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Journey to the End of the Earth: Analyzing the outcomes of a field-based research program in Antarctica

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Abstract

With the need to increase minority representation in science, specifically in polar science research, the University of Texas at El Paso (UTEP) developed an innovative field research experience entitled the International Polar Year- Research and Educational Opportunities in Antarctica for Minorities (IPY-ROAM). Supported by a National Science Foundation (NSF) grant, twenty-eight participants including undergraduate students, graduate students, teachers and university faculty completed a semester long online course and performed field research in Antarctica within the areas of aquatic ecology, terrestrial biology, physical science, ecotourism and education. The purpose of this article is to determine possible outcomes that individuals experienced through their participation in IPY-ROAM as related to their educational and career aspirations. Two outcome areas that are explored in this investigation are the participants' self-reported career competencies, and their professional and academic goals. Results from this study indicated that participants perceived an increase in their career competencies due to participation in IPY-ROAM. In addition, participants also stated that the improvement of their career competencies motivated them to reach their professional and academic goals. This study provided an insight on the benefits, as perceived by students, of performing hands-on research in

field-based settings. Data generated from this program may serve as a measurement tool to justify further investment in field research programs for students in both Antarctica and the Arctic, and to refine programs designed to enhance the career options for minorities in Science, Technology, Engineering, and Mathematics (STEM) fields.

Introduction

Science research programs that involve the participation of undergraduate and graduate students are common models seen in university settings. Undergraduate research in particular, "is widely promoted by faculty, administrators, institutions of higher learning, government laboratories, private industry, professional associations, and funding agencies as an effective method of training college students pursuing careers in science, technology, engineering, and mathematics (STEM)" (Mabrouk, McIntyre, Virrankoski, & Jeliffe, 2007, p. 18). Research programs such as Undergraduate Research Experiences (UREs) can serve as a beneficial venue in which students can apply the knowledge and scientific concepts learned in the classroom to a real world context. Robertson (2008) mentions, "research-based programs give students the ability to retain fact through critical thinking by working through problems logically and making connections to the real world" (p. 15). In contrast to laboratory courses, in which students often repeat a determined experiment with known outcomes, research programs aim to have the student conduct authentic investigations that create and add new information to a particular discipline (Hakim, 1998, p. 190). Research programs allow students to perform authentic research in a scientific area of their choice, and may also provide the opportunity for travel, since research can be outside of a student's home institution (Lopatto, 2007, p. 301). The opportunity to be part of such a thrilling endeavor can serve as the fuel to motivate college students into pursuing a degree in the sciences.

Intuitively, we expect students who take part in academic research to experience positive outcomes that can benefit their professional and academic lives. However, few studies have statistically demonstrated the personal and professional benefits of performing research at the graduate or undergraduate level. Hunter, Laursen, & Seymour (2006, p. 72) suggests that, to better understand the gains student attain by taking part in research programs, further research needs to be done on these experiences. In 2003, a report from the National Science Foundation stated, "there are increasing pressures to assess whether educational activities, including research, actually improve student learning." (p.8). A literature review performed by Seymour, Hunter, Laursen and DeAntoni (2004, p. 495) identified only nine well-supported evaluations of research experiences and 45 reports in which the benefits of undergraduate research are simply stated but not adequately demonstrated. Methodical evaluations of research programs are needed to determine if the students are learning new concepts, as well as determine what skills they are gaining when they engage in research. Furthermore, with the reduced representation of ethnic minorities graduating from STEM disciplines, conducting investigations on the effectiveness of research programs with a focus on these specific populations could point out advantages that could motivate minorities to purse degrees in these fields.

This article aims to address this need by evaluating the experiences and outcomes of participants, primarily from underrepresented minority students, in the International Polar Year – Research and Educational Opportunities in Antarctica for Minorities (IPY-ROAM) program. Outcome areas reported in this investigation are centered on the participants self-rating of their career competencies and professional and academic goals before taking part in the research experience, immediately after their participation, as well as six months after completion of the program. Assessment of the IPY-ROAM experience provided an opportunity to contribute to the

literature regarding the evaluation of student research programs, particularly by reporting the outcomes experienced by underrepresented populations in science and more specifically in the polar sciences.

