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Affinity Research Group Model

Affinity Groups A Framework for Developing Workplace Skills

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Abstract - *This paper describes the affinity group concept and model as an alternative to traditional research groups in university computer science programs. The affinity research groups provide a physical setting in a cooperative environment in which undergraduate and graduate college students engage in research. Affinity groups involve students with a wide range of experiences, talents, interests and skill levels, and provide them with an opportunity to deepen their knowledge in a computer science area and to develop skills and strategies that will make them effective leaders and successful in academia and industry. The structured activities that are characteristic of affinity groups facilitate the transfer of knowledge and skills from an academic setting to the workplace. The paper addresses issues in the development of workplace skills, the challenges of the transfer of knowledge and skills, and the particular ways in which the affinity group processes take into account what is known about transfer and the development of research, technical, and social skills.*

Introduction

Business, industry, and government have voiced the need for students graduating from engineering programs to have stronger skills in the following areas: problem-solving, team-building, brainstorming, conflict management, leadership, listening, critical thinking, communication (oral and written), and the ability to apply new information quickly and effectively [4] [2] [10]. Students can learn these skills in a variety of courses offered through the Liberal Arts and Engineering colleges and in classes that are centered around the cooperative learning paradigm. Although these skills can be learned in an academic environment, the transfer of knowledge and skills from the classroom to the workplace requires that the skills are integrated, used, monitored and adapted to new settings that differ from the initial learning situations.

The affinity group concept and model provides the framework to facilitate the transfer of knowledge and skills from an academic setting to the workplace. The model integrates the knowledge and skills required for research and projects with the knowledge and skills of cooperative work, providing students with opportunities for personal and academic growth and for practice in applying knowledge and skills to new situations. Developed as both a socialization and infrastructure mechanism for attracting and retaining traditionally underrepresented groups in the computing areas, affinity groups involve students with a wide range of experiences, talents, interests and skill levels in research and projects. Faculty group leaders contribute to the education and training

of the group members and foster a cadre of “new” professionals and graduate students by encouraging group members to participate in a variety of structured activities. Each semester students set both long-term and short-term goals, and define strategies for meeting those goals. The activities promoted by the affinity group range from discussion of technical papers and attendance of technical seminars to student presentations and technical paper writing. This paper discusses the theory behind the transfer of knowledge and skills from academe to the workplace and the role of affinity groups in developing relevant strategies and competence.

Issues in the Development of Workplace Skills

Business, industry, and government need employees who have a good understanding of engineering fundamentals, are good communicators, and have a profound understanding of and commitment to team work [2] [10]. They recognize that as markets expand, people must be able to work with others who have diverse cultural backgrounds and differing personality styles. Many of the needed skills can and have been taught in higher education. A 1988 survey of major businesses and industrial firms, reported by the American Society for Training and Development and the U.S. Department of Labor, identified the following workplace skills that can be learned in an academic environment.

1. the ability to apply new information quickly and effectively in a self-directed environment;
2. listening skills and oral communication;
3. creative thinking and problem solving;
4. personal management characterized by self-esteem, motivation to set goals, and personal development;
5. group effectiveness characterized by interpersonal skills; negotiation skills and teamwork; and
6. organizational effectiveness and leadership.

In addition to technical and social skills, employers seek people who know how to solve problems and how to improve solutions of old problems [10]. That is, employers want people who can competently transfer knowledge and skills acquired in one setting and creatively apply them to another.

Typically in university settings, knowledge and skills are taught and viewed as discipline specific, and

classes promote individualistic and/or competitive environments. Students are responsible for linking or integrating discipline-specific knowledge and skills to other bodies of knowledge. In this type of setting, two types of knowledge transfer exists: within disciplines and across disciplines. Students develop knowledge in non-sequence courses within a discipline, but many times fail to see the connection between concepts or strategies that they can adapt to new applications. For instance, consider a problem that requires developing an efficient algorithm for manipulating an image. In this case, knowledge from Data Structures, Graphics, and Analysis of Algorithms must be integrated. Across disciplines, students acquire knowledge in areas such as composition and technical writing; however, in classes requiring written reports, many students fail to see the connection between their English courses and the development of their final report.

