

Demonstrating Sustainable Success: Using Ethnographic Interviews to Document the Impact of the Affinity Research Group Model

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Abstract - The Affinity Research Group (ARG) is a model of undergraduate research that extends the undergraduate research experience to a broad range of students by providing opportunities to learn and integrate the knowledge and skills that are required for research with those required for cooperative work. ARG creates an integrated research environment in which a collective of diverse students and faculty contribute to the research effort. The framework and pedagogy enable faculty to create and sustain a cooperative environment that explicitly develops skills needed for success in research, academe, and the workforce. This paper describes a qualitative design used to investigate ARG. The objectives of the effort were to gather alumni descriptions and to gauge the long-term effects of their experiences in the research group. The study shows that former ARG members readily describe specific aspects of the ARG model, such as paper and presentation critiques, through which they developed technical and social skills that they continue to use in the workplace and that they believe have contributed significantly to their professional mobility and success. To ground the findings, the paper relates components of the ARG model to sociocultural learning theory.

Index Terms – Undergraduate research, qualitative design, cooperative learning, professional skill development.

INTRODUCTION

There is a growing and urgent need for the U.S. to increase and diversify the number of qualified graduates in science, technology, engineering, and mathematics. Undergraduate research is a well-known approach for integrating knowledge and providing practice of the skills critical to the workforce. It has gained popularity in recent years, and there is heightened interest in investigating its efficacy [1]-[5]. The various aspects of undergraduate research under investigation include: 1) identification of best practices for promoting undergraduate research; 2) creation of methods for analyzing and describing the development of disciplinary knowledge through undergraduate research experiences; and 3) development of a theoretical framework for describing the elements of undergraduate research experiences that lead toward personal, professional, and intellectual growth for students.

Common practice in undergraduate research is to recruit and involve the most visibly successful students. By contrast, the Affinity Research Group (ARG) model, among a few other models, extends the undergraduate research experience to a broader range of students by providing them with opportunities to learn and integrate the knowledge and skills that are required for research with those required for cooperative work. Unlike models that focus on a one-on-one mentor relationship, the ARG model creates an integrated research environment in which a collective of diverse students and faculty contribute to the research effort [6].

The Affinity Research Group (ARG) is a research environment focused on a team effort in which faculty mentors and students support each other. Members have or are developing an affinity for the particular research topic. ARG team members share, to varying extents, common research goals, as well as goals for academic and professional development. They are actively engaged in discovering and sharing ideas in a cooperative environment. The ARG model comprises a set of principles and practices for involving undergraduates in research groups. Its framework and pedagogy enable faculty to create and sustain a cooperative environment that explicitly develops skills needed for success in research, academe, and the workforce. Application of the model entails the *deliberate design* of research groups whose members share a common purpose – an *affinity* – and it emphasizes the conscious development of students' disciplinary knowledge, research abilities, and team skills, as well as their sense of professional identity. As a result, students and faculty can reach higher levels of productivity and achievement. Additionally, student persistence is improved [6].

This paper describes a qualitative design to investigate ARG using ethnographic interviews. The evaluators conducted one-on-one and focus group interviews with ARG alumni. The objectives of the effort were to gather alumni descriptions of their experiences in the research group and to gauge the long-term effects of these experiences. The study shows that former ARG members readily describe specific aspects of the ARG model, such as paper and presentation critiques, through which they developed technical and social skills that they continue to use in the workplace and that they believe have contributed significantly to their professional mobility and success. To ground the findings, the paper

relates components of the ARG model to sociocultural learning theory.

ABOUT THE RESEARCH DESIGN

Over the last twenty years, qualitative research has evolved into a robust paradigm for research in education, yet it is rarely seen in engineering education research. In the educational research arena, the debate over which paradigm of research is more valid and yields more reliable, useful results has been in play for many years and continues today [7]-[9]. While it is not the purpose of this paper to address this ongoing debate, it is imperative to highlight a few issues of research design to explain why the evaluators of this study chose a qualitative approach. In his study of active learning research models, Prince [10] highlighted some of the limitations of various quantitative studies he examined, and he described problem-solving and lifelong learning as "difficult to measure" as compared to "standard measures of academic achievement such as test scores" [p. 224]. Likewise, to study the effects of ARGs, it would be challenging to design survey instruments to investigate all the ways experience in a research group may have influenced individual members. Adopting a qualitative approach helps address this challenge by allowing for the emergence of themes that are salient for the participants themselves and for clarification of those themes.

More specifically, ethnographic interviews can produce "thick descriptions" [11], or richly contextualized explanations of human behavior. For example, in this study, a significant theme surfaced during a focus group interview when one of the interviewees mentioned "a very good point that we have not touched upon" that the leadership hierarchy of ARGs is flat and that among ARG members, "we are all equals." A discussion then ensued among the interviewees about norms of respect and hierarchy among undergraduates, graduates, and faculty mentors that are related to Mexican/Hispanic cultural norms. This culminated in a discussion about trust, when one of the interviewees described students' relationships with their ARG faculty mentors, saying: "That's the trust you build: they trust you and you trust them." The relationship among the themes of hierarchy, equality among members, respect and trust, overlaid with cultural norms, would have been difficult to elicit using a survey or other quantitative research design.

When investigating human subjects, the possible effects of race, ethnicity, gender, discipline, cultural, and class differences may influence how researchers design their methods and interpret their data [9,12]. It is imperative for the researcher in a qualitative study to examine his or her ontological, epistemological, and methodological stances to validate the findings in their examination of the data. The researchers in this study were conscious of their biases and considered them in interpreting the data [13]-[14]. Moreover, the researchers shared the emergent themes with the research subjects to corroborate the findings, a necessary condition for validity in qualitative studies [14].

STUDY CONTEXT AND METHODOLOGY

The ARG model was conceptualized by Andrew Bernat, Ann Quiroz Gates, and Sergio Cabrera at the University of Texas at El Paso with the goals of improving retention in Computer Science and Electrical and Computer Engineering and advancement of students from those disciplines into graduate school. UTEP is situated on the U.S.-Mexican border, and over 70% of its population of 19,000 students is Mexican-American. One of the model's original purposes was to address retention and advancement of students from underserved groups [15]. Evaluation of ARGs at UTEP demonstrates the model's effectiveness at creating an environment that promotes the success of students with varied educational, cultural, linguistic, and socioeconomic backgrounds and experiences. It has since been adopted in research groups in engineering and computing programs in such diverse settings as University of Puerto Rico Mayaguez, Florida International University, and Wayne State University.

The present study involved alumni of an ARG in software engineering at UTEP led by two faculty mentors. Nine former or graduating ARG members took part in the interviews that were held at UTEP. Four of the interviewees had graduated within the last six years and five were about to graduate at the time of the interview. All were selected based on their availability to be interviewed; they were returning to UTEP for an alumni function unrelated to their ARG experiences. Of the nine interviewees, four are female. Seven are Mexican-American; one female is Asian and one male is from a Middle-Eastern country. Table 1 provides summary interviewee information.

Three former or graduating ARG members participated in individual interviews lasting between 45 and 65 minutes. Six alumni or graduating students participated in a 75-minute focus group interview. The choice of interview format, individual or focus group, was based on the interviewees' availability and the evaluators' concerns for efficiency in use of time, as well as an interest in generating the widest possible range of experiential themes. While the individual interview format allowed for more in-depth questioning of the interviewees, participants in the focus group interview built upon each other's ideas so that synergies of themes and ideas began to emerge that were not possible in the individual interviews. In all the interviews, the interviewers followed the same protocol of seven open-ended questions; however, additional probing questions were created in the moment as the interviewers discerned the need to seek clarification or elaboration of interviewees' statements. The fundamental research questions underlying the interview protocol were: 1) To what extent and how have experiences in the ARG influenced former participants' professional identities, perceptions of self-efficacy, and for the alumni, their post-graduate professional mobility and experiences? and 2) Which specific components of the ARG model, if any, do participants mention as influential in forming their identities and shaping their post-graduate experiences?

TABLE I
ARG INTERVIEWEE SUMMARY INFORMATION

Name	Gender	Ethnicity	Status at Time of Interview/ Highest Degree Received	Employment Type/Years of Employment/Years in ARG
Maggie	F	Hispanic	Alumna/M.S.	Technical Writer/5/6
Mark	M	Hispanic	Alumnus/M.S.	Computer Scientist II/2/3
Jorge	M	Hispanic	Alumnus/B.S.	Sr Software Engineer/3/1
Leticia	F	Hispanic	Alumna/M.S.	Technical Support/2/3
Ahman	M	Middle Eastern	Recent Graduate/Ph.D.	Asst. Professor/0/5
Lin	F	Asian	Recent Graduate/M.S.	Technical Support/0/3
Ignacio	M	Hispanic	Doctoral Student	NA/NA/4
Felix	M	Hispanic	Doctoral Student	NA/NA/4
Ana	F	Hispanic	Master's Student	NA/NA/1

All of the interviews were audio-recorded and subsequently transcribed. Analysis of the transcripts followed a grounded theory approach [16]-[17] in which salient themes emerged as the researchers read and discussed the transcripts multiple times. These themes were coded and grouped around such topics as participants' references to components of the ARG model; their statements about self-efficacy or changes in their identities over time; references they made to the social aspects of ARG participation; and discussion of their current job satisfaction, skills, and abilities. Themes were then cross-referenced in order to investigate if and how interviewees' made connections in their statements about their self-efficacy, identities, or job satisfaction, for example, with their experiences in the ARG. Key themes emerged that address our initial research questions and illustrate how ARG participants themselves understand the tenets of the model and how participation in the ARG influenced their personal and professional development. Themes we will discuss here are: 1) development of skills and disciplinary knowledge; 2) transformation of identities; and 3) sustainability.

Development of Skills

The interviewees described how ARG participation helped them to develop the skills in research, problem-solving, and communication, as well as the ability to work independently and in teams. The interviewees who were about to graduate spoke of the unique social environment of the research group and how it enabled them to develop skills that were recognized by students and faculty outside the group. Although some of the interviewees had been acquaintances of people in the group before joining, the group members became their primary social group after joining the ARG. They describe the ARG and the lab as a place they looked forward to going to every day, including weekends. They specifically credit their intense social interaction in the ARG with helping them to develop strong understanding of software engineering content so that they are able to converse with faculty at a level and with a degree of confidence that other students are unable to muster. They also attribute their abilities to make strong oral presentations of their work, in classes, at professional conferences and on job interviews, to their regular practice of such skills with ARG peers and mentors. Ignacio, a Ph.D. student, described outsiders' perceptions of the group:

Our group has the best presentations, the best content...And it's not because we are smarter. We're not. It's just because we work together so much and we help each other. I mean, I look at [my peer's] presentations, and he's looked at mine, and we critique each other's, and we learn from each other. So when we take a class, we show that knowledge... It's like, "Wow! These people are on the ball. They know what they're doing."

The alumni spoke of being aware that their experiences in the ARG were unusual and that they felt these experiences had given them a "leg up" in the labor market and enabled them to distinguish themselves within their organizations vis-à-vis their peers. Jorge, software development leader in a small company, described how skills he developed in the ARG had helped him to get to know and impress the top executives in his firm:

At my office, when it comes time to do a presentation, no one wants to do it. Everyone's saying, "Jorge you do it. You present really well. You did really well the last five times we made you do it"... In our setting, the more you present, the more you get to interact with people higher up in the company, and the more you get to know them. I've actually gotten to know the executives in my company very well. Others in my team, it's not that they can't present. In some cases they can do okay, but they're just intimidated by it.

Mark, who has held positions in three different organizations since graduation, said that he felt the ARG experience had helped him to land well in each of these positions. He spoke of being well-prepared to manage constantly shifting priorities:

In the research group, it was just one task after another. It was either buckle under the pressure or multitask and start getting all these projects out of the way to continue working on the main stuff we are supposed to be working on. That's [something] I picked up.

Development of strong written communication skills was also something the interviewees felt they had learned through participation in the ARG. They described it as a process of direct mentoring and modeling by the mentors and senior members of the group that was then picked up and passed on to junior members. Ahman, a recent Ph.D. and new Assistant Professor whose participation in the ARG

began during his doctoral studies, described the process by which he gradually came to be able to write journal papers by attempting a first draft on his own and then sitting alongside his mentor and talking through revisions, and later by sending multiple drafts and revisions back and forth with her:

My mentor had a very hands-on approach... Sometimes we would just stay in her office and work on [a paper]. I mean, we would never start working from scratch. I'd have to write something and then we would edit it or re-write...She would go through it all. I mean, every paragraph, and let me know that, "You know, this should have been this way, and this, do it this way."...Before, I would have needed seven or eight revisions. Now I would need five...

Ahman then began applying the same methods toward mentoring a Master's student in the group:

And I'm doing the same thing with [the Master's student I'm supervising]. I am hands-on. He wrote a paper a month ago and...especially in the technical stuff, with the content of the paper, I was very much involved. I'd say, "You know what, this needs to be changed." And, yes, many revisions also...I wasn't going to be a co-author in that paper or anything, so no matter what I told him, I think he took it well, because I had no agenda or anything. Just to help him out. So that's the way we do things here.

