diverse peers and realizing that one's perspectives developed from media or other sources may not be correct, participants feel more comfortable visiting other countries as they will be able to relate to different ideas and perspectives. A consensus is that "*I've seen that at the end of the day transcontinental cultures have far more similarities than differences*." For some, the Youth TechCamps inspired students to appreciate and be curious about other cultures. As a result, generally, participants have become more open to immersing into different cultures than before.

Some students have taken the initiative to actively participate in their local culture. These ranged from being friendly and open to everyone to engaging and learning from cultures in the host country. One student from the U.S.A., an enthusiast of Hispanic music and Latino culture, described "*During another day, I had the pleasure of talking to a student about the various styles of dance in,*

including típico, and how these styles both came about and evolved-again this was in Spanish."

Theme 2: Peer education and community outreach

The Youth TechCamps have resonated with participants tremendously. As a result, the scale of action plans ranges from doing something for the self, for/with peers, and for the larger community. A list of these plans for the near future or items in action is summarized below:

Action for/with self

- Join the New Global Citizens club and Model U.N. club at school to continuously be involved with international issues.
- Study environmental issues, major in International Relations, with a goal to work for developing countries on social justice issues. This student mentioned that "*The experience completely changed the course of my life.*"
- Independently study effects of climate change and Spanish language.
- Plan to map the impact of mountaintop removal in Appalachia, Kentucky.
- Study abroad in college for the experience. This participant explains '*Now I want to do this so much more than I did before. It is now an official requirement of my college experience*.

Action for peers

- Initiate Earth club at school to plan a garden and teach students about food sustainability.
- Contribute ideas to class projects on climate change (GIS Analysis class), explained climate change to Geography class.
- Educate peers on the importance of individual action. For example, the idea of carbon footprint and ways to minimize this.
- Educate peers and community about reforestation and its value to the environment.
- Describe the experience of interacting with a new culture with family and friends.
- Continue interacting with friends from host nation and U.S.A. via Skype.
- Educate peers on technology (e.g., ERDAS, GIS, GPS etc).
- Involve with Green team at school.
- Start a GIS club at school and have contacted a local university for support.

Action for community

- Model after a Youth TechCamp project on sink holes at Centurion mall, will visit malls around the community to document evidence of sink holes (as a result of glacial retreat).
- Organize a clean-up day/trash pick-up day.
- Assemble a support group to reduce pollution in the community.
- Use GIS skills in local GIS group, part of 4-H program (leading one in the US).
- Interview organizations for school paper/blogs about climate change/GIS.
- Encourage school to participate in National Service Weather Program (Storm ready) that engages community readiness.
- Organize a book drive to raise money for children in low income areas. This idea is motivated by the participant's experience interacting with children on Mandela Day.

An example of a project a student initiated after participating in the Youth TechCamps:

> As a result of the program I have currently finished the first stage of an investigation project about the quality of water resources in the area we visited near the Zongo Glacier and Milluni Valley. The Project consists of the analysis of anions through out the current that flows from the Glacier to Lakes near by. I am testing the water in the Environmental Chemistry Lab UMSA (Universidad Mayor de San Andres). This project is to prove how great the contamination of mining is. In our second stage I will analyze cations and bacteria, and how soiled water with contaminants affects the glacier.

There were overlaps in ideas between International and U.S.A. peers, however, one difference was apparent: the location of their action. International students' outreach was generally in their community, such as picking up trash, organize groups of people for various activities. The U.S.A. participants also participated in some large group activities such as teaching about geospatial technology to peers, starting an Earth Club at school, but these are within a formal setting rather within the community.

Theme 3: Research and collaboration

The value of working in a team is apparent in participant answers. Overall, participants enjoyed working with peers from the host nation, building

"*lifelong friendships with people completely different*' from themselves. Similar sentiments provide evidence that the Youth TechCamps were "*incredible and life changing*".

Participants experienced an authentic situation where they worked with peers different from themselves, bringing forth perspectives, language proficiency, and life experiences. The majority of participants saw these differences as positive learning opportunities. A majority of participants saw value in different viewpoints and opinions because "*each of us came from completely different backgrounds and so we were able to bring unique suggestions to the table*." A concrete example given is of a team whose members, familiar with the state of local ongoing drought, supported the project with "*their knowledge of leading news-sites (such as La Prensa) which became invaluable during our data collection period*."

