AC 2011-1633: THE CHALLENGE OF RETURNING: TRANSITIONING FROM AN ENGINEERING CAREER TO GRADUATE SCHOOL

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The Challenge of Returning: Transitioning from an Engineering Career to Graduate School

While many graduate students have progressed directly from their undergraduate education to graduate school with little or no time passing in between the two, many graduate students have not followed this pathway. Because of these experiences, "returning" students are different in many ways from "direct-pathway" students, and these differences can enrich the graduate experience both for the returning students and for their fellow students. However, these returning students also face certain challenges that direct-pathway students do not. While the published literature on returning students has discussed some of their special skills and particular challenges, there are many unanswered questions, particularly in regard to returning students in engineering and other STEM fields.

Introduction

While many graduate students in the science, technology, engineering, and mathematics (STEM) fields begin their graduate program immediately after completing a bachelor's degree, there are also many who enter the workforce and later pursue a graduate degree. In the larger population of graduate students, statistics show that many are older; in 2001, only 43.4% of graduate students were in the age range of 22-29[1]. Naturally, statistics will vary across fields, since pathways vary by academic field, and in some fields, such as education, it is expected that graduate work will follow significant work experience. Furthermore, these statistics will vary over time, since a person's educational decisions are affected by many external factors, including general economic conditions and the job market in a given field. In the mechanical engineering department of the University of Michigan, there are currently 57 students with a gap of three years or more between the completion of their undergraduate program and enrollment in graduate school. Given that the University of Michigan graduates over 150 mechanical engineering graduate students each year, this is a significant minority of the graduate population. Statistics on the exact length of time these students were in the workforce are not currently available. For the purposes of this study, we define returning students as those who have had a gap of at least five years between completion of an undergraduate degree, and enrollment in a graduate program. This gap length is chosen to ensure that the returning students have spent enough time in the workforce to establish a professional identity.

While there are limited published statistics available about returners, there is a variety of evidence that indicates they are a specific group worthy of study and attention. There are seminars and programs at national conferences for returners and those considering returning to graduate school. For example, the Society of Women Engineers (SWE) national conference has included speakers on returning to graduate school in 2009[2] and 2010[3]. Graduate schools host groups for returning students, i.e. the University of Michigan has a returning students group that is open to returning students from all academic disciplines, and which hosts frequent networking events. There is a LinkedIn group for returning students, established in 2010, which has over 20 members.

Research is also limited on returning students; however, a few studies have been published that support the necessity of attending to this population of engineering graduate students[4,5,6].

Recruitment and retention of diverse populations are often the focus of engineering education research[7]; however, diversity is defined by gender and ethnicity, and often do not include diversity in age and professional experience. Just as an engineering population diverse in gender and ethnicity adds to the quality of engineering programs and the engineering workforce, a graduate student population diverse in age and experience also has much to add to the engineering university community. Furthermore, by encouraging diversity in age and experience, universities may also realize an increase in gender diversity. In some STEM fields, such as computer science and engineering (CSE), women are disproportionately represented among returning graduate students[8], further adding to a diverse academic environment.

While the published literature on returning students has discussed some of their special skills and particular challenges, there are many unanswered questions, particularly in regard to returning students in STEM fields. These questions include the decision-making processes of returning students and the types of guidance they seek when considering the pursuit of graduate education, academic, personal, and social issues they face in returning, and success strategies that enable returning students to persist and succeed in graduate school. In this work, we addressed the following research questions:

- How do returners experience graduate school?
- What factors hinder or facilitate the success of returning students in graduate school?
- What similarities and differences do returning students perceive between themselves and direct-pathway students?

The data from this study are useful in beginning to answer these questions, and in informing future studies. Furthermore, with such data, universities will be able to more effectively advise returning students. This will allow the university to gain from the strengths returners bring, as well as better equip returners to earn their graduate degrees.

Background

A significant number of graduate students have not followed a direct pathway from their undergraduate education to graduate school. These students, referred to in various places as "older," "mature," "adult," "non-traditional" or "returning" students, have had a variety of career and life experiences between their undergraduate and graduate studies. These returning students differ from direct-pathway graduate students; they are often more motivated and mature[9,10], more goal-directed[4,10], more aware of ethical issues[9], have better teamwork skills[9], have a high work ethic[10], and more skilled with a variety of tools and types of equipment[10]. They also utilize time management strategies more effectively than younger students, and model effective study strategies for direct-pathway students to emulate[11]. These characteristics can add to the classroom environment and enrich the graduate experience for the student body as a whole[9,10].

While these students have great potential to add the to classroom environment and support different kinds of learning, there is a lack of research on how to integrate these students into the classroom environment in ways that allow teachers and research advisors to positively take advantage of the unique skills returners bring. Returning students have used the skills and information they learned as undergraduates in the workforce, and have seen how different classes relate to each other. They have a broader view of their field than a student who has not had their experience, and may be able to better identify certain types of research questions for their

graduate work. Furthermore, upon completion of their graduate degree, they may be able to use that experience to promote their work more effectively and impact the technical community.

However, they also face certain challenges that direct-pathway students do not. These challenges include the lack of information and mentoring available to direct-pathway students as they prepare to move from their undergraduate program to a graduate program, personal and family responsibilities, fitting in to the graduate school community, and changes in learning style over time.[5,6,12] Often, returning students' computer skills are less developed than those of direct-pathway students, and they may be less practiced in the mathematics required for graduate study[10]. They may feel that they do not "fit in" with younger students[6], in part because of personal and family responsibilities[5,6]. They also face challenges in admissions, funding, and preferred working style[5]. Such challenges hamper the returning student's ability to successfully enter and complete graduate degree programs[4,5,6].

Challenges for returners also include admission to a program, since some programs are less welcoming to returning students than others[5]. In some cases, metrics that accurately predict success of direct-pathway graduate students are inaccurate. In particular, it has been found that for women over 24, the GRE underestimates academic success[7]. Thus, programs that rely heavily on GRE scores to determine admission to engineering graduate programs may not consider potential returners. Those same potential returners are often the ones universities invite to lead guest lectures and seminars, but their credentials may not map well to admissions requirements designed with direct-pathway students in mind.

Some schools, including the University of Michigan, have networking groups for various populations of graduate students. One of these groups may be a returner students' group; however, aside from such networking groups, there are no large-scale organized efforts to assist returning students in dealing with these challenges, and due to the lack of research into such students, it is currently unknown what types of programs might be most effective.

Research Methods

Participants. The study participants were identified through networking channels of the researchers. The aim for participants in this case study was diversity in background, experiences, and years in the workforce currently at the University of Michigan. We selected three participants to include in this work so that we could discuss the depth of each of their experiences. Key demographic data for each participant is given in Table 1.

Table 1. Demographic Data for Study Participants

Pseudonym	Gender	Age	Years in workforce	Current Status
Andrew	Male	33	7	Third year Ph.D. student
Brenda	Female	38	5	Post-doctoral Researcher
Catherine	Female	41	18	First year Ph.D. student

We also found it useful to represent the pathways of each of the participants. Figure 1 represents their current status and key academic and professional events prior to returning.

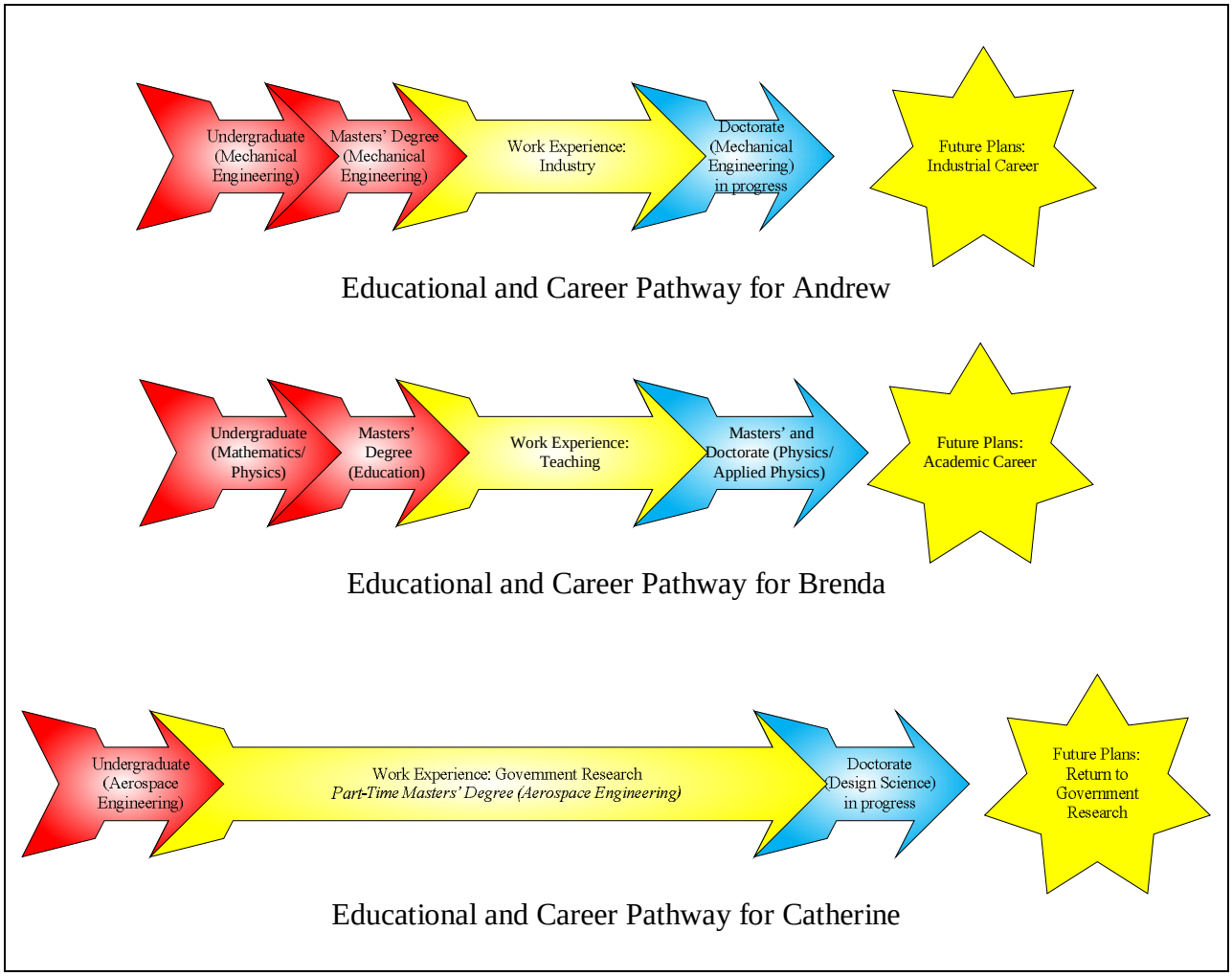

Figure 1. Educational and Career Pathways for Participants

Data Collection. Data was collected by semi-structured interviews. The questions asked covered three primary topics. The first topic was the participant's preparations to return to graduate school; the second was the participant's perception of the differences between him or her and direct-pathway students; and the third was the participant's views on what factors or strategies contributed to his or her success in graduate school. The full interview protocol is given in the appendix to this paper. The interviews were approximately one hour long. Interviews were recorded, and a transcript was produced after the completion of each interview.

Data Analysis. The data were analyzed for emergent themes using the constant comparative method[13,14,15]. The primary techniques used in order to identify themes were the identification of repetitions, and the study of similarities and differences both within and across interviews. First, each interview transcript was studied by itself in order to determine three to four themes that were strongest in that interview. Next, the interviews were analyzed as a collection. Six themes were identified that appeared in at least two interviews.

The issue of researcher bias was of considerable importance in this study. The first author returned to school for a doctorate in mechanical engineering after a thirteen-year career in engineering, during which she obtained a masters' degree on a part-time basis. As a member of the population for the study, it would be possible for her experiences and perspectives to influence the data analysis. In order to guard against the effects of this bias, the second author, who is not a member of the study population, analyzed the data independently. The results were then compared to ensure that conclusions were drawn from the data, and not from the first author's experiences.

Results

Within-Case Results

Andrew, in the third year of his doctoral program in mechanical engineering, had earned a bachelor's degree in mechanical engineering, graduated with a masters' degree in mechanical engineering, and worked in private industry for approximately seven years before returning to graduate school. His primary reason for returning to school was to provide mobility into a new area of research and development.

Three key themes emerged in his discussions of his experiences: the importance of non-technical skills developed while working, the frustrations and challenges of working in teams with younger students, and navigating ways to relate work experiences in the classroom context.

Theme #1: Importance of non-technical skills

Andrew acknowledged how important technical skills were, but emphasized the development of non-technical skills such as communication, project management, and networking were critical to his success, and a key differentiator between him and traditional students.

> I feel a lot more confident about things like giving presentations or writing reports, like those things don't stress me out at all, whereas I see they stress out a lot of other, you know, younger students, and for me it's sort of second nature, it's not a big deal. I feel a lot more comfortable as far as knowing how to talk to other people sort of in a networking way versus when I was getting my masters', I didn't really know what it meant to do that or how to make these connections or how to further these connections, things like that. I feel like nobody tells you, and it's sort of a learning process, so I feel very, you know, more comfortable with that sort of thing.

The development of these skills was, furthermore, something that he perceived as happening primarily in the workplace, and not during his previous tenure as a student.

> It's more like how to deal with suppliers, and vendors, you know, how to get things done, if you will, that are outside of sort of the academic-technical core, you know, learning kinds of things. How to make things happen, you know. How to handle a project. Things like that. So, I'd say it's mostly soft skills which are the things you tend not to get the experience with in school.

The development of these skills, while critical to his success, presented certain challenges in dealing with traditional students.

Theme #2: Frustrations and Challenges Working in Teams with Traditional Students

Andrew felt disadvantaged as a returning student in his team interactions. He felt different from the group in his abilities and struggled with those interactions.

> The strange, maybe, disadvantage that I noticed, but it depends on how you look at it, was that I found I had a harder time doing group projects, because I felt like the students that I was working with tend to be immature.

He recognized that at times he may be assigning undue importance to some aspects of a project; however, he also felt that traditional students could focus on the wrong things as well.

