

AC 2007-2110: SPONSORSHIP: ENGINEERING'S TACIT GATEKEEPER

Kevin O'Connor, University of Rochester

Kevin O'Connor is Assistant Professor of Human Development in the University of Rochester's Warner Graduate School of Education and Human Development. His research interests are in the social organization of learning and development. He holds a Ph.D. in developmental psychology from Clark University.

Daniel Amos, University of Washington

Daniel Amos was one of the first ethnographers from the United States to do ethnographic research in the People's Republic of China. He has taught at five Chinese universities, and directed the Chinese Studies program at Clark Atlanta University. His graduate degrees are from UCLA (Anthropology, 1983) and the University of Chicago (Social Science-Psychology, 1974). He is currently an Acting Instructor in the Department of Educational Psychology at the University of Washington.

Tori Bailey, Stanford University

Tori Bailey is a PhD student at the Center for Design Research in the Mechanical Engineering Department at Stanford University. Her research interests include academic and professional identity development of engineering students, academic advising of engineering students, history of engineering education in the U.S., and the organization of engineering education programs. Ms. Bailey received a Bachelor's Degree in Mathematics from Spelman College and a Bachelor's Degree in Mechanical Engineering from the Georgia Institute of Technology where she was a NASA Women in Science and Engineering Scholar. She also holds a Master's Degree in Mechanical Engineering from Stanford University.

Lari Garrison, University of Washington

Lari Garrison is a Ph.D. candidate in Cognitive Studies in Education at the University of Washington. Currently, she works as a Research Assistant for CAEE (Center for the Advancement of Engineering Education). She received a B.A. and a M.Ed. from the University of Illinois at Urbana-Champaign and taught high school mathematics for ten years before beginning work on her Ph.D. at UW.

Gary Lichtenstein, Stanford University

Gary Lichtenstein, Ed.D. is a Consulting Associate Professor of Engineering at Stanford University, specializing in quantitative and qualitative research methods. His areas of intellectual interest include engineering education, community-based research, and education evaluation and policy. His extensive teaching experience includes courses on qualitative research methods (for graduate students), and on writing and critical thinking (for students ranging from high school to professionals). He lives in southeast Utah. He can be contacted at: garyL@stanfordalumni.org.

Heidi Loshbaugh, Colorado School of Mines

Heidi G. Loshbaugh is an Assistant Research Professor in the Center for the Advancement of Engineering Education at Colorado School of Mines. She is also the Associate Director for CSM's Center for Engineering Education. Dr. Loshbaugh taught in CSM's EPICS program, for which she developed extensive course and faculty-support materials, and designed and implemented a leadership course and overseas summer field session. She has recently been appointed to develop a diversity plan for CSM, and has experience in international education, corporate training and coaching, and academic editing.

Marcus Jones, Howard University

MARCUS JONES is a doctoral student in Educational Psychology at Howard University, and a graduate research assistant for the Center for Advancement of Engineering Education. His research interests include the academic achievement of African American males and the factors that influence attrition among engineering students.

Derek Seward, University of Rochester

Derek Seward is a doctoral student in the department of Counseling and Human Development at the University of Rochester's Warner Graduate School of Education and Human Development.

Lisa Perhamus, University of Rochester

Lisa Perhamus is a doctoral student in the department of Teaching and Curriculum at the University of Rochester's Warner Graduate School of Education and Human Development.

Reed Stevens, University of Washington

Reed Stevens is an Associate Professor in the College of Education at the University of Washington. He specializes in ethnographic and comparative approaches to studying how people learn, especially in disciplines related to mathematics, science, technology, and design. He is currently co-leading two NSF Centers working on issues related to how people learn, the LIFE Center and CAEE.

Sponsorship: Engineering's Tacit Gatekeeper

Abstract

Recent educational theory emphasizes the importance of considering identity processes in studying learning and development. In engineering education, identity has been cited as central in student development, for example, as a key factor in retention of students in the discipline, in particular with regard to underrepresented groups. This paper adopts a social theory of identity to examine how dynamics of “sponsorship” relates to students’ decisions of whether to remain in or switch out of engineering. This paper draws on longitudinal case studies of two students to examine the relationship between students’ interests and their decisions to persist in or leave their major. We argue that students’ interests become differentially identified as “intrinsic” or “extrinsic” to engineering through the work of powerful sponsors within the discipline. We argue further that a view of identity as socially produced is necessary in order to avoid taking for granted crucial aspects of disciplinary practices of identifying engineers, and in particular ways in which certain kinds of interests might be sponsored over and above others.