The language barrier was cited as an obstacle, but only a temporary one. Each team found ways to communicate their idea, such as through translation of a bilingual teammate. This was not left to chance; the program design was set up for teams to mediate this expected obstacle and facilitators actively placed team members where needed to facilitate this kind of communication. An exemplary quote is "*75% of the members did not speak English, it resulted in the best experience of my life by overcoming a challenge and creating lifelong friendships with people completely different from me*." Some participants understood "*That language barriers can't stop you from becoming friends.*"

Perhaps related to culture and language, were lessons on learning to compromise in a group with strong and differing opinions. The teams recognized this obstacle and either "*powered through it*" or worked it out. Again, this approach was reinforced by the program design, where facilitators were explicitly trained and decided to forgo intervening too soon to permit the learning experience to unfold, rather than prematurely solving problems of group dynamics at play. In all groups, the participants enjoyed working with their team and found it rewarding to find solutions to address issues. Many participants reported developing friendship and "*deep respect for each other grew*" from working long hours together.

Discussion

Supported by the quantitative (responses from U.S.A. participants) and qualitative datasets (responses from all participants), both U.S.A. and international participants demonstrated increased confidence and ability to work collaboratively, their keen interest to learn about culture, and reflection on cultural sensitivity. The changes measured included different results for short- and long-term impacts.

The grounded theory approach brought out a concept worthy of note, which may foreshadow gains from international exchanges. The authors propose the idea that short- or long-term changes are preceded by an internal awareness, an element of maturity. Unlike the Likert scale that can be quantified or the responses that can be analyzed qualitatively, the element of personal growth is a subjective observation by reading between the lines. A number of answers across the survey questions, demonstrated students' deep reflection and mindfulness such as taking on responsibility to improve the community. These responses shed light on the profound influence of the Youth TechCamps on participants' attitudes, thinking, perspectives, engaging with people and the world, and how they want to conduct themselves to make meaningful contributions in their communities. Such favorable shifts in engagement with a new culture seems to be a consistent outcome of international experiences observed in adolescents, regardless of exchange duration (Zhu et al., 2011; Zsiray et al., 2001). A powerful example from this project is that of Kayla Soren, a co-author of this article and a student from the U.S.A. who took part in the Panama camp.

Kayla is a co-founder of the International Student Environmental Coalition (ISEC) (https://www.isecoalition.org/about), a global youth climate change movement. Soren elaborates, "I know the program was absolutely life-changing and completely opened the door to international youth activism for me. I would not have founded the International Student Environmental Coalition if it weren't for the YouthTech Camp program!"

Personal growth comes in different forms, but always when the participant has an insight about themselves or a shift in their plans for the future or even attitudes about people outside of their home country. Time may be the filter that clarifies what learning is ephemeral and what persists and is incorporated into their thinking. For example, between the pre- and post-tests, U.S.A. students believed that they should focus on similarities rather than differences between people (Question 3) ('I understand that differences exist but believe that we should focus on similarities. We are all human'). This was statistically significant within 6 weeks of their return to the U.S.A but it did not persist longer than this. The same is true for Question 5 ('I have long-term friendships with several people from other cultures') and Question 10 ('People are the same despite outward differences in appearance'). Perhaps the short-term impact of these changes may be attributed to environmental factors. Travelling overseas, being part of a structured learning environment, and living in a new culture may have all been push-factors to interact with international peers, clearly a mandate of the Youth TechCamps. However, once the students returned home and perhaps faced with decreased opportunities to connect with diverse communities and peers in their home city or school, the impact of the international experience subsided. Even more so if students return to a hometown that is

culturally homogenous, there may simply be few opportunities to integrate their earlier perceptions or lack models of what cultural sensitivity looks like.

Alan Coronado, co-author on this article who was a U.S.A. student who participated in the Panama camp, now lives in the country. Half a decade later, he is still adamant on the personal impact of this project. He says *"This type of investigative paper gives the real-life data of what intercultural collaboration can actually achieve, and to not be wary about learning and living in other cultures. Having this type of knowledge can be helpful for the youth of now that want to make the world a much more understanding place. In particular we are surrounded by issues that exist as a result of cultural differences. In my opinion, cultural awareness can only lead to advantageous circumstances for the future."*

Long-term changes in perception were equally interesting, as demonstrated in Question 4 ('I question my own prejudices as well as national and cultural stereotypes'), Question 6 ('I incorporate the attractive aspects of other cultures into my own way of doing things'). These changes persisted nine months after participation in the Youth TechCamps. This finding suggests that once a change in perspective, behaviour, or new understanding has been integrated into one's learning, **this change perseveres past the actual experience.** The authors surmise that once the change becomes part of the person's character or mindset, it is no longer dependent on the environment, unlike the short-term changes above. Dara Carney-Nedelman, co-author of this paper and a participant from the U.S.A. to the Bolivia camp, reminds us how long-term changes may also be reignited by world events.

