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**Center for Adaptive Optics  
Education and Human Resources Program**

**Evaluation Highlights  
2003 Internship Program**



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## Evaluation Highlights

### Center for Adaptive Optics 2003 Internship Program

#### Goals

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CfAO's internship program offers students an opportunity to work for two summer months in science and technology organizations involved with adaptive optics research. The primary goals are to:

- engage community college students and undergraduates from 4-year universities in an eight-week summer research experience with an emphasis on adaptive optics research
- provide support and professional opportunities to prepare participants to pursue their educational and research career goals
- support participants in preparing and presenting their research at a student symposium at UC Santa Cruz and at a fall national conference

#### Evaluation Activities

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Three evaluation activities were carried out to document the accomplishments and benefits of the CfAO internship program as a whole, and to identify opportunities for program improvement.

These activities included:

- Post orientation survey distributed on June 29, 2003 at the conclusion of the 5-day Internship Orientation program
- Post internship questionnaire distributed on August 11, 2003 at the conclusion of student internships
- Two intern focus groups conducted August 11, 2002

The CfAO staff have designed a tracking system for alumni in the program, and are reporting the results separately.

#### Evaluation Highlights

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This summary of evaluation results is divided into two parts: Intern Orientation and CfAO Internship Program. It is followed by a concluding section, Lessons Learned and Planning Considerations.

#### ***Intern Orientation***

##### Overview

The Intern Orientation was designed to prepare interns for their 8-week internship placements in science and technology organizations. It was held at UC Santa Cruz from June 25-29 and facilitated by CfAO members. Activities emphasized research in Adaptive Optics (AO) and included lectures, labs, science inquiry activities, mentor talks, and field trips.

The goals of the Orientation include:

- give students an understanding of the structure and purpose of the CfAO and their role in it
- expose students to a variety of scientific content emphasizing the research areas of the Center for Adaptive Optics
- foster a sense of community among the interns that they can continue to cultivate
- give students experience with research environments and practices such as developing questions, formulating hypotheses, and presenting results both orally and visually

Most of the interns learned about the internship opportunity through a personal discussion with a friend, colleague, or faculty member. Several found out through formal programs, like MESA and the SWE. Twelve students participated in the Orientation and thirteen completed full internships.

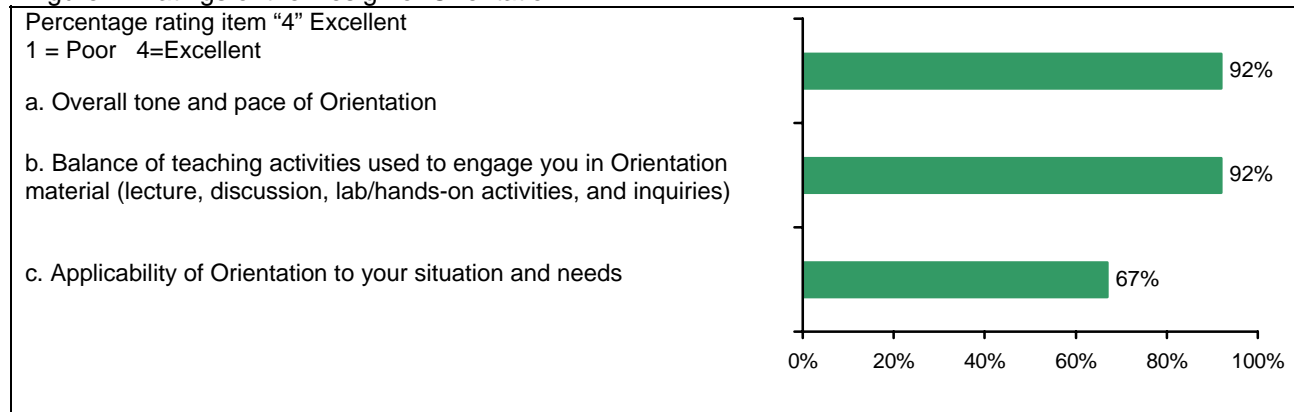
#### Overall Assessment of the Orientation