Introduction

Recent educational research has emphasized the centrality of identity to learning and development.¹ In engineering education research and in SMET fields more broadly, formation of a professional identity is increasingly viewed as fundamental to learning, retention, and persistence, in particular with regard to historically underrepresented groups.^{2,3,4} In this paper, we explore the relationship between students’ interests and their decisions to persist in or withdraw from their majors. Our paper contributes to this research through a longitudinal ethnographic study of students’ trajectories into and out of engineering, focusing analytically on what social scientists have termed “sponsorship.”⁵

Identity and engineering education

We address these issues by adopting a social and relational theory of identity.^{6,7,8} Most work on identity in engineering education has viewed identity as part of a “psychological core” that is located in individuals.^{3,4} In this view, while identity can be influenced by aspects of the social context through processes of socialization, it is seen as essentially a psychological phenomenon and an individual possession. In contrast, we draw on anthropological and other sociocultural approaches that see identity not as a relatively stable *possession* of an individual, but as an *ongoing project of construction* by a given individual together with the others with whom she comes into contact. Thus, who an individual is—that is, her identity—depends upon how she actively identifies herself and is actively identified by others within the various social fields in which she acts: friendships, a families, universities, professions, etc. In this view, identity is “double-sided,”⁸ meaning that identity is both something experienced (as in “I am an engineer”), and also something ascribed and maintained by others (as in “you are an engineer”); through these processes, identities are contingently accomplished. We view as an open question the issue

as to whether and how various acts of identification accumulate into either a stable sense of one's self or a stable position with the particular social world that makes up engineering.⁹

This double-sided view of identity is critical to our analytic goals of understanding students' development in the multiple contexts in which they participate as engineering students. This perspective opens up analytic avenues that complement the important work done within individualist approaches, focusing on somewhat different questions, or at least on different approaches to similar questions. Among the questions we are asking in our research are the following: How do engineering students go about integrating their developing knowledge into their "identity projects,"¹⁰ that is, their emerging sense of who they are and where they are going? How do students coordinate the multiple possible pathways that they might take towards a successful, valued future? What possibilities are made available in a social field such as the discipline of engineering, and how do these possibilities allow or disallow the engagement of certain kinds of people, while possibly excluding others? What conflicts might there be over views of the nature of engineering, and how are these conflicts manifested in the identity projects of students?

This paper explores one aspect of identity that has been widely discussed in literature on the recruitment and retention of underrepresented students in engineering. Several authors have claimed that "intrinsic interest," or "intrinsic motivation," is a key factor in students' choices of major, including both initial choices that they make and their subsequent decisions to remain in the major or to switch to another.^{4,11,12,13} This literature draws a contrast between those activities that are intrinsically motivated, that is, activities "that individuals find interesting and would do in the absence of operationally separated consequences,"¹¹ and those that are extrinsically motivated. Researchers have claimed that intrinsic interest is associated with retention, while extrinsic interest is associated with decisions to change majors. For example, Seymour & Hewitt, in one of the most important and comprehensive works on retention in SMET disciplines, take intrinsic interest to be among the most important factors in understanding students' decision to persist in or to change their major. They claim that "the best foundation for survival and success is to have chosen one's major because of an intrinsic interest in the discipline and/or the career fields to which it is leading."¹³ It is important to note for our purposes that intrinsic interest or motivation is taken to be an aspect of one's core identity,³ understood as an enduring possession of individuals that motivates, even "strongly determines"⁴ the choices they make.

In our work, we are similarly interested in students' decisions to persist in or to leave their majors, and in how identity and motivation are related to this. However, our social and relational view of identity leads us to a somewhat different approach to these issues, one that differs from and in important ways complements these individualist approaches. We do not, of course, question whether people *have* interests, or that interests are involved in the choices people end up making about majors and careers. Rather, our work explores how some motives or interests become construed as "intrinsic," and result in students becoming channeled toward engineering, while others—which could just as well be understood as "intrinsic" to what engineers do—become construed as "extrinsic" and channel students away from engineering. We thus conceive of motives or interests relationally, and attempt to understand them as an aspect of what we call, following the educational theorist Brandt,¹ "sponsorship."