> *"Due to everything that has been happening in Bolivia, I've reignited some of my relationships with the Bolivian students. The Youth TechCamp you (Dr. Solís) worked so hard on is still having lasting impacts. I've been in touch with four of the Bolivian students just this week. I've also reached out to my local news agency to try to get more publicity about the demonstrations and election fraud in Bolivia. Personally, on my recent Fulbright English Teaching Assistant application, I was able to reflect back on several experiences I had in Bolivia."*

Finally, the third long-term impact is one's perception of their language ability, as seen in Question 8 ('I am linguistically competent in a language other than my native language'). This may be interpreted in a couple of ways. Some of the students from the U.S.A. were already able to speak Spanish before the trip. For those who travelled to Bolivia or Panama, they benefited from being immersed in a Spanish-speaking country where they could interact with peers and locals. Furthermore these students, being bilingual, served as interpreters between peers during the Youth TechCamps. These two experiences may have provided confirmation and self-confidence of their ability in the language. However, since

participants' language abilities was not inquired in the surveys, it is not possible to separate out the differential impact of being conversant or fluent on the end results here.

There are a couple of surprises in the results. It is curious that neither Questions 7 nor 9, in the survey, showed any statistical difference in the short- or long-term gain. A closer look at Question 7 suggests that the U.S.A. students scored high in this question prior to the trip, so with the international experience, this does not move the needle much farther. It may also reflect the "self-selection" bias that participants chose to apply for an international exchange experience in the first place. For Question 9, the expectation is that the U.S.A. students would have a heightened desire to learn about the people, cultures and issues around the world. Another look at the data show that the respondents were generally as enthusiastic prior as they were after their trip to explore this learning opportunity. Thus, the positive affection was strong even at the start of the Youth TechCamps.

This research brings to light the impact of intentional opportunities that support student learning and sensitivity to different cultures. Here, the authors recount the key results of the Youth TechCamps but are cautious to generalize beyond the sample cohort. Mirroring the findings from the literature, the authors found impactful changes in students' perception of a new culture, depth in relationships, and increased expectation of self to contribute to the world. The data suggests that those changes that directly challenge the way one thinks or feels about differences, have the most long-term impact. For example, survey questions 4 and 6 tackle the notion of questioning one's own prejudice(s) and incorporating new ways of doing things, respectively. These reactions require more than rote doing but likely a sense of maturity and reflection prior to deciding to take action. Perhaps taking the time to ponder and deliberately choosing what makes sense to include in one's way of doing makes these actions persist over time. On the contrary, the impact on one's understanding of differences (Question 3) or making friends with diverse peers (Question 5) seems to taper out over time and thus have a short-term impact. The authors venture that these actions, once completed, may not require continual action and thus the effect may ultimately stagnate without repeat access to cultural learning to reinforce it. In other words, the most profound learning opportunity over the long run may be those cultural exchanges which present an internal struggle or challenge associated with taking action, such as an intentionally-designed experience to pursue a team science problem, rather than those which simply offer moments of friendship and understanding. Further research is needed to determine the parameters of such a possible interpretation.

Similar to some findings in the literature, this study found discernible short- and long-term impacts. For example, the international experience in this study influenced the reported education and future career choices (*e.g.,* Bachner and Zeutschel, 2009; Paige et al., 2009; Bachner and Zeutschel, 1994),

particularly drawing students' interest in environment and international study and to work in developing countries on climate change.

> *"It (Youth TechCamps) definitely did influence my view of climate change. I knew (obviously) that environmental problems affect every country, but seeing this in person had a huge impact on me. I am even more committed to my current plan of majoring in Environmental science in college."*

The global engagement variables reported by Paige et al. (2009) were not found in this study perhaps due to the differences in the age of participants between this study and the work of Paige et al (2009) (*i.e.,* high school versus university students), longitudinal time frame (*i.e.,* months versus years after international experience) and length away in an international setting (*i.e.,* weeks versus months).