- After its second program year, CfAO staff has continued to use feedback that they have collected informally and through evaluation activities to fine-tune the 5-day, 40-hour program. Changes were made in the 2003 program design based on feedback from the 2002 program.
- Overall, the Orientation received very high marks from participants, with 92% rating it a “very good” or “outstanding” experience. Participants left the Orientation with information on their internships, more refined views of AO, exposure to the “inquiry” teaching approach, and a heightened awareness of the scientific research enterprise. CfAO was very successful in cultivating an inviting professional community among the participants, the instructors, and the CfAO staff, and in responding to individual questions and needs throughout the program. This is a consistent and highly commendable strength of the CfAO staff and instructors that is strongly valued by these young scientists.

#### Participants’ Perceptions of the Orientation Design

- Participants gave high marks to the design of the Orientation, with 92% rating it “Excellent” on the tone and pace of the sessions provided. An equal number, 11 out of 12 participants or 92%, gave the highest rating to the balance of strategies used to engage them in the material (see Figure 1).
- There were slightly lower ratings on a question related to the applicability of the Orientation to participants’ specific internship situation and needs—1 rated it “Fair” and 3 rated it “Good.” More information is needed to determine the specific reasons for the lower ratings, but a possible explanation may be that some participants were unclear about the details of their placements and research projects in advance of their arrival at sites. Comments on the surveys and in the focus groups also showed that in some cases participants were not clear on the relationship between the AO presentations and activities and their responsibilities in their internships. Some interns were not working directly in AO areas, and found the content less useful or applicable to their research projects. To resolve this issue, it would be helpful to clarify the purpose and role of the AO content and activities in the Orientation.

Figure 1. Ratings of the Design of Orientation



- Ratings on the quality and the usefulness of the individual elements of the Orientation were uniformly high. The Light, Color, and Spectra inquiry was the element that was rated as the most useful. The internship overview and orientation goals session and the basics of optics presentation were among the other sessions that were viewed as the most useful.
- Three of the 12 respondents gave the alumni intern panel a quality and usefulness rating of "2" or "Okay." Several indicated in their comments that it wasn't as well organized as the other activities and that two panel members were not adequate for a panel presentation. The other 9 respondents found it of sufficient quality and usefulness.

#### Participants' Experiences with the Inquiry Approach

- Over half (7 out of 12) participants had no previous inquiry learning experiences prior to the Orientation. It was clearly an eye-opening experience for the group to systematically work through and reflect on a full inquiry. Participants indicated in their comments that experiencing the Light, Color, and Spectra activity was like shining a light on the concepts so they could see and understand them more deeply. All but one participant (92%) thought that the inquiry was the most useful component of the Orientation.
- In comparing the traditional lecture and lab instructional methods, almost all of the participants viewed the inquiry approach very favorably, noting that the hands-on, informal approach was enjoyable and helped them focus more on understanding the concepts.
- The benefits of experiencing the inquiry identified by the participants included learning a new process to approach problems, more deeply comprehending concepts that were previously unclear, and discovering that the hands-on, discovery approach was a powerful way to more deeply understand concepts. Some participant comments were:

*It helped me to develop a new thinking process of how to attack a problem.*

*This inquiry helped me learn things I was not aware of like how an adaptive optics system works.*

*I was vaguely familiar with these concepts, but this activity helped pull them all together.*

*This helped me comprehend more deeply light and color concepts.*

- Participants indicated that facilitators' questioning approaches were key in helping them learn the concepts. Seven of the 12 respondents indicated that they were helped most by not getting immediate answers to their questions from the facilitators, but rather by having the opportunity to dialog with them, and to construct their own meanings. Participants found the wrap up session at the

end of the inquiry useful for reflection on and weaving their experiences together. Several responses concerning the value of the inquiry wrap up session were:

*...because they filled gaps that were not covered by our own or our peer's explanations.*

*...by pointing out what it was we learned. It gave the knowledge a structure that will help me use it consciously.*

