

EXCITE CAMP FOR NATIVE HAWAIIAN MIDDLE SCHOOL GIRLS

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Abstract *The Excite Camp for Native Hawaiian Middle School Girls was held on August 1-3, 2001. This day camp serves as a model for integrating the scientific traditions of indigenous peoples into current science education. The Women in Technology Project, Kamehameha Schools (a private school for Native Hawaiians) and the U.S. Air Force Research Laboratory, Detachment 15 co-sponsored the camp. The goals were: for the U.S. Air Force to open its technological facilities to students; to expose Kamehameha Schools students to technology in the context of Native Hawaiian culture; and to develop a workshop for Native Hawaiian middle school girls integrating hands-on math and science learning with exposure to science and technology careers on Maui. To address the dual barriers of gender and ethnicity facing Native Hawaiian girls the event utilized: hands-on activities demonstrating math and science in a context that made them relevant, a team-based atmosphere, mentoring opportunities, exposure to science and technology in their communities, and indigenous scientific traditions.*

Index Terms *Day camp, multicultural, hands-on, indigenous people, middle school, K-12.*

PROGRAM GOALS

The Women in Technology Project ("WIT") of the Maui Economic Development Board, Inc. in Maui, Hawaii is funded by the U.S. Department of Labor as a workforce development project. The mission of WIT is to encourage women and girls to pursue education and careers in math, science, engineering and technology in the state of Hawaii. WIT started in the fall of 1999 with the County of Maui, and will expand statewide in Hawaii in FY 2002-2003.

The Excite Camp for Native Hawaiian Middle School Girls was held on August 1-3, 2001. The Camp was the result of collaboration between WIT, Kamehameha Schools (a private school for Native Hawaiians) and the U.S. Air Force. (Kamehameha Schools is 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 the funding for the program,

WIT provided program development assistance, and the U.S. Air Force offered students the opportunity to visit the facilities of the Maui Space Surveillance Complex, as well as technical assistance and program development assistance.

The program goals were as follows:

- To provide an opportunity for the U.S. Air Force to share its facilities on the 10,000 foot summit of Haleakala Volcano with Maui students as part of an integrated educational program.
- To provide Kamehameha Schools with an outreach opportunity to expose students to technology careers on Maui in the context of Native Hawaiian culture.
- To provide WIT the opportunity to expand its program outreach to include middle school girls of Native Hawaiian ancestry.
- To develop a model workshop/curricular program to integrate hands-on math and science learning with exposure to science and technology careers on Maui.
- To maximize the impact of this program initiative while achieving cost and time effectiveness for the various partners.

In order to maximize the opportunities for hands-on participation and personal attention, the goal was to limit registration for the Camp to 20 girls, to be divided into teams of four, considered the optimal size for most of the activities. The timeline for the Excite Camp was very compressed. Planning began on around June 22nd, recruitment of students began around July 12th and the Camp itself took place on August 1st to 3rd. Recruitment included a press release to local media, as well as faxes and mailings to organizations serving the Native Hawaiian community. Even though recruitment started very late, the response was tremendous. Due to overwhelming demand, enrollment was expanded to 25, with teams of five students per mentor. Even though enrollment was expanded to 25, many interested students were not able to participate. Over 50 girls indicated an interest in participating, showing that there is demand for this kind of opportunity.

PROGRAM APPROACH

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A best practices review was made of model programs nationwide designed to encourage middle school girls of under represented race/ethnic ancestry in math and science careers. 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. Native Hawaiian/Pacific Islanders have been identified as an under represented race/ethnic group in math and science. 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. 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. Hawaii public schools rank poorly in math and science. According to year 2000 findings from the National Assessment of Educational Progress, Hawaii 8th graders rank lower than 31 other jurisdictions in math [1], and rank lower than 36 other jurisdictions in science [2].

