# AC 2008-337: PARTNERSHIP FOR MENTORING: THE GEORGIA TECH CSEMS PROGRAM AT AGE SIX

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# Partnership for Mentoring:
# The Georgia Tech CSEMS Program At Age Six


## Abstract

This paper reviews six years of experience from the Computer Science, Engineering and Mathematics Scholarship (CSEMS) program funded at the Georgia Institute of Technology by the National Science Foundation (NSF). The primary feature of this program is the partnership between academic faculty across a large institution, with the Financial Aid department, in mentoring and supporting the students. In completing their education, students are guided to participate in activities that broaden their horizons. Other innovative features are a grade point requirement profile adjusted to the demands of a challenging program, a requirement to seek out professional-level seminars, and mandatory mentoring. Assessment results indicate continued success in enhancing retention and supporting diversity. A new survey of graduating students reinforces the foundations of the program.


## Introduction

This paper summarizes the experience at the Georgia Institute of Technology with the National Science Foundation's Computer Science, Engineering and Mathematics Scholarship (CSEMS) program, midway through its second phase. Earlier work was presented in 2004[1]. Our program is named "Financial Assistance for Success in Technology". This paper analyzes recent findings including responses of the students who have graduated with support from the program, and the findings from the numerous seminar summaries developed by the scholars

The original CSEMS program was set up as a Congressional condition for expanding the H-1B visa program. It sought to address the shortage of qualified people going into technological careers in the US. NSF provides the funds as a lump sum grant for 4 years, to be distributed at $100K per year. As the CSEMS program's continuation under Congressional mandate appeared doubtful in 2004, our project was renewed early, with the new program's official start date being January 2005. Funds from the new project were first used in Fall 2005, so that this is the end of the second year of its operation. The original parameters of the program were that

1. Recipients had to be US citizens or permanent residents
2. They had to be taking full academic loads towards an approved CSEMS degree
3. They should be aiming for technical careers in these disciplines
4. The scholarship was intended to relieve students of the financial burden of seeking outside jobs, thus allowing them to focus on their academic programs.
5. The program was prohibited from requiring research or other productive activities.

## Program Objectives & Elements

The objectives of our program are to enable access to a top-quality education to the most deserving students and to ensure the best guidance for their success. It was anticipated that many

such students would be from under-served backgrounds that include rural and inner-city environments. Basic elements (Ref. 1) are to:

- introduce the most deserving and talented students to the excitement of CSEM careers,
- provide access to a top-quality education, and
- furnish the best guidance for their success and development.

Major components of data and findings used in this paper are:

- Distribution of students by academic discipline and other criteria
- Their responses through summaries of what they learned there.
- Graduating seniors' suggestions to the program and to those following them in the program.
- Mentor observations.

**The Environment of the FAST program**

Table 1 presents benchmark data[2,3] for our present program. The program is successful in attracting a slightly more diverse demographic pool than the overall CSEMS student population. Diversity is not used as a criterion in selecting students for this scholarship. Should two students have identical credentials and need but differ only in non-merit aspects, we certainly hope that we will be able to find support for both. In the CSEMS program we strive to make students aware of the many other opportunities on campus (described in Ref. 1) early and provide experienced guidance on how and when to pursue given opportunities.

**Table 1: FAST demographics vs. overall GIT CSEMS undergrads**

| | African-American | Asian-American | Caucasian | Hispanic-American | Native-American | Women |
|---|---|---|---|---|---|---|
| FAST | 8.5 | 17 | 56 | 14.9 | 0 | 25.5 |
| GIT CSEMS colleges, 2008 | 6.5 | 22.2 | 64.6 | 5.5 | <1% | 24.98% |

Our program is used exclusively to help undergraduate students, since there are many other avenues of support for graduate research. In 2004-2005 there was a debate in the science community, resulting in the maximum funding per student allowed under CSEMS being increased to $10,000 from the previous $3100. Our Institute, however, is rich in numbers of excellent but needy students. We see the opportunity to mentor as many as possible of these students towards leadership in technology as being tremendously important in positive impact on these students' choice of careers. Accordingly, we did not change our policy of a standard $1000 per semester to students, with a possibility of increasing that in cases of dire need. Once we get the students' attention through this scholarship, we try to guide them towards other sources of support, including scholarships and paid undergraduate work experience.