Program overview

The International Polar Year – Research and Educational Opportunities in Antarctica for Minorities (IPY-ROAM) program was a unique research experience that occurred during the International Polar Year (IPY) 2007-2009, a globally coordinated effort to gain a better understanding of the polar regions. Hosted by the University of Texas at El Paso (UTEP) and funded by the National Science Foundation (NSF), IPY-ROAM offered a life changing opportunity for 16 undergraduates, 7 graduate students, and 5 public school teachers, from all over the United States to learn more about Antarctica by conducting original field research on this icy continent. The program was designed to increase the number of underrepresented minorities continuing on to higher degrees or careers in science and to increase public awareness and knowledge of the polar regions.

Prior to the trip to Antarctica, IPY-ROAM participants took part in a series of activities, which included an online course in Antarctica System Science and a trip to Washington D.C., in order to prepare them with the necessary knowledge needed to conduct polar research. The main research trip took place during the winter break of 2007 where participants traveled from the United States to Ushuaia, Argentina and crossed the Drake Passage on board a tourist vessel to arrive at the Antarctic Peninsula. Here the ship made eight landings where "ROAMers" (a nickname of the IPY-ROAM participants) divided themselves into teams and collected the necessary data for their projects. Participants also had sufficient time to appreciate the beauty

and fragility of the Antarctic environment and interact with ship passengers that came from all over the world. The voyage lasted 10 days at which point the ship returned to Argentina where the students worked on data analysis, started forming conclusions about their investigations, and created a plan to finalize their data analysis upon their return to the U.S. A more detailed description of the IPY-ROAM program including group projects and educational materials created from this experience can be found in Robertson, Garcia, Lougheed, Tweedie, and Velasco (2009).

The IPY-ROAM program represented an invaluable opportunity for minority students to conduct research and interact with their peers in a unique and remote environment. During this experience the students conducted an array of educational activities and gained important information about polar science and research techniques. In order to obtain a clear idea on gains, benefits, and outcomes it was necessary to formally evaluate this program. As described previously, there is a strong need to document the end results of research programs and determine the impact these have on students. The intricate design of IPY-ROAM opened the possibility of evaluating a range of factors and impacts from the program. Studying all the possible outcomes would have been an overwhelming task; therefore, only a handful of factors are presented in this work.

Research objectives

The first objective of this research was to analyze the participants' self-reported views of career competencies. According to Troutman (2004, p. 64) career competencies are "observable, measurable patterns of skills, knowledge, abilities, behaviors, and other characteristics that an individual needs to perform work roles or occupational functions successfully." Career competencies analyzed in this research include critical thinking skills, awareness of other

cultures, leadership abilities, ability to communicate effectively, problem solving abilities and consideration of others people's feelings. Investigating these competencies can offer a better understanding of what characteristics the students consider important for their own professional development and future success. This part of the evaluation focused on determining if participants reported a change in possessing these competencies before and after the IPY-ROAM experience and if they believed that participation in IPY-ROAM helped them to acquire or to improve such characteristics. The benefit of understanding these self-perceptions is that it can guide principal investigators of future projects to focus on developing the appropriate skills that minority participants consider important to their professional and personal development.

The second area examined was the participants' professional and academic goals. In particular, the researchers wanted to create a profile of the particular goals students wanted to achieve, including the maximum level of education to be obtained, and to determine if any changes occurred due to participation in the IPY-ROAM research program. A report by Seymour et al. (2004, p. 522) comments, "it is important to distinguish between claims that the undergraduate experiences can prompt undergraduates to choose a graduate school career path, and more qualified claims that the experience can clarify, refine, and reinforce such a choice." Thus, it was important to establish how IPY-ROAM influenced or modified the professional and academic goals of the participants.

The information provided in this study is of great importance to other researchers that are interested in understanding the benefits that underrepresented minority groups in science experience when participating in research programs. It may also provide insight into the necessity of creating efficient evaluation tools for research experiences, as well as the need to document the results of such evaluations.