The notion of sponsorship was initially developed as a way of studying changing forms of literacy in such a way as to locate specific literate abilities to read and write within their social, cultural, and institutional contexts. Sponsors of literacy, for Brandt, “are any agents, local or distant, concrete or abstract, who enable, support, teach, model, as well as recruit, regulate, suppress, or withhold literacy—and gain advantage by it in some way.” According to this view, reading and writing are not simply individual abilities; while individuals *do* read and write, they read and write in ways that are sponsored or underwritten by powerful societal agents. These agents include not only individuals—for example, reading teachers—but also larger forms of social organization, such as formal schooling, disciplines that require particular literate skills, industries such as the publishing industry that actively promote certain reading and writing practices, etc. For our purposes, it is important to note that there are identities being produced as part of these relations of sponsorship. To cite an example used by Brandt, if one’s career as a union leader brings one into required contact with increasingly privileged legalistic forms of literacy practices, it is important to identify oneself with those privileged forms of literacy so that one becomes identified as a capable practitioner; not to do so puts one’s continued career—one’s identity as a union leader—at risk.

In our view, this notion of sponsorship provides an important conceptual resource for a social and relational approach to the production of engineering identities. To reiterate: an “engineering identity” is not solely or primarily an individual “possession”; identities are constructed by individuals in relation to others, including social agents who sponsor particular kinds of people in becoming engineers—and, of course, who do not sponsor other kinds of people. Thus, it becomes important to look closely at the dynamics of sponsorship, including who is being sponsored and denied sponsorship in becoming engineers. In this view, “kinds of persons”^{14,15}—that is, particular forms of engineering identities—are a large part of what is being “engineered” in the undergraduate curriculum.

We have identified several limitations to the notion of intrinsic interest from our social and relational perspective.¹⁶ Two of these are of particular importance for our purposes here. The first arises from our empirical work. In our interviews with engineering students at four campuses during their first year, we find mostly only very vague ideas about what exactly it is that engineers do. This is true even of students who are doing quite well in their majors. In addition, our fieldwork for the Academic Pathways Study suggests that students are often not presented with opportunities to learn what “authentic” engineering activities are until well into their undergraduate careers. Of course, if students are not aware of what it is they will eventually be doing, the notion of “intrinsic interest in engineering” becomes problematically related to their achievement of success.

A second point is particularly relevant for engineering disciplines and for educational practitioners. Some theories that understand success and failure, switching and nonswitching, in terms of “intrinsic motivation,” are, in our view, risking taking for granted forms of disciplinary and pedagogical structuring that should not be taken for granted. There are many possible interests that can be viewed as at least potentially intrinsic to engineering: an interest in disassembling and reassembling objects; a high level of skill at and enjoyment of school-based mathematics; an interest in assembling social networks that will make a technology benefit a

large number of people; an interest in competition with others; and interest in cooperation with others—we have seen each of these and more identified as strong interests by the students in our study. While some work that focuses on intrinsic motivation—for example, that of Seymour & Hewitt—are quite clear in their challenge to current ways of structuring SMET education and careers, there is nonetheless a strong possibility that responsibility, and even blame, for “inappropriate” choices of majors will fall on students rather than on a social and relational system that sponsors certain kinds of interests and withholds sponsorship for other kinds.

The point here is that none of these interests is *necessarily* intrinsic to engineering in the absence of institutional sponsors who might recognize them as such. We argue that both “matches” and “mismatches” between students’ interests and a disciplinary identity are actively and jointly constructed, though not necessarily with conscious awareness. Individualist approaches to identity risk taking crucial aspects of entry into disciplinary identities for granted, especially, for our purposes, the ways in which certain kinds of interests might be sponsored over and above others. In our view, it is essential to examine these “dynamics of sponsorship,”⁵ particularly so in that underrepresented groups such as women are often identified as less intrinsically motivated than men.^{2,3,13} We turn to this task in the case studies that follow.