**Some Features of the FAST Program**

The above might inform the reader why we decided on another feature of the Georgia Tech program: Not only is there no "overhead" in this program, but 100% of the funds go to the students, with zero funds taken for either the Office of Financial Aid administering the program, or the project team, including the PI, any co-PIs, or the faculty mentors. It might also explain why we have an outstanding record of "allowing" so many of the most enthusiastic and the most experienced undergraduate advisors and researchers on Georgia Tech's faculty to become our

most active Mentors. The project team started with 4 faculty from the Colleges of Engineering, and quickly expanded to 10, which was the status at the end of the first 3 years of the program in 2004. Today, the number stands at 26, recruited from across the schools of engineering, computer science and mathematics. This is one of our greatest successes – the demonstration of our hypothesis that the best mentors in the university could be "recruited" simply by offering them the opportunity to mentor enthusiastic students who would be most receptive and benefit the most from such mentoring. A corollary is that the project administration has to be as non-intrusive and yet pro-active as possible in utilizing the precious time and expertise offered by these mentors. We minimize expenditure of time consistent with quality of mentoring, and avoid needless commitment of resources. Thus there are no Mentors' Conferences, no Invited Seminars, no Mentors and Directors' Lunches (let alone Dinners). A very strong feature of our program is a partnership between the academic faculty and the Financial Aid department, in our common interest of helping our students stay in school. Funding priorities are determined through an interactive process, and the PIs of this project work with the financial aid office on weekly basis.

**Program Requirements**

To make the most effective use of resources with the best impact, we developed a requirement that awardees meet with their assigned mentors at least twice a semester to discuss their progress and plans. They must also choose and attend two seminars presented by visitors to Georgia Tech, generally on technical content. They have to then write a paper of one to two pages summarizing what they learned – a requirement that encourages not only attentive listening, but also follow-up discussions with the presenters, technical writing skills, and interactions with their mentors. A particular format is specified for this write-up, and that format is demanded, sometimes through repeated re-submissions of the write-up to ingrain the importance of following format guidelines (e.g., proposals, project reports) that will be critical throughout their careers.

These requirements are enforced, with reminders ranging from the gentle to the not-so-gentle, and resulting in suspension from funding if the requirements are not met. It must be emphasized that the recipients, smart as they are, are also quite young, independent-minded, and often come from high-school environments where they may have felt little need to heed their teachers' advice. They are also, as a rule, rather clueless about the opportunities and requirements of the technical workplace, the university and research environment, or about the discipline and level of competitiveness needed to succeed at the upper levels.

**Student Participants**

During the past year, 69 of the 94 students listed in the program were supported financially. This was possible because several students were in the CoOp program, where they are only in school during alternate semesters. The present distribution by major field is shown in Figure 1. Their GPA distribution is in Fig. 2. Students are generally selected as they enter in the Fall of the first year, and those once admitted into the program are generally given continued funding in subsequent semesters unless they no longer qualify under FAFSA, or are dropped due to non-responsiveness to program requirements, transfer out to non-qualifying programs such as in the College of Management, or are dropped due to academic non-performance.