> I guess it's in a variety of ways, whether it's that they don't really know how to interact with people, they don't know how to work in groups in a way that is sort of equitable to everybody, they're all very self-absorbed, self-focused, really focused on getting work done no matter the quality, and trying to push work off onto other people, and not really doing a lot of listening, you know, these types of things. And so I found that very frustrating but then myself I had to realize that for me it was harder because I was used to signing my name to work and that I had done and really worrying about the quality of it because it was, you know, something that was going to be implemented versus at least in coursework, when you're doing work, and you're doing a group project, it's generally not something that ends up having any impact beyond that class and so I had to learn to let go of some of that – I mean honestly to do a worse job on things or like not care as much. So that was interesting. I wasn't used to that. I wasn't expecting that for sure…I find I don't have a lot of patience for things that I realize don't matter, that they tend to put a lot of effort and focus into.

While Andrew saw the value of his skills and was able to use them in his academic work, the fact that he had a different view from his teammates of what was important in a project and how best to go about doing the work caused friction within the team. This friction was a source of frustration to him, and a challenge that he had not anticipated when he was making the decision to return to school.

Theme #3: Classroom Interactions of Returning Students

Andrew acknowledged that he had something to add from his previous experiences that could be valuable to the university learning environment, saying that "I have a lot more anecdotes to give then maybe they do, you know, things like that." However, he was more concerned that it could be a problem to have one student dominate a class discussions, thus, he tried to avoid doing so.

> So – so I've been in classes before where you get returning students who are somewhat over exuberant about discussion within the classroom setting and that can get tiresome, and so I didn't want to be that person, and so if I had something to offer I would offer it, if I thought that it would be useful and interesting for example. But, you know, I wasn't always trying to be the one, you know, asking, you know five questions per class period,

> and, you know, extensive, you know, deliberations about this or that or the other. "Well, in my experience, blah blah blah…" But I think there are times where, you know, specific situations could come up, you know, and I could give a, you know, reasonably brief anecdote about it, and I think it was usually well received.

One of the reasons that Andrew was aware of the potential problems with dominating class discussions, and concerned about it, was because he had observed it in the past, particularly in the case of returning students.

> I think in a lot of classes I've had, where there are returning students, they tend to be the most talkative, and sometimes it's fine, and sometimes it – it gets a little overbearing. So I've had a lot of classes that way.…And it wasn't just me that had pointed this out, I'd heard other people talk about this too, like, oh, you know, the 45-year-old student who's the one who always goes on and on in class, and like, you know, it's like we're all just trying to, you know, get out of the lecture, come on, you know like that kind of thing. But in – you see a myriad of reasons why it happens, and I can understand some of them, and I think part of it is maybe they're just – you know, they may not be aware of how much they are talking in the class, or even if they are maybe then, you know, maybe they think people appreciate it, maybe they don't care, and they want to get their money's worth. You know, there's plenty of – plenty of reasons to do it, but that was sort of an interesting thing.

As a student who had obtained his master's degree in a traditional pathway, and then returned later for a doctorate, Andrew was able to see both sides of this type of classroom interaction. He was able to see the value in bringing work experiences into the classroom, but also knew that it could be a problem in some cases. By recognizing that this could be a problem, he was able to provide the advantages of his experience in a way that he felt was constructive for the class and added to the learning environment.

Brenda, female, age 38, had completed her masters' degree in physics and a doctoral program in applied physics as a returning student. She had earned a bachelor's degree in mathematics and physics, then a masters' degree in education, then taught in both high school and college settings for five years before returning to graduate school. She is married, and has three children, two of which were born prior to the completion of her doctorate. Her primary reason for returning to school was the wish to be able to teach in a university setting.

Her experiences presented three primary themes. These were the importance of role models, the role of allies in her education, and the importance of self-efficacy.

<u>Theme #1: Importance of role models</u>

Brenda actively sought out role models to help her persist through graduate school. She rated role models as being far more important than getting advice for her own situation and career.. She felt that advice was not helpful since "I didn't feel like they understood my constraints anyway", and because she felt that although many faculty members are experts in their field, "that doesn't mean that they're an expert in the way that *you* want to become an expert." As a professional and a mother, she felt a need for particular role models – women who had

successfully pursued a career and raised children. Her role models included both famous women scientists, such as Marie Curie, and currently living successful women with children.

> I was going down the halls of all these women physicists, and I decided to read a biography on Marie Curie. And she had two children, and she did not get her Ph.D. until she was 35, so that became my goal. I was going to have my Ph.D. when I was 35, and I did finish that, had my Ph.D. at 35. She had two children; I had two children when I finished my Ph.D….I sought out role models who have been successful mothers and careers, including the first woman who was prime minister in Norway, Dr. Gro Brundtland, who coined the sustainable definition – sustainability definition that everybody uses. She was I think the founder and first director of the World Health Organization, and I got to talk to her about her having five kids and what she did when she had five kids to still be successful, and I talked to lots of other women…I have to seek role models. Role models are very different than advice.

By seeking out role models, Brenda was able to see that she could be successful, and choose from those models in finding ways to navigate her own personal and professional challenges. The ability to meet some of her role models and talk with them was useful to her, although simply reading about women who were successful as both mothers and professionals was also helpful.

Theme #2: The Role of Allies

In addition to role models, Brenda felt that allies were a key to success. While she did not seek out advice on what to do, or how to do it, she did feel the need for people who supported her in her efforts and helped her to accomplish her own goals and objectives. When asked what were some of the things that contributed to her success, she explicitly stated, "Finding allies. Finding people who would support me and stand up politically for me." Her entry to graduate school was possible because of the allies she formed:

> [T]he department chair said, "Everyone rejected you, but I have veto power." And I knew they were going to reject me, so I came with like a many-page document saying why I deserved or would not disappoint him. So my first semester I got all A's and I gave it to him, I said I will not disappoint you. And he was just like blown away because one of his best students didn't get all A's.

In particular, when pursuing a research program that was unconventional, she found that allies were useful in gaining funding to do her work the way she wanted to do it when others doubted that it would lead to the types of publications that they valued.

> And luckily there were a group of people who stood up, who said even if it's not going to become a research paper, we should spend a certain point zero zero zero zero zero zero one percent of our budget on something that might potentially have the possibility of becoming a research paper because it's really important stuff. And so I had enough people backing me that – that that was good.

Because she recognized the importance of allies, Brenda devoted considerable time to building alliances. She has learned how to explain the importance of her work to potential allies, and how to recognize who is in a position to serve in this role. This allowed her to pursue a research program that she designed and establish her own professional identity as a researcher.

Theme #3: The Importance of Believing in Herself

The third major theme in Brenda's interview was the importance of believing in herself. Brenda faced a significant number of people in various areas of her life who doubted her ability to succeed, and who often told her so. In order to successfully complete her degree, she had to maintain a belief that they were wrong and that she was capable of success.

> … it was very difficult for my family to think of me as smart enough to get a Ph.D. In fact, when I first turned in some of my homeworks I typed everything up, mainly just because I wanted to be able to use it for future reference so I typed it up and I like typing things up, it's easier to edit later on, and some of my family members would see these homeworks that were like fifteen pages long in like quantum mechanics and they'd be like, "Do you really understand that?" and I would say yes, but they didn't see me as someone who was able to do that, so I think along the way I had to believe in myself when no one else did.

Prior to the completion of her degree, she discussed her work with a female professor who explicitly told her that "… you're a mother, and mothers can't be professors …". When challenged with information about the student's role models who had combined academic careers and children, she was told, "I still don't think you're going to be successful." She summarized her attitude towards other people's doubts as, "I think that – that it's important to have people guide you along the way, but you have to believe in yourself."