The Academic Pathways Study

The Academic Pathways Study (APS) is a multi-year, longitudinal study of learning and development in undergraduate engineering students. The study is being conducted at four US universities, each representing an institutional “type” within engineering education. The APS is attempting to understand issues of learning and development—both successful and unsuccessful—in engineering education. One major component of the APS is an ethnographic study of students at each campus, led by Reed Stevens. This ethnographic study focuses intensively on a small number of students—16 at each campus—over the course of their undergraduate careers, setting longitudinal ethnographic work against the backdrop of a more general ethnography of the context of engineering and engineering education.

The APS makes use of a variety of ethnographic methods, including the following: 1) regularly scheduled observations in which we “shadowed” our focal students through the day as they participated in various activities, both in class and outside of class; 2) observation of key spaces and activities in the college of engineering (e.g., career fairs, departmental major workshops, etc.); 3) individual and focus group interviews with our focal students, as well as with college faculty and administrators; and 4) analysis of official texts of the college of engineering (e.g., course syllabi; descriptions of the major application process; check lists of courses, etc.).

In this paper, we will illustrate some of the general themes of sponsorship through two analytic case studies of students at one campus, which we call the University of West State (UWest), during the first two years of the APS. Our person-centered framework led us to design ethnographic interviews that “encourage respondents actively to reflect on and evaluate their life experiences” with the aim of exploring “the most significant and meaningful aspects of the world of the individual as experienced by him and in terms which he thinks, is motivated to act, and satisfies his need.”¹⁷ This approach leads us to construct detailed case studies of individuals, especially with an eye to how similarities and differences in cases can inform our understanding

of the broader culture. In this paper, we explore how two students at UWest identify themselves as part of the social and cultural worlds of engineering education and prospective world of engineering work.

Case studies

In this section we will draw from our ongoing case studies of students in the Academic Pathways Study to illustrate how the notions of relational identities, sponsorship, the mutual construction of intrinsic interest, etc., are relevant to understanding the pathways taken—and not taken—by students who began their college careers with a stated interest in engineering. We will present a short comparative case study of two students who are enrolled in programs designed to prepare them to apply to an engineering major at UWest, a large flagship state university in the western US. Most students are not admitted directly into an engineering major upon admission to the university, but rather apply for admission to majors, typically after their sophomore years, though a relatively small number of students can gain early admission after their freshman year. Students spend much of their first two years on prerequisites offered outside of the college of engineering, such as math, chemistry, and physics.

We focus on how the identity projects of two students, whom we call “Adam” and “Bryn,” intersect with routine practices of sponsorship within engineering education. Before discussing the individual students, we want to note two important similarities between them. First, according to their own accounts, neither Adam nor Bryn had a clear idea, as they began college, of what being an engineer entailed. Whatever intrinsic interests they might have had, it was an open question as to whether, from their perspective, these interests were intrinsic to engineering—their interests would have to be made to fit with what was valued in the discipline. Second, both were strong students by a number of measures, including their GPA’s. At the end of their second year, they were separated by only 0.05 points on a four point scale.

Adam

Adam is a White male who came to UWest from an affluent nearby suburb. By his own description, he was an outstanding student in high school—for example, he reported taking all of the AP courses that were available to him, and said that he had done particularly well in mathematics. He identified strongly with his math abilities, seeing himself as “super smart.”

We want to outline several themes that we have identified in our case study of Adam. These are, first, Adam’s view of math as “black and white”; second, his identification of math with engineering; third, his use of his academic ability to separate himself from, and elevate himself above, his peers. We then discuss a shift in Adam’s view of engineering and his relation to it that took place during his second year at UWest.

A major theme in Adam’s discussions of math was what he called the “right or wrong,” or “black and white,” nature of math:

“I like things with more solid answers, you know. Things that, there’s a right and there’s a wrong, and then I get it right, and that’s my reward, being right. As opposed to things that can be done a lot of different ways, and there’s not really a right or wrong answer.”

This “right-or-wrongness” is both immediately rewarding for him, as well as a way of getting recognition from his peers and being able to offer them help.

“I like the immediate reward of math, of the black and white. It’s like, if it’s wrong, ‘OK, I’ll try it again.’ And then I get it right and it’s like, ‘Yes, I get it right!’ And then also with, like, in school, you know, when other people are having troubles solving that stuff, then it’s like, I figured out how to do it and I know the right answer, so I can help you do that.”

Adam’s mathematical abilities were an important part of what led him to choose to major in engineering. Talking about this with us during his first year at UWest, he said:

“Math and engineering are just closely related, like every time you hear ‘math,’ they’re like, ‘Here’s these real world problems,’ you know, to solve.”

Adam was talking here not about actual “real world” problems, but about “school math” word problems, in both high school and college, that have content drawn from real world concerns. He went on:

“And it’d always seem like these real world problems were things that would interest me, things that I could do, you know, as a future. And it just appeals to me, I don’t know exactly why. I mean it’s just- it’s where my strong suit is.”

At the end of his first year in school, he continued to see himself as an exceptional, “super smart” student, who was more competent than “normal” students, both in his ability to solve problems and in the speed with which he solved them. For example, in discussing the stress he felt during momentary difficulties in a computer programming class, he said:

“It kinda stressed me out cause I think I’m failing. Because I compare it to the other projects I’ve done, that these have taken so much amount of time, and this is taking a lot longer, so I’m thinking to myself, “Hey, I must not be understanding this. I’m not getting it. And I should’ve picked up on this by now.” Cause things usually click, and when things don’t click, that’s when it kinda stresses me out, you know. That’s when it feels like I’m a normal kid, a normal guy stressing out, and it’s like, “Nooooo!”

I asked him, “You don’t want to be that?” He laughed and said, “I *don’t* want to be. I like being super smart guy that everyone goes to for help in the X hundred math class.” Here we see indications that, even in discussing temporary difficulties that he had had during one class, and from which he had recovered, Adam’s identity was tied up with his success at rising above the “normal kids.”

Following Adam's first year at UWest, he applied to and was accepted to the mechanical engineering program. In the framework we're using here, he had now become officially "sponsored" by the ME department—a powerful representative of the discipline of engineering.

During his second year, he began to experience more difficulties in his classes, and reported becoming quite dejected, which led to a change his view of himself and his relationship to engineering. We focus here on his developing view that engineering isn't as black and white as he had thought. He said:

"When you get into engineering and stuff, there's not always a right answer. You know, eventually when I get into a career and stuff, it's not going to be like, somebody tries to do this and then I say and then they're like, 'Oh, I got the wrong answer. Here's the right answer.' That's going to be like, more a matter of opinions, where people say, 'Huh, maybe I should build this material.' And I say, 'No, maybe this material.' You know, it's not definite. There's not one right answer, which is so much like the real world and is better, I think, for me to be able to, you know- I think I've always been in some kind of world where there's a right and there's a wrong and do it the right way. Whereas it's not-life is not like that and engineering will fit more into that way of, you know, there's not just one right answer. There's a lot of right answers and there's a lot of ways to get them and there's a lot of ways to get wrong answers, you know."

He was asked how this felt to him, and he went on:

"It's scary, being that it is so much of a change. That's like, what the real world is. There's not a right and a wrong. Whereas a lot of my life it seems basically can be broken down into that. You get the right answers or you do well in class and then you can go to the right college or you can get into the right major and stuff. But, I mean, that still applies somewhat, that if you do everything right, do everything good, then you get a promotion and stuff. But the real world isn't as right and wrong. ... But yeah so for engineering and stuff, it's like, you won't get everything out of it right away. It's not as right and wrong, which is scary. It's scary to know, you know, this is going to change. Instead of me getting it right or getting it wrong and reworking it, it's like it might work out and it might not. You're not going to know right away. So it's scary, that fact that this might be, I might be nearing the end of black and white, right and wrong phase."

Adam was asked whether, before beginning college, he had ever thought that he'd be thinking about engineering as very different from math. He responded, laughing:

"Oh, hell no. No way did I think that. Honestly, I was thinking, engineering is math, just a little bit different, but definitely there's a right or wrong. And now it's like, uh, that's not true. It's definitely not true."

This shift in his way of thinking about engineering has not been an easy process for him—it is "scary," he says—and in fact he has considered switching his major to math. Asked about this, he responded:

“I’ve realized I have a lot higher GPA on my math classes than I do in all my other classes. I still have a pretty good one in my engineering classes. So I’m like, ‘So if I have this great GPA in math, then maybe that’s what I should stick with.’ And then I’ll be able to say, ‘Ha, I beat all you other people!’ But you know, I don’t really want to be a math major, I realized. I mean, it’s fun, I like figuring out- I like being able to work down and being like, ‘Ah, I found the answer and I did it fast.’ So that’s kind of fun and rewarding, but it’s not something I want to do for all of my time. It’s just the fact that it’s like immediately rewarding, and that I’m good at it all, and I have these good grades. That was maybe some motivation behind me thinking of switching.”

So even as Adam struggles with fitting himself with the unexpectedly ambiguous world of engineering, he continues to find at least potential refuge in his habitual interests, such as competition against his peers, and the immediate rewards offered by getting an unambiguously right answer to a problem.

We want to summarize our brief discussion of Adam by noting that, as he engages in his identity project, which has been dramatically transformed in a “scary” way by the unexpected ambiguity of engineering work, he is doing so as a sponsored participant in the discipline. This sponsorship results in large part from his early academic performance, which was motivated by interests that he now recognizes as being somewhat at odds with how he’s coming to see engineering. Our work will continue to follow Adam as he moves through his undergraduate career; what is of interest for our purposes here is that whatever identity dilemmas he is experiencing, he is experiencing from within the safety of a position of having been chosen—sponsored—by the discipline.

Bryn

Bryn came to UWest from a small town in a rural part of the state. A Latina, she was the recipient of a competitive academic scholarship available to minority students from the state who attend UWest. Bryn often speaks of herself as a “people person,” and sees the ability to interact meaningful with people as an essential part of her college experience and her eventual career.

Elsewhere we’ve suggested that Bryn expects her college experience to provide her with a range of experiences that will help her to broaden her perspective, in large part in order to better equip her to do the kinds of socially oriented work that she wants to do.⁹ Here we will build on this by discussing three further themes drawn from our case study of Bryn. These are, first, her view of knowledge as not simply a matter of right or wrong, black and white; second, her view of the importance of introducing diversity into engineering education, specifically with respect to women and minorities; and third, her dissatisfaction with what she sees as the competitive, individualistic nature of the engineering curriculum. We will then turn to discuss how Bryn, like Adam, experiences identity dilemmas related to her role in engineering, and consider these with respect to our framework of sponsorship.

One central organizing theme in our analysis of Bryn is her emphasis on communication and collaboration in the service of deeper understanding. In describing herself as a student, Bryn said:

“I thirst for knowledge, I mean, just to understand how things work and not just to be able to get the right answer. Cause I mean the answer’s great, but what is an answer to you if you don’t know the meaning behind it? I think that’s interesting to be able to dig deeper into the knowledge, ... to have that knowledge and be able to talk to people about it, and really, cause I think that other people can contribute too, but not just be able to, you know, talk to people and be like, ‘Oh.’ I like to be able to investigate what they say, not just go on what people say and to know if it’s true.”

In contrast to Adam, Bryn does not see knowledge as “black and white,” something that is demonstrated by getting the “right answer.” She sees “answers” as occasions for exploring more deeply, not only by herself, but by taking account of the multiple perspectives that different people bring to an area of inquiry.

This idea of multiple perspectives is central to her strong views on the issue of increasing diversity in engineering and engineering education. Asked specifically to talk about diversity, she said:

“I think that um, just diversifying the field of engineering is just so good, because everyone has these great experiences that contribute to the work. And not just someone’s education, cause you and I might have the same education, but we might take it differently and be able to solve problems differently, and if we both work together, we might get this awesome answer versus you working on it and me working on it. So having minorities in it, they’re gonna come from a completely different background, and have these different experiences and you won’t- we won’t just have white males answering everything, we’ll have women and people of color in there that’ll have these different experiences, so then we’ll have a, just this array of ideas. It’s kind of my feel on those type of things.”

Here again, Bryn comments on the importance and value of introducing multiple perspectives into a problem.

However, Bryn finds that her interests in considering multiple perspectives, in including an “array of ideas” into the work that she does, to be undermined by the competitive, individualistic nature of the curriculum. Towards the end of her sophomore year, she described her experiences in her pre-engineering classes:

“It just seemed like there was just a different frame of mind and the whole ‘me succeeding,’ like ‘me, me, me,’ and really not wanting to help people, and I didn’t understand that, because I really, if I know something, I’m gonna help you figure it out, and I would hope that if I didn’t know something, it would be the same way.”

Asked where this different frame of mind comes from, Bryn said:

“Oh man. I don’t know. I think that it just might be the atmosphere of this institution, that it’s so big and it’s so competitive, and I think a lot of classes I was taking, people were

going for some really competitive stuff. I mean they were pre-dentist, pre-med, pre-engineering. I mean you had all these students who were pre-this, there's 500 students and they're gonna take what, 5 for each of these things? So obviously, a lot of those were gonna be weeded out. So that, I think that might go into it because there was that huge competition and that huge- it was always that pressure that at the next level, someone's gonna be cut. So I think that might go into it."

Our interview went on to explore whether she had taken any classes in which she didn't experience this "frame of mind." She mentions a graduate course in Educational Policy that she took during her sophomore year:

"Like the graduate school class I took, um, I took a research methods class with Jim, winter quarter this year? And it was so helpful, I mean it- the grad students were of course way more advanced than I was, but this class gave me an opportunity to really understand how to write a proposal and those type of things. And we had to work with partners and the grad student I worked with was just really helpful. I mean, we exchanged papers and she always gave me really good feedback, and I tried to give her really good feedback, like it was just a community more and we were able to talk. There was never a feeling of, like, when you're in the other classes that are competitive, there's always this underlying feeling of tension, and there wasn't that in that class. More relaxed I would say. ... So there was just, it was just a different community, a different feel. I felt a lot more supported, I felt like I could really get good feedback from other students, which I think is great. Feedback from other people is awesome because any other perspective you can get on things is really good."

Here, Bryn describes finding the kinds of experience that she valued, but outside of the engineering curriculum. In our terms, the kinds of interests she had *do* have sponsors, but the sponsors she found were not in engineering.

Bryn, like Adam, was engaged in a struggle over the relationship between her own interests and values—that is, key aspects of her identity—and the discipline of engineering as she saw it. She expressed this struggle quite clearly in an interview near the end of her first year:

"I've questioned if I was for engineering or if engineering was for me. Um, I'm a very people person, and a lot of the stuff that I've been exposed to in engineering has been behind the desk. Not as much exposure with um people. And I know that I need to be working with people. And I've seen that a lot this summer. ... I was around people and I was just- you know I know that that's a gift that I've been given, and to deny that would not be good. And I don't know where engineering would fit into that. And so I'm still looking at that. But the experiences I've had that's really been something that has- that has turned me off."

By the end of her second year, Bryn was having serious doubts about whether she would pursue a career in engineering—she was considering other fields, such as law and education that she saw as better suited to her interests—though she was "leaving her options open" by applying to, and being accepted into, the technical communications major. An important part of her lack of confidence in her fit with engineering is, in our view, the lack of sponsorship she found within

engineering for her interests. It is important to note, though, that Bryn's interests are at least *potentially* seen as intrinsic to the discipline of engineering, and recent calls by industry to the engineering education community to increase the social and communicative abilities of their graduates indicate that there are some attempts to sponsor interests similar to Bryn's. However, Bryn's interests are not as high status within the current organization of disciplinary practices. Consequently, in contrast to Adam, Bryn's identity work is being done from the margins of the discipline, a common scenario for women and other underrepresented groups.²

Discussion

We conclude with a brief discussion of the implications of a social and relational approach to identity and sponsorship with respect to our case studies of Adam and Bryn. Both of these students are engaged in ongoing attempts, even struggles, to fit their own emerging identity projects with their developing understanding of the discipline of engineering. Both Adam and Bryn have interests that could be viewed as integrally related to the profession of engineering; however, Adam's interests in math hold prestige within the discipline, and sponsorship of such interests is embodied in the routine practices of engineering education. Bryn's interests, on the other hand, are more problematically related to routinized practices of evaluating and selecting students. It is important to be clear that we are not questioning whether people *have* intrinsic interests—though we would offer a different account of these than do individualist approaches. Rather, what we are arguing is that students' intrinsic interests develop into discipline relevant intrinsic interests only through the processes of sponsorship. Thus, "intrinsic interest in engineering" is always *mutually* constructed by the student and sponsors within the discipline. These processes of sponsorship, furthermore, are neither natural nor neutral, but contingent and contestable, and thus a major task of a social theory of identity is to explore how particular kinds of persons are produced as belonging to disciplines, while other types of persons are produced as not belonging. This is a major goal of our continuing work.