### Influences of the Orientation

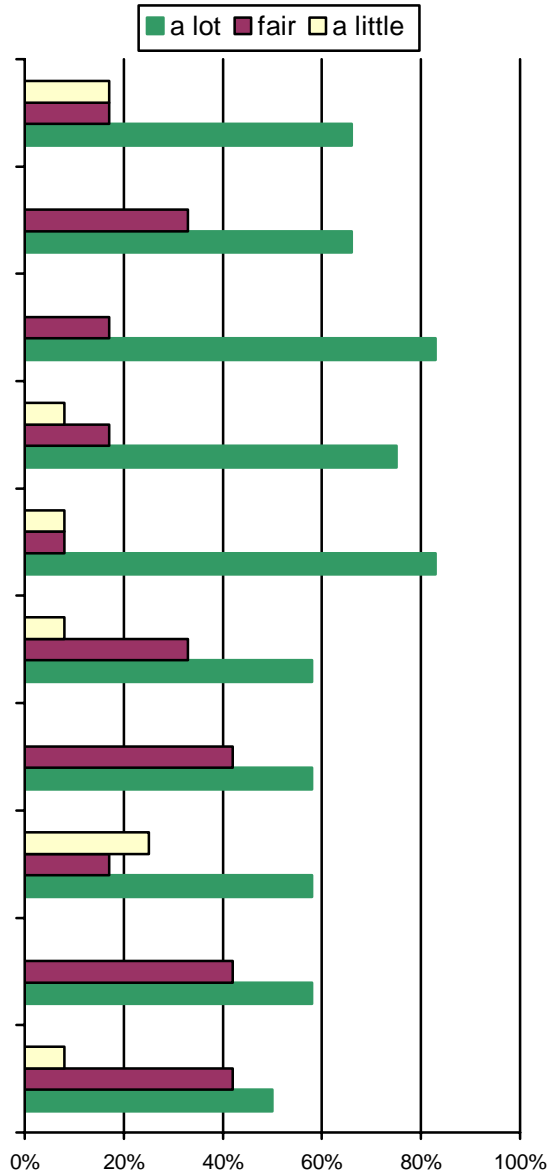
- The survey also asked the 13 participants to rate the ways they felt the Orientation had influenced their knowledge, sense of preparedness for their internships, and their collegial relationships. As Figure 2 below illustrates, areas that received the highest ratings (4 = a lot) were participants' personal connection with CfAO (83%), understandings of adaptive optics (83%), and knowledge of basic optics (75%). In addition, 66% of the participants felt the Orientation also cultivated a sense of collegiality with their fellow interns and gave them a firm understanding of CfAO and activities at partner institutions.
- Components with more participants giving "fair" marks included presentations related to the technical aspects of optical instrumentation and vision science/vision science research—topics that are understandably difficult to grasp in a short period of time.
- Five of the 12 interns reported feeling only fairly prepared for their internships at the conclusion of the Orientation. At the end of the internship program, participants were asked to reflect once again on how well the Orientation prepared them for the roles and responsibilities at their sites. The results were similar, with 42% reporting "somewhat", 33% "adequately", and 25% "very well." Some possible reasons for participants' lower ratings on preparedness may be due to insufficient information on the details of their internship sites, their living arrangements, and/or their research projects. This rough pre/post assessment shows that interns may need more thorough preparation during the Orientation on the logistics of their internships so they feel more confident as they begin their internships.

Figure 2. Ratings of Personal Influences of the Orientation

Rating scale:

1 – none 2 – a little 3 – fair 4 – a lot

- a. sense of collegiality with other interns
- b. understanding of the CfAO and what takes place at member institutions
- c. personal connection to the CfAO
- d. knowledge about basic optics
- e. understanding of adaptive optics
- f. knowledge of the optical instruments used in adaptive optics (like telescopes)
- g. general knowledge about how the eye works, visions, and current research in vision science
- h. comfort with making scientific presentations to peers
- i. feeling of preparedness and confidence for internship
- j. connections with people in field(s) of interest at CfAO and elsewhere