Catherine is female, age 41, and in the first year of a doctoral program in Design Science. She had earned a bachelor's degree in aerospace engineering, then went to work in a government research position. During her working career, she obtained a masters' degree in aerospace engineering on a part-time basis. After working for approximately 18 years, she took a leave of absence to begin her doctorate. She is divorced, and has one child. Her primary reason for returning to school was the wish to learn something that she felt would be of value in her existing career and position.

Her experiences presented four primary themes. These were the need to progress rather than regress in a doctoral program, the wish to broaden her perspective, an emphasis on understanding as opposed to simply knowing, and the importance of family and community.

Theme #1: Emphasis on Progress, Not Regress

As a professional who had been working for a significant time period, she felt that many graduate schools wanted to erase or ignore her experience, and this presented a problem. She wanted to learn new things, but felt the need to start from where she is now, not where she was in the early stages of her career.

> I needed a place that would respect what I brought to the program as a returning graduate student. A school that seemed to say, you know what, I don't care what you know, you're going to be treated like you're a 22-year-old and, you know, and there's no advantage whatsoever to what you bring, you'll be grunt labor and you'll be my whipping child… You know, I'll make you do all my grunt work and write my papers for me for the next several years – was not a place that was going to be conducive for me. It really wasn't. And so I needed a school that I felt like I could grow in where I would not regress, but I would progress…

In particular, she was concerned with wasting time re-learning things she had known once, which would take away time that she wanted to spend on learning new things and advancing her research. She had been warned by many others, who had considered returning to school, but had decided against it, because of what they had forgotten.

> I would spend 80% of my time in grad school re-proving to some professor that I knew how to do a triple integral, run Matlab code, run SPSS, and 20 – it would exhaust my time there, and I would only have a small fraction of that time to actually advance and grow from there…

This was a key theme in her decision both to return to school, and in her choice of where to go and what type of program to pursue.

> I looked for a program that built on what I have already and that I could bring something new that we don't have, so I was looking for a program that would do that…I looked for a program that would allow me to expand upon what I already have, not re-learn what I already knew.

In the course of her decision process, Catherine ruled out many potential universities based on that criterion. If she felt that she would be treated as if she were a recent bachelor's degree graduate and would have to re-learn significant amounts of material, she declined to consider that university any further.

<u>Theme #2: Broadening of Perspective</u>

Catherine was actively engaged in research in her job. She saw the value of deep technical knowledge, and worked among many people who had such expertise in a particular field, but did not feel that this fit her own goals and objectives. This was a key reason why she chose to pursue a degree program that was fundamentally multidisciplinary in nature, and was one of the factors that influenced her choice of school.

> My goals in getting this particular degree were not to go further into the fields I was already in. I already had two degrees in aerospace engineering. Traditionally most people go back and get their third degree in the same thing their first two degrees were in, and I wanted to expand my horizons, I wanted to bring something to aerospace that I did not believe there was sufficient expertise in. So I went looking for a way to broaden as opposed to narrow my perspectives, and bringing a new perspective in…the assumption was you were coming to go narrower and deeper and I was not coming for that. I was

> wanting to broaden… so I wanted a place where I could talk to the other people and learn something. My actual GPA didn't matter to me, to be honest with you. It was the opportunity to talk with some of the best in this field and engage.

Catherine felt that this broadening of perspective was extremely important for what she hoped to accomplish; while she was intellectually capable of studying a narrow area very deeply, this did not serve her purposes in pursuing a graduate degree. Her work is multi-disciplinary in nature, and her job requires a broad, holistic view of technical problems.

Theme #3: Importance of Understanding Rather than Knowing

One of the key distinctions that Catherine made between her current state of knowledge and her younger self, and between herself and the younger students around her, was the difference between knowing something and truly understanding it. She considered that someone knows something if they can solve problems and demonstrate proficiency in a class, but said that they might not understand it on a deep and fundamental level

> [W]e all know that you can get an A or a B in a class and not understand it. You can know it, but not understand it…And as a practicing engineer I know you have to KNOW it, you have to understand it fundamentally in order to use it in practice. So my goals now are to understand…you know that you need to know it. Period. And get it in your head and understand it. Fundamentally. So you can change any knob and understand what's going on.

Catherine recognizes that, in the workforce, engineers face problems that they never explicitly learned to solve in their coursework. By understanding material thoroughly, they are able to apply concepts to situations far outside of anything that they have ever encountered before, and solve a wide range of important problems.

Theme #4: Importance of Family and Community

A fourth theme, and another differentiator between her life and that of a direct-pathway graduate student, is the importance of family and community. She described younger students' lives as being "singular", while an older person such as herself has a more complex life, with more demands on her time and attention. A part of this was due to her son, but she had other outside interests that are not necessarily dependent on having a child.

> And now, as a 41-year-old, as a mom, it is all about my family, and helping them and helping us grow together and be healthy, and the community and the church and the broader society overall. Very different perspective. And saving, and buying and all those things, everything is very – I'm much more mature, I'm much more concerned about what's happening around me, not just what's happening with me…I'm a mom, which is a full-time job by itself. You know, I have, now, I'm in the in-between generation as they call it, I have parents that are elderly, that I want to make sure are well and safe, and so I spend some emotional energy checking on them. I have nieces and nephews that need and want mentoring as well, that I can't just ignore. And so, so between my extended family and my immediate family that requires time. Real, critical time that's way more important than anything I do at the university…I needed to come to a simpler, smaller

> house which is exactly what I did. But I still wanted some of the other things that you get from living in a community, like I wanted to have neighbors that were involved, not just at the university but in the community because I was living in a community, an adult, if that makes any sense.

Her attitude towards these parts of her life was that, while they do take time away from research and from her job, they are important and worthwhile parts of life. The need to spend time on non-research activities is not a burden but a source of perspective, and a part of a rich adult life.

Across-Case Results

After performing a thematic analysis of each interview by itself, the interviews were studied as a set. A thematic analysis of the collection yielded six themes that appeared in at least two of the three interviews, with most of these themes manifest in all three.

Common Theme #1: Definite Goal for the Return

Each of the participants had a different goal that led them to enroll in graduate school; however, each did have a very definite and personally significant goal. All of them acknowledged that, for younger students, it could be seen as the logical next step in a progression. For them, however, it was a break in the usual life pattern, and required a strong motivation to make this decision.

Andrew stated that he had always had it in his mind that he might someday return for a Ph.D., and the issue was one of timing. He made the decision to do so when he felt it would allow him to move into new research areas that interested him.

> Now at the time I decided to come back, part of the reason was that I was in R&D and it had been pointed out to me that getting a Ph.D. would be more useful as far as mobility within an R&D environment, as well as the particular company I was working for, their focus was less interesting for me, or their application and the tasks that were potentially available, but to make sort of a sideways move in R&D can be difficult if you don't have experience in a given area, and so I had an idea of the kind of research I wanted to do and so I figured if I could go back to school and do that research that would be a way to get into that area.

This goal contributed to a stronger feeling of engagement with the program than he had previously felt, when working toward his masters' degree, although he also commented that maintaining that focus was not always easy.

> I definitely had a better focus, coming back, than I did when I was doing my master's, I had a lot more idea of, you know, this is what I want to accomplish versus I'm doing this because it's the next step kind of thing.…one of the advantages of being a returning student, I thought, was – and I've heard other people talk about this – is the focus you have, and sort of the drive, and you – you tend to know more of what you want, and have a clear picture of how to get it, or at least how to find out how to get it, that type of thing. But I found that it can be, like, after being here for two years, I find some of that focus has been lost. And so, that's been challenging.