Participant selection and demographics

Participation in the IPY-ROAM program was open to undergraduate and graduate students as well as middle or high school science teachers from around the United States. Eligibility for the program required that undergraduate applicants be entering their sophomore, junior, or senior years in the fall of 2007, graduate students had to be enrolled in a graduate program at a U.S. university and teachers needed to be employed in a minority-majority serving school. In order to bring diversity of thought and skills, participation in the IPY-ROAM program was open to individuals from all disciplines, not just scientific fields. A total of 137 applications were submitted to a triple blind review in which the review committee used an evaluation rubric in order to determine the best candidates for the program. In total, twenty-eight participants were selected; 16 undergraduates, 7 graduates, and 5 teachers. The majority of participants were female (71.4%) and the most common reported ethnicity was Hispanic (53.6%). See Table 1 for complete ethnicity percentages of participants. Over 75% of the Hispanic participants were recruited from the home institution (UTEP)

Table 1

Ethnicity of IPY-ROAM participants

Ethnicity	***n***	**Percentage**
African American or Black	3	10.7
Asian	3	10.7
Hispanic or Latino	15	53.6
Native American	1	3.6
Native Hawaiian or Other Pacific Islander	1	3.6
White, non-Hispanic	5	17.8
Total	28	100

Research design

We employed an exploratory study model, which consisted of a one group pre-post test design with a one year follow-up. The subjects of this study (*n*=28) consisted of the individuals that took part in the IPY-ROAM experience. As participants were recruited through specific means and selected by the characteristics previously described, the individuals represented a non-random sample of the population. This exploratory study focused on exploring outcomes that occurred due to a specific treatment, rather than manipulating any variables. In the case of this study, the treatment can be defined as the participation and completion of the IPY-ROAM research program. The outcomes of the treatment were determined by comparing results of the pre-survey with results from the post-survey and follow-up survey.

Survey design

Data gathered for this investigation was done using three assessment tools that were designed using a non-systematic protocol with the purpose of acquiring a diverse amount of data useful for this investigation and other future studies. These were labeled pre-program, post-program, and follow-up survey to distinguish each of them. Each survey was composed of two sections. The first part included exploratory items that were used to determine the outcomes of the IPY-ROAM program. The second section of each survey was composed of demographic items used to determine the participants' gender, ethnicity, age group, marital status, highest level of education completed, and their college classification. At the start of the program, the participants created personal and anonymous identification codes that allowed tracking of changes in individual responses through time.

The first survey was conducted at the beginning of the IPY-ROAM experience and was used to collect data prior to their participation in the program. The second survey gathered

information immediately after the research trip to Antarctica. The final assessment tool was applied a year after participation in the IPY-ROAM program with the purpose of obtaining specific examples on what participants felt that they had achieved in the longer term by taking part in this research experience.

Data analysis

During the pre-program and post-program surveys participants rated, using a five-point Likert scale, their views of possessing the career competencies, their beliefs of how the career competencies are important for their personal growth and/ or professional success, and whether their career competencies improved due to participation in IPY-ROAM. Based on tests of normality, either the paired-sample t-test or the Wilcoxcon rank-sum tests (for data that did not meet a normal distribution), were used to compare the mean values from the pre-program and post-program survey responses. The tests were performed to determine if the null hypothesis (H_0) of no difference between the two means existed or if the alternative hypothesis (H_A) that there would be a difference between the two means occurred. Alpha was established at 0.05. Cases which contained missing values on either the pre-program or post-program were excluded from the evaluation process.

To determine the participants' beliefs on how IPY-ROAM impacted their professional and academic goals, an open-ended and a five-point Likert question were analyzed. Open-ended responses were initially read, and a list of coded categories was created for the responses provided. Next, answers were re-written in more generalized terms and each of these generalized answers were analyzed for similar meanings and placed into the coded categories. In many cases, the participants' answers fell into several categories. A response that was unusual and could not fit into any of the assigned categories was included in a category named 'other' which was

represented by the value of 0. Finally, the codes were entered into an SPSS data sheet and a frequency analysis was performed to report the results. Responses from the five-point Likert scale question were also entered into SPSS and a frequency analysis was run.

Results

Participants' self-ratings of possessing the career competency

In the pre-program and post-program survey, participants rated the statement "I currently see myself as possessing the following characteristics" in each of the six competencies previously described, using a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Post-program means were significantly higher than pre-program means for all the competencies examined ($p < 0.001$) (Figure 1).