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. The following strategies were identified as crucial elements of any program aimed at Native Hawaiian middle school girls:

- Hands-on activities demonstrating math and science principles in a context that makes them relevant for the girls.
- Team-based atmosphere, rather than individual or competition based. Team-based learning environments have been shown to be more effective for girls.
- Mentoring opportunities. The student teams each had a woman mentor as a team facilitator. The girls were also exposed throughout the program to women and persons of Native Hawaiian ancestry who were either studying or employed in science and technology. Mentoring has been shown to be one of the most effective 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 making the connection between math and science as academic pursuits and math and science as meaningful careers. In order to accomplish this, it was important for the girls to see how math, science and technology are used by people working in their community.
- Cultural context. Kamehameha Schools provided female Native Hawaiians to speak to the students on the

use of astronomy by Native Hawaiians to navigate the Pacific Ocean, as well as to speak on the cultural, environmental and religious significance of Haleakala Volcano. One of the women who spoke was especially inspiring because she was recently returned from a historic voyage as the first female navigator to lead the Hawaiian oceangoing canoe, Hokule'a, on a voyage from Hawaii to the South Pacific.

The Excite Camp incorporated elements of the following programs, all of which were described in the WEPAN/NAMEPA 2001 Conference Proceedings.

- Attracting Women into Engineering Summer Workshop, Rowan University College of Engineering. [3]
- Outreach Activities by Benet Laboratories, US Army Armament Research, Development and Engineering Center, Watervliet, New York. [4]
- IBM Excite Camp at Purdue University. [5]

PROGRAM ACTIVITIES

The central focus of the program was to expose the girls to the U.S. Air Force Research Laboratory's Maui Space Surveillance System. This facility rests at the summit of 10,000 foot Haleakala Volcano, and is home to 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. The program focused on exposing the girls to the Maui Research and Technology Park and the Maui High Performing Computing Center (MHPCC). Due to the focus of technology in Maui on astronomy, optical imaging, and supercomputing, much of the camp's activities focused on these fields.

FSEA Planet Venus Project

WIT is the Regional Director for the Future Scientists and Engineers of America (FSEA) program, and has integrated FSEA's hands-on program model into middle and high schools throughout Hawaii. Since WIT was familiar with FSEA, it used the Planet Venus Project as a hands-on activity to expose the girls to the science of space exploration. An additional objective of using the FSEA Planet Venus project activity was to pilot it as a means of integrating the activities of the Maui Space Surveillance System and the Institute for Astronomy into the ongoing expansion of FSEA in middle and high schools.

The purpose of this team-based activity was for the students to use "radar altimetry" to map a simulated Venusian surface to locate safe landing areas for a spacecraft. The objectives were to: use principles of measurement by accumulating data on a simulated Venusian

surface; convert decimal data to binary form; simulate the transmission of information through space and the decoding of binary data; construct a 3-D model of the Venusian surface from the data collected; interpret the data and apply landing criteria in the selection of the landing site; and perform a simulated landing on the planet's surface. This project had students perform the following jobs: radar engineer; communication engineer; geographer; and mission planner.

This activity nicely coordinated with the missions of Maui Space Surveillance Complex and Institute for Astronomy by giving students an exposure to issues that arise in tracking and imaging space objects, including using radar, infrared, and other techniques to capture images of objects outside of the visible spectra; transmitting data in binary form; interpreting data; using technology to collect, transmit, and interpret data; and using problem-solving skills to utilize the data and available technologies to achieve mission objectives.

Web Scavenger Hunt

Students conduct a web-based scavenger hunt to search for information about the Maui Space Surveillance Complex and Institute for Astronomy in anticipation of the tour. They were also given free time to explore websites designed to encourage girls in math, science, engineering and technology.