Acknowledgments

This material is based on work supported by the National Science Foundation under Grant No. ESI-0227558, which funds the Center for the Advancement of Engineering Education (CAEE). CAEE is a collaboration of five partner universities: Colorado School of Mines, Howard University, Stanford University, University of Minnesota, and University of Washington. We wish to acknowledge the contributions of the student participants in the Academic Pathways Study.

Bibliography

- 1) Lave, J. Wenger, E. *Situated Learning: Legitimate Peripheral Participation*. New York: Cambridge University Press, 1991.
- 2) Eisenhart, M.A. & Finkel, E. *Women's Science: Learning and Succeeding from the Margins*. Chicago: University of Chicago Press, 1998.
- 3) Eccles, J.S., "Understanding Women's Educational and Occupational Choices: Applying the Eccles et al. Model of Achievement-Related Choices," *Psychology of Women Quarterly*, 18, 585-609, 1994.

- 4) Simpkins, S.D. & Davis-Kean, P.E., "The Intersection Between Self-Concepts and Values: Links Between Beliefs and Choices in High School," *New Directions for Child and Adolescent Development*, 110, 31-47, 2005.
- 5) Brandt, D., "Sponsors of Literacy," *CCC* 49.2, 165-185, 1998.
- 6) Holland, D., Lachicotte, W., Skinner, D., & Cain, C. *Identity and Agency in Cultural Worlds*. New York: Cambridge University Press, 1998.
- 7) Harre, R. & Moghaddam, F., *The Self and Others: Positioning Individuals and Groups in Personal, Political, and Cultural Contexts*. London: Praeger, 2003.
- 8) Skinner, D., Valsiner, J., & Holland, D., "Discerning the Dialogical Self: A Theoretical and Methodological Examination of a Nepali Adolescent's Narrative," *Forum: Qualitative Social Research* [On-line Journal], 2 (3), 2001.
- 9) O'Connor, K., Perhamus, L., Seward, D., & Stevens, R. (2006). Engineering student identities in the undergraduate curriculum: Dynamics of sponsorship in the social production of engineers. *Proceedings of the 2006 American Society for Engineering Education New England Section Conference*, Worcester, MA, March 2006.
- 10) O'Connor, K., "Contextualization and the negotiation of social identities in a geographically distributed situated learning project," *Linguistics & Education*, 12, 285-308, 2001.
- 11) Deci, E.L., & Ryan, R.M., "The support of autonomy and the control of behavior," *Journal of Personality and Social Psychology*, 53, 1024-1037, 1987.
- 12) Eccles, J.S., "Studying Gender and Ethnic Differences in Participation in Math, Physical Science, and Information Technology," *New Directions for Child and Adolescent Development*, 110, 7-14, 2005.
- 13) Seymour, E. and Hewitt, J. *Talking about leaving: Why Undergraduates leave the Sciences*. Boulder, CO: Westview, 1997.
- 14) Hacking, I., *Rewriting the Soul*. Princeton, NY: Princeton University Press, 1998.
- 15) Gee, J.P., Allen, A., & Clinton, K., "Language, Class, and Identity: Teenagers Fashioning Themselves Through Language," *Linguistics and Education*, 12, 175-194, 2001.
- 16) Stevens, R., O'Connor, K., & Garrison, L., "Engineering Student Identities in the Navigation of the Undergraduate Curriculum." In *Proceedings of the American Society for Engineering Education Annual Conference*, Portland, Oregon, June 12-15, 2005.
- 17) Hollan, D.W. & Wellenkamp, J.C. *Contentment and Suffering: Culture and Experience in Toraja*. New York: Columbia University Press, 1993.