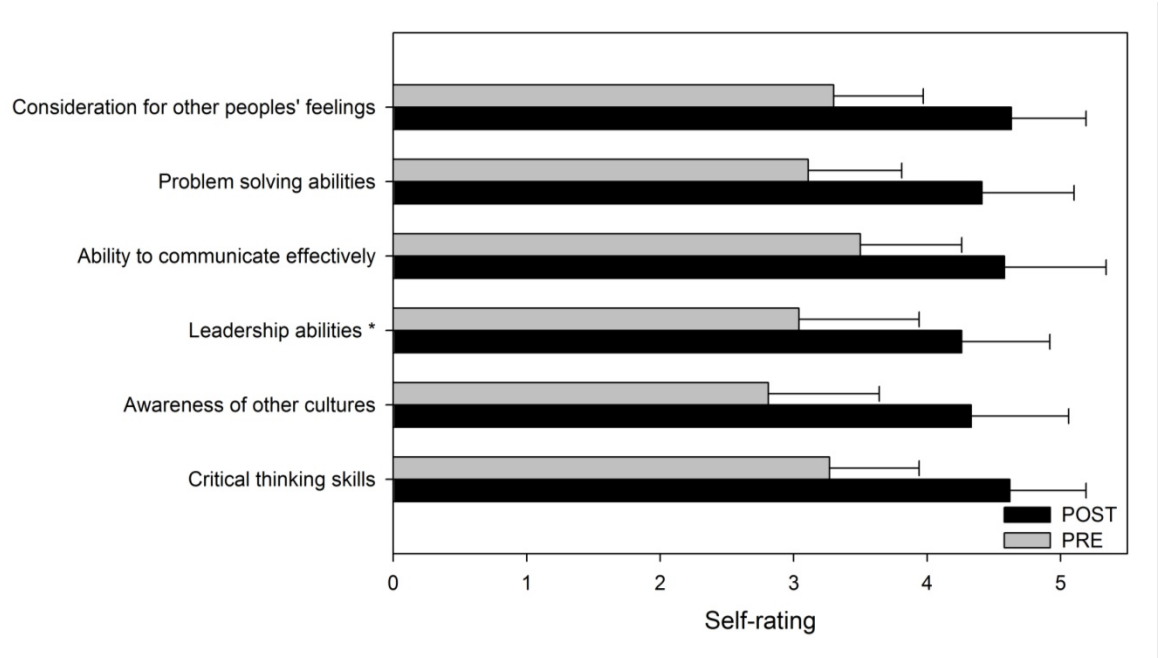

Figure 1. Mean comparison of participants' pre-post self-ratings of possessing the competency. All comparisons are significantly different ($p<0.001$) with n=26 or 27. All comparisons, except

that indicated with an asterisk (*) were made using a paired-sample t-test; the asterisk indicates that a Wilcoxon rank-sum test was used.

Competencies important for personal growth and professional success

Participants also responded to the question "Which of the following skills do you think are important for personal growth and/or professional success?" Ranking and analyses are as described above. Similar to the previous questions, the paired sample t-test and the Wilcoxon tests indicate a significant difference ($p < 0.001$) between the responses provided from the pre-program survey and the post-program survey on all the competencies analyzed, with the exception of critical thinking which could not be analyzed (Figure 2).