Brenda began a graduate program because she had decided that she wanted to teach at the college level, and needed to have the credentials to do so.

> I wanted to be able to go back and actually teach at St. Mary's College and do this kind of work in Africa…

In her case, she had not previously considered pursuing a Ph.D. She described herself as being "pretty hostile" to the idea. However, once she began the degree, she had a strong sense of purpose.

> …you're making sacrifices and you're not going to play around, this isn't like, you know, just something that you do because it's the next stage of life. No, it's something that you do no one else understands. And that's crazy, and so you better have some – you better not mess it up. You know, there – there are just higher stakes, you know. It seems like it, anyway.

Like Andrew, her motivation had not been strong at all times. At least once, she considered quitting the program, but was encouraged by others to continue; "they're like…you can't just walk away, especially when there's no reason for you to walk away."

Catherine was motivated to begin her Ph.D. by a professional and intellectual need, which she described as follows.

> I wanted to bring something to aerospace that I did not believe there was sufficient expertise in. So I went looking for a way to broaden as opposed to narrow my perspectives, and bringing a new perspective in…my motivation was more to learn something new, to expand my horizons and to grow personally, and if that opened doors professionally, that was icing on the cake.

As she is in the early stages of her program, it is not yet known if she will experience the same motivational challenges as the other two students interviewed.

All three participants had definite goals that produced strong motivations for their return to school. These goals were a product of their individual interests and priorities, as well as the differing paths they had taken in their careers.

<u>Common Theme #2: Decision Process Focus on People</u>

All three participants, once they had made the decision to return to school, focused their decision processes specifically around the advisor with whom they would work. Andrew and Brenda only considered the University of Michigan, while Catherine conducted a wide-ranging international search, but still focused a major portion of the decision around the choice of advisor.

Andrew considered only the University of Michigan, but spoke with a number of different professors to gather information.

> Yes, I only looked at U of M and mainly it was because I wanted to work with my master's advisor… and I talked to him and he was interested in having me come back and having me do my Ph.D. and working on the project I wanted to work on, so for all those reasons it made sense. … I talked to some other people from U of M because initially I was looking at maybe doing a joint degree between School of Natural Resources, so I talked to some people down there, to see what kind of projects they were working on, you know, whether they could be an advisor, things like that. So basically I just set up meetings with various professors that I already knew about or at least knew some of their work and was interested in and talked to them before coming.

Brenda chose the University of Michigan because of a family-related need to stay in the area, but considered carefully who she would work with. She discussed her potential research program extensively, and worked with a professor for a year prior to applying for the Ph.D. program.

> So I worked with a professor for a year… got to know the whole department, did kind of pre-research, and so when I went to go apply they knew who I was, they had read my NSF application, and I kind of went in a back door.

Catherine performed an international search, since she was able to relocate temporarily for the right program. She began by looking at schools' websites, programs, and requirements, but the critical factors in her decision were related to the people at those schools.

> Then I called some schools. And then I called some colleagues, and – many colleagues, actually. And that led to some critical insight… So I called another government program manager, a couple of them, they asked me to call a couple other places, and I got some incredible insight and some – some – I headed down some paths that I may not have headed down as strongly without that insight…I asked questions about who these people were. And one of my decisions was, who are these advisors? How do they treat their students? Are they – do they respectfully engage them, and can I grow with this person, can I work with this person?

In all cases, the participants focused exclusively on the people in the department, particularly on the advisor for whom they would be working. They focused on their potential advisors both as scholars and as people. Each looked for an advisor who would value the work they wanted to do on a technical level, and who would respect their contributions.

<u>Common Theme #3: Significance of Research</u>

All of the students interviewed had a very definite sense that research is far more important than coursework in their doctoral program, and each had a definite sense for what about their research was important. Andrew had initially planned to refresh his skills with engineering software, such as Matlab, but in the end spent his time differently in the preparation to return to school.

> I spent a lot of work researching, like doing reading on my research topic that I wanted to research, because that was what was important to me, it wasn't, you know, taking more classes and things like that, it was the research.

As previously stated, Brenda began working with a professor prior to applying for the doctoral program. While she did well in her coursework, she felt that it was not as important as her research, which she described as "really important stuff". One of the things that she valued most was that "I had the freedom to make my Ph.D. be anything I wanted."

Catherine put it even more strongly.

> I'm not doing this just to get a grade. I'm doing this because it matters. I want to understand what I'm learning so I can make a difference in this world.

Each of the participants mentioned coursework, and recognized that it was an important part of the educational process. Brenda specifically mentioned getting A's in all her courses, and all three participants spoke about their class projects and challenges in the classroom. However, they focused more strongly on the research component of the doctorate, and felt that it was by far the most significant part of their educational experience.

<u>Common Theme #4: Challenges with Group Projects</u>

All three participants faced certain difficulties in group projects. In the case of Andrew, this was a primary theme of his interview. While it did not feature as strongly in the other interviews, it was present. Group projects can present certain challenges, but some of the challenges these students faced were due to their different attitudes and different stage of life. In the case of Andrew, his difficulties stemmed from a lack of patience with what he saw as other students' immaturity.

> I think I have a better time seeing the long view of things than maybe they do and so it's hard for me to say, you know, I can't continue to say, that doesn't matter, that's not what we need to focus on. Like, I find myself constantly wanting to lead the group because I feel like it's poorly organized, and yeah, just sort of dis – you know, in a bit of chaos and so I feel like – and I mean that's probably a pretty common thing, but, you know, not having the patience for that made me want to have a tendency to lead the group, I guess.

Brenda faced significant logistical difficulties because she is a mother, and that placed constraints on when she could be on campus to work with others.

> I mean, if someone wants to work with me, they have to come to my house, because if I'm going to do homework with them or a project with them – I mean, I did tons of projects in the basement of my house… And people were willing to do that, you know, it's – and so, one of the challenges that I've faced was not necessarily returning student, but because I was returning as a mother. You know, that posed a lot of extra constraints that other people didn't have. And that was a challenge, you know, it was a challenge for how people viewed me, they viewed me as a mother…

However, the challenges she faced went beyond the logistics imposed by parenthood. Some students appeared to view her differently, and this caused some friction in group interactions.

> I mean, I was on this one group project and they wrote messages in the code, 'Oh, mama, do you think this is good enough?', or whatever they said. I'm exaggerating a little. But there were all these comments about being a mother, and very very sarcastic comments in the Matlab code. And you know, one said to me, 'Oh, I feel sorry for your husband.'

Catherine did not face the same type of sarcastic comments from fellow group members, but she did need to deal with similar logistic issues imposed by motherhood.

> So my project group, for example, for one of my classes will say, hey, let's meet tonight, and I'm like, I have to get a babysitter. I can't just plan it like that. And they don't understand that, they don't plan far enough ahead, they want to plan meetings a day or two ahead of time, and when I ask for longer than that they look at me like I'm crazy.

Like Andrew, Catherine felt somewhat frustrated with the skills of her teammates. Not having been in the workplace, direct pathway students are less skilled and less practiced in some aspects of teaming, and she spent much of her time trying to remedy this lack.

> I'm spending a lot of the time in my current class mentoring the undergrads. Not that I'm not learning something, again, but most of them don't know how to collect data, where to find the data, once they get it all they get all confused about how to use it, how to write a paper, how to present, so I'm spending hours and hours and hours of time coaching and mentoring, which is not advancing my degree one iota.