The Transfer of Knowledge and Skills

Transfer of knowledge and skills is a major challenge for education. If the aim of education is to increase students' ability to competently transfer knowledge and skills acquired in one setting to another, then the outcomes of learning from one setting must provide support for the learnings and performance of *new tasks* in *new situations*. Based on recent work in cognitive theory, the issue can be reframed in the following way: the challenge of instruction is to develop ways of organizing learning that permit skills to be practiced in environments similar to those in which they may be used. Learning is needed (1) to fine-tune skills and knowledge for future environments of use (*e.g.*, the workplace, the research program), and (2) to provide motivation for practice in settings in which they are learned (*e.g.*, the university classroom, the university-based research project) [9]. Most importantly, frameworks are needed that specify an array of potential linkages among educative and work experiences and processes.

Studies of successful learners and learning conditions point to at least nine dimensions of learning that build capabilities that transfer from one task or situation to another.

1. The tasks share common elements (*e.g.* knowledge structures and learning contexts).
2. The learner goes beyond what is directly taught by elaborating it and developing self-explanations.
3. The learners monitor their understanding as they work and are aware of what they know and how they come to know.
4. The learners seek and see relationships or patterns in what they learn.
5. The strategies are learned to a high level of fluency in the context of expected application.
6. The learners see themselves as in charge of learning rather than being directed by others.
7. Meaning is developed through dialog in which both (all) parties establish what the other knows and adjust their communication to the partner's knowledge status.

8. Learning contexts make use of scaffolding in which other people, tools, or guidance systems carry some of the performance load.
9. Learning is practiced in social communities where elaboration and adjusting interpretations are regularly practiced.

One area in which transfer of skills is partially addressed is in classrooms in which the professors use cooperative learning techniques. Students learn group skills that they can transfer to other classes, study groups, and the workplace. Studies have shown that cooperative-educated students found the transition from the university to the workplace less difficult than their noncooperative-educated peers because they had already been exposed to the self-directed teams and workplace learning environments [7].

There are four basic levels of group skills that students can learn in a cooperative learning environment: forming, functioning, formulating, and fermenting [8]. *Forming* skills are the basic skills that are needed to establish a group. These include staying on task, active participation, and active listening. The *functioning* skills are those that are needed to manage the activities and maintain relationships in the group. Sharing ideas, clarifying the task, and paraphrasing represent skills from this area. Skills that help maximize understanding and retention of material are called *formulating* skills. These skills include the ability to summarize, check for accuracy, and verbalize reasoning skills. The highest level skills, *fermenting* skills, involve higher-order thinking skills. This includes integrating ideas, extending answers, seeking justification, and resolving conflict. In college classrooms that use cooperative learning techniques, it is not reasonable to expect the students to become proficient beyond the first two levels of skills because of the amount of material that must be covered in the typical computing course.

Because a cooperative classroom typically provides an environment in which students work on problem-solving activities in which students share ideas and strategies, transference of knowledge between and within disciplines is more likely to occur. Of course, this assumes that the professor structures this in the activities.

The affinity group model [1] [3] [6] provides a framework that facilitates the transfer of learning and skills from an academic setting to the workplace. This model incorporates and builds on the nine dimensions of learning that are essential for transference of knowledge and skills.

The Affinity Group Model

Participating in an affinity research group provides students with the opportunity to practice and adapt the technical and social skills valued by business, industry and government. The affinity research group model provides the framework that involves students in research, curriculum development projects, mentoring and outreach programs. The objectives of affinity groups are to develop students' research, technical, group, and social skills through methodic, structured and intense activities that provide the students with the knowledge and strategies that will make them effective leaders and successful in academia and industry.

The affinity groups involve both graduate and undergraduate students, as well as students who represent a variety of educational and familial backgrounds with varying levels of expertise, abilities, interests and skills. The students develop technical and social skills in a highly structured and deliberate manner, rather than in an *ad hoc* way.

The most important feature of the affinity groups is that they are built around the cooperative paradigm [8]. The mere formation of a group, as in traditional research groups, does not ensure that it will function as a cooperative group. The key is structuring the group by explicitly teaching and practicing social and group skills. The five basic elements that are present in the group activities include the following:

- *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.
- *Face-to-face promotive interaction* ensures that students support and encourage each other's learning and involvement.
- *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 strong individual. In the affinity group, each student is responsible for his or her deliverables. As a group, members assist each other achieve mastery or competence of a task
- *Group skills* are taught. The faculty mentors do not assume that the students come with the necessary skills to work in groups. Group skills are explicitly taught and practiced in activities designed around technical topics (*e.g.*, a discussion of a journal paper, critiquing a technical presentation).
- *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 and the effectiveness of the group.