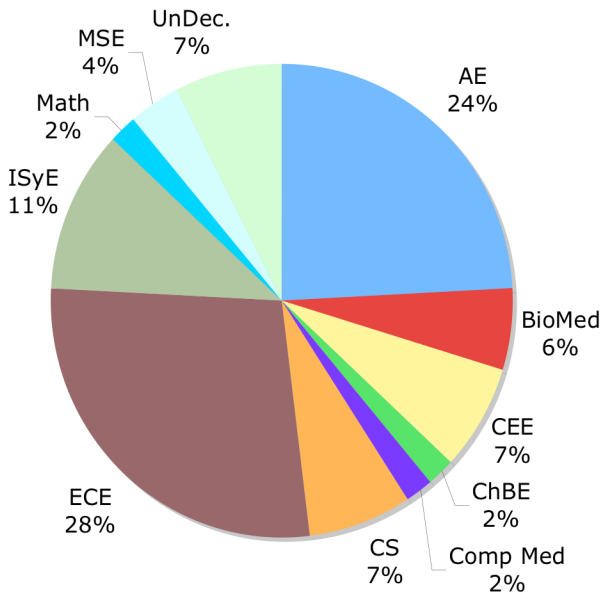


**Figure 0: Distribution of students By Discipline**

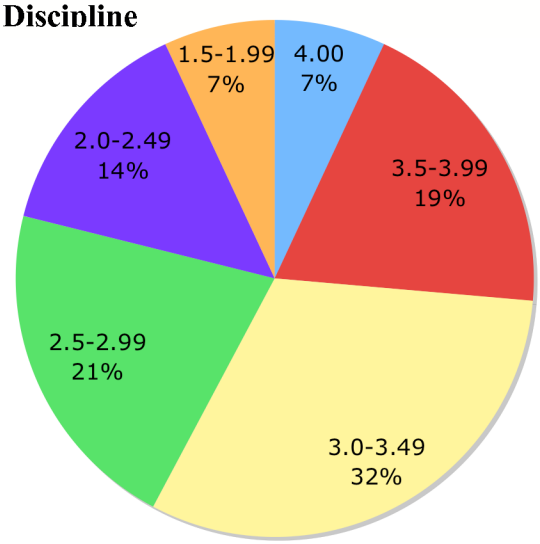


**Figure 2: Grade Point Average**

## The Seminar Requirement Experience

Even in a research university, many students go through their four years with little awareness of the research and industrial development activities that occur in the university. The seminar requirement was aimed at undergraduates who were least likely to be cognizant of the vast opportunities available to them. We decided to let students explore and discover their own interests.

Students immersed in full-time CSEMS programs are using the seminar requirement to attend research presentations well outside their coursework, broadening their horizons. In writing a summary of what they learned, students state their own well-considered opinions on what the presenters stated, and comment on presentation styles. Seminar options meet diverse needs:

- Freshmen and sophomores are encouraged to go to the Division of Professional Practice and Student Success Center, who arrange Co-Op and Internship opportunities, and take seminars and one-to-one help with interviewing and resume writing.
- Juniors and seniors are encouraged to attend at least one PhD or Masters Thesis defense to learn what kinds of research and student expectation levels occur in graduate school.

Experience with this requirement confirms that it is *essential and successful*. Students who took the initiative early to explore for seminars have sent in abstracts that reflect genuine excitement and interest. The discipline of having to plan, explore, find and actually attend two seminars is a tough challenge to several students. The program requirements are summarized in Table 2.

**Table 2. Summary of FAST Scholarship Requirements**

| | Cum GPA | *Recommended* Activities Outside Classes | Mentoring Requirements: Minima |
|---|---|---|---|
| Freshman Hrs.0-30 | 2.0 | Seminar series; One "project team", limit of 1 extra-curricular | Twice a semester |
| Sophomore Hrs.30-60 | 2.3 | Seminar series; Two project teams; 2 extra-curricular; peer-leader of | Twice a semester. Resume writing; interviewing. |

| | | | |
|---|---|---|---|
| | | freshmen | |
| Junior<br>Hrs. 60-90 | 2.4 | Two project teams including one research/ design competition; 3 extra-curricular; Peer leader | Once per semester. Interviewing skills; grad school/ career surveys |
| Senior<br>Hrs 90-136 | 2.6 | Two project teams incl. one research; 4 extra-curricular. Peer leader | Once per semester. Grad school applications; letters; scholarships |

**Graduating Senior Survey Results, 2007**

There were 27 responses to the senior exit survey by 2007 graduates. The remainder of this paper summarizes those results. The responses below are for the questions that brought comment.

**1. What did the scholarship funds enable you to do?**

| |
|---|
| Reduce loans (ALL 27 Responses) |
| Reduce/eliminate part-time job (13 responses) |
| Didn't have to get a part-time job (1 response) |
| Responses under "Other":<br>1. Have more study time because I was able to reduce my job hours.<br>2. Made Daycare for my daughter affordable so I could stay in school. |

**2. How did the seminar attendance requirement affect you?**

| |
|---|
| I was able to narrow down technical area of interest (13 responses) |
| Made contacts with future employers (2 responses) |
| Nuisance, didn't help at all: (1 response) |
| Responses to "Other"<br>1. Gave valuable insight into what engineers do in the real world.<br>2. Helped learn more about my field.<br>3. Gathered information on succeeding in the professional world. It was tough to find seminars that interested me. However there were a couple, most were over my head.<br>4. Helped prepare for applying to graduate school. Kept me up to date with current research.<br>5. Important for showing professional presentations should be conducted. How research is performed in general.<br>6. I couldn't have successfully applied to graduate fellowships if it weren't for the seminars.<br>7. Able to learn about technical areas (of which) I previously had little or no knowledge.<br>8. Informative, but the writeup was a hassle.<br>9. Provided motivation to learn more about topics I'm interested in.<br>10. Interesting and learned about topics related to my field.<br>11. They were interesting and informative.<br>12. Made me more knowledgeable about current research in my field.<br>13. I went to seminars before FAST<br>14. Improved my understanding of how science and technology advance. Gave me a better perspective of how my skills could be applied towards further advances. |

