Asserting CS != Can't Socialize
Building Community in a Computer Science Program

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Introduction

Computer scientists are often stereotyped as asocial beings who can not communicate and are happy only when sitting at a computer writing code or playing games. These stereotypes are reflected in the popular media and in jokes such as: "How can you recognize an extroverted computer scientist? When talking to you, he looks at your shoes instead of his own." While there may be many examples to support this stereotype, and while many of the students entering computer science programs do fit this mold, there are many counter-examples as well. Furthermore, this trend can and should be challenged and reversed by providing opportunities for computer science majors to learn communication skills and to develop confidence in social interactions.

As Christians, we are called to live in relation to others: to help others and be helped by others, to encourage others, to use our gifts for others, to serve others, and to stimulate growth in others. In the creation account we read, "The LORD God said, 'It is not good for the man to be alone. I will make a helper suitable for him' " (Genesis 2:18) [New International Version, 1984]. The passage goes on to recount Adam's task of naming the animals, which required him to study them and determine their essential character. We then read, "But for Adam no suitable helper was found. So the LORD God caused the man to fall into a deep sleep; and while he was sleeping, he took one of the man's ribs and closed up the place with flesh. Then the LORD God made a woman from the rib he had taken out of the man, and he brought her to the man. The man said,

> 'This is now bone of my bones
> and flesh of my flesh;
> she shall be called 'woman,'
> for she was taken out of man.'

"For this reason a man will leave his father and mother and be united to his wife, and they will become one flesh." [New International Version, 1984]

This passage shows that there is something unique about human relationships. Relationships with other humans cannot be replaced by relationships with anything else in the creation. We must become a community that builds each other up in Christ. "And let us consider how we may spur one another on toward love and good deeds. Let us not give up meeting together, as some are in the habit of doing, but let us encourage one another - and all the more as you see the Day

approaching" (Hebrews 10:24-25) [New International Version, 1984]. Human relationships must be developed through teaching, mentoring, and investing in lives; mutual care and sharing of passions; and working together in the classroom, laboratory, athletic field or dormitory.

The importance of teamwork and group communication skills in software development and other areas of computer science has been well documented by practitioners and scholars, *e.g.*, [Heil, 1999, Rosca, 2003, Seat and Lord, 1998, Teles and Oliveira, 2003]. These skills can be developed and honed within the context of social situations and community. However, as Robert Putnam writes, we have been witnessing a nationwide decline in community and social capital. Putnam describes social capital in this way, "By analogy with notions of physical capital and human capital – tools and training that enhance individual productivity – the core idea of social capital theory is that social networks have value. Just as a screwdriver (physical capital) or college education (human capital) can increase productivity (both individual and collective), so too, social contacts affect the productivity of individuals and groups" [Putnam, 2000].

Our higher education system has not been effective in counterbalancing the trends away from social capital and community. Fort Lewis College president Joel Jones writes, "One might summarize most of the current critiques of American higher education by saying that the underlying cause of many problems could be described simply as the collapse of community and the correlative depersonalization of experience" [Jones, 1998].

Motivation

Building community in a computer science program is important for several reasons. As Christians, we have a high calling: that of educating the whole person and equipping the individual to become all that God intends him or her to be. The scriptures teach us that as a youth "Jesus kept increasing in wisdom and stature, and in favor with God and men" (Luke 2:52) [New International Version, 1984]. This indicates that He was growing intellectually, physically, spiritually, and socially. The college experience must stimulate growth in all of these areas, including the social. It must equip students for a lifetime of Christian service and leadership, whether it be on the mission field, in the church, in academia, or in the secular workplace.

It is important to produce computer scientists who are not only technically competent but who also have people skills and can work well with others. A recurring theme in industry is the need for computer scientists who are able to function well within a group, *e.g.*, [Armour, 2002]. Large software projects have become the norm, and development teams have increased in size and diversity to include not only those with technical skills but also non-technical specialists. Group skills, communication ability, teamwork, and leadership are skills and abilities that are increasingly desirable and necessary for professional growth and competence among computer scientists. "[H]ow a team behaves can be even more important than its professed goals" [Armour, 2002]. The narrowly focused "geek" who cannot communicate or work with others is increasingly placed at a disadvantage in the workplace, as compared to workers with similar levels of technical competence but more people skills.