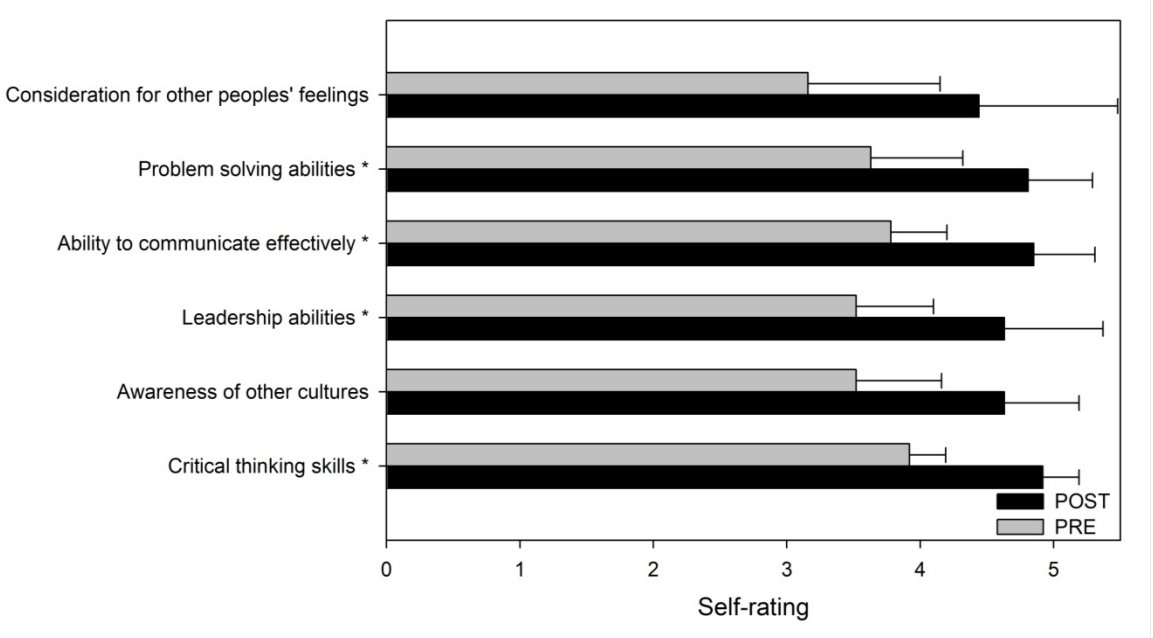

Figure 2. Comparison of participants' pre-post self-ratings regarding the importance of the competency for personal growth and/or personal success. All comparisons are significantly different ($p<0.001$) with n=25 - 27. All comparisons, except that indicated with an asterisk (*) were made using a paired-sample t-test; the asterisk indicates that a Wilcoxon rank-sum test was used.

Career competencies improved due to participation in IPY-ROAM

Participants responded to the pre-program and post program survey item "I believe that the opportunities provided for me by the IPY-ROAM program will help me …".The results from the paired sample t-test indicate a significant difference ($p < 0.001$) in the mean values of each of the competencies studied (Figure 3).

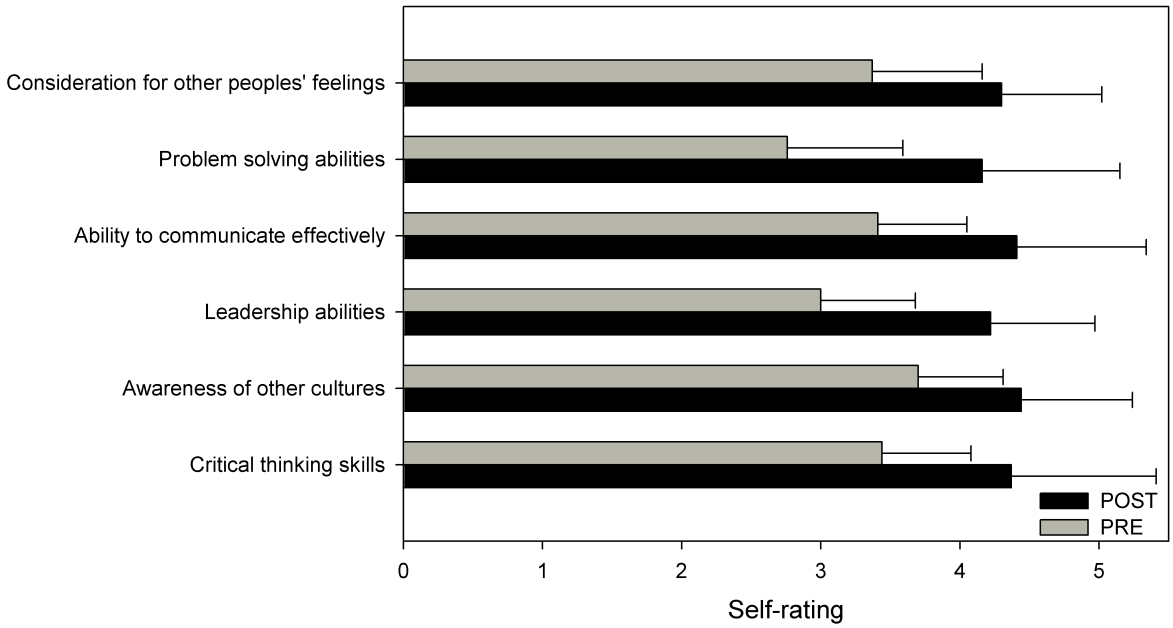

Figure 3. Comparisons of participants' pre-post self-ratings that opportunities provided by IPY-ROAM will help them improve the competency. All comparisons are significantly different ($p<0.001$) with n=25 - 27 (paired-sample t-test).

