BUILDING AFFINITY GROUPS TO ENABLE AND ENCOURAGE STUDENT SUCCESS IN COMPUTING

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INTRODUCTION

The NSF-funded affinity research groups[3] provide a physical setting in a cooperative environment in which undergraduate and graduate college students engage in research. The goal of the affinity group program is twofold: to increase the retention and participation of traditionally underrepresented groups in the computing areas, and to provide the framework that involves these students in activities that include research, curriculum development projects, mentoring and outreach programs. The objectives of affinity groups are to develop students' research, technical, group and social skills that are essential for retaining traditionally underrepresented groups in the computing areas and to increase the number of these students that enter graduate programs. Through methodic, structured and intense activities, the affinity groups provide the students with the knowledge, skills and strategies that will make them effective leaders and successful in academia and industry.

It is anticipated that the affinity group experience will instill in many of the students the desire to continue their education and development. The intent is to involve capable students that are not fulfilling their potential. Clearly, this concept provides a "small school" environment at a large, commuter university in a cost effective manner. The ultimate goal of the project is to document the infrastructure for creating and managing research groups in which students with a wide range of abilities, talents, interests and skill levels work effectively.

The affinity group concept is being developed in the Computer Science and Computer Engineering departments at the University of Texas at El Paso (UTEP). The second oldest academic component of the University of Texas system, UTEP serves a rapidly growing binational and bicultural community. The university is a regional school in which 85% of the students come from El Paso County. 62% of the student population is Hispanic, closely reflecting the cultural breakdown of El Paso. The students come from

families with little disposable income and with greater demands on that income. Almost 75% of the students work at least part-time and only 2% live on campus. The average age of the undergraduate and graduate students is 25 and 35, respectively, and almost 2/3 of the students are first-generation college students[9].

PERSISTENCE OF HISPANICS IN HIGHER EDUCATION

A study of fifty low-income Hispanics examined what influenced their academic success in higher education[4]. Although academia places importance upon ability and intelligence, fewer than one-fourth of the subjects mentioned these as keys to their academic success, but instead rated persistence as the single most important characteristic. Another study[8] showed that the following factors lead to persistence in school:

- engage students as role models for each other,
- provide opportunities for faculty and students to interact outside the classroom,
- foster a "student culture" in which students can interact with each other and discuss issues in a competent manner,
- help students clarify and maintain goals, and
- involve students in their college learning experience because the greater the degree of involvement, the more likely the student will persist to graduation.

Students learn by becoming involved, and success in learning leads to improved retention of students. This is critical for minority as well as low-income and otherwise disadvantaged students who have been found to be passive in academic settings. It is clear that isolation and alienation are the best predictors of failure. Setting clear, personal goals was rated as important by students in Science, Engineering and Math (SEM); however, those that did not persist reported confusion and instability as characterizing their decision to leave SEM fields[8]. This finding affirms the notion that regulating aspirations is more important than other factors[7].

These and other studies[3] serve as a guide for developing the affinity group concept. The affinity groups provide an atmosphere in which students can become involved and serve as role models for each other. Modeling is the principal means of developing a *self-belief of efficacy*, i.e., the strength and determination to persevere in the face of obstacles and sometimes even rejection[2]. A person's own self-worth is raised when a representative of his or her group succeeds by sustained effort. Affinity groups also provide a platform for students to set and assess personal and group goals throughout their education.

THE AFFINITY GROUP CONCEPT

The activities of the affinity group are centered around developing the students' research, technical and team skills. The hypothesis is that this will lead to student growth, both academically and socially, and ultimately to success in graduate school and industry. Industry and government have voiced the need for stronger team skills, including

leadership and interpersonal relationship skills, in students graduating from computing programs[5]. In addition, the involvement of students in heterogeneous groups, i.e., students with different educational and familial backgrounds, and varying levels of expertise, abilities, interests and skills levels, will expose them to different viewpoints and, we hope, help them make informed decisions about graduate school. Another anticipated outcome is that the students will value life-long learning.

The differences between traditional research groups and affinity research groups are distinct. First, the group involves both undergraduate and graduate students. Second, the students develop the aforementioned skills in a highly structured and deliberate manner, rather than in an *ad hoc* way. Third, the groups are centered around the cooperative paradigm[6]. Last, the students are required to work on projects during the year that reach out to primary and secondary schools. The purpose of this requirement is to promote awareness of the issues in encouraging students to attend college and pursue science and engineering degrees, and to encourage community involvement.