## CfAO Internship Program

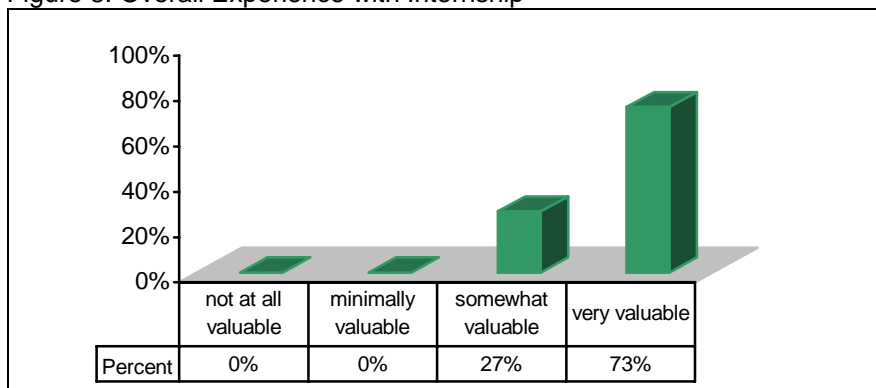
### Overview

- The CfAO internship program was designed to give students interested in adaptive optics an advanced opportunity to practice professional-level science in an AO research culture, be part of an active research team, and produce a scientific presentation to present to their peers at a UCSC symposium and then later at a professional conference. Twelve students participated in the Orientation program and 13 students completed internships between June and August 2003.

### Overall Assessment of the Internship Program

- This rich and authentic immersion in the scientific culture in the early stages of students' educational careers brought many benefits to the thirteen students who completed the program. For most, the internship experience increased their motivation to proceed along scientific research pathways and to increase their involvement in the field through their new contacts and colleagues. Practicing science in a real world environment with the support of a research advisor helped confirm students' career directions and set in motion some specific academic plans. For a few students who were still exploring career directions, the experience helped them determine that they would rather pursue other related career pathways.
- About three-quarters of the participants (see Figure 3) reported that their overall experience in the program was "very valuable" and the remaining quarter "somewhat valuable."

Figure 3. Overall Experience with Internship



- Minor fine tuning on logistics and guidelines (outlined in Lessons Learned and Planning Considerations) as the program moves into its third year should increase effectiveness and the impacts of the program on the participant side. Some additional evaluation of partner organizations and research advisors can provide additional data on participant progress and other opportunities for expansion and refinement.

### Influences of the Internship Experience

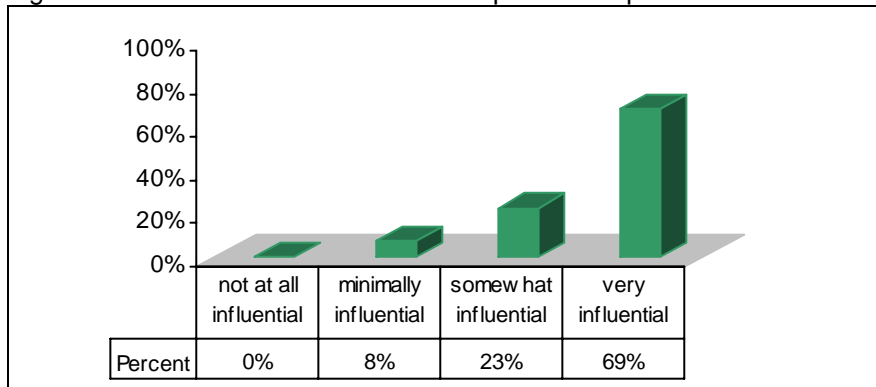
- The supportive staff and peer culture afforded students an opportunity to learn about new advances in educational and research and have extensive professional dialog at a level not common in community college or undergraduate science programs. Both aspects were viewed by participants as elements that contributed to their positive experiences during the program.