Participants' professional and academic goals

Impact of IPY-ROAM on participants' personal and professional goals (open ended items)

To gain insight on how the IPY-ROAM program influenced participants' personal and professional goals, they were asked in the one year follow-up survey to describe their opinions of how participation in the program impacted them. The open-ended responses from 24 participants were coded and arranged into 10 categories (Table 2).

Table 2

Participants' self-reported descriptions of the impact of IPY-ROAM on their personal and/or professional life

Category	Frequency	Percent
Increased confidence to achieve academic/professional goals	10	41.7
Increased interest in their profession	7	29.2
Offered motivation to perform more research	6	25.0
Gained skills and experience for their profession	4	16.7
Provided useful network connections	3	12.5
Increased appreciation of the polar regions	3	12.5
Offered a sense of pride to family	3	12.5
Increased involvement with the community	3	12.5
Becoming more mature individuals	2	8.3
Provided a life changing experience	2	8.3
Total	43	

Note. Percent is based on the number of responses in a category divided by the total number of participants who responded to the question.

Impact of IPY-ROAM on participants' personal and professional goals (Likert Scale items)

The final item reported in this section also aims to evaluate the degree of influence that the IPY-ROAM program had on participants' personal and professional goals. Specifically, participants were asked in the post-program survey "to what extent has the IPY-ROAM program

…" (1) made your reconsider your career plans, (2) changed your academic or professional goals, (3) contributed to your professional development, (4) helped you gain experience for your current field of study, job, or profession, (5) helped you gain experience for your future job or profession, and (6) motivated you to apply for future research experiences. Once more, participants rated their opinions of the statements using a 5-point Likert scale that ranged from 1 (very low) to 5 (very high).

The responses given show that participants have a high degree of agreement on the extent IPY-ROAM has contributed to their professional development, has helped them gain experiences for their current and future job or profession, and has motivated them to apply for future research programs (Figure 4).

Figure 4. Comparison of participant' self-ratings the extent to which IPY-ROAM has influenced the statements, ordered from highest average self-rating to lowest.

Discussion

This investigation represents one of the few published studies that provide statistical evidence of the impact of a research-based program on its participants, over seventy percent of whom came from groups traditionally under-represented in the sciences. Overall, the data indicate that the IPY-ROAM program has had a positive influence on the participants' career competencies and increased the importance they give on these competencies for their personal and professional success.

We found that ROAM participants reported a significant increase in their perceived career competencies, including critical thinking, leadership, communication and interpersonal skills, at the culmination of the program. These claims are not only supported by statistical data, but also by first hand anecdotes. For instance, an undergraduate student commented "I can say that the IPY-ROAM experience has helped me gain critical thinking skills, and problem solving skills, skills which I had never had before. Other students made similar statements, such as:"IPY-ROAM has helped me gain experiences and skills I never had before."

Not only did participants perceive an increase in these competencies, but there was also a significant increase in how important ROAM participants perceived these skills were to their professional growth and success. It was striking to encounter students who were able to make connections between the skills gained through their participation in ROAM and how it would benefit them in their field of study or career. For instance, according to one graduate student:

> Critical thinking, leadership ability and communicating with others are by far the most important qualities I believe necessary to be a successful researcher. If you are able to think critically then there is no problem that cannot be solved or worked through when in the right mind set. Being a good leader is also important not only in science but in life.

> Working with groups in harsh environments makes for quick solutions to problems in a quick manner; time not spent bickering on who is right and what to do. Your ability to communicate effectively with others makes problems like this less likely or quickly resolved.

Similarly, one teacher expressed how her participation in ROAM increased her critical thinking and problem solving skills, as well as motivated her to teach these skills to her students. She states: "The most useful tools we can model and teach our student is how to find information, be independent thinkers, adapt to new situations, and apply knowledge creatively".