Even if this were not the case in the computer science industry, we believe that a balanced person, who exhibits growth and strength in social as well as in technical areas, will experience a higher quality of life and greater personal satisfaction both in and outside of the workplace. In the field of computer science, which attracts so many young people who lack many of these people skills, it is especially critical to encourage social growth and interaction. John Naisbitt observes, "The more high technology around us, the more [there is] the need for human touch" [Naisbitt, 1982].

In addition to developing necessary group skills, building community is key in enabling us to attract and retain students. Nationwide, we have been experiencing a decline in the number of students that pursue computer science as a major [Foster, 2005, Vegso, 2005, Zweben, 2005]. It has been shown that social engagement is key in retaining students. Vincent Tinto lists six principles that govern successful retention programs; the second (after providing skills for academic success) is reaching out to make personal contact with students beyond the formal academic domain. "Institutions should act so as to enable individuals to become congruent with and become integrated within (that is, establish competent membership within) the social and intellectual communities of the college. Insofar as integration is the direct outcome of wide-ranging personal contact among members of the institution, institutions should strive to provide a range of opportunities for interaction among members of the institution, especially in situations outside the formal confines of the academic system (*e.g.*, classrooms). Successful institutions are, in this regard, like healthy communities and families, collectivities whose members reach out to one another in order to establish the social and intellectual bonds so important to community membership. Successful retention programs are vehicles for such bonding" [Tinto, 1987].

It is particularly important to attract and retain those who are underrepresented in computer science, such as female, minority, and economically disadvantaged students. Building community can be key in this goal as well. "The limited evidence we have regarding programs for disadvantaged students suggests that their persistence depends greatly on academic support and, among disadvantaged minority students, also on the character of their social participation in the communities of the institution" [Tinto, 1987].

One much-discussed problem in computer science is the lack of female participation in the field. It has been postulated by many educators (*e.g.*, [Henderson et al., 2002, Kihlstrom, 2003, Margolis and Fisher, 2002]) that men and women come to computer science differently due to male–female differences. One of these gender differences is that men tend to be more oriented toward function and women toward relationship [Kihlstrom, 2003]. Women seem, on the whole, to have greater tendencies to want to care for people, work together, and to be in relationship with others. Men more often come to computer science through the love of the machine itself, while women often want to link computer science to social concerns and a desire to use computers to help people solve problems. Thus, building community in a computer science program is critical to creating a hospitable environment for female students.

Philosophy

Our faculty members have a vision for preparing computer scientists that are not only technically competent, but that are also strong communicators, are able to work effectively with others in diverse settings, and that can articulate ideas in both verbal and written form.

The faculty-student relationship is central to our mission as Christian educators and contributes significantly to the overall quality of the educational experience. Faculty must serve as role models and mentors, both in their Christian faith and in their professional area of expertise. It is crucially important for faculty members to seek to develop relationships with students, both in and out of the classroom. We must love, nurture, serve, lead and inspire our students, and thus encourage and equip them for lives of thoughtful Christian service and lifelong learning. Learning must take place with the goal of exploring biblical perspectives on individual areas of learning and knowledge, as well as the interconnections between disciplines, in the knowledge that God is the author of all truth.

Figure 1: Computer science barbecue at faculty home

We desire to model effective people skills by developing good rapport with the students. We believe that students sense when faculty members genuinely like them and care about them, and have found that they respond well to such nurturing. We have a strong desire to be available to students, both in and outside of office hours, and we view our role with a sense of calling. We view teaching as an act of service in which faculty gifts and talents are to be used to encourage and support students. For example, we have brought cookies over to a late-night student work session preceding a large project deadline. Students have commented years later that acts of kindness such as these are a great encouragement. We aim toward transparency with our students, and seek to nurture and care for them. We are very alert to students who are struggling with emotional, health, or family issues, and pray with them or simply offer a listening ear as needed.

We try to be encouraging to students who lack confidence or who are struggling academically. For example, giving a word of encouragement ("I really think you have a gift") to a student who had not previously excelled, but who demonstrated an underlying aptitude for programming, helped lead to a rather remarkable transformation in which the student truly blossomed academically. We have paid particular attention to female students who lack confidence and have encouraged them in their abilities as well as paired them with other students who are able to help in a non-threatening way. We strive to be motivational in helping students desire to do well academically. We have worked very hard to build a sense of community in our computer science program.