Part of the participants' frustration stemmed from the lack of understanding they got from direct-pathway students. While each participant could remember when they were younger and more like traditional students, the students with whom they worked could not understand their point of view. In the cases of Brenda and Catherine, in particular, they have family responsibilities that are non-negotiable. This can create conflicts, since they may not be able to adapt to the workings of the group.

<u>Common Theme #5: Ability to Meet Traditional Students on Common Ground</u>

While working with traditional students was frustrating at times for all three participants, they all saw some ways that they could relate to these students could identify some common ground. They cited the learning experience, though the emphasis was slightly different in each case. Andrew spoke of the classroom experience and its challenges.

> [W]e're all generally all learning something new in a given class, or something like that. We, you know, we have the same deliverables we have to deal with, we have the same, you know, stresses about getting a project done, or you know, learning how to use a new software, or whatever…

For Brenda, the intellectual interest was the key area of common ground. She spoke of the inspiration that students of all ages and life stages feel, and how that allowed her to relate in a positive way to younger students.

> I think in general the commonality is the overall enthusiasm for doing things that most of the world thinks is boring. That's a good commonality. I mean, you – when you go into this area, you really – most people go into it because they're interested in it. Some people go into it because it's easy for them. But most people have some sort of spark of inspiration, and so that – especially if you can focus discussions around the spark of – of inspiration then you can find a lot in common with young people because young people often are very easily inspired, and they will spend a lot of time on research projects that they're inspired by.

Catherine also focused on intellectual interest, but with an emphasis on their curiosity and on her interactions with them.

> Desire to learn. What I really love about, particularly I think that's the difference between master's and Ph.D. students, the Ph.D. students are on a mission, they're more dedicated than the masters' students, I'd say, and I love the desire to learn, and that – they – they – they ask good questions, they're curious like I am, they are tenacious about wanting to find out more about a certain subject, they are not your undergrads that are kind of, hey, I'm just here cause mom and dad said I needed to be here. They're much different than that, and so I have thoroughly enjoyed the intellectual stimulation of interacting with the other masters' and Ph.D. students, they are a different breed of students than the undergrads, and I have found the intellectual Q&A to be fascinating.

Despite the challenges that Andrew, Brenda and Catherine faced in working with traditional students, they all felt that they are part of an intellectual community. This feeling of community helped them to relate to classmates, to feel a part of the university environment, and was one of the benefits they received in pursuing a graduate degree.

<u>Common Theme #6: Life Outside of School</u>

The final common theme is that of life outside of school. While this was a stronger theme for Brenda and Catherine, who are parents, it did appear in Andrew's interview as well. Andrew, who was the youngest of the three, indicated that he had more friends from outside of school than was the case when he was younger and needed to balance that part of his life with school.

> I think I tend to be friends with a wider group of people now than I was then but it doesn't make it strange for me to be friends with, you know, current grad students who are younger…Yeah, maybe I have a few more former work friends, or community friends who aren't in school, things like that.

For Brenda, her status as a mother significantly affected her life, and requires time. This affected her ability to spend time on campus working on research, and also affected her social life.

> …a lot of people have more free time than I do, and it's not because I'm coming back, it's because I'm a mother. As a mother, I don't have free time, you know.

For Catherine, this was a primary theme, as stated previously. She discussed her family, the community, and her focus as an adult who is used to living in a broader community.

> And now, as a 41-year-old, as a mom, it is all about my family, and helping them and helping us grow together and be healthy, and the community and the church and the broader society overall. Very different perspective. And saving, and buying and all those things, everything is very – I'm much more mature, I'm much more concerned about what's happening around me, not just what's happening with me.

All three of the study participants had a social life that extended beyond the university. They had friends among their fellow students, but they valued friendships with other people who were not associated with the university. Furthermore, Brenda and Catherine, as parents, had a social circle which included other parents in the community. These additional social contacts were important to them, and were a major part of their lives.

Discussion

This study sought to understand the experiences of returning students, the factors that hinder or facilitate their success, and their perceived similarities and differences to "direct-pathway" graduate students. In previous work[2], the challenges faced by returning students were grouped into five categories: admissions issues, academic challenges, family and personal issues, financial concerns, and other issues. Here, we will use a modified version of this grouping; our organizational scheme, however, focuses on aspects of returners' identities as opposed to the types of issues they face. This shift in categorization was due to the focus of the themes that emerged in this work. The distribution of the themes into these categorizes are represented in Figure 2.

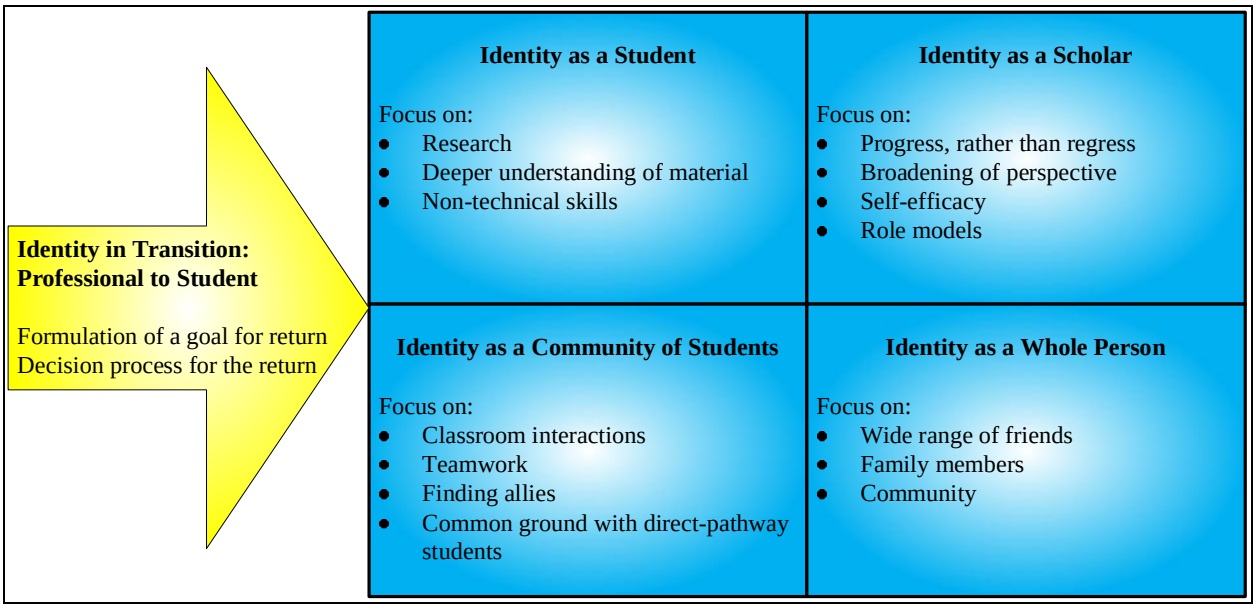

Figure 2. Categories of Themes

Identity in Transition.