Additional advantages of performing research are the ability to apply the learned skills in a real situation (Hakim, 1998, p. 191). In the case of this program, performing research in the harsh Antarctic environment and only being able to visit each research site once meant that any challenges had to be resolved right away. This was one way that the students needed to utilize their problem solving and interpersonal skills. A description from an undergraduate illustrates how the remote polar environment brought a unique opportunity to plan ahead for any potential problems. He stated:

> I think the most beneficial part of this experience was that we had to plan experiments for an environment we had never seen and within an unpredictable schedule. I have never had to plan for potential problems, in the past I have just dealt with problems as they came up. I think it was very beneficial for me to deal preemptively with problems because it gave me a better understanding of my project before beginning and it also made me more prepared.

Other positive outcomes of applying competencies at once are described by another graduate student:

> By the nature of IPY-ROAM, I was put into a new situation, in an unfamiliar ecosystem and with new colleagues. Therefore, it was necessary to think in new ways and work with people who I had never worked with before. I think those skills will translate as I take on new projects.

Similarly, other researchers (Kardash, 2000; Gum et al., 2007; and Seymour et al., 2004) have found supporting evidence in which interns of UREs perceive a significant increase in their abilities to perform skills that are necessary in their profession. A study by Landrum & Nelson (2002) highlighted that the increase or acquisition of professional skills through research experiences better prepared participants for graduate school and ultimately had a positive influence on individuals' careers. Research experiences such as IPY-ROAM help participants build and improve skills and competencies necessary for personal and professional success. The IPY-ROAM program provided students with an opportunity to become better critical thinkers, to use their knowledge to solve problems, to communicate their ideas more effectively and to incorporate interpersonal skills such as awareness of other cultures and consideration of other people's feelings. Although the competencies explored in this paper can be applied to many disciplines, other studies have indicated that skills acquired in the participation of UREs are tools needed to become successful scientists and increases confidence in feeling like a scientist (Seymour et al., 2004; Hurtado et al., 2009; Lopatto; 2007). With the emphasis that has been placed increasing the proportion of under-represented minorities in STEM fields, providing opportunities to participate in innovating research experiences such as this one can become a powerful tool to adequately train the next generation of scientist.

Also examined was the extent to which participation in the IPY-ROAM program affected participants' professional and academic goals. Approximately 42% of respondents stated that the

program provided them with the confidence to achieve these goals. An undergraduate student commented that "Participating in the program has made me gain confidence in myself and my decisions, as well as the drive to achieve the goals that I have set for myself." Similarly, another graduate student expressed "I think my participation in the program increased my confidence. Now I really feel like I can do anything if I set my mind and efforts towards a specific goal." These statements are also supported by research performed by Hunter et al. (2006), in which they observed that UREs provided individuals with greater confidence to make decisions about their future careers.

The confidence gained when participating in authentic research should be used by university faculty to increase students' interest in their field of study. One way of integrating this benefit would be by incorporating an authentic research component into undergraduate courses. A study performed by Nadelson, Walters, and Waterman (2010), demonstrated that a course-integrated undergraduate research experience had a positive effect on students' interest and knowledge of science. Traditional models of research experiences have also described participants reporting a raised interest in their field after completion of the program (Alexander et al., 1998; Kardash, 2000; Lopatto, 2007; & Seymour et al., 2004). As expected, participants' in the IPY-ROAM program reported similar outcomes, as 29% of them expressed an increased interest in their profession. For example, one participant described a new-found interest in climate science and that "This program has got me really interested into polar research. It made me want to study in Alaska". Another student comments, "I am now even more interested in climate change and its global effect". The heightened level of interest expressed toward their profession can serve as a vehicle to promote academic retention. As noted by Jones, Barlow, and

Villarejo (2010), “undergraduate research is positively associated with obtaining a baccalaureate degree, persisting in biology, and performing well in biology” (p. 106).