Activities

There are a number of ways that we as departmental faculty have tried to foster a sense of community in which social growth can take place. First, we invite students to faculty homes multiple times each semester for various social activities. These activities include events such as dinners and barbecues (as shown in Figure 1), computer science-related movie viewing and discussion, football super bowl parties, and hot tub nights. When we first instituted these activities they were only lightly attended, but quickly grew in number to include about 50 students regularly. We have also set up a ping-pong table at barbecues and played traditional as well as "round-robin" games.

Figure 2: Computer science TA executing cookie algorithm

When dinner is involved, we have found that students love having home-cooked meals, and so we try to accommodate this as much as possible. Sometimes the host faculty member will prepare all of the food, and sometimes the responsibility is shared among various faculty members. The students particularly love our homemade chocolate chip cookies hot out of the oven. In fact, these cookies have become somewhat legendary within our department, and appear frequently in classes as well as outside activities. We have even used the cookie recipe as an example of an algorithm, and have had a TA "run" the algorithm in an introductory (CS 0) class, using a mixer and all of the ingredients (see Figure 2). We have purchased a small convection cookie-baking oven for our departmental office so that we can serve them hot at school as well.

Students have also begun to take the lead in organizing social activities, and have held an annual potluck dinner near the end of the school year at an apartment where several CS majors have lived over the years.

We have instituted weekly departmental dinners in the dining commons (including both students and faculty), which have been very popular. The main meal consists of the regular dining commons offering, but we almost always bring chocolate chip cookies for dessert. Sometimes we simply talk casually with those around us, and at other times we have planned a short program. These programs have included Grace Hopper or SIGCSE conference reports given by students who attended, personal career path presentations by alumni, a panel in which seniors shared "what I wish I had known earlier," and a commissioning service for a student who was about to embark on a eight month service project to the homeless [Yankoski, 2005].

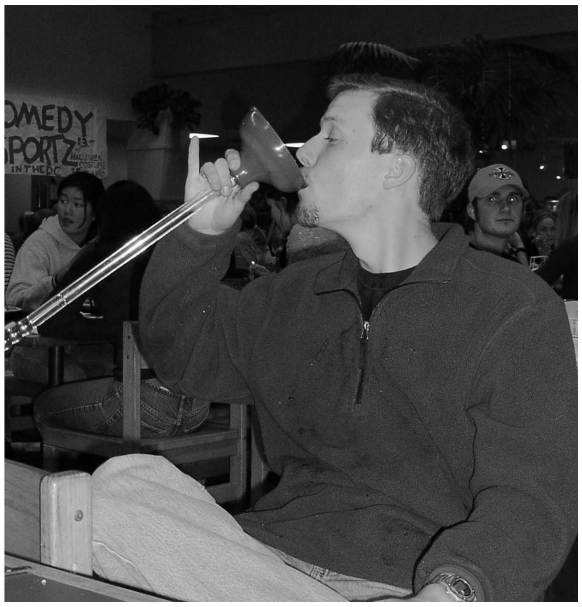

Figure 3: Sipping soda from a (new) plunger during a departmental dinner

These departmental dinners sometimes take on a life of their own, such as when a student brought a tiny radio-controlled car and navigated it around the dining table. Another time, a student brought a package that had just arrived from home that included a brand new plunger. The plunger was used to serve French fries as well as soda over the course of the evening (see Figure 3).

We try to make students aware of the activities and accomplishments of their peers by making announcements in class and at social events. We attend, and also encourage students to attend, student activities such as sporting events, musical performances, theater and dance performances, art shows, and social dances. We have organized faculty and staff members to sing Christmas carols to students around the campus dormitories during finals week in December.

Ours is a Christian college, and we have initiated a weekly time in which our departmental faculty members pray for our students. We make students aware of this and encourage them to share specific needs they might have, which are treated confidentially among the faculty. We find that students both within and outside the major feel comfortable opening up to faculty members about personal issues and struggles, and we have provided support and encouragement for such students.

Attracting and retaining female students has been a key focus for us. To aid in this, we established a support group to provide mentoring and encouragement to our female students, led by female faculty. This group has organized dinners, lunches, desserts, and hot tub nights. They have fun together and discuss pertinent issues such as academic confidence and feelings of inadequacy, to which female students seem particularly prone. We also encouraged our female students to apply for scholarships to attend the Grace Hopper Celebration of Women in Computing, and a female faculty member attended the conference along with two students. This was a wonderful time of growth for both students, and helped to spark an interest among these young women in attending graduate school.

