

# **Honoring Culture, Diversifying the Workforce, Strengthening Science**

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## **Abstract**

Now in its seventh year, “Excite Camp” continues its focus on the importance of keeping middle school girls engaged in math and science. The objective the program is to rekindle and bolster the interest and build self-efficacy of Native Hawaiian girls in science, technology, engineering and math (STEM) before they enter high school. Research indicates that girls’ interest in math and science begins to wane significantly at the middle school juncture. Girls start to self-select out of STEM career and education paths under the premise that these subjects are boring, male-dominated, and not relevant to their lives. In a two-prong effort to help increase awareness, enthusiasm, and self-confidence in math and science, Excite Camp exposes Native Hawaiian girls to real-world science applications with connections to their native culture and history. Program development for Excite Camp is provided by the Women in Technology Project (WIT) of the Maui Economic Development Board, Inc. (Maui, Hawaii) and is funded in part by the Department of Labor as a workforce development initiative. WIT developed program content collaboratively with Native Hawaiian cultural specialists, Kamehameha Schools (a private school for students of Native Hawaiian ancestry), and the U.S. Air Force Research Laboratory (which manages Maui’s astronomical resources).

Female math and science-based professionals of Native Hawaiian descent are recruited by Excite Camp to provide support, guidance, and mentoring for student participants. Excite Camp is a team-based environment, rather than an individualistic or competition-based environment, because collaborative environments have proven most effective for girls’ learning. Challenging, hands-on engineering activities are presented in fun and exciting ways. Local, tech-based companies open their doors for site visits and the campers are given the rare opportunity to visit the Haleakala observatories as part of the program. This paper will present survey results from WIT’s multi-year tracking of past participants who are currently in high school, college, or the work force; discuss modifications made to the program in response to participant feedback over the years; and describe WIT’s methods of providing support for Excite Camp alumni.

WIT developed Excite Camp, in line with available research, to be community-based, cost-effective, and reverent of its host cultural values and environment. This paper will discuss the need for further funding of programs like Excite Camp, which can positively impact the ways in which girls from indigenous populations choose their career pathways. It will further discuss the broader economic and community impacts of building awareness and respect for Native

Hawaiian culture within Hawaii's growing scientific and technology community. Training and education protocols used in Excite Camp have become an important catalyst to build cultural training protocols within the U.S. Air Force and its civilian Department of Defense contractors, helping to mitigate sometimes contentious relationships between cultural preservation and scientific exploration.

## **Background**

The Maui-based Women in Technology Project (WIT) was launched in 1999 and is funded in part by the U.S. Departments of Labor, Agriculture, Education and the County of Maui as a workforce development project. Its mission is to encourage females and other under-represented groups to pursue education and careers in science, technology, engineering and math (STEM) in the state of Hawaii. WIT successfully creates systemic change by building awareness among educators and employers of the return on investment in recruiting and retaining a diverse and inclusive skilled technical workforce that is homegrown.

In 2001, WIT approached the U.S. Air Force on Maui to partner in an educational outreach program designed to engage Native Hawaiian middle school girls in STEM education and careers on Maui, including authorization for guided student access to the classified Maui Space Surveillance Complex. The partnership also involved Kamehameha Schools, a private school funded by the Estate of Princess Bernice Pauahi Bishop to fulfill her desire to create educational opportunities in perpetuity to improve the capability and well being of people of Hawaiian ancestry. Kamehameha Schools provided some seed funding for the project, WIT led the program development, including gender equity principles and minority outreach, and the U.S. Air Force offered students the opportunity to visit the Maui Space Surveillance Complex, as well as technical and program development assistance.

The first Excite Camp was held August 1-3, 2001. The three-day event was designed to serve as a model for integrating the scientific traditions of indigenous peoples into current science education. The goals were:

- To provide a venue for WIT to reach middle school girls of Native Hawaiian ancestry and other minorities in Hawaii;
- To develop a model workshop/curricular program integrating hands-on math and science learning with exposure to science and technology positions on Maui that will "excite" middle school girls into pursuing careers in these fields;
- To provide an opportunity for the U.S. Air Force and growing Maui-based technology companies to share their technology and research with Maui students as part of an integrated education program that demonstrates the relevance of science and technology in the community;
- To maximize the impact of this program initiative while achieving cost and time effectiveness for the various partners.

