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Affinity Research Group Model

A Cooperative Model for Orienting Students to Research Groups

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Abstract - The affinity research group model provides students with opportunities to learn, use, and integrate the knowledge and skills that are required for research with the knowledge and skills that are required for cooperative work. Membership in affinity groups is dynamic, i.e., members graduate and new members join, and students come to the groups with different levels of knowledge and skills. Because of this, an annual orientation is needed for new members to facilitate their understanding of the philosophy and goals of the affinity model, understanding of the research goals of the projects to which they are assigned, learning of the basis of the cooperative paradigm, and awareness of group expectations. More importantly, the orientation develops new members' basic understanding of the research process and provides information about available resources. The orientation also is important for established members. It provides them with an opportunity to renew their commitment to the group, improve their research and cooperative group skills, and process within the group with the goal of improving the group's effectiveness. The orientation also allows faculty mentors to become aware of members' misgivings and expectations of the affinity group experience, and to process among themselves with the goal of reevaluating the model and its success. The orientation, which is the topic of this paper, consists of five components that provide a cooperative platform for meeting these objectives.

Introduction

Business, industry, and government have voiced the need for stronger group, communication, and problem-solving skills [5]. The affinity research group model [2,3,4,5], called the affinity model, addresses this by providing undergraduate and graduate students with opportunities to learn, use, and integrate the knowledge and skills that are required for research with the knowledge and skills that are required for cooperative work. Affinity research groups, referred to as affinity groups, expose students to a wide range of experiences that develop their research, technical, communication, and group skills. The model supports transference of these skills and classroom skills to a research environment. Research involvement deepens students' knowledge in technical areas. Methodic, structured, and intense activities hone students' knowledge, skills, and

strategies that will make them effective leaders. As a result, students grow personally and academically. Figure 1 depicts the major goals of the non-hierarchical, scaleable affinity research group model (on the outer wheel) and the essential elements of the model (on the inner wheel). Developed as both a socialization and infrastructure mechanism for attracting and retaining traditionally underrepresented groups in the computing areas, the model can be used in other disciplines and for a more general population.

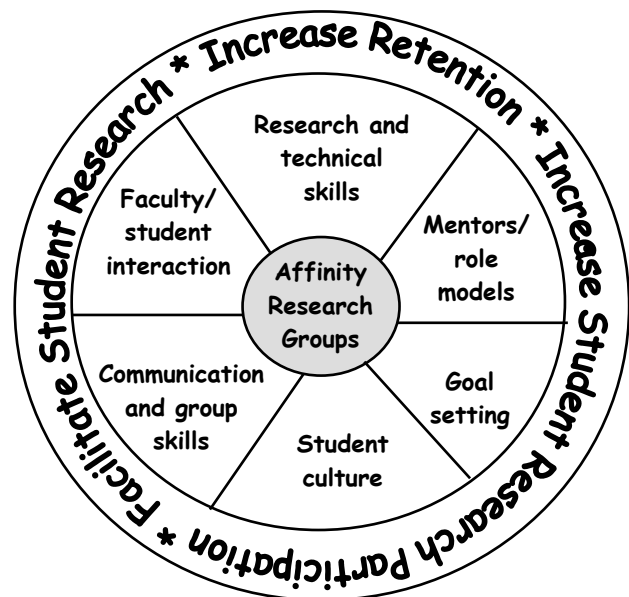


Figure 1. The Affinity Model

Students working in an affinity group contribute to research projects and, reciprocally, the research impacts students. Students benefit in that they:

- attain a higher level of competence in mathematics, engineering, and technology areas,
- understand the methods and process of research,
- learn to make informed judgements about technical matters, and
- communicate and work in groups to solve complex problems.

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The affinity model recognizes that group membership is dynamic, i.e., members graduate and new students join with different levels of knowledge and skills that grow at different rates. As a result, an orientation is needed, making it a critical component of the model. As described in [2,3], the model is comprised of five other components: the research project framework, defined deliverables, weekly meetings, monthly meetings, and outreach involvement. The orientation is motivated by the need for:

- new members to understand the philosophy and goals of the affinity model, the research goals of the projects to which they are assigned, and the basic elements of the research process;
- new members to learn the basis of the cooperative paradigm and become aware of the expectations of the faculty mentors and the resources available to them;
- established members to renew their commitment to the group, improve their research and cooperative group skills, and process within the group with the goal of improving the group's effectiveness; and
- faculty mentors to become aware of members' misgivings and expectations of the affinity group experience, and process among themselves with the goal of reevaluating the model and its success.