*... This experience was, for the most part, a way for me to get focused on something that I really like. It allowed me to meet people that inspired me to believe I CAN do what I set my mind to.*

*That was nice... getting be in the network around the Jet Propulsion Laboratory and the California Institute of Technology. Those people are really brilliant and they explained stuff in such a way that helped my research and made me realize that hey, I can do this as long as I am around people that make it feasible.*

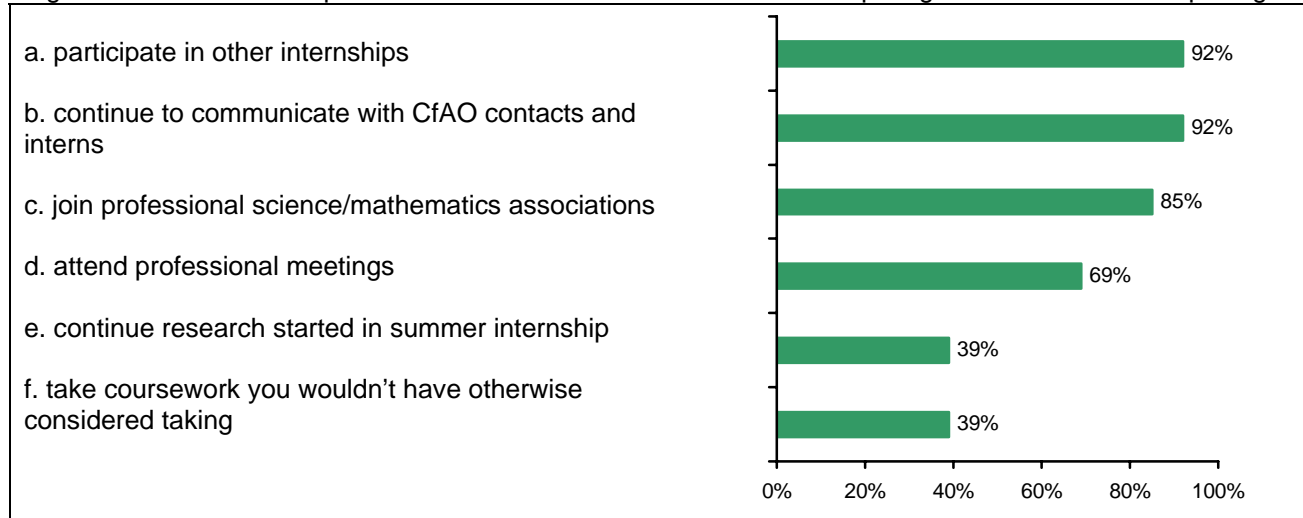
- Almost 70% of the interns anticipated that their internship experience would have a significant impact on their education and career plans (see Figure 4).

Figure 4. Estimated Influence of Internship on Participants' Education and Career



- As Figure 5 below illustrates, interns are motivated to remain active in scientific research and intend to continue their relationships with CfAO and other professional communities as a result of their internships. This is clear evidence that the internship program is achieving its goal of supporting students in their research pathways. Several students mentioned gaining an increased understanding through the program of the way that research is conducted and the collaborative nature of research.

Figure 5. Activities Participants Plan to Undertake as a Result of Participating in the CfAO Internship Program



## Lessons Learned and Planning Considerations

CfAO staff support was highly applauded by interns. Interns indicated that they felt well cared for by staff and in a sense, in a supportive “family” like environment during the program. This is and has been strength of CfAO staff in their educational programs and a positive factor in the ongoing relationships they have established with alumni.

Internship Orientation facilitators. Both the survey and the focus group data revealed that participants as a whole highly respected and valued the expertise of the Orientation instructors. Some participants indicated that they would like to have some more social time with instructors during the Orientation.

*I really enjoyed how every single instructor taught their lectures very well. Also, I think that they are very easy to talk to and they are very approachable.*

*They were very well organized and knowledgeable.*

Clarify expectations about the role of AO in the Orientation. While interns were very interested in the AO background and activities, some indicated that the AO content wasn’t applicable to their internships, and therefore found it to be a less useful component. Since a primary goal of the Internship is to expose interns to research in adaptive optics, it would be useful to make the goal clearer in promotional and application materials, as well as in the goals presentation during the first day of the Orientation.

Information on educational and career opportunities in AO. Several interns suggested that CfAO add more information on graduate school and career opportunities in optometry and AO. One intern asked for specific career and academic counseling. Perhaps a session could be integrated into the Orientation to give interns some awareness of the academic and career options available to them before they become immersed in their internships. It also may be helpful to provide more information related to professional associations and conferences.