All of the interviewees emphasized the formation of strong social ties and a sense of connectedness within the ARG as having been key to their development of skills, knowledge and abilities, and that in many cases had led to personal transformations. Maggie, an alumna who became a technical writer with a Fortune 50 IT company, spoke of her initiation into a student computing society by a senior student who was a member of an ARG:

I was a freshman and Martha was a senior, and one day, I was walking in the hall and Martha was like, "You're coming to the ACM meeting." And I had never been to an ACM meeting, didn't know what it was all about, and so just having someone senior say, "Hey, why don't you come with me?"...I don't think I would've gone in on my own or become involved in ACM on my own, but it was the encouragement from somebody I respected [that got me involved].

Felix, a doctoral student, and Jorge, an alumnus, spoke about how, through daily interaction, the members of the ARG developed strong ties and came to depend on one another for help not just with their research and coursework, but also with personal problems:

Felix: [On any given day] you could probably count eight to nine people in the lab, working on their own stuff. But at the same time it was like a big social group, because they know, "Okay yeah, I'm going to go to work because I enjoy going there." And if anyone was having any troubles – and it doesn't necessarily have to be in school, it could be in

anything – it's like you can go and say "Hey, you know what, I don't feel good. Help me out."

Jorge: My project was completely unrelated to what anyone in this room was doing...But I got to know everyone in the group...From about 10 o'clock in the morning to 11:00-12:00 at night, [the lab] was where I was. There or in class or at lunch. And whenever I needed help, "Oh, wait. I don't know how to do this. Anyone know how to-?" "Oh, you know what, talk to Ignacio." "OK, Ignacio, help me out." You know, I got to know everyone like that.

Transformation of Identities

Many of the interviewees spoke of the change in their senses of self and their development of self-confidence through participation in the ARG. They described themselves as not being the sort of high-achieving students who would typically be recruited into research. Ignacio, for example, did not think of himself as a good student, and prior to being recruited into the ARG, he didn't imagine himself going to graduate school:

There's the type of students that, no matter what, they will be successful. But there's a subset of students that don't look as good on paper, and they will fall through the cracks, like myself and Jorge. We would not have gone on to [graduate school] if [our mentors] had not recruited us. I think most of us would have graduated with a bachelor's and gotten a job, and because of the Affinity model we are here. And if it had been like traditionally, whoever has the highest grades has the research position, then we would never have been here.

The ARG founders explicitly recruit students who, while they might lack confidence, are competent. These are students who might not otherwise be exposed to the research environment, but who might be successful if introduced to it through a nurturing, cooperative, yet demanding environment. Leticia was one such student. Like the majority of students at UTEP, she was the first in her family to attend college. She credits participation in the ARG with giving her access to a world that she would not otherwise have known about and helping her to develop a sense of herself as a scholar and researcher, which led to her persistence through graduate school and into a technical support position:

I was the type of student that would do my homework and go home. I really didn't know what [resources were] available and didn't know my professors to the level to where I could talk to them. When I started talking to [my ARG mentor], I realized that, even though I didn't think that I could do certain things, whatever I could do was enough. And it just kept growing from there.

Through her experiences in the ARG, Maggie changed from being an individualist to a firm believer in the value of cooperation. Now she laments that the principles of cooperation she and her peers had come to regard so highly during their participation in the ARG are not yet fully in practice in her current workplace:

I was pretty individualistic, wanted to study on my own and was being forced to work together with other people...And [we were] learning about cooperative learning. Not just, "Here's the theory," but we were seeing it work in practice... [Some in the management at my firm] want a cooperative environment, but it's very results-driven. That's the bottom line...All those other things that take time go out the window.

Evidence of Sustainability of ARG's Benefits

Despite having to transition from the demanding but nurturing and cooperative environment of the ARG to a demanding, pressure-filled, and competitive environment in her current workplace, Maggie, like the other alumni interviewed, stressed that participation in the ARG prepared her well for the challenges she faces. The skills that Jorge, Mark, and others have developed, which they attribute to their participation in the ARG, are serving them well in a variety of positions. Over and over, the interviewees referred to the development of self-confidence as one of the primary benefits of participation in the ARG, something that they perceive to be lacking in many of their peers in the workplace.

Not only has the ARG helped prepare these alumni for the shifting demands of the labor market and the pressures of profit-driven concerns, a more immediate goal of the ARG model is also being met: that of encouraging undergraduates from minority and other underrepresented groups to persist to graduation in CS and engineering majors and to enter and complete graduate school.