We have been greatly encouraged by growth in student leadership in community-building activities. One example of this occurred one Valentine's Day. A faculty member made a comment to a few male CS majors that it would be great to communicate to the female CS majors how much the males value them by doing something special for them on Valentine's Day. The male majors took this small spark and developed it into a wonderful and significant activity. They wrote new

Figure 4: Surprise Valentine's Day serenade for female CS majors in the dining hall

Figure 5: After the Valentine's Day serenade

lyrics to a familiar song (shown below) and, dressed in ties and bearing roses, serenaded the female CS majors in the middle of the dining hall (see Figures 4 and 5). The women were overwhelmed; one said it was the best Valentine's gift she had ever received.

Only You (Can Make My Code Compile)
Adapted from "Only You" by Buck Ram and Andre Rand [Ram and Rand, 1955]

Only you can make my code compile,
Only you can link my object files;
Only you, and you alone, can loop me like you do
And stack my queue with love for only you.

Only you can make my errors right,
For it's true: you make my code take flight.
If you catch my heart you'll understand the values that I send;
You're my dream come true, my one's complement!

Figure 6: Showing support for a female CS major who is also a volleyball player

Another wonderful example of student support occurred during volleyball season. One of our female CS majors is a volleyball player, and departmental faculty made several comments to students about supporting her by attending an important upcoming match. The CS students took this to heart and organized a cheering section. During the match several male CS majors stood up, cheering, and took off their shirts to display the letters of the player's name painted on their chests (see Figure 6). This show of support had a great effect, not only on the player targeted, but also on the entire team, and sparked an intense comeback.

Although our institution is a liberal arts college, each of our CS faculty members actively engage in research and involve students in their work. This provides opportunities for mentoring and relationships between faculty and students. We also meet with students on an individual basis for mentoring and personal growth. We especially try to identify and encourage students with aptitude in leadership to take an active role in developing and utilizing those leadership abilities. We were able to bring a number of students to a SIGCSE conference, which was a wonderful experience for both the students and faculty involved. We also brought several students who worked on research and co-authored a paper with a faculty member to a research conference. We have found that traveling as a small group away from campus has a profound impact on building relationships and forming community.

We hold an annual departmental retreat, in which we cancel classes for the day and go together to a location off campus. Activities include corporate worship, presentation of vision and mission statement for the department, discussions regarding ethical issues, seminars on preparing for job interviews and applying to graduate school, and panel discussions reflecting on the educational experience led by senior students.

While there are many activities and events that we have organized, there are many more possibilities. One of our future goals is to institute community service projects utilizing technical skills, such as has been done at Purdue in the EPICS program [Jamieson et al., 2001]. Another is to offer a computer science summer program in the United Kingdom, targeting Bletchley Park as a key site. The courses that would be offered as part of this program include information theory and cryptography as well as ethical and historical issues in computing.