Preparing interns for diverse internship settings. An inherent issue that CfAO can only partially address through the Orientation is preparing the annual intern cohort for their individual internship settings and research projects. Because each setting is unique, perhaps relationships can be established earlier, so interns can initiate a dialog with their supervisor prior to the placements and begin any advance preparation and/or reading. Interns who had internships in AO areas, indicated that the background they received on AO was beneficial.

Internship placements. CfAO could consider strengthening its strategy for recruiting and preparing sites and research advisors. In response to a question about the extent to which the internships met participants' expectations, about a third (33%) indicated that their placement was "fair," 42% reported "good," and 25% reported "excellent." The main concern voiced about the Orientation was that about half of the participants felt they lacked clear information on their internships and their research projects prior to arriving at their sites. To the extent possible, specific criteria and expectations need to be met by the advisor and sites for interns to maximize their experience during their 8-weeks at their assigned sites. It is also important to note that the partnerships are still in their initial stages and that it is difficult to anticipate all issues that may arise. Staff has received detailed evaluation summaries with specific suggestions for changes and is addressing issues in the 2004 program.

Living arrangements. While the majority of interns were very satisfied with the way they were received at their sites and their living arrangements, several interns had difficult situations that hampered their internship experiences. Some of the difficulties included inadequate sleeping quarters, lack of pre-arranged meal plans, or refrigerators.

Internship research advisors. In screening advisors, it is important to assure a good working relationship and elicit details on the internship placement and research projects. Participants whose mentors left for long periods of time or who were not available were less satisfied with their internships. Advisors also need to be oriented to the expectations of the research projects and the timeline for preparing presentations. One intern suggested that it would be helpful for interns to provide a written report on what was done/learned to the supervisor.

Research projects. For the most part, interns were satisfied with their research projects. There were problems in several cases: (1) when a research project was not defined until later in the internship; (2) equipment did not arrive on schedule, thereby derailing an intern's planned project; (3) mentors who left interns without supervision for periods of time, resulting in interns who were left "floating"; (4) lack of productive communication with advisors, and (5) research projects that were shifted or changed completely mid-course in the internship. In addition to causing some anxiety, the changes impacted the length of time interns had to conduct their research and their presentations.

Weekly meetings. There were some mixed perceptions of the weekly meetings among interns. Some found them essential for helping them stay on track with their research and presentations, while others didn't feel they were necessary. In order to maximize the efficiency and usefulness of the meetings, a detailed schedule with key discussion topics could be developed and presented at the Orientation. It also became clear from the focus group sessions that it is important to set some ground rules related to timeliness and the amount of time each individual can talk during the videoconference. Several individuals felt that having the full group in conference at one time was somewhat frustrating and that some individuals weren't able to participate and benefit fully from the meeting.

Preparation for research presentations. Interns were grateful for the opportunity to practice and get feedback on their presentations. Several interns specifically mentioned how helpful it was to give their presentations at their sites. However, some of the logistics need to be tightened up, so that everyone has an equal opportunity to get feedback and that the feedback sessions don't run too long. To the extent possible, it would be helpful to provide more specific information on the research presentations at the Orientation.

Internship Orientation program evaluation. The Intern Orientation survey instrument developed in 2002 by the evaluator was adapted by the instructional team for use in the 2003 program. In reviewing the items, there are several that need to be reworked to gather the intended information and to eliminate confusion on the part of the respondents. It is recommended that the evaluator review and provide suggestions for the instrument prior to the 2004 program.

Feedback on research presentations. Since the research presentations are the capstone activity for the internship and (for most), a major professional accomplishment, CfAO may want to consider developing a mechanism to get feedback from interns after their research presentations. For example, distribute the post survey and/or conduct focus groups after the symposium is completed.

CfAO Internship alumni tracking. CfAO may want to consider a simple strategy for tracking internship alumni to identify the ways their experience influenced their educational and research career plans and activities, their relationship and activities with CfAO, their continuing relationship with their internship sites, and other professional activities such as pursuing other internships or application of skills from their internships and presentations.