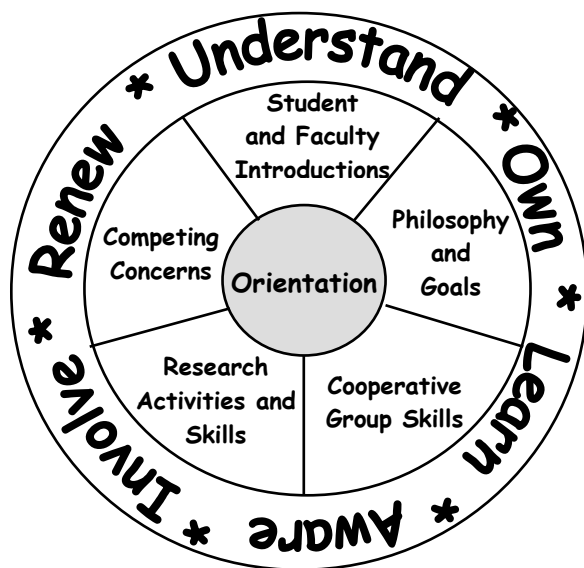


Figure 2. The Affinity Group Orientation

Typically, orientations are not used in university research environments. Without an orientation, the assimilation of new members into a research group can be a time-consuming process for both the students and faculty mentors. This is particularly true for affinity groups which include non-traditional students, i.e., students who may lack confidence and preparedness, and which are based on a non-

traditional structure, i.e., one that is non-hierarchical and built upon a cooperative paradigm.

This paper presents a model for structuring an orientation to affinity groups. The structure of the orientation is unique in that the activities are conducted using cooperative learning techniques, further promoting cooperative skills, which are essential in affinity groups. As shown in Figure 2, which gives the goals of the orientation (on the outer wheel) and the names of the components (on the inner wheel), it consists of five components: student and faculty introductions, affinity group philosophy and goals, cooperative group skills, research activities and skills, and competing concerns. Each component of the orientation achieves its main objectives through carefully designed activities, and achieves secondary objectives, i.e., the teaching and practice of cooperative group skills. In general, the organization of the paper mirrors that of the orientation. The following section consists of five subsections that correspond to the five components of the orientation. Each subsection defines the goals and objectives of a component, and describes example activities that are used to meet the component's objectives. Activities change from year to year. The subsequent two sections describe the preparations for the orientation, the evaluation process, and the assessment. The paper concludes with a summary.

Orientation Components

The annual orientation is scheduled at the beginning of the fall semester. New members of departmental affinity groups, student facilitators, and faculty mentors are asked to arrive one-half hour before the anticipated start to share a continental breakfast. During this time, students register for the orientation, make name tags that provide information about themselves, and complete fact sheets. Name tags are used in various activities throughout the orientation and facilitate identification of participants and formation of groups. Fact sheets are used to populate a student database. Each participant receives an information packet that includes an itinerary, contact information for each group member, and relevant handouts.

Groups are used throughout the orientation. The composition of groups depends on the objective of the activity. Facilitators assign roles (e.g., gatekeeper, summarizer, timekeeper, recorder, paraphraser, direction giver, and initiator) to group members and use T-charts [6,7] to describe the physical and verbal actions associated with roles. Although this may seem unnecessary, providing the students with concrete behaviors that can be modeled is effective in teaching basic group skills. Each student is responsible for being able to articulate the answers of other group members.

Student and Faculty Introductions

The orientation officially begins with the Student and Faculty Introductions component. The *goal* of this component is to assimilate new members into the group and to motivate the remainder of the orientation. Its *objectives* are to:

1. establish familiarity among participants, and
2. peak student interest in understanding the affinity model.

To increase the number of undergraduate students involved in research, competent but unconfident students are deliberately recruited [3]. As a result, affinity group members have varying levels of skills and confidence. Because many of the students do not know one another and some may be reluctant to introduce themselves, an activity that establishes familiarity among participants is essential. To address this, students can be instructed to acquaint themselves with three unfamiliar people, using information on name tags as conversation catalysts. This “ice-breaker” is effective when time is a concern. When more time is available, heterogeneous groups comprised of undergraduate and graduate students can perform an alternate activity. The groups are asked to answer the following questions: (1) How do you rate your university experience on a scale from 1 to 10 and why? (2) What person most influenced your decision to go to college? and (3) How did you choose your major? To enhance familiarity among groups, intra-group discussion is followed by inter-group discussion, which highlights the variety of answers to these questions. Faculty and student facilitators monitor the groups and encourage elaboration of answers. In the process of meeting the first objective of this component, *base groups* [6,7], i.e., groups to which students return at different times during the orientation, can be formed. Given enough time, base groups provide trusted environments.

To meet the second objective, students complete a questionnaire that can be used to evaluate how a student contributes as a member of a group [6,7]. Specifically, the questionnaire identifies student actions that directly contribute to the completion of a task (e.g., information and option giver or seeker, direction and role definer) and that indirectly contribute by maintaining the effectiveness of the group (e.g., communication facilitator, encourager). The degree to which each of these actions is performed indicates the leadership that a student exhibits. The assessment can be used to track student growth in leadership through the model.

Affinity Group Philosophy and Goals

The *goal* of the Philosophy and Goals component is to educate students about affinity groups. The *objectives* are for new members to:

1. discuss the issues being addressed by the affinity model,
2. understand how the model addresses these issues, and
3. differentiate the model from other traditional learning models.

To meet the objectives, the component presents a statement that justifies the goals of affinity groups: increase retention and student research participation. An example statement is:

A National Academy of Science survey showed that over 50% of high school seniors surveyed dropped out of the science, engineering and math (SEM) pipeline by the end of their first year in college. Some returned later; however, only 35% of high school seniors who planned on SEM degrees actually graduated in SEM [8].

Facilitators pose questions to students in base groups. The questions for the example given above are:

- What are the factors contributing to students switching from SEM majors?
- What can be done to increase the numbers of students going to graduate school?

Roles are rotated for each question. After the time period for group discussion ends, a member from each group discusses her/his group’s responses, which the facilitator records on a flip chart. Afterwards, using Figure 1, a faculty mentor relates the discussion back to the goals of the affinity model. In particular, the facilitator emphasizes that the affinity model addresses the SEM pipeline issues by providing an atmosphere in which students are taught technical, research, communication, and group skills. In addition, the facilitator explains the distinguishing features of the model, such as the integration of undergraduate students and the development of skills through the use of cooperative learning.

Another effective activity is to introduce and discuss Boeing’s Desired Attributes of an Engineer [1]. Discussion focuses on how the affinity model contributes to the development of these attributes in students.

Cooperative Group Skills

The *goal* of the Cooperative Group Skills component is to facilitate the students’ understanding of the effectiveness of cooperative group skills and how to structure them in their groups. The *objectives* of this component are to:

1. enhance the students’ awareness of how they work in groups and
2. learn the five basic elements that are needed to structure cooperative groups: positive interdependence, individual accountability, face-to-face promotive

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interaction, interpersonal and small group skills, and group processing.

The following three example activities, which correspond to these objectives, are performed in groups of five. The first objective can be met by having students solve a problem under each of the three paradigms of learning: individualistic, competitive, and cooperative. When solved cooperatively, roles are assigned. Group discussion focuses on the advantages and disadvantages of each paradigm and the differences among the paradigms.

The second objective can be met by an activity that employs the jigsaw technique [5,6]. Each member of a group of five is assigned one of five sections of a handout that discusses the five basic elements of cooperative groups. Students assigned to the same section meet to read, discuss, and plan a presentation that includes an example of how the element was modeled during the orientation. Returning to their original groups, each student, in turn, explains her/his section of the handout.

The first objective also can be met by an activity that follows the jigsaw exercise. Students (in groups of three) use cooperative skills to solve a problem. Using an observation form [5,6], facilitators evaluate group interaction. At the end of the exercise, the facilitators discuss their observations with the group.

The component ends with a summary that relates the importance of cooperative skills to their use in research groups. A handout is included in the information packet that summarizes skills and techniques that can be used to achieve cooperative groups.

Research Activities and Skills

The *goal* of the Research Activities and Skills component of the orientation is to provide students with a framework for understanding how they can contribute to research. The *objectives* of this component are for students to gain a basic understanding of:

1. the goals of research,
2. the research process, and
3. the infrastructure that is designed to support their research efforts.

This component is comprised of two sessions. New members attend the first, while new and established members attend the second.

The first two objectives can be met in the first session via the brainstorming technique [7]. After facilitators explain brainstorming and pose questions, groups brainstorm for a fixed time period. For each question, a facilitator records group responses and, afterwards, promotes discussion. Example questions are:

- What are the goals of research?

- What steps are followed in doing research?
- What are the rewards and challenges of doing research?

To further assimilate the new members, the discussion of the third question can occur at the beginning of the second session. Heterogeneous groups of new and established members are formed in the second session; faculty mentors can be invited to share their ideas.

The third objective can be met in the second session by group discussion of project management tools that are used to direct students in a research group. For the System and Software Engineering Affinity Research Lab, SSEAL, many of these tools are included in PC³ (Project Coordination, Collaboration, and Communication Tools for Teams), which currently is under development. Three PC³ forms, used in the activity described below, are: (1) the *project definition form* that defines the project's mission, goals and time duration, identifies the project's managers and team members, and provides contact information for these people; (2) the *task record form* that identifies a task that is assigned to a student, associates the task with a project goal, catalogs the activities required to complete the task, and defines associated deliverables, activity dependencies, and time duration; and (3) the *status report form* that indicates the status of a student's task and its associated activities and deliverables.

The activity included in the fall 1998 orientation had heterogeneous groups of five discuss the values of the above-described forms. With all groups, facilitators recorded comments about each form and led a discussion. In addition to meeting the third objective, this activity can provide students with an opportunity to learn the importance of clearly defining a project's mission and goals, the steps that must be completed in order to reach these goals, individual accountability, and time management.

Time constraints do not allow the orientation to address such topics as selection of a research topic, methods to conduct research, time management, written and oral presentation skills, proposal preparation, and paper review criteria. Thus, the information packet includes materials on these and related topics, which are practiced in subsequent affinity group weekly and monthly meetings.

Competing Concerns

The *goal* of the final component of the orientation, called Competing Concerns, is to promote communication and professionalism and to foster trust among members of each affinity group. The *objective* is to reach consensus on concerns that could affect the group, e.g., expected time commitment, group goals, and membership responsibility. Based on experiences over the past three years, faculty concerns center on student professionalism, e.g., meeting responsibilities, managing time, behaving proactively, and being ethical. Student concerns center on mentor

expectations, ability to contribute to research, and balancing coursework and research.

As with the other components, the activities that meet the objective can take many forms. An activity in the fall 1998 orientation addressed professionalism issues using Lockheed Martin's Ethic's Challenge Team Guide, a component of The Ethic's Challenge board game. The Team Guide contains ethical scenarios, which are focused on honesty, integrity, respect, trust, responsibility, and citizenship, which may confront a person in a workplace. For each scenario, a set of possible actions that the person can take are given. Groups discuss the scenarios, come to consensus on actions, and present their justifications to the larger group.

Another possible activity is group discussion that directly addresses immediate concerns of students and faculty. Students can be placed in groups based on affinity group affiliation or research project; faculty mentors are in a separate group. Using brainstorming, students address the question: "As a member of an affinity group, what concerns do you have?" Faculty addresses the question: "As a faculty member of an affinity group, what do you expect from a student who is a member of your group?" After each group constructs a list of answers, the nominal group technique is used to prioritize the list. After the final lists are made, each faculty member joins her/his respective affinity group and discusses the students concerns along with her/his concerns.

Orientation Preparation

The preparation of the orientation also reflects the cooperative nature of the affinity model. Student facilitators, who are established affinity group members, assist faculty mentors in the preparation and delivery of the orientation. In this way, students are given the opportunity to gain ownership of the affinity model and to further develop cooperative group skills. More importantly, they are given the opportunity to facilitate a cooperative meeting, applying what they have learned.

Faculty planning meetings are used to define the general outline of the orientation, and to assign tasks to each faculty member. The design and development of each component of the orientation is the responsibility of one faculty member. A session template is used to define the essential elements of a component (e.g., goal, objectives, time duration, and materials) and its activities. Methods used to form groups and the delivery of the component activities are decided *a priori*. Documentation is required.

Evaluation and Assessment

There have been three orientations. The experience gained through designing, organizing, and facilitating these orientations and through student and faculty evaluation has

led to continual improvement of the orientation. Due to space limitations, only a brief description of the evaluation methodology and a summary of the assessment of the fall 1998 orientation are presented below. Results from previous years are consistent with the fall 1998 assessment.

The assessment evaluates the effectiveness of the orientation from the students' points-of-view. All students are required to attend the orientation. Students are asked to complete a post-orientation evaluation; this questionnaire targets assessment of the effectiveness of the orientation in increasing:

- interest in and commitment to the affinity groups,
- level of knowledge of the affinity group concept,
- cooperative group skills, and
- research skills.

In addition, the questionnaire asks the students to evaluate the design, organization, and environment of the orientation, citing specific strengths and weaknesses.

Nineteen students completed the fall 1998 orientation evaluation. Of these students, seven were new members, six had been members for one year, three for two years, and three for three years. The evaluation instrument indicated that the orientation was responsible for increasing student understanding of the philosophy and goals of the affinity groups, knowledge of skills that can be attained by participating in an affinity group, interest in affinity group activities and skills, and commitment to an affinity group. It also was responsible for causing students to recognize their deficiencies in communication and research skills. Thus, the evaluation identified topics that should be the focus of subsequent affinity group weekly and monthly meetings.

STATEMENT	BEFORE	AFTER
I have an awareness of how to address the challenges of working with other students in a research setting.	78%	100%
I have an understanding of how to meet the challenges of working with faculty.	72%	94%
I have knowledge of how to present myself in a professional manner.	89%	100%
I am prepared to work with all members of my affinity research group.	71%	95%
I am prepared to accept the responsibilities needed to complete my project.	95%	100%
I have confidence in my ability to be a professional in different situation.	89%	100%

Table 1. Impact of Fall 1998 Orientation

The evaluations indicate that over 90% of the students were satisfied with the helpfulness of the information presented in the orientation. Table 1 gives statements

presented to the students and the percentage of the students that agreed with the statements before and after the orientation. These results indicate that the orientation has a positive impact.

Based on an empirical study of the undergraduate research experience, Stefani et al. [9] modified a graduate research model to one in which the focus is undergraduate research projects. They identified five key elements that must be incorporated to ensure success: general overview of the process, familiarization of expectations, resources, explicit training of necessary skills for success, and social and teamwork skills. These elements were used as criteria to assess the affinity model. The orientation, as well as weekly/monthly meetings and management foci that are essential components of the affinity model, were identified as targeting the first two key elements. The affinity model, as a whole, was identified to support the other key elements.

Summary

The affinity model provides students with opportunities to learn, use, and integrate the knowledge and skills that are required for research with the knowledge and skills that are required for cooperative work. The activities of the affinity groups center on developing students' research, technical, communication, and group skills. As a result, the model provides to students the ability to grow personally and academically, and to practice applying their knowledge and skills to research. The hypothesis is that this will lead to student growth and ultimately to success in graduate school and industry.

The membership in the affinity groups is dynamic, i.e., members graduate and new members join, and students come to the groups with different levels of knowledge and skills. Because of this, it is necessary that new members understand the philosophy and goals of the affinity model, the research goals of the projects to which they are assigned, and the basic elements of the research process. It also is important that established members regularly renew their commitment to the group, hone their research and cooperative group skills, and process within the group with the goal of improving the group's effectiveness. Finally, it is essential that the faculty mentors become aware of members' misgivings and expectations of the affinity group experience, and process among themselves with the goal of reevaluating the model and its success.

As shown in Figure 2, the annual orientation, consisting of five components, provides the platform for meeting these objectives. Although the structure of the orientation remains constant, the activities that meet component objectives can be customized to serve the needs of the affinity group. For example, adjustments may be needed as a result of changes in group composition or attitude, and alignment or misalignment of student and faculty mentor goals.

A common thread runs through the preparation and facilitation of the orientation. That thread is spun from the

goals of the affinity model depicted on the outer wheel of Figure 1. The orientation has proven to be a powerful tool. As planned, it facilitates the assimilation of new students into the affinity groups, increases student ownership of the model, and teaches basic research and cooperative group skills. In summary, the orientation is a valuable tool for maintaining functioning research groups.

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