The authors believe that the changes illustrated in students could have a strong influence in their future in any career that necessitates working with someone from a different geographic region, whether that is a different state in the U.S.A. or another country in the global context. These experiences are found in powerful quotes that attempt to capture the subtle and explicit messages of change powered by this program.

> *"The impact that the Youth TechCamp has had on me and everyone that participated has been immense. I was really energized and had that special 'goosebump' feeling again." (local coordinator, in an unsolicited email).*

> *"I'm a worthy human being. I have talents that I'm good at and I should be proud of them. This camp increased my confidence, seven-fold."*

Conclusion

Participants' reaction to the Youth TechCamps has been overwhelmingly positive. This opportunity has provided them with technological and soft skills, as well as precious exchanges to broaden their views and understanding of different cultures. For many following the exchange, the motivation to act, whether alone or in an organized group, to improve the world's environmental issues is clear. The learning did not stop at the conclusion of the Youth TechCamps. Years later, alumni still actively engage their peers, classmates, extracurricular groups, and the community to share their knowledge and skills. At the time of this publication, alumni connect with peers on social media platforms as well as give regular updates of their successes with Dr. Patricia Solís.

The current research findings, similar to those from previous studies on the impact of international exchanges, have found that some changes are short-term while others have a longer effect on the understanding and perspectives of different cultures. Here is a fitting time to summarize the Youth TechCamps experience from Aishah-Nyeta Brown, one of the authors of this paper and a participant of the South Africa camp, reflecting 5 years later.

> *While in South Africa, I connected with the South African peers on such a deep level that we still keep in contact regularly, for birthdays, holidays, and no occasion at all. This is not my only valuable take away, in fact, it shaped the way I approached my future. Before South Africa, I had little confidence in my academic outlook, but always had a positive feeling for the future. My confidence soared from the interaction and learning in a classroom setting in South Africa. I was asked by counterparts what I wanted to do with what I was learning there. At that time, I had a vague understanding of wanting to synthesize my creative passions with making a global impact, but it sounded silly.*
>
> *Five years later, I am a Global Sustainability Scholar and an undergraduate student with some incredible global career hopes. I study climate change in hopes to creatively bring awareness to environmental injustices to the world with the knowledge of sustainability.*

A gap in this research that invites further investigation is to examine what factor(s) determine short- versus long-term impact and if changes effected can be extended. Essentially, how do we help students make those impacts persist after the experience, like Aishah-Nyeta Brown. Another area in this line of research could look at whether the learning setting, such as exposure to cultural differences in one's own community or online would generate similar changes as an in-person international exchange. Participation in an international exchange is an obvious experience to measure, however, the financial element limits its access by the mass. Given the diversity generally found in major cities around the world, students may experience stimulating cultural exchanges within their own geography (*e.g.,* celebrate festivals of ethnic communities or learn through discussion with people of varied experiences) (*e.g.,* Chamberlin-Quinlisk, 2005), online (*e.g.,* Peiser, 2015) or in curriculum in the classroom (*e.g.,* Seifert, 2009). Unlike structured and formal learning opportunities, informal experiences are certainly harder to track and to measure because they happen on a personal level, but the interest here is to look at everyday exchanges across cultures that are happening organically and how these might induce short- and long-term changes.

These lines of research would contribute to experiential learning that fits neatly into 'doing geography' called for in the national geography standards *Geography for Life: National Geography Standards, Second Edition* (Heffron and Downs, 2012) and add to the recommended research on how geography knowledge is learned across individuals, settings and time as put forth in *A Road Map for 21st Century Geography Education: Geography Education Research* (Bednarz et al., 2013).

What is the importance of providing learning opportunities with potential to shape students into culturally sensitive people? The answer lies in what they can contribute to society in general and more specifically using geography to this effect. We are living in rapid changes steeped in such big influences as technology, human migration, and climate fluctuations. Given these large-scale and interdisciplinary concerns, geographical concepts and information are used by scientists and policy makers alike (National Research Council, 2010). It is clear that sound geography knowledge, which lends to informed perceptions of people and cultures, has an important role in national and international decisions, whether for government, business, or environmental challenges. In the U.S.A. how knowledgeable are our students in their geography understanding to exercise global influence for this kind of future?

Declaration of interest

No potential conflict of interest was reported by the authors.

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Notes

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