The initial Excite Camp was based loosely upon the following model programs:

- Attracting Women into Engineering Summer Workshop, Rowan University College of Engineering (Jahan 2001)
- Outreach Activities by Benet Laboratories, U.S. Army Armament Research, Development and Engineering Center, Watervliet, New York (Kendal and Johnson 2001)
- IBM Excite Camp at Purdue University (Stwalley 2001)
- Since then, the program has steadily grown in recognition among middle school girls, teachers, parents, the Native Hawaiian community, and high tech employers, successfully broadening its reach to Native Hawaiian and other minority applicants each year, as well as improving the educational value and cultural integration of its program activities and mentor presentations.

### **Program Approach**

Hawaii public schools traditionally rank poorly in math and science compared to the rest of the nation. According to year 2006 findings from the National Assessment of Educational Progress, Hawaii 8th graders perform very poorly in math (only 18% scored “proficient” or better in the standardized exam) and among the worst in the nation in science (U.S. Dept. of Education 2006). Per the Maui District DOE Standardized Test Scores for School Year 2002-2003, 35% of Maui’s Native Hawaiian 8th graders scored below average on their Math SAT and 44% below the HCPS-II Math standards (Office of Hawaiian Affairs 2006).

A best practices review was made of model programs nationwide designed to encourage middle school girls of under-represented race/ethnic ancestry in STEM. The existing research suggests that girls experience a precipitous decline in interest in math and science beginning with the middle school years, the main barriers being the perception of these subjects as boring, a disconnect with the relevance of these fields, and a sudden decline in confidence in these subjects (Campbell 2000).

Native Hawaiian/Pacific Islanders have been identified as an under-represented race/ethnic group in STEM. Barriers for under-represented race/ethnic groups, according to the research, are focused mostly on lack of equal opportunity to educational opportunities and the resulting lack of academic preparation in math and science (Maui Economic Development Board 2000). For example, students of under-represented race/ethnicity are more likely to attend schools with teachers not properly trained or certified to teach math and science, and to attend schools where math and science performance is below the national average.

Based on a 2000 Native Hawaiian Educational Attainment Survey, only 9% of Native Hawaiians (NH) living on the island of Maui obtained Bachelor’s degree or higher, statewide only 12% (Office of Hawaiian Affairs 2006). Per the 2003 Educational Attainment of Individuals 18 years and Older: Hawaii Health Survey, Maui County is home to about 11% of the state’s Native Hawaiian population. Nearly 20% of Maui’s Native Hawaiian population did not graduate from high school or obtain a GED. Economic hardships may be a factor for the high percentage of non-high school graduates with a telling statistic 47% of state’s NH school population is dependant on free or reduced lunch (Office of Hawaiian Affairs 2006).

As a means of addressing the dual barriers for Native Hawaiian girls, the program goal was to provide the girls with confidence-building exercises in math and science using models that have had demonstrated success, as well as providing the girls exposure to educational

opportunities in math and science in which they might not otherwise have the opportunity to participate. There was no cost to the child or parent for their daughter's participation.

After six years of refinement, the following strategies have been identified as crucial elements of any STEM program aimed at Native Hawaiian and other minority middle school girls.

### *Hands-on activities*

Excite Camp demonstrates math and science principles in a context that makes them relevant for the participating girls. Adjustments are made to the activity agenda based on feedback from participants and WIT's ongoing review of other model programs.

### *Team-based atmosphere*

Participants collaborate as teams instead of competing as individuals. Team-based learning has been shown to be a more effective catalyst for girls' education.

### *Mentoring opportunities*

Each student team had a woman mentor who was raised on Maui and was either enrolled in higher education or employed in science and technology. Mentoring has proven to be one of the most successful mechanisms for encouraging girls into these fields.

### *Exposure to science and technology in their communities*

The need for relevance has been identified as crucial for girls to make the connection between math and science as academic pursuits, and math and science as meaningful careers. In order to accomplish this, it was imperative for the girls to see how people working in their community use math, science and technology.