One feature of the affinity groups is that they are built around the cooperative paradigm. The mere formation of a group does not ensure that it will function as a cooperative group; the key is structuring the group by teaching and practicing the skills. The five basic elements that are present in the group activities[6] include the following:

1. *Positive interdependence* instills the feeling that each member is vital to the success of the others. This can be structured, for instance, through roles and shared goals.
2. *Face-to-face promotive interaction* ensures that students support and encourage each other's learning and involvement.
3. *Individual accountability* requires that each group member does his or her fair share and is responsible for the final outcome. This is critical for developing a stronger individual. In the affinity group, each student is responsible for their deliverables. As a group, members assist each other achieve mastery or competence of a task.
4. *Social and group skills* are taught. The faculty mentors do not assume that the students come with the necessary skills to work in groups.
5. *Group processing* requires that the group takes time to reflect on how well the group functions. The members determine what behaviors are helpful and should be continued, and what behaviors should be modified. This provides them with an opportunity to refine their actions and, as a result, improve the group dynamics.

AFFINITY GROUP ACTIVITIES

Students engage in a number of activities that range from structured weekly group meetings, small group meetings that are held throughout the semester for students working on related research, outreach development and involvement, and technical seminars. This section discusses the activities that develop the students' team, technical and research skills.

Setting Goals

At the beginning of each semester, students set personal and research-oriented goals. Each student identifies and documents activities that will help realize his or her goals. In addition, the student writes how the activity will be accomplished, who is involved in the activity, the projected finish date, and appropriate indicators of success. It is critical that the students set distinct milestones on semester-long projects and discuss them with fellow group members in order to evaluate the feasibility of their goals. At weekly meetings, each of the students briefly answers the following questions: 1) What have you accomplished this week? 2) What needs to be done? 3) What obstacles have you encountered?

Developing Skills

A major feature of the affinity group model is the structured activities that develop the members' technical, communication, research and group skills. The students develop research skills throughout the semester by working with the faculty mentor and by pairing novice with experienced researchers in the group. Several research projects are defined within the scope of an affinity group. Students first develop a background in their area of interest by extensive reading and regular project group discussions. The example activities given below demonstrate how the various skills are developed, reinforced and refined; due to space limitations the discussion of how skills are taught is not included.

Activity 1: Technical paper discussion

Skills: Primary - technical and group; Secondary - oral communication
Duration: 90 minutes
Preparation: The students read an assigned technical paper before the group meeting. One student prepares a 10-15 minute overview of the paper and a list of questions.
Structure: A student presents an overview of the paper. Students work in cooperative groups to answer the list of questions, gaining a deeper understanding of the concepts and terminology used in the paper. The groups are composed of three students (a mixture of graduate and undergraduate students) and roles are assigned by a predefined scheme. Roles, such as idea integrator, answer summarizer, and active participation checker, are discussed before the groups are formed. The faculty mentor facilitates an open discussion of the answers at the end of the group session. The activity ends with group processing.

Activity 2: Student research presentation

Skills: Primary - oral communication and constructive criticism;
                Secondary - technical
Duration: 15-20 minutes with 5 minutes for questions
Preparation: The student creates slides and refines them based on peer-review.

Structure: A student presents a talk on his or her research topic and the audience is asked to critique the presentation using a standard form. This activity teaches constructive criticism, i.e., criticizing the idea and not the person. In addition to hearing a technical presentation, the skill of asking questions is reinforced and the presenter gains experience in answering questions.

Activity 3: End-of-the-semester research review

Skills: Primary - research, written communication, constructive criticism; Secondary - oral communication
Duration: 90 minutes; 10-15 minute presentation of each project
Preparation: All students are required to write at least one paper by the end of the semester (this may be a published paper) that summarizes their work. Each member reads the other members' papers and critiques each of them using an evaluation form.
Structure: The faculty mentor discusses the skill of asking questions. Each student gives a 10-15 minute presentation followed by a question and answer period. The critiques are integrated and discussed with each student who uses them to improve his or her work.

Involving Students in Outreach Programs

Students are required to work on projects that reach out to high school and junior high school students. This not only educates the students about the issues of retention discussed earlier, but also provides them with an opportunity to serve as role models to others. There is an emphasis on collaboration and leverage with programs that already exist and reusing components that work[1].

EVALUATION

The investigators of this project have established an interdisciplinary evaluation and research team. The group holds regular meetings to review the progress of the group. In addition to tracking the students throughout their studies at this university, the team has conducted two studies. One is a self-report survey that has explored student's attitudes and their beliefs in teamwork, group skills and communication competence. The other is one-to-one interviews that have explored significance of critical events, stereotypes and possible selves.

SUMMARY

From the student's perspective, affinity groups provide the students with an opportunity to become involved in their learning with the support of fellow students with similar interests. Because many of the students are from the local area, they come to school with an established group of friends and, as a result, tend to isolate themselves from the department. The affinity group provides them with an opportunity to become involved

with students majoring in the same area and to become connected to the department. More importantly, the affinity group provides the students with an opportunity to work on their communication, group, technical and research skills.

From the perspective of the faculty and the department, the affinity group concept is an integrated model that brings undergraduate students, graduate students and faculty members together in a team atmosphere that promotes quality work. The affinity group investigators are currently developing the framework to support faculty who are interested in creating and managing effective research groups and for involving students in outreach projects using this model.

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