In this study, all of the participants had a definite goal for their return to graduate school, and all of them focused their pre-admission activities on the choice of an advisor, rather than the school

itself. Previous studies of adult students at various different educational levels and institutions have shown that adult learners are more goal-oriented than direct-pathway students. Knowles reports that "Adults are motivated to learn as they experience needs and interests that learning will satisfy"[12]. This was evident with the participants in this study. Each one of them indicated a need they had in their career or personal goals that drew them back to graduate school. This contrasts with the general population of students, some of whom may see graduate school as a "default" option. One study surveyed approximately 1400 graduate students, and reported that 23% indicated that at least part of the reason they began doctoral study was that they were not "able to think of anything better to do".[16]

Identity as a Student

As the participants each developed an identity as a graduate student, they formed strong views on what aspects of their graduate school experience would be important to their success and satisfaction with their education. These aspects included the importance of non-technical skills, the importance of research, and gaining a deep and fundamental understanding of the material learned. In this context, participants discussed the differences they noticed between themselves and direct-pathway graduate students. For example, Catherine acknowledged that her computer software skills in programs such as Matlab were not as current as the direct-pathway students; however, she also believed that it did not matter for her career. In her workplace, Matlab coding was important, however, in her position, other things had greater importance, such as the ability to manage projects with hundreds of engineers.

The three participants in this study also noted that in the workplace, the importance of different types of skills seemed to shift. While technical skills are necessary for success both in school and in engineering employment, they were not the only skills necessary for success as a working engineer. These skills include problem-solving, teamwork, managing projects and work tasks, and dealing with change[17,18]. While some efforts are made to teach these skills to engineering students, it is widely acknowledged that this is challenging[17], and it is reasonable to believe that further practice in the workplace will result in improvement in these skills. It does however, present a challenge for returning students who have had time and experience in the workplace to develop these skills. It also prompts a question about the goals of graduate programs, and meeting the needs of diverse students.

Catherine, who had been in the workforce the longest, exemplified the difference between a novice and an expert in her wish to truly understand material deeply and fundamentally, and not simply know it. This understanding, which she defined as being able to apply it to new, unfamiliar situations, is a key differentiator between an experienced engineer and a novice[19].

Identity as a Community of Students

Catherine stated that part of the reason she returned to graduate school was to engage intellectually with others. While Andrew and Brenda did not make such a statement, all three participants did see themselves as part of a community of students. Within this category, the participants focused on classroom interactions, teamwork, finding allies, and finding common ground with direct-pathway students.

Group dynamics within student teams were particularly prominent in the discussions by the study participants. Teamwork is known to present significant challenges for many students. In particular, differences in goals and expectations can present problems in the functioning of a team. While the development of teamwork and project management skills on the part of all team members would be beneficial, if only one team member has highly developed teamwork skills, they can become frustrated with their teammates[20,21]. The participants in this study experienced these types of frustrations, as they had become acclimated to successful teams in their workplace and felt that their fellow graduate students had not yet achieved as successful teamwork skills as they had.

Clearly, one of the differences between direct-pathway students and those who return to school after working is the experiences that the latter have had while working. Ideally, these experiences should add to their classroom experience, and to that of others, functioning as "the adult learner's living textbook"[22]. However, as discussed by Andrew, this is not always the case. At times, the returning student's contributions are not seen as being valuable by others. This presents an opportunity for instructors; if an instructor is aware of the availability of this "living textbook", he or she can integrate it into the course and make use of a valuable resource without disrupting the flow of the class.

While the participants did encounter challenges in establishing themselves as part of the student community, all were able to integrate into the student community. A key factor in their integration with direct-pathway students was the ability to find common ground with those students. While the participants all perceived significant differences between themselves and direct-pathway students, these differences did not create a gap that could not be bridged. In all three cases, they perceived common experiences and shared passions that did, in fact, allow them to be part of a community of students.

Identity as a Scholar

As the participants began their graduate work, they each established an identity as a scholar, in addition to their identity as a student. The word scholar is representative of their life-long pursuit of learning, while the word student represents the short period of time the participants are graduate students. The key themes involved in establishing an identity as a scholar were the importance of progressing rather than regressing, broadening of perspective, self-efficacy, and finding role models. Brenda, in particular, discussed self-efficacy rather extensively, as she spoke of the need to believe in herself. Self-efficacy has been shown to be important in the persistence and success of students, particularly women, in graduate school.[23]

Role models are important in encouraging students, particularly minorities and women, to pursue successful careers in STEM fields[24,25,26]. This was a key theme in Brenda's experiences. She was consciously aware of the importance of role models, and of her need to seek them out. She selected role models who were both scholars and mothers, and who she could look to for examples of how to successfully balance those two roles.

Identity as a Whole Person

This category of themes represents the responsibilities, interests, and roles the participants had outside of graduate school. The discussions were primarily centered on the participants' roles as a responsible family member.

Family issues were a major concern for two participants in particular, Brenda and Catherine. Both of them are mothers, and needed to balance their academics with family responsibilities. They felt the culture of the university had expectations of late night work hours, and this was not manageable with their lives. Similar concerns have been reported in other studies of graduate students who were balancing academics and raising children. In particular, a study of women who had returned to graduate school to pursue psychology doctoral programs showed that being in school strains their family relationships[27]. This was a significant concern for both Brenda and Catherine. In addition to the logistical issues involved with parenthood, their status as mothers has influenced how others see them. Being a mother was challenging to Brenda as she felt that her group members viewed her differently. In her view, group members showed a lack of respect and failed to take her seriously because they saw her as a mother rather than a fellow student. This type of attitude towards mothers has been seen in a number of studies; mothers are seen as less competent than non-mothers with the same qualifications[28,29].

While a significant challenge, both participants found that the University of Michigan's resources for graduate student parents were helpful to them. These resources included a Center for the Education of Women, which provided child-care assistance to Brenda, and a parent's group, which assisted Catherine in finding community resources. Other studies have revealed that family and community support systems are crucial to the success of under-represented students[30] .

Future work will include the consideration of ways in which schools may both accommodate returning students, and take advantage of their background. Two themes in particular, classroom interactions and the desire for a deeper understanding of the material, demonstrate questions that exist about how to best support diverse students in the classroom. The questions of how a professor can utilize the returners' experiences in their course, and how to provide them with the opportunity to gain a deeper understanding of the course material, have not yet been answered. Universities may also be able to facilitate the integration of returners into the student community. Some programs that might accomplish this integration could include pairing them with direct-pathway students in their field of study who are more familiar with current software at the university, having them give guest lectures on their experiences, or establishing networking and support groups within the university community. By implementing such initiatives, universities would be able to support a group that contributes to a diverse graduate population and gain the benefit of their wide-ranging talents and experiences.

Conclusions

Many studies in engineering education research focus on the ways programs can transform to better support diversity. This study draws attention to an under-studied under-represented group, that of returning students. The experiences of three people who returned to school for a graduate degree after spending at least five years in the workforce were considered. Each person had a

unique history and life situation, and therefore, each case study gave rise to different themes. However, there were also many common themes. By understanding the unique characteristics of this population of students, universities will be better equipped to draw on their experience to benefit the returners and the student population as a whole.

Bibliography

[1] "Digest of Education Statistics 2001", National Center for Education Statistics, U.S. Department of Education Office of Educational Research and Improvement.

[2]Peters, D. L. and Lucietto, A. M. "Success and Challenges as a Returning Student." SWE National Conference, Long Beach, CA, October 2009.

[3]Vaicik, M. and Brenneman, K. "Back to School." SWE National Conference, Orlando, FL, November 2010.

[4] MacFadgen, L. (2008). "Mature Students in the Persistence Puzzle: An Exploration of the Factors that Contribute to Mature Students' Health, Learning, and Retention in Post-Secondary Education", Canadian Council on Learning.