Site Visit to Maui Space Surveillance Complex and Institute for Astronomy

The day included the following activities:

- Balloon activity. On route to the 10,000 foot summit, students were given balloons and instructed to blow them up. As the students gained altitude, some of the balloons popped, demonstrating how the atmosphere at altitude is different than that at sea-level.
- Spectrascopes activity. Students built and tested their own simple spectrascopes. The goal of the activity was for the students to observe the qualities of light in the visible spectra and to understand the use of spectrascopes in imaging technologies.
- Infra Red Camera. The students applied cold water to their faces and looked through the infra red camera to see how the cold water changed the thermal images of their faces.
- AEOS Telescope. The students toured the AEOS telescope.
- Hawaiian Culture Presentation. Representatives from Kamehameha Schools gave a presentation on the cultural significance of Haleakala and the Native Hawaiian use of astronomy for navigation purposes.

- Tour of Institute for Astronomy facilities. The students saw how the IFA uses their instruments to observe the sun and conduct solar research.

Appliance Disassembly Activity

The students disassembled and then reassembled hair dryers and telephones to learn about the design components of basic household appliances.

Computer Disassembly and Reassembly Activity

The students disassembled and then reassembled computers to working order. Disassembly included:

- Opening CPU casing
- Removal and replacement of video card
- Removal and replacement of floppy drive
- Removal and replacement of memory chips
- Identification of input/output card components
- Reassembly of computer to working condition

Tour of Trex Enterprises

Tour of "clean room" for semi conductor production led by female Native Hawaiian technician.

Tour of Maui High Performance Computing Center

The students met four female student interns of the Maui High Performance Computing Center (MHPCC) and see a demonstration of its 3D imaging technology.

PROGRAM AGENDA

Day One

8:00 – 9:00	Introduction of Project Team and Student Mentors, Team Assignments, Ice Breaker/Team Building Activity
9:00 – 11:50	Planet Venus Project
11:50 – 12:30	Lunch
12:30 – 2:30	Planet Venus Project
2:30 - 3:15	Web Scavenger Hunt

Day Two

7:30	Depart for Summit
9:15	Arrive at Summit
9:15 – 11:10	Tour of Maui Space Surveillance System
11:10 – 11:40	Lunch
11:40 - 1:15	Tour of Institute for Astronomy
1:15	Depart from summit
3:00	Arrive back

Day Three

8:00 – 9:00	Planet Venus Project/Site Visit Wrap-Up
9:15 – 10:00	Appliance Disassembly Activity
10:00 – 12:00	Computer Disassembly and Reassembly Activity
12:00 – 12:30	Lunch
12:30	Depart for Maui Research and Technology Park
1:00 – 1:45	Tour of Trex Enterprises
2:00 – 2:45	Tour of MHPCC
3:15	Arrive Back

CULTURAL ELEMENTS

Persons of Native Hawaiian or part-Native Hawaiian ancestry make up approximately 25% of the population of Maui County. Several program elements were added to make this program appropriate for Native Hawaiian girls. First, Native Hawaiian female students from the local community college's computer networking degree program were sought to serve as mentors for the event. Since it was summer vacation, and since the degree program is small, we were only able to find two Native Hawaiian women to serve as team mentors. (These were supplemented by females of diverse ethnicity from the WIT staff). These two Native Hawaiian women were great role models. One is a LAN Apprentice for the local electric utility, and the other was serving as the lead networking assist to the community college that served as the host location for event. The girls got to see her in action when the network in the computer lab we were using crashed, and she was able to get everything working for us in a very competent way.

Second, the visit to Haleakala included presentations by two female Native Hawaiian cultural experts from the faculty of Kamehameha Schools, a private school for Native Hawaiians. One of the women spoke about the cultural, environmental and religious significance of Haleakala Volcano, including its role in Hawaiian creation myth. The other woman spoke about the proud tradition of ancient Native Hawaiians who explored and populated the Pacific with seafaring canoes using traditional navigation techniques and astronomy. The speaker had just returned from a trip on the double-hulled canoe, Hokule'a, on which she served as the first female navigator in modern Hawaiian history. She relied solely on Native Hawaiian navigation techniques to guide the canoe to Tahiti and back.