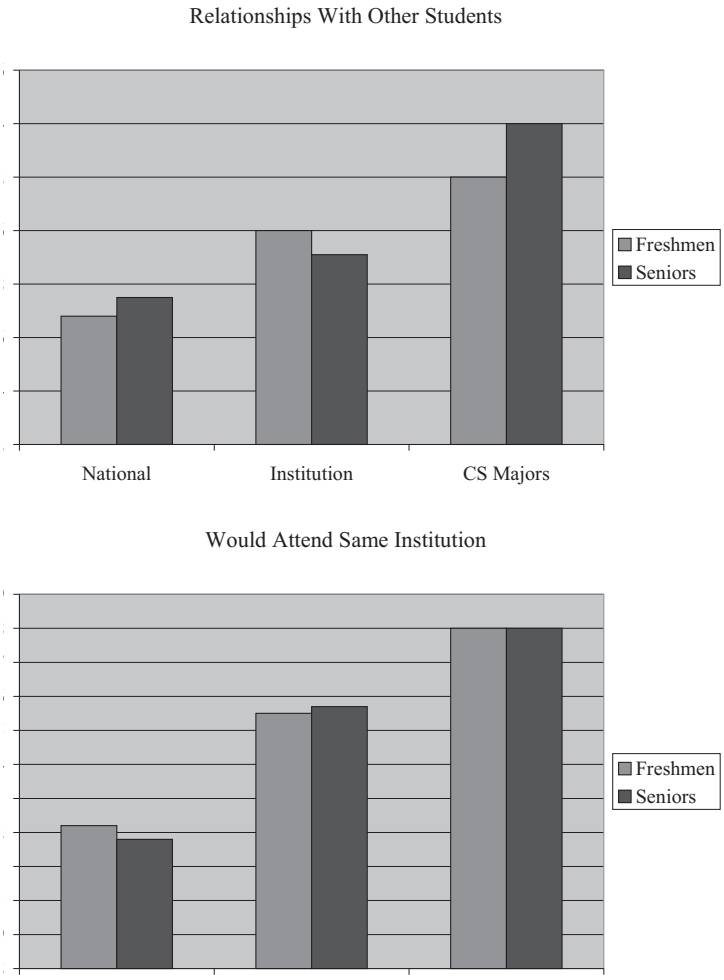

Figure 7: NSSE 2004 Data

While the activities we have mentioned are specific to our setting, similar strategies can be employed in other institutions. In a situation where faculty lack the time or interest, student leadership in planning activities can be encouraged.

It is important to note that we are not advocating the sacrifice of core computer science content in our pursuit of community. Most of our activities take place outside of class time, such as dinners and gatherings of our support group for female students. The one exception to this is our departmental retreat, which we hold annually and in which we cancel computer science classes for the day. The sacrifice of one day of classes out of the academic year seems to us to be acceptable given the benefits that are experienced in discussing ethical issues, looking ahead to graduate school and employment, and having senior students share perspectives on their educational experience.

Observed Results

We are very excited about the sense of community that we are experiencing more and more within our computer science program. Our students are a diverse group that includes extreme introverts as well as extroverts, and those who have been experimenting with computers all their

life as well as those who just recently got their first computer. Our students are reaching out to and encouraging each other toward growth in many areas. We are seeing extremely shy students who are beginning to become more comfortable socially, and students who have little computer experience who are beginning to develop confidence.

We see our computer science students sitting together during our college chapel services, attending performances in which fellow CS majors are participating, and getting together for bike rides, Ultimate Frisbee, and other outdoor activities. Our students tend to congregate in our departmental offices even when they don't need help on assignments. We find our shy students growing in their ability to make eye contact while talking to others and to engage in conversations with the opposite sex. All of this has been extremely encouraging, and has served to demonstrate that our efforts in community building have been fruitful.

More quantitatively, we present results from the 2004 National Survey of Student Engagement (NSSE) [National Survey of Student Engagement, 2005]. This survey is given annually to seniors and freshmen at over 400 colleges and universities throughout the US. Two questions are particularly relevant for our purposes, and are summarized in Figure 7 and described below.

In one NSSE question, students are asked to rate the quality of their relationships with other students on a scale from 1 ("unfriendly, unsupportive, sense of alienation") to 7 ("friendly, supportive, sense of belonging"). The national averages for freshmen and seniors were 5.68 and 5.75, respectively; the averages for freshmen and seniors at our institution were 6.00 and 5.91, respectively, and the averages for freshmen and senior CS majors at our institution were 6.20 and 6.40, respectively. This illustrates that, in a major not usually associated with high level relationships, our CS program is doing quite a bit better than the national average for all majors, and better even than our institution as a whole, which does better than the national average.

In a second NSSE question, students are asked to rank whether, if they could start over again, they would go to the same institution they are now attending, on a scale of 1 ("definitely no") to 4 ("definitely yes"). The national averages were 3.22 and 3.18 for seniors and freshmen, respectively. At our institution overall, the averages were 3.55 for freshman and 3.57 for seniors. For CS majors at our institution, the average was 3.80 for each both freshmen and seniors. This data shows that our CS students have a high degree of satisfaction; much higher than the national average, and higher even than our institution as a whole.

Conclusions

As Christians, we are called to community. We believe that it is both desirable and possible to build community within a computer science program, and that it aids in student recruitment, retention, and development of the whole person. We have provided our philosophy and motivation for doing so, have given examples of relevant activities and events, and have presented some anecdotal evidence as well as quantitative results that demonstrate positive student reaction.

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