### *Connections between culture and science*

Native Hawaiian girls are exposed to current math and science applications in their community and historical examples of sophisticated scientific exploration and discovery within their native culture. Excite Camp staffing includes a Native Hawaiian cultural consultant (known to the girls as *kumu*, Hawaiian for teacher) who participates actively to infuse Hawaiian history and culture into the activities. Native Hawaiian females from the community studying or working in STEM areas are sought as mentors and role models for the event. With regard to the success of this endeavor, 71% of the 2001-2004 participants claimed that the Camp improved their awareness of their culture. Nearly all participants in the 2006 and 2007 Excite Camps (95%) indicated that they learned something new about the Hawaiian culture.

## **Recruitment**

The Camp is limited to 20 girls per year. The limitation on enrollment was derived via analysis of participant feedback. Keeping the program small allows each student to take full advantage of the opportunities and benefits offered by hands-on participation and personal mentoring. The entire cohort is divided up into five groups with four girls per mentor.

Each year, middle school girls of Native Hawaiian ancestry and other minority backgrounds are targeted for recruitment. Each interested student is required to complete the Registration and

Permission form. A total of 20 girls are typically selected from a targeted applicant pool of about 30.

To ensure WIT project's outreach services are equitably distributed throughout Maui intermediate schools, selection is also based on securing a spot for at least one student from each school. Student participants come from eight different middle schools on Maui and also include home-schooled students of 7th and 8th grade age.

## **Program Elements**

The primary focus of the program is to address the dual barriers of gender and ethnicity facing Native Hawaiian girls by exposing them to science and technology in the context of their native culture and community. During the three-day camp, the students participate in a variety of hands-on activities requiring STEM skills and teamwork. The students also visit and hear from local STEM employers at the Maui Research and Technology Park, the Maui High Performing Computing Center (MHPCC) and the U.S. Air Force Research Laboratory's Maui Space Surveillance System. This facility sits atop the summit of 10,000 foot Haleakala Volcano, and houses the Advanced Electro-Optical System (AEOS) telescope, the nation's largest optical telescope designed for tracking satellites. Haleakala Volcano provides some of the best viewing conditions in the world, and is also home to the University of Hawaii Institute for Astronomy. This experience is especially impressive as indicated by the fact that, when surveyed in 2008, 72% of responding past participants from 2001-2006 mentioned it when asked for their memories of Excite Camp.

Students are pre-assigned to teams. WIT has learned that this provides advantages over allowing the students to self-select into teams. The girls are paired with a partner and each pair of partners is matched with another pair to form a group. The methodology used to determine partners/groups includes the following criteria:

- Each group is assigned members ranging in age from 11 to 13 so that older girls are teamed with younger girls. This is done to allow the older girls to serve as leaders or mentors to the younger girls.
- Girls who are known to be friends or from the same school are placed on different teams. This is done to encourage the girls to make new friends and minimize "clique" behavior.
- Instead of announcing the team assignments, on Day One, each participant is given an envelope that contains a puzzle piece that is half of a star. They are instructed to find the person (team partner) who has the matching piece to complete the star. The star shape is chosen because of the Camp's focus on astronomy as a vehicle to expose students to STEM. Each partner team has a different color and the Hawaiian name of a star.

Over its years of running the program, WIT has learned that specific measures are needed to encourage the students to ask questions. Currently, the girls are instructed to ask at least three questions of the presenters before Camp is through. At the end of the Camp, the girls' question and answer forms are collected, and in return, each girl receives an Excite Camp T-shirt.

On the first day of Camp, participants are given an introduction to Hawaii's past and present in the context of science and technology by Native Hawaiian members of the local educational

and technology communities. This sets the tone of the Camp as a place where the girls can come to recognize and identify with the scientific endeavors of their ancestors and recognize the modern importance of higher education for their people.

The program closes with an inspiring message by the *kumu* that weaves in all elements of the program's goals for the girls—to ignite an interest in STEM, to expose them to opportunities in their home communities, to encourage them to pursue higher education, and to perpetuate and respect themselves and their culture.