**3. How did mentoring help you?**

| |
|---|
| Able to narrow down technical area :10 responses |
| Mentor helped schedule more productive classes: 8 responses |
| Helped get me coop or internship: 1 response |
| Suggested seminars that helped in weak aspect: How? 6<br>• Resume-writing 2<br>• Technical focus areas: 5<br>• Writing proposals<br>• PhD proposals. |
| Gave me great advice on:<br>• DSP (diXXXal signal processing).<br>• School; accepting job offers.<br>• What to do after graduation. Professional skills.Encouraged me to pursue grad school.<br>• Survival in grad school. Life after graduation.<br>• Graduate school. Pushed me not to be complacent, through tough love. Grad school funding. What to do after undergrad studies. Grad school. Choosing graduate schools; very helpful in the overall process of applying to grad schools and fellowships. Job search, grad school, options available to me after graduation. Also gave me great suggestions when I asked questions or was confused about what to do. He pointed me to sources, people who I could talk to and learn more from.<br>• Attending graduate school, contacting professors whose research is in fields of interest. Jobs, grad school, class.<br>• Internships.<br>• Research, graduate school<br>• Graduate school.<br>• Graduate school.<br>• Keeping my options open and diversifying my academic pursuits for personal enjoyment / fulfillment. |
| "I was predominantly self-sufficient and don't need mentor guidance" |

**4. Suggestions to Improve the FAST program**

| |
|---|
| 1. Add semester lunch or dinner for all mentors and students. Never really got to network with any other students & only met with mentor and no one else.<br>2. Increase mentor/mentee interaction; keep same mentor for all semesters [Note: This is attempt, however mentor scheduling and commitments sometimes necessitates changes]<br>3. More leeway on seminars; allow AE Brown Bag lunch<br>4. $1000 feels insignificant in light of $13000 tuition and housing. It is significant, and my concept of money is undeveloped.<br>5. Helpful to have more info and guidance about seminars. I found myself struggling to understand many topics.<br>6. Make scholarship more competitive and award more money per person.<br>7. Program is great, I'd try to let more students know about it – probably an email to the undergrad lists would do.<br>8. Allow writeup of other technical resources such as proposals, articles of general interest.<br>9. Have an orientation meeting at the beginning. I don't remember there being one. |

10. More seminars; summaries ½ page long. More advisors, and provide the student with the opportunity of selecting the advisor and selecting a different one anytime.
11. Make it more well-known
12. Probably the requirement to meet twice with one mentor could be substituted with still two meetings total but with different mentors, say from the same department but working in different areas in order to diversify the view points.
13. Have monthly or at least a few events every year where students and mentors, as well as the FAST directors come together to meet and have dinner or lunch to share knowledge, experience or advice. Also could have guest speakers from the industry or educational environment to share advice and experiences.
14. Send out two seminar announcements via email
15. It would be interesting to recruit more professors and provide students a choice by semester to choose one by field of interest. My latest mentor has been responsive and helpful, but my initial one was difficult to meet and far removed from my area of interest.
16. Did not know of program's existence until Senior year, could encourage promoting it more. Mentoring and seminars would have helped more if entered program sooner vs. only 1 semester in the program.
17. I would like to see a broader range of mentors throughout the different academic programs. Perhaps students could be assigned a mentor within his/her academic interest or curriculum.
18. Nothing really – the program is already strong, with an adequate time commitment.
19. More requirements – job research requirements
20. Put a list of links to the seminar schedule for each on the FAST web page
21. -25: Three people wanted no changes; one wanted more seminars.

**5. Advice for younger students in the FAST program now**

1. Take the seminars seriously
2. Understand that it is a simple but valuable program to be involved. They would start early on picking seminars & meeting with their mentor.
3. Great program, take full advantage of your mentors
4. Finish mentor meeting early in semester; Make good connections with mentor because they are good resources.
5. Start looking for seminars early to find pertinent ones.
6. Its basically free money. If you take care of your seminars early, you have nothing to worry
7. Take advantage of mentor requirement – it is hard to make the effort to get to know them for class, but as the scholarship requires it, this provides a great benefit
8. Attend seminars early, to have greater choice
9. Don't wait to get your seminars completed
10. Choose seminars relevant to your goals – do not just try to satisfy the requirements. Attend the seminars early in the semester.
11. Start early, ask for mentors' opinion on relevant topics and graduate schools and experiences.
12. Make use of your mentors – be polite and professional when scheduling with them, but take the meetings seriously to gain useful feedback and advice. They were very willing to help, so ask questions and ask about their experiences and suggestions. They have lots of experience and can point you in the right direction. Choose seminars wisely and find ones that you are really interested in and will be beneficial to you. Get an internship or coop or some form of

work experience that is applicable to your field (good things to do when you are not in school in the summer). Study abroad and/or learn a language – it will be beneficial as lots of companies are going global. Be active and take leadership roles on campus, participate in organizations and give back to the community. Be a well-rounded person and don't stress too much; Tech is a hard school, so give it your best and it will be worth it.