[5] Schilling, W. (2008). "Issues Effecting Doctoral Students Returning to Engineering Education Following Extensive Industrial Experience", *American Society for Engineering Education Annual Conference & Exposition*, Pittsburgh, PA.

[6] Gardner, S. K. (2008). "Fitting the Mold of Graduate School: A Qualitative Study of Socialization in Doctoral Education." Innovations in Higher Education **33**, 125-138.

[7] Purdy, C. and Washburn, M. (2005). "Diversity in Engineering Education - What are the Perceived Issues?" *American Society for Engineering Education Annual Conference & Exposition*, Portland, OR.

[8] Cuny, J. and Aspray, W. (2000) "Recruitment and Retention of Women Graduate Students in Computer Science and Engineering". Computing Research Association: Committee on the Status of Women in Computing Research.

[9] Hofinger, R. J. and Feldmann, L. J. (2001). "The Role of the Adult Student in the Classroom". *American Society for Engineering Education Annual Conference & Exposition*, Albuquerque, NM.

[10] Prusak, Z. (1999). "Learning Environment in Engineering Technology with a High Percentage of Non-Traditional Students". *American Society of Engineering Education Annual Conference & Exposition*, Charlotte, NC.

[11] Richardson, J. T. E. and King, E. (1998). "Adult Students in Higher Education: Burden or Boon?" *Journal of Higher Education* **69**:1, 65-88.

[12]Knowles, M., *The Adult Learner: A Neglected Species*, 2nd edition, Gulf Publishing Company, Houston, TX, 1973.

[13] Ryan, G. W. and Bernard, H. R. (2003) "Techniques to Identify Themes". *Field Methods* **15**:1, 85-109.

[14] Glaser, BG. and Strauss, AL. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New York: Aldine De Gruyter.

[15] Strauss, A. and Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage Publications.

[16] Anderson, M. S. and Swazey, J. P. (1998) "Reflections on the Graduate Student Experience: An Overview". *New Directions for Higher Education*, no. 101, 3-13.

[17] Woods, D. R., Felder, R. M., Rugarcia, A., and Stice, J. E. (2000) "The Future of Engineering Education III. Developing Critical Skills" *Chemical Engineering Education*, **34**:2, 108–117.

[18] National Academy of Engineering. (2004). *The Engineer of 2020: Visions of Engineering in the New Century*. Washington, DC: National Academy of Engineering.

[19] Bransford, J. D., Brown, A. L., and Cocking, R. R. (1999). "How experts differ from novices". In *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academy Press.

[20] Tonso, K. L. (2006) "Teams that work: Campus culture, engineer identity, and social interactions". *Journal of Engineering Education* **1**(1) 1-13.

[21] Oakley, B., Felder, R., Brent, R., and Elhajj, I. (2004). "Turning Student Groups into Effective Teams". *Journal of Student-Centered Learning*. **2**(1). 9-34.

[22]Lindeman, E.C., *The Meaning of Adult Education*, New Republic, New York, NY, 1926.

[23] Rittmayer, A. and Beier, M. (2010). "Self-efficacy in STEM". In Bogue, B., & Cady, E., Olio: *Research on Women in Science & Engineering*, 23-43.

[24] Nauta, M. M., Epperson, D. L., and Kahn, J. H. (1998) "A Multiple-Groups Analysis of Predictors of Higher Level Career Aspirations Among Women in Mathematics, Science, and Engineering Majors". *Journal of Counseling Psychology* **45**(4), 483-496.

[25] Levinson, W., Kaufman, K., Clark, B., and Tolle, S. W. (1991) "Mentors and Role Models for Women in Academic Medicine". Western Journal of Medicine, **154**(4), 423-426

[26] Roberts, E. S., Kassianidou, M. and Irani, L. (2002) "Encouraging Women in Computer Science". *CM SIGCSE Bulletin - Women and Computing*, **34**(2), 84-88.

[27] Padula, M. A. and Miller, D. L. (1999) "Understanding Graduate Women's Reentry Experiences: Case Studies of Four Psychology Doctoral Students in a Midwestern University". *Psychology of Women Quarterly*, **23**, 327-343.

[28] Heilman, M. E. and Okimoto, T.G. (2008). "Motherhood: A potential source of bias in employment decisions". *Journal of Applied Psychology*, **93**, 189-198.

[29] Cuddy, A. J. C., Fiske, S. T., and Glick, P. (2004). "When professionals become mothers, warmth doesn't cut the ice". *Journal of Social Issues*, **60**, 701–718.

[30] Ceci, S. & Williams, W. (2007). "Why aren't more women in science? Top researchers debate the evidence". Washington: APA.

Appendix: Interview Protocol

Opening Statements

- Thank you for taking the time to talk to me. I'm going to give you some background on how this will work.
- Explain interview logistics
    - Our conversation will be recorded and later transcribed. Everything you tell me will be confidential. All identifying information will be removed on the transcript and the audio will be kept in a secured location.
    - Do you have any questions about the consent form?
    - Can I get you to sign it if everything seems okay to you?
- Structure and purpose of the interview
    - The purpose of the interview is for me to understand your experiences as a returning student in engineering. By "returning student", I refer to the fact that you experienced a gap between your undergraduate and graduate education. Your experiences will inform the goals of the study which are to understand the challenges, strengths, and success strategies characteristic of returning students. This information will be used to influence future education of returning students.
    - There are no right or wrong answers to any of the questions I ask you.
    - I'll ask follow-up questions so that we can arrive at a deeper understanding of your experiences.
    - I'm going to leave some open time after I ask a question. I won't jump in to clarify a question if there is a pause. I want to give you time to think. If you need clarification of a question, please ask me.
- Do you have any questions for me before we get started?

Demographic questions

- I'd like to start by getting a little bit of information about you. How old are you?
- And how many years passed between the time you received your bachelor's degree and the time you returned to school?
- What were your undergraduate and graduate programs? (possible clarification – mechanical engineering, electrical engineering, etc.)

Preparation for Graduate Return

- Tell me about your decision to return to school for a graduate degree.
    - What were your goals in getting the degree?
    - Why did decide to do it now?
    - Had you thought about going back before?
- Can you walk me through your choice of a program and school?
    - How many different schools did you consider?
    - How did you choose the schools you thought about?
    - How did you gather information about the schools?
    - What programs did you consider?
- What kind of advice did you receive on your decision?
    - Did you seek out advice?
    - In what ways was it helpful?

    - In what ways was it not helpful?

Differences and Challenges

- In what ways are you different now than you were right after your undergraduate education?
    - Can you give me an example of what you mean by…
    - In what ways has this been an advantage to you?
    - In what ways has this been a disadvantage?
- In what ways are you different from younger students?
- What do you feel you have in common with younger students?
- Can you tell me about a particular academic challenge you faced on returning to school?
- Can you tell me about a particular social challenge you faced as a returning student?
    - If time, get a second anecdote for either or both of the previous two questions.

Contributions to Success

- What kinds of things were most helpful to you in your studies?
    - Did you have any mentors who understood the issues you were dealing with?
    - Were there particular programs or initiatives at your school that contributed to your success? (If so, ask about them.)
    - Were there other students in the same situation you were in?
- Tell me about some of the strategies you used to deal with challenges (could mention a specific challenge if it's come up earlier).
    - Did you work that out for yourself, or was that suggested by someone else?

Closing

- Do you have anything else you want to add about your experiences as a returning student?
- Do you have any questions for me?