Finally, tours of MHPCC and Trex Enterprises showcased the role of female and male Native Hawaiian employees, as well as women of other ethnicities. For example, their tour of Trex was led by a female Native Hawaiian technician. They also got to meet female interns at MHPCC, where 80% of the summer interns were female.

PROGRAM EVALUATION

The unstated goal of the event is highlighted in its title, "Excite Camp". The research suggests that in the transition from middle school to high school, girls lose interest in math and science overall, and in math and science careers in particular. Stereotypes of these fields and careers as boring, isolated and male-dominated has been identified as one barrier to girls' continued interest in these fields after middle school. In addition, girls have been shown to not understand the relevance of math and science to their own lives and the communities around them. Therefore, one objective of the Excite Camp was to expose the girls to math and science in their community in a way that they would perceive as exciting, fun, and relevant. In doing this, a balance needed to be struck between the educational objectives of the event and the need to keep it engaging for the girls.

Based on their ranking of and comments on Excite Camp overall, the event was successful in achieving this balance. Fifty-two percent of the participants rated the Excite Camp as "Excellent". Given the opportunity to comment on what they thought of the Camp, 60% of participants commented that they thought the Camp was "Fun", 32% commented that it was "Cool" or "Exciting", and 24% commented that they learned something.

Evaluation of Individual Program Elements

Participant feedback was solicited in two different ways to measure the individual program elements. Interestingly, the feedback on the program elements varied between these two measures. First, the students were asked to rank each activity on a scale from "Excellent" to "Poor". Based on this measure, the Infra Red Camera rated highest, with 84% ranking it "Excellent". Filling out the top five were: Planet Venus which ranked second with 80% "Excellent", the MHPCC tour in third with 68%, the Appliance Disassembly in fourth with 56%, and in fifth place the Computer Disassembly activity with 48%.

Students were next asked to list which program element they liked the best. Based upon the responses to this question, the tour of the MHPCC was the most popular, followed in order by: the Planet Venus activity, the Balloon activity, the Computer Disassembly, the tour to Haleakala, the Appliance Disassembly, the AEOS telescope and the Infra Red Camera. Curiously, the IR Camera went from first in the previous ranking to last in this ranking.

Evaluation Measure of Program Efficacy in Meeting Program Goals

Participants also provided valuable feedback on the variety of science and technology jobs about which they learned. This is especially important, since lack of exposure to career paths in math and science has been identified as one of the barriers for girls, as opposed to boys, in pursuing these careers. Thirty-two percent of the girls indicated that they

learned about engineering. One girl commented, “I learned what engineers do and how important they are.”

Another 24% recognized the use of computers and technology as tools used by people doing a variety of different of jobs. Understanding the role of technology is important for girls, who typically do not understand its relevance or appreciate it as an end in itself. It has been noted in the research that while boys appreciate technology for technology’s sake, the relevance of technology to the world around them is important to girls. One girl made this connection, saying “at the super computer people use graphics and programming to help the military design boats and planes.” Another girl said she learned about “the way people use computers to operate a lot of stuff.”

Asked how the Camp increased their interest in learning about and using science and technology, 24% of the girls said by teaching them about science and technology jobs. According to one girl, “It told me that it’s more than numbers and such, and that it means something.” Seeing real people working in science and technology jobs also had a great impact. “Because I saw what they do and I learned that it’s fun to do anything.”

Getting down to specifics, the girls came away from the Excite Camp with a clear understanding of what work in science and technology is being done on Maui, particularly at the Maui Space Surveillance System. According to one girl, the U.S. Air Force does “more than fly jets and stuff, and that’s looking for satellites also.” They came away with the message that MSSS has several important missions, from tracking satellites and space trash, to taking images of these objects and researching them. One of the goals was to help the Air Force build bridges with the Native Hawaiian community by highlighting its contributions to the preservation and protection of Haleakala, which is considered sacred by many Native Hawaiians. There seems to have been some success in conveying this message. One girl even commented on the caretaking role of MSSS, saying “They track satellites, take care of animals that live on Haleakala, and get rid of rats” (which prey on endangered native wildlife).

The girls indicated that from the cultural presentations they learned about how Native Hawaiians navigated great distances using the stars, sun, planets and other techniques. “I learned that the Hawaiians use the stars, current, wind and sun to navigate through the water.” One girl noted that Native Hawaiians “didn’t need computers and such and that they used their own minds and thoughts” to navigate.

CONCLUSIONS AND RECOMMENDATIONS

Discrepancies in Students’ Emotional and Intellectual Maturity

The Excite Camp was open to all Native Hawaiian girls of middle school age. However, it became evident that there are broad discrepancies in emotional and intellectual

maturity between younger and older students. These discrepancies were most apparent in the students’ comments, which clearly reflect these differing levels of maturity. The older girls seem to have gotten the most educational value from the Camp, while the younger girls showed evidence of shorter attention spans and a need to be constantly engaged. Recommendation:

- Limit enrollment to eighth grade girls.

Group Size

In order to offer the kind of hands-on activities and mentoring opportunities that are most effective with girls this age, it is vital to limit the group to no more than 20 students, particularly in a group that includes younger girls from the sixth and seventh grade. The initial enrollment was set at 20. However, given the overwhelming demand, with over 50 interested applicants, this was increased to 25. Even with only five girls per mentor, this was too many, since four girls per mentor has been identified as the ideal for a number of the activities included in the camp, and the larger groups were harder to control and keep on task. Increasing the group from 20 to 25 also overwhelmed the available space for the site visits, and prevented the girls from having as interactive an experience as they would have had were the group smaller. Several girls complained of not being able to have a chance to see something or participate in an activity, and of other girls “hogging” resources. Recommendation:

- Limit enrollment to 20 participants to be divided into five groups of four with one mentor per group.

Mentors Must Be Trained in Mentor Role and Pedagogy

While each mentor was provided project resources and project-oriented training prior to the workshop, this focused on the technical or logistical aspects of the projects. The comments indicated that the mentors also need to be prepared beforehand as to the role of the mentor and basic pedagogy for the event. For example, some student comments on the Project Venus Activity refer to an “island” and “water park”. Clearly, since the project objective was to expose the girls to space exploration, the mentor allowing redefinition of the activity as an island or water park was significantly off task. There is also evidence from the comments on the Balloon Activity that some, but not all, the girls were able to draw on their balloons with pens provided by their mentor. The comments suggest this created resentment on the part of girls not able to draw on their balloons. Finally, it seems that the mentors were not able to effectively utilize cooperative or team learning techniques, since some girls complained that they could not see or could not participate in the activity the way they wanted. Recommendation:

- Provide mentors with pre-training in tools to effectively lead their teams using cooperative learning techniques

and to exert sufficient control over their teams to keep the girls on task.

Clearly Convey Camp Objectives While Keeping Presentations Age Appropriate

Attributable again to the discrepancies in emotional and intellectual maturity of the audience, the Camp's educational objectives were not clearly conveyed to participants, particularly the younger participants. The educational objectives of the Camp must be made clear to the participants if they are to garner the most benefit from the Camp. However, this must be done in an age appropriate manner. Several students complained of too much talking and lecturing, and not enough hands-on activities. Considering that the program was very focused on hands-on and interactive activities, the prominence of this complaint suggests that what talking there was may have not been age appropriate. Several students indicated they did not understand what was being said. Much of the difficulty associated with this can be overcome by limiting events to eighth grade girls with the emotional and intellectual maturity to handle more sophisticated content.

Recommendation:

- Clearly convey camp objectives to participants prior to and during the event
- Strictly limit lectures or "talking-head" type presentations
- Preview lectures or "talking-head" type presentations for audience appropriateness

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