13. Although the seminars may seem like a hassle, they are interesting and the scholarship is more than worth the time.
14. Remember that the program is a grant; students should be grateful and eager to participate in the requirements, which are reasonable for a college student in a tight schedule. Take advantage of opportunities to establish a relationship with a professor. They can be very helpful in references, guidance etc.
15. Take advantage of relevant seminars.
16. I would recommend that students attempt to attend as many technical seminars as possible and perhaps even a PhD thesis defense if graduate school is an option.
17. Get your seminar summaries done early!
18. Use summers to your advantage so you can decide what field you want to pursue, learn about current events, and make department contacts.
19. Do the work, you are a failure if you loose this scholarship
20. Start early in planning your seminars. Sometimes the most interesting ones are in the first week of school. Check out seminars from other schools (eg, Chem, Biol, BMED) as they may be very interesting. They may increase your perspective and will often involve your major in some aspect even if the seminar is not from your school.
21. Be sure to complete the requirements in a timely manner. Losing the scholarship over not writing an essay would be a terrible loss.

**6. Where are the graduates going?**

| | |
|---|---|
| Graduate School in technology disciplines | 14 |
| National Labs (NASA) | 2 |
| Private Industry | 7 |
| Industry, unrelated to degree | 1 |
| Undecided, going to industry | 3 |

## Discussion and Conclusions

As the program moves through its 7th year, steady-state operation is producing the intended results. The first large group has moved through graduation. Anecdotal evidence is showing that the FAST program is making a crucial difference in enabling many students to devote fuller attention to studies and graduate earlier. Many students come to CSEMS programs with personal-interaction skills seriously lagging their exceptional technical aptitudes. Such students appear to be more at risk of failure, merely through not having the ability to recognize what a small change in discipline / attitude could achieve. We direct such students to sources of help, until they gain the necessary perspective and understanding of people around them. The incidence of this problem has significantly decreased from 4 years ago, perhaps because we have learned to deal with it better.

It is encouraging to see that the graduating seniors appear to "get" much of what we have tried to do in the program. The "sign of the times" that comes through is that practically every student in engineering school, not just in law and medicine, has large debt to get through school. What we are able to do is to provide some relief, to let them see that debt go down through something that they won on merit and commitment. The students' comments on the seminars, both under the questions about the seminars, and their advice to those following them, provide much material for continued analysis and thought. Some specifics:

1. The seminars, though by external speakers, have not resulted in building direct contacts leading to internships or jobs. This is a major disappointment, and suggests re-direction. We insisted on "technical" seminars, and have not been counting corporate "pitches". Technical seminars by researchers do not lead to job offers for undergraduates, but they do result in better preparation of undergraduates for graduate school.
2. We see that our insistence on seminar attendance is good and essential strategy.
3. The students' comments on mentors do not hold surprises at first sight, but may be unrealistically positive. Where there were serious problems with access to individual mentors in given semesters (not unexpected in such a busy place), we try to provide alternatives to ensure that each student has someone to talk to. Students do not appear to have a realistic view of the schedule pressures on faculty mentors, which we take as an indication of how accessible most of the mentors are. Suggestions such as setting up lunches and dinners for the mentors, bring total agreement in principle from us, but please note that this is being written at 9:30pm on a Saturday. We take pride in being able to be at least this well organized, without dragging people to unnecessary meetings.

**Acknowledgements**

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**Bibliography**

[1] Komerath, N.M., Smith, M.J., "Mentoring Students to Technology Careers". ASEE Annual Conference Proceedings, Salt Lake City, June 2004.
[2] Bramblett, S., "College of Engineering Retention Data- Special Request". Georgia Institute of Technology, Registrar's Office
of Institutional Research and Planning. Nov. 1999
[3] Anon, "Graduation Analysis: First-Time Freshmen, Fall 1993". Office of Institutional Research and Planning, Georgia Institute of Technology, December 6, 1999.