These elements are structured in the weekly activities, in the day-to-day functioning of the group, and throughout the life of the projects. Because the group has a dynamic membership, it is important to continually reflect on the functioning of the group and to make adjustments as necessary.

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.

The affinity group concept targets teaching the formulating and fermenting group skills discussed earlier. The forming and functioning skills are reinforced through structured activities. Many of the skills that are found at these levels are those that comprise leadership skills. Because students are involved with the research group for an extended period of time (an average of two years), they

have the opportunity to learn the skills well and transfer them to other situations without the faculty leader facilitating.

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 student answers the following questions: 1) What have you learned or accomplished this week? 2) What needs to be done? 3) What obstacles have you encountered? This provides the students with an opportunity to reflect, refine approaches, and improve their functioning in the group and projects.

The students develop research skills throughout the semester by working with the faculty mentor and through pairings of novice and experienced student researchers in the group. In this environment, students learn how to communicate knowledge to people with varying levels of expertise. Several projects are defined within the scope of an affinity group and are usually funded through a research grant. Projects are also defined across disciplines in areas such as Knowledge Acquisition, Computer Architecture, Software Engineering, Compiler Theory, Operating Systems and Logic. As a result, students work in an atmosphere in which they must integrate knowledge from different areas of computer science, share ideas and knowledge between members of affinity groups, and educate others on topics in which they are developing expertise. Much of the learning is self-directed (students develop a background in their area of interest through extensive reading), although regular project group meetings are held to discuss the literature. Brainstorming sessions are used to generate new ideas and to seek solutions to problems. One of the important aspects of the affinity group model is that students must integrate knowledge from a variety sources into one or more applications.

Students are required to present technical talks in order to reinforce their understanding of the technical material. This activity helps the student acquire a depth of understanding in an area of research, and helps determine if he or she can convey their knowledge of the material and answer questions from the audience. The audience members evaluate the talk based on criteria provided on a form. The notion of constructive criticism, *i.e.*, criticizing ideas and not the person, is taught and practiced. Written communication is emphasized through the requirement that students write technical papers at least once during a semester. To accomplish this activity, students must apply skills they have acquired in other classes, in particular English Composition and technical writing. The papers are peer-reviewed, which provides the students with useful feedback for improvement. Papers go through numerous reviews and revisions.

Each activity requires students to use knowledge and skills from multiple tasks and settings to achieve the desired outcome.

Summary

The transfer of knowledge and skills acquired in one setting to another is a major challenge for education. The

demands on time and course content make it difficult for professors to effectively provide students with opportunities to explore and re-enforce linkages between courses within and across disciplines. The affinity research concept and model provides a framework to facilitate the transfer of knowledge and skills from an academic setting to the workplace. The approach helps address the call from business, industry and government to graduate students who have effective team skills, communication skills, higher-level thinking skills and a solid foundation of computing concepts.

The affinity research group model provides explicit mechanisms for developing students' research, technical, social and group skills in a cooperative environment. Affinity groups involve students with a wide range of experiences, talents, interests and skill levels, and provide them with an opportunity to deepen their knowledge of computing and to develop skills and strategies that will make them effective leaders and successful in academia and industry. The structured activities that are characteristic of affinity groups facilitate the transfer of knowledge and skills from an academic setting to the workplace by incorporating many of the nine dimensions of learning.

The formulating and fermenting skills, which characterize higher-level thinking, are explicitly taught and practiced in group discussions. Example skills from these classes include seeking justifications to answers, elaborating answers and concepts, and integrating ideas from different group members. Group processing facilitates adjusting and improving the group's functioning. Processing is an integral part of all of the affinity group activities. For example, students regularly reexamine the goals that they set at the beginning of the semester. Furthermore, these activities in conjunction with the development of research skills teaches the students to become self-directed learners. Regular group discussions and interactions with students with a wide variety of backgrounds requires students to regularly adjust their level of communication, and to seek and integrate knowledge. The development of written and oral communication skills is another important part of model.

The affinity group model provides the framework to increase the students' ability to competently transfer knowledge and skills from academe to the workplace. Students involved in the program leave the university with the tools, strategies, and competence to become effective and productive workers.

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