



Mentoring African-American Science, Technology, Engineering, and Mathematics (STEM) Undergraduates: An African-American STEM Mentor's Perspective

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Abstract—One approach to understanding and learning about the African-American STEM college student experience is to examine the personal, professional, and mentoring experiences and mentoring relationships of African-American STEM mentors in higher education. In this paper, we examine the personal and professional experiences of an African-American STEM PhD mentor in higher education in an attempt to understand the African-American STEM college experience from the perspective of African-American mentors. As a pilot study of the first author's dissertation research, this paper is not intended to generate theory or present a universalized narrative for all African-American STEM mentors. Rather, this study examines the preliminary findings of a storied experience of someone who can speak to the experience of being an African-American STEM undergraduate and mentor. Emergent themes from the narrative data focus on the potential needs of African-Americans in higher education to see others who look like them in academia and to have mentors who are knowledgeable about social and cultural resources. Future research should examine how mentors implement different methods and strategies to help their African-American protégés and how to help other mentors learn how to be better resources for protégés.

Keywords: mentoring, African Americans, undergraduates

Introduction

National policies and educational reports call for an increase in the production of U.S. scientists and engineers by tapping into pools of underrepresented populations such as African-Americans^{1,2}. To address the call, it is critical to examine the African-American science, technology, engineering, and mathematics (STEM) undergraduate experience and to understand how the experiences of underrepresented populations influence decisions to go into and persist in STEM majors³⁻⁵. But what do we really understand about the African-American STEM college experience? What can we learn from the experiences and reflections of African-American STEM PhD mentors about the African-American college experience and how to navigate it? In this paper, we examine the reflections and insights of an African-American STEM mentor using a narrative analysis method. This research study seeks to lay a foundation for examining the African-American college experience from the perspectives of individuals' undergraduate and professional experiences and provide new insight on approaches for increasing the number of African-Americans in STEM fields.

Challenges Facing African-Americans Students in Higher Education

In higher education, African-American students may deal with issues such as social and academic isolation or confronting fears of fulfilling stereotypes^{6,7}. Mentoring may be an effective deterrent in assisting minority students in combatting these issues^{8,9}. However, there is a paucity of research literature that specifically examines the mentoring experiences of African-American STEM mentors relative to their relationships with their African-American STEM protégés and how and why these mentors are successful in mentoring their protégés.

Examining the experiences of African-American STEM mentors who have progressed from being college students to faculty and advisors who engage in mentoring relationships with African-American undergraduate protégés may provide crucial insights about the minority college experience and mentoring. One way of understanding these experiences is through examining the life histories and mentoring experiences of minorities⁷ such as African-American STEM mentors.

An Overview of this Narrative Research Study

This study's research question is: what are the personal, professional, and mentoring experiences of an African-American STEM PhD mentor who mentors African-American undergraduate protégés? In this paper, we examine the personal and professional experiences of one African-American STEM PhD mentor in higher education as a first step towards understanding the African-American STEM college experience from the perspective of African-American mentors in higher education^{10,11}. Narrative research is not intended to try to generate a theory about the entire population¹⁰⁻¹³. Rather, this method allows us to examine the storied experiences of someone who can speak to the experiences of STEM African-American undergraduates due to their experiences as a prior undergraduate and a current mentor^{7,14}.

This paper reports the pilot research study findings of the first author's dissertation research. The dissertation research study examines the lives and mentoring experiences of ten select African-American STEM mentors. Study participants are African-Americans PhDs who possess at least one STEM degree and have: a) a history of impacting STEM undergraduate students as evidenced by their substantial track records for facilitating undergraduate student success in STEM fields, b) a history of commitment to mentoring underrepresented minority undergraduates, and c) national acclamation and/or recognition by their peers and prestigious organizations and institutions as exemplars for their work with mentoring underrepresented minorities.

This dissertation research contributes to mentoring research about the experiences of African-American STEