

OVERVIEW

The Akamai Workforce Initiative (AWI) is a program that seeks to develop a skilled local STEM workforce to meet the needs of Hawai'i's growing high-tech industry. Launched as an internship program in 2002, AWI today is the result of a long-term collaboration among the University of California Santa Cruz's Institute for Scientist and Engineer Educators (ISEE), the University of Hawai'i, local Hawaiian high-tech businesses, observatories, and U.S. Air Force facilities, and other higher education institutions.

This brief presents an external perspective on AWI and is authored by Inverness Research, a research group with more than 25 years of experience studying the design, implementation, and contributions of a wide range of educational improvement initiatives. Inverness collaborated with the leaders of ISEE and AWI to examine the returns on the long-term investment in AWI for this brief. These returns are described here in terms of:

- contributions to Akamai interns and the local STEM workforce
- broader contributions to Hawai'i's STEM workforce development and the next generation of scientists and engineers
- research findings that inform the broader field.

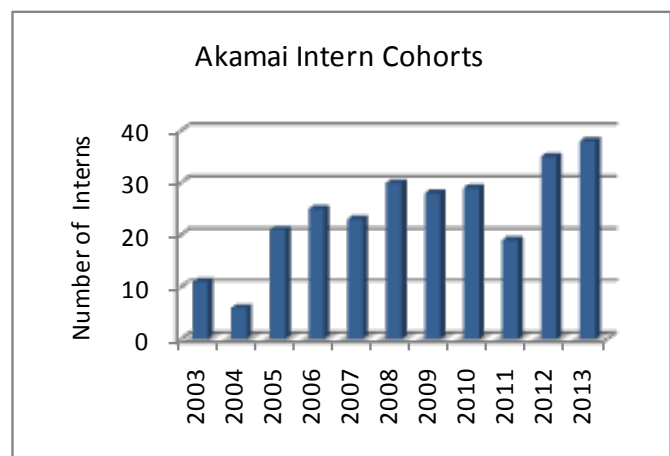
This brief is meant to complement two related briefs: [The UCSC Institute for Scientist and Engineer Educators](#), and [The Design and Evolution of the Akamai Workforce Initiative](#).

CONTRIBUTIONS TO AKAMAI INTERNS AND THE LOCAL STEM WORKFORCE

Hawai'i is home to numerous observatories, where the majority of the workforces are comprised of engineers and technicians. With ongoing national and international investments in building high-tech telescopes in Hawai'i (Thirty Meter Telescope, Daniel K. Inouye Solar Telescope), demand for workers with technical expertise continues to rise well above the available supply. Thus there is a serious need for a local workforce with high levels of scientific and technical skills. Over the past ten years AWI has been able to make a major contribution to the quantity and quality of the STEM workforce in Hawai'i, as demonstrated by the following evidence.

Akamai Interns

Akamai interns are college students from Hawai'i, selected on their potential to contribute to the local high-tech workforce. Eighty percent were born in Hawai'i or graduated from a Hawai'i high school, while only 20 percent came to Hawai'i to go to college. To date, 222 college students have participated in the Akamai Internship Program. Annual cohorts have grown over time, as shown in the graph to the right.



The demographics of Akamai interns are diverse, reflective of the population of the state of Hawai'i, and inclusive of groups underrepresented in STEM:

- 37% Women
- 23% Native Hawaiian/Pacific Islander (NHPI)
- 48% Underrepresented minority (NHPI and others)
- 37% Community college students
- 60% Born in Hawai'i
- 80% Born in Hawai'i or graduated from high school in Hawai'i

The majority of Akamai interns are from groups that historically have high attrition rates in college—they are not students who will “make it anyway.”

Unlike many “research experience” programs, Akamai accepts students early in their college education. Fifty-seven percent had just completed their freshman or sophomore year when they entered the program. Akamai also accepts from both 4-year and 2-year institutions—as noted above, 37% are from community colleges.

Local STEM Workforce

Intern placements are in fields with high workforce demands, where women and some minority groups are severely underrepresented, i.e., computer science, electronics, mechanical engineering, optical engineering, electrical engineering, and information technology.

- Based on a study of participants three years after entering the program, the vast majority (79%) of undergraduates who participate in AWI persist in either a STEM education program and/or move into a STEM career pathway.
- Ninety-six Akamai alumni are now in full-time STEM jobs. Nearly two-thirds of them are working in Hawai'i, contributing to the local STEM workforce.
- The Daniel K. Inouye Solar Telescope is hiring Akamai interns for short-term and permanent positions to establish a local workforce.

Akamai has generated many successful intern stories. There are many Hawai'i college students in the STEM pipeline who with support, training, and access have the potential to become valued members of the local workforce.

Akamai is a highly cost effective way of building the local workforce. Two summer projects and a career development workshop (see “One Intern’s Story” above) are just a fraction of the cost of relocating and training an engineer from the mainland—who is twice as likely to leave within three years.

The mentors of Akamai interns report on the real contributions the interns make to the projects they work on and to the success of the program:

These kids are doing more than menial work...they are doing real work of real value.

This (project) is really important because it demands the interns reach a certain higher level... if they are successfully to do work in this project. They need critical thinking skills and problem-solving skills that come from a lot of hands-on experience.

Akamai is to me a very effective and efficient use of our funding for workforce development. They just do it really well.

One Intern’s Story

James Linden grew up on Hawai'i Island, graduated from Waiākea High School, and then moved to O'ahu where he majored in mechanical engineering. In 2007 Linden was selected by the Akamai Internship Program and placed at Gemini Observatory. Under the mentorship of an engineer he created a computer model of a cooling system for a telescope instrument. In 2010 he attended an Akamai career development workshop sponsored by the National Solar Observatory (NSO). He spent the summer of 2011 in Arizona working at NSO, where they were so impressed with him that they hired him for a permanent position. Linden now lives on Maui and is a thermal technician for NSO's Daniel K. Inouye Solar Telescope (DKIST).

BROADER CONTRIBUTIONS TO HAWAII'S STEM WORKFORCE DEVELOPMENT AND THE NEXT GENERATION OF SCIENTISTS AND ENGINEERS

A major component of AWI is ISEE's Professional Development Program (PDP). The PDP immerses early career scientists and engineers (graduate students, postdocs, and professionals) in a professional development experience where they interact with college students in "teaching lab" environments such as the Akamai Internship Program, college courses, and other workforce development activities. ISEE and AWI have increased the local capacity of the universities in Hawaii to contribute to the development of indigenous high-tech workers.

- A total of 116 AWI participants have completed the PDP, including 15 University of Hawaii faculty members.
- Maui now has a 4-year degree program that prepares students for local tech jobs.
- University of Hawaii (UH) Maui College has doubled the student capacity of its 2-year engineering technology degree.
- Six of eight graduates to date have tech jobs on Maui. In the small community of Maui, these numbers make a large difference.

Akamai has helped to create a local institutional infrastructure that helps meet the state's need for a high-tech workforce. New high-tech college training programs, new courses and laboratory facilities, carefully engineered internships, articulation with statewide community colleges, and an ISEE chapter in Hawaii are some of the many mutually advantageous institutional relationships and structures built through the AWI investment.

Outcomes from integrating the PDP into AWI are summarized in more detail in a companion brief, [The UCSC Institute for Scientist and Engineer Educators](#).

The ISEE Professional Development Program has involved 240 active or "primary" participants for over a decade. These graduate students and postdocs learned to successfully integrate inquiry and inclusive teaching strategies into their own instruction. They have participated in and learned about generating and assessing learning objectives. They have gained professional skills including teamwork, mentoring, leadership, project management, and collaboration. A third have advanced into the STEM workforce (approximately 43 into academic positions; 32 into non-academic positions). The others are continuing their studies and will advance into careers soon.

RESEARCH FINDINGS THAT INFORM THE BROADER FIELD

In addition to directly supporting student participants and developing institutional infrastructure, AWI has supported research studies, development of new tools, and refinements of strategies that have positioned the program to inform the broader field of workforce development. Here we highlight just a few key ideas and tools of merit generated by AWI with the potential to inform other similar efforts and to spur the refinement of its own efforts.

Findings about Effective Professional Development

- In a study carried out within AWI by ISEE, an assessment tool was developed to identify specific, observable "inquiry indicators" that could assess how well ISEE's Professional Development Program participants accomplished designing, teaching, and assessing an inquiry activity. (More information about this tool and other papers about the PDP can be found at isee.ucsc.edu/publications/proceedings/volume-abstracts.html.)
- Using the inquiry indicator tool, research findings indicate that about 95% of PDP participants

integrate what they learn into their teaching experience, 70% with a high level of proficiency. This is important because very few professional development efforts are able to demonstrate such a high level of implementation, i.e., their participants put into practice the strategies they learn.

- ISEE experience has shown that effective professional development takes multiple cycles of learning, practice, and reflection. In the above study, there was a moderate positive correlation between the inquiry indicator score and the number of years the leader was involved in the PDP. These findings match what the project has observed for many years, namely, that it is usually in the second cycle of the PDP that participants gain a solid understanding of how to design an inquiry activity.
- A tool and protocol were developed as part of a study designed to assess PDP participants' gains in their understanding of inclusive teaching strategies. Using this tool, findings from a pre-post assessment indicated a statistically significant difference in participants' retention of knowledge about inclusive teaching strategies a year after their learning about the strategies.

Findings about Undergraduate Persistence in STEM

- Akamai interns of all ethnicities and of both genders persist in STEM careers at the same rate. There have been no gender or ethnicity-related differences as typically seen in college persistence rates.
- GPA upon entrance into the Akamai internship has not been a determining factor in the retention in STEM. The GPA of interns upon acceptance is from 2.2 to 4.0, with a median of 3.3. Interns with higher GPAs did not have a higher probability of staying in STEM.
- New knowledge about the relationship between the quality of the intern project and mentor-mentee relationships provides important lessons learned for the field of mentoring, as a quote from the AWI annual report suggests: *These findings inform the field of mentoring—an extremely important part of workforce development—that has largely focused on everything except the trainee's actual STEM work, which is the vast majority of their experience in the internship.*

SUMMARY STATEMENT

Evidence cited in this brief illustrates how AWI and ISEE have contributed in a wide range of ways. The programs have supported the development of individual interns, aided workforce development in Hawai'i, built institutional infrastructure, and created tools that build the knowledge base of the STEM education community. These contributions are all the direct result of the sustained, long-term commitment of ISEE and AWI.

Funding for AWI was provided from multiple sources over many years, including: National Science Foundation (AST-9876783, AST-0710699, AST-0836053, AST-0850532); Air Force Office of Scientific Research (AFOSR) (via NSF AST-0710699 and FA9550-10-1-0044); University of Hawaii Vice President for Research office; Thirty Meter Telescope International Observatory; National Solar Observatory; Air Force Research Laboratory Directed Energy Directorate. More information on AWI can be found at: akamaihawaii.org.

Visit the Inverness Research website at inverness-research.org/abstracts/ab2014-06_Rpt_Akamai_Briefs.html to view two related briefs: *The UCSC Institute for Scientist & Engineer Educators*, and *The Design and Evolution of the Akamai Workforce Initiative*.

Inverness Research, a national education evaluation and consulting group headquartered in Northern California, has over 25 years of experience studying local, state, and national investments in the improvement of education.