As a follow-up to the event and to foster continued positive relationships with Excite Camp hosting companies and presenters, parents of the participants are asked to encourage their daughters to write thank you letters to two companies/presenters. The companies and presenters are pre-selected in advance for each student based on the highest company ratings each provided on her own evaluation of her Excite Camp experience.

### **Activities**

The hands-on, team-based activities used at Excite Camp include the following:

- *Spaghetti Bridge*—students build bridges using marshmallows and spaghetti under specified parameters, then test their capacity to bear a load of pennies. In 2007, 100% of participants surveyed rated this activity very good or excellent. Representative comment: “I liked trying new ways to make the spaghetti bridge more stable.”
- *PVC Telescope Activity*—students build a telescope from a kit developed by Oceanit, a progressive Hawaii-based engineering, science, and research company specializing in optics manufacturing. This activity was introduced in 2004 and includes an introduction to physics and astronomy principles, the history of Hawaiian celestial navigation. The students get to keep their telescopes if they promise to share them with family members and friends and continue using them. In 2007, 89% of the students rated this activity very good or excellent. Representative comment: “I had a good time making a telescope with my own two hands.”
- *Computer Disassembly and Reassembly Activity*—every year the students start out afraid of breaking the computer and end up impressed with their own capacity to take apart a computer and put it back together in working order. In 2007, 84% of the students rated this activity as very good or excellent. This type of tinkering activity is purposefully included as researchers have noted that women engineering students often suffer a lack of confidence in their tinkering skills (Thom 2001). Representative comment: “Fun to take it apart, but hard to put it back together. It really made me think.”
- *Float Da Boat*—this activity, known as Das Boat by Future Scientists and Engineers of America (FSEA), challenges students to design a boat using a single piece of 6” x 12” foil that can carry as many marbles as possible before sinking. This activity includes discussion of Native Hawaiian voyaging and canoe design. Students are exposed to concepts regarding engineering design, buoyancy, and volume (Archimedes Principle of Displacement).
- *Ice Cream Engineering*—Concepts of freezing temperature and the effect of salt on freezing temperature are demonstrated in this fun and tasty activity. The girls are taught

how making ice cream the “old fashioned way” involves science and engineering. Students also learn how salt was used in Hawaiian culture for medicinal remedies and food preservation. In 2007, 94% of the students rated this activity very good or excellent. Representative comment: “I thought it was really cool how we made the ice cream and it tasted good too!”

- *Molecule Mission*—student groups have to construct a model of a molecule using colored gum drops and colored toothpicks. Each student is assigned the role of scientist (the only ones able to see a prototype molecule which they have to analyze and communicate a description of), technician (conveyers of information between the scientist and the engineer), or engineer (building the model based on the scientist’s description). The teams compete to see who can build the most accurate model within a limited time. Surveys consistently show this activity makes the need for teamwork and communication vivid. Eighty-three percent (83%) of the students rated this activity as very good or excellent. Representative comment: “Fun and hard. Helps you with team work.”

### *Site visits*

Site visits typically include the following:

#### *Maui Space Surveillance System*

This day begins with a cultural presentation by a female University of Hawaii-Hilo Astronomy graduate and our Native Hawaiian consultant regarding *The Ancient Art of Ocean Voyaging by Early Polynesians*. The presentation includes a discussion of the astronomy techniques used by Native Hawaiians to navigate and predict weather patterns. This presentation is consistently given outstanding reviews by participants.

Upon arrival at the University of Hawaii—Institute for Astronomy, participants are guided by the *kumu* with a Hawaiian chant respectfully requesting permission from the ancestors to access the sacred land and an offering is made. In 2007, every student rated the experience of hearing the Hawaiian chant as excellent or very good. This underscores the merit of including such familiar and grounding cultural elements to reinforce the compatibility of scientific pursuits with respect for the students’ cultural backgrounds.

Visits are made to the following telescopes:

- *Faulkes Telescope*—operated by the University of Hawaii’s Institute for Astronomy, owned by the United Kingdom for use by U.K. students (since Hawaii’s night is the U.K.’s day). In 2007, 95% of the students experienced this activity as very good or excellent. Representative comment: “It was interesting and cool—especially the high tech telescopes.”
- *Advanced Electro-Optical System (AEOS) Telescope*—U.S. Air Force personnel conduct the tour, the students were able to view up close the AEOS Telescope, learn about its functions, and why Haleakala summit is considered one of the best telescopic viewing sites in the world. Every student rated this activity very good or excellent. Representative comment: “That was a spectacular site and I really enjoyed learning about all the

telescopes, how they were made, when, what they did, how fast they move, and much more! This is like a once-in-a-lifetime thing to see.”

### *Monsanto*

Students learn that Monsanto is a leader in biotechnology research with genetically-engineered corn crops on Maui. They are taken out to the crop fields to see firsthand the work being done. Every student experienced Monsanto’s presentation as very good or excellent. Representative comment: “It was interesting to hear how they are changing our agricultural ways.”

### *Pacific Disaster Center Presentation*

Students learn about applied information and research and analysis support for disaster management. Students get ideas for how Global Informational Systems (GIS) can be used to build their own evacuation plan. Feedback from the 2006 cohort indicated that this presentation was a little too advanced to hold the students’ interest and only fifty-five percent (55%) of the students rated this presentation as very good or excellent. WIT provided PDC with this feedback and asked it to craft a more accessible presentation. As a result, among the 2007 cohort, 90% rated it very good or excellent. Representative comment: “It was cool how we learned about the tsunamis, roads, and shelters.”

### *Akimeka’s Digital Bus*

This visit is also a hands-on activity as students are shown how to use Global Positioning Systems (GPS) units for “Scavenger Hunt” and map-making assignments. In 2007, 90% of the students rated the experience very good or excellent. Representative comment: “It was cool and interesting to look in the microscope and see the sand and which beach it belongs to.”

### *Maui High Performance Computing Center—Visual Lab*

Students learn about satellite and aerial photography, and enjoy a demonstration of how the Center’s 3-D imaging technology is used for research. Ninety-one percent (91%) of the students rated this experience very good or excellent. Representative comment: “SUPER COOL! Never knew we had a super computer on Maui.”

## **Program Impacts**

Like its name, Excite Camp’s mission is to expose the girls to math and science in their community in a way that they would perceive as exciting, fun, and relevant. The latest cohort of participants, consistent with those before them, was positively impacted by the experience. Most reported that they were now considering pursuing a STEM degree (83%), and had increased awareness of technology jobs available in Maui County (95%).

For the past two years, WIT has endeavored to survey past as well as current Excite Camp participants. Data was gathered to see if there is a lasting positive impact on participants’ interest in STEM and whether that interest manifests itself in the choice of college major or career, and confidence in STEM subjects.

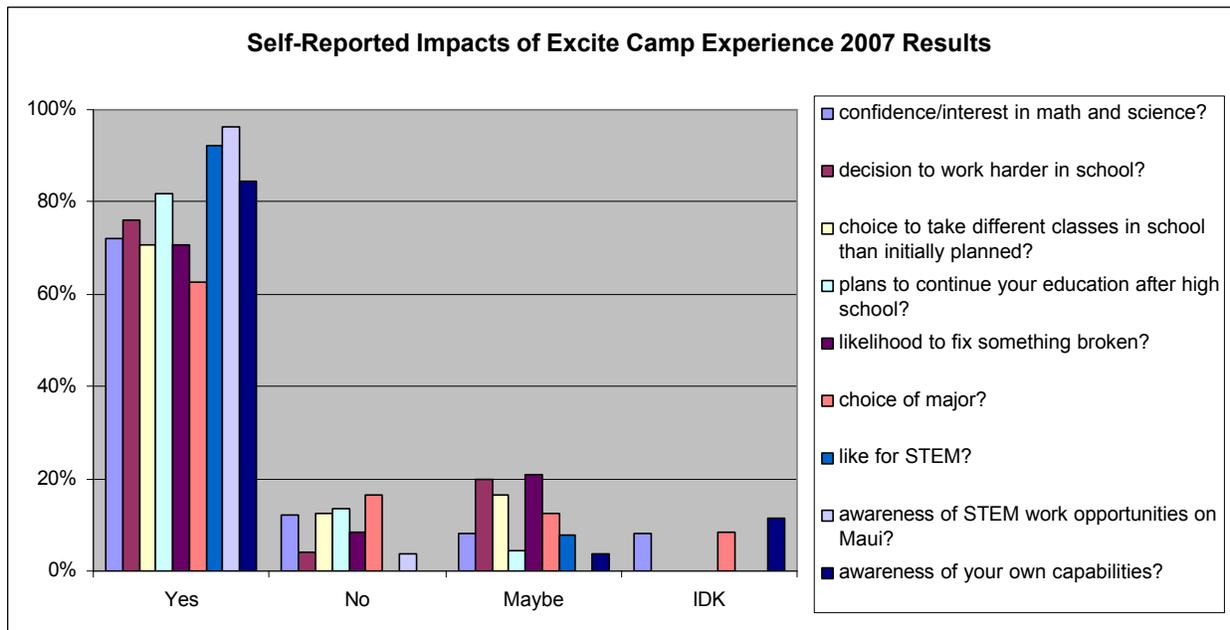
So far the surveys indicate that Excite Camp is a memorable experience. Overall, the past participants report that they gained confidence in their capabilities, increased their interest in

pursuing STEM interests and made valuable connections with job opportunities on Maui, their home.

Those currently in high school are self-selecting STEM related courses as electives and the majority plan on continuing on to higher education. The percentage of surveyed Excite Camp alumni in high school who report they are taking a STEM-related elective and have a serious interest in a STEM-related subject consistently ranges from 72 to 74%.

A handful of surveys are available from high school graduates who attended the program in its first two years. While the numbers are still too small to draw conclusions from, those responding were attending or had plans to attend college, and reported having felt successful in a science or math course while in high school. Most reported that Excite Camp inspired them to work harder while in school, and impacted their choice of courses, like for and thoughts about STEM.

As a pilot project and established annual program, the results confirm that Excite Camp influences awareness, interest, and understanding of STEM. Well over 60% of the past participants surveyed in 2007 responded with “yes” answers to questions that began with “Do you feel your participation in Excite Camp increased...” The chart below depicts the results graphically. The 2008 survey produced similar results, with a notable 100% reporting that the Excite Camp experience increased their confidence/interest in math and science.



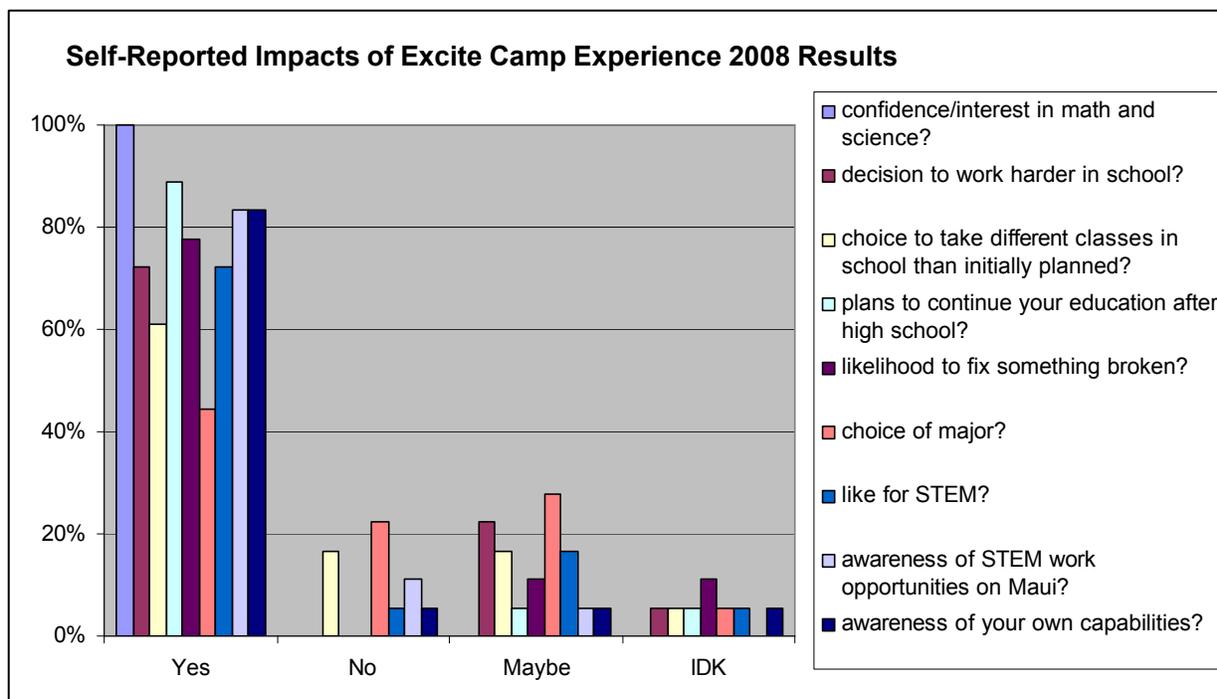


Table 1. Self-reported impacts of Excite Camp experience

WIT also asks past participants what is important to them in deciding on their future career. The results are consistent with national research showing the need to demonstrate the social relevance of STEM pursuits and to better provide for work/family balance if women are to be attracted to these fields. The vast majority of Excite Camp alumni report that it is very important to them to find work that is challenging, socially relevant (helping to solve people’s problems and making a difference in their own community) and allows them time with their family. Most also reported that it was very or somewhat important to them to use math and science skills in their job. Money, titles, and dictating orders are distinctly not a priority to them.

### Broader Community Impacts

Excite Camp has further served as a catalyst to step up the cultural protocols observed by scientists and technical staff using instruments and facilities located at the Haleakala Observatories. Mount Haleakala is considered a traditional cultural property with religious and sacred significance to an indigenous population. Both the Institute for Astronomy and the U.S. Air Force were moved by the integrated cultural/scientific platform used in Excite Camp and subsequently commissioned Maui Economic Development Board to develop a training film and related collateral on the sacred Haleakala “Sense of Place,” which is host ground to the telescopes. Now all Air Force personnel, faculty, visiting scientists, contractors, and interns are required to participate in this orientation, to ensure cultural respect.

These proactive efforts to bridge Maui’s scientific community and the Native Hawaiian community, joining sometimes historically contentious parties in the shared goals of educating Maui’s youth, is making a significant impact in mitigating suspicions, misunderstanding and entrenched opposition. Mutual respect is the common denominator leading to the premise of this

paper: that when cultural practices are honored and respected, when community efforts are made to reach broadly and empower all children with the skills needed for the technical workforce, it strengthens the science.

## References

- Campbell, P. 2000. Equity Means All: Rethinking the Role of Special Programs in Science and Math Education. *Fifth Annual National Institute for Science Education Forum, 2000*, 15
- Jahan, K. 2001. AWE: An Interactive Project Session. *2001 Joint NAMEPA/WEPAN National Conference Proceedings*, 61.
- Kendall, G., and M. Johnson. 2001. Community Outreach to Instill Interest in Science and Engineering, *2001 Joint NAMEPA/WEPAN National Conference Proceedings*, 192.
- Maui Economic Development Board, Inc. Women in Technology Project. 2000. *Maui County High School Survey*.
- Office of Hawaiian Affairs. 2006. *Native Hawaiian Data Book*.
- Stwalley, C. 2001. Experiences from an IBM Exite Camp at Purdue University. *2001 JointNAMEPA/WEPAN National Conference Proceedings*, 22.
- Thom, M. 2001. *Balancing the Equation: Where Are Women and Girls in Science, Engineering and Technology*. New York: The National Council for Research on Women.
- U.S. Dept. of Education, Office of Educational Research and Improvement, National Center for Education Statistics. 2006 *Report for Hawaii: Findings from the National Assessment of Educational Progress—The Nation's Report Card*.  
<http://measuringup.highereducation.org/>.

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