While participation in the IPY-ROAM program has motivated students to apply for future research experiences, contributed to their professional development, and helped them gain experience for their current/future job or profession, it does not seem to change their current academic goals or career plans. A number of articles support this trend (Alexander et al., 1998; Hunter et al., 2006; Mabrouk, 2000; and Seymour et al., 2004). In particular, Lopatto (2007) demonstrated that participation in research does not change student's prior plans to either initiate or discontinue a plan for postgraduate science education. Similarly, it seems students in IPY-ROAM entered the program with a clear set of professional and academic goals, with Ninety-six percent of them stating that one of their goals was to enroll in a postgraduate program. While no evident change in career goals was reported after participation in the program, the data indicated that this research experience clarified or confirmed respondents’ career plans. As one student stated “IPY-ROAM was an extreme motivator that clarified my goals to become a career ecologist.”

Additional Outcomes

IPY-ROAM also provided participants with the opportunity to gain additional skills after the completion of the program. These included writing abstracts for conference presentations, presenting their research at local and national conferences, creating lesson plans for K-12 classrooms, providing outreach presentations to K-12 students and other members of the community, and organizing a museum exhibit that displayed information about the Arctic and Antarctic regions. For example, fourteen graduate and undergraduate students presented over 35 different poster and oral presentations at regional, national or international conferences, such as

the SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) Annual Meeting and the Ecological Society of America (ESA) National Meeting. Seven of these poster presentations were awarded prizes for scholarly achievement, and many of these participants travelled to these meetings on merit-based travel scholarships. This was an exciting and rewarding accomplishment, which allowed participants to present their IPY-ROAM projects and receive feedback on their IPY-ROAM research projects from scientists and other students. As noted by Mabrouk (2009, p. 1339) participation in national meetings are a vital element of the research experience that can motivate student to continue with their projects and inspire participation in other conferences. A more detailed account of other benefits and outcomes of the IPY-ROAM program can be found in Garcia (2009).

Conclusions

In recent years a number of studies have been published stating the positive outcomes of participating in research programs (Felix & Zovinka, 2008; Gum et al., 2007; Hakim, 1998; Hunter et al., 2006; Hurtado et al., 2009; Jones et al., 2010; Kardash, 2000; Kremer & Bringle, 1990; Lopatto, 2004 and 2007; Seymour et al., 2004). While these studies provide valuable insight on the benefits of conducting research in a laboratory based environment, very few studies examine the impacts of field-based research programs, or programs catering to minority participants. This study represents one of the few published articles that provide quantitative and qualitative data on the benefits of field-based research programs, and probably the only one that analyzes the gains of conducting polar science research. Moreover, data reported in 2011 by the National Science Foundation illustrates only a small percentage of minorities are obtaining graduate degrees and entering the workforce in STEM fields; an issue that requires attention. This study supplies insights on how the IPY-ROAM program influenced the career

competencies, and professional and academic goals of participants who happened to be minorities. Data presented here can be used as a starting point for further investigations on this subject. Overall, results demonstrated that participation in the IPY-ROAM program increased the participants' career competencies, increased their belief that these skills are important for personal and professional success, and allowed application of these skills in a real world context. In addition, the IPY-ROAM program positively reinforced their professional and academic goals and helped them gain invaluable experience for their current or future job, career, or field of study.

Several limitations of the exploratory designed model of this research are noted. First, no formal statistical analyses were used to assess validity of the survey instrument; however, questions employed were based on similar studies and were created through rigorous discussion among the researchers, which provide an informal measurement of validity. Second, external factors acting on participants' beliefs, such as other research or professional development opportunities that they participated in should be accounted for and could have influenced the responses provided in the surveys. Finally, the scoring of open ended items is a well-known source of potential bias in these types of studies.

Admittedly, this was a highly unique experience and most students would not have had the opportunity to travel to Antarctica to perform field-based research. Thus, one recommendation for future research includes evaluating the impacts and benefits of other, more typical, field-based research programs on student participants.

With the need to increase diversity in the scientific disciplines and to establish which initiatives work at increasing and/or preparing the next generation of scientists, it is important to understand how hands-on research programs such as IPY-ROAM can accomplish this task.

Formal and rigorous program evaluations are needed, not only to support the existent research on this topic but also to discover new ways in which participation in research programs prepare individuals for a career in the sciences. This research study aids in such a task by serving as a valuable piece of literature that provides strong evidence that individuals, whether or not they are from a science background, can highly benefit from participation in science research and become individuals with an increased level of confidence and preparedness to reach their professional and academic goals.

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