Explaining ARGs' Success: Sociocultural Learning Theory and Communities of Practice

Under the ARG model, research groups are formed around shared goals (technical/research, as well as cooperative/social) that newer members come to appreciate more deeply through participation in the groups' activities under the guidance of more experienced members. The theory of situated cognition/learning [18] offers a framework for elucidating how learning and development occur through participation in personally and socially meaningful practices. First of all, ARGs *situate* learning in meaningful experiences. That is, they engage students in a supportive learning environment that is affirming, while it also makes the goals and processes of research explicit. As a result, participants are gradually able to make sense of what they are learning, turn these new experiences into abstract ideas, and ultimately, transfer what they are learning into new situations.

ARGs embody what Lave and Wenger [18] refer to as *communities of practice*, a form of social organization in which a common underlying purpose motivates the group's activities and facilitates the organization of these activities into a body of established practices. The ARGs' continuous and deliberate focus on the development of research, professional, and team skills in a cooperative environment provides students with an optimal situation for developing

skills and abilities that are highly valued in academia and industry.

As evidence of this, the comments of the alumni quoted above strongly suggest that they are conscious of having benefited from an unusual learning experience, one that few of their counterparts at their university, and later in their workplaces, have been fortunate enough to have had. To a person, the interviewees articulated stories of their time in the ARG that illustrated how they gradually became aware of the goals and purposes of the research group and, through intense mentoring from ARG peers and faculty, developed the skills that enabled them to confidently and competently complete research tasks, present the findings of their research within and outside the group, and make significant contributions to the group's publications. In turn, as their skills and confidence developed, they became mentors to newer ARG members, thus continuing the learning/mentoring cycle. Such a process of development within communities of practice is referred to by Lave and Wenger [19] as movement from *legitimate peripheral participation* to *full participation* in a community.

DISCUSSION AND CONCLUSION

In this paper, we have presented an argument for the use of qualitative research methods, specifically ethnographic interviews, for evaluating the effectiveness of a programmatic model, and we have illustrated the affordances of this approach through an evaluation of the Affinity Research Group model. This type of research design, supplemented by descriptive program data, provides a much richer description of the experiences learners underwent, and the ways in which they make sense of those experiences, than reliance on survey data or other common quantitative methods alone would allow. Participants' experiences are elicited through open-ended questions that allow them to describe these experiences in their own words, emphasizing what was most salient for them, rather than responding on a rigid scale to a set of questions or prompts that were predetermined. This data collection method allows the participants to clarify the meaning and intent of the questions, and to rephrase or clarify their own intent when interviewers attempt to rephrase or paraphrase what they have understood. The researchers' analysis summarizes the themes and chooses quotes to illustrate them, but by providing direct quotes from the interviewees, this interpretative analysis is open to question or reinterpretation by other scholars.

Through the specificity and richness of detail in the ARG interviewees' responses, their experiences come alive; and the fact that they are able to recall specific incidents from events that had taken place in many cases several years prior to the interview adds veracity to their claims that participation in the ARG had been deeply transformative. Interviewees were able to make connections between specific ARG experiences and their outcomes and provide us with glimpses into exactly *how* their experiences had unfolded. Although it was not possible to fully capture in the

quotes shared above, focus group participants demonstrated their continuing close ties with one another through repeatedly completing each others' thoughts, referring to past experiences through a sort of short-hand language that the interviewees often needed to probe the meanings of, and through corroborating and expanding on each others' stories.

While we firmly believe in the value of this approach, we also must acknowledge a few of its limitations, and specifically those of the present study. We believe that the experiences the interviewees described are representative of those of most ARG participants, but we cannot claim that they describe the experiences of *all* ARG participants. The resources and time involved in ethnographic interviewing does not permit us to interview all ARG alumni. Moreover, for limitations of space we have had to choose from among all of the anecdotes the interviewees shared those that best represent the themes found across all interviews.

Another important acknowledgement qualitative researchers must make is how our own assumptions, expectations, and biases may have influenced the types of questions we ask and, therefore, condition the types of responses we receive. We attempt to mitigate such biases by avoiding leading questions that would guide participants to make false connections between their experiences in the ARG and any positive post-graduation experiences, changes in identity, and perceptions of self-efficacy. Indeed, although the interviewees were made aware in the invitation to interview and again at the outset of the interview that we were interested in their experiences in the ARG, they sometimes mentioned influential experiences they had had outside the research group, in the classroom or in other non-research, extra-curricular activities. Nevertheless, all of the interviewees were eager to relate their experiences in the ARG and all provided anecdotes and examples that suggest that these experiences have had a profoundly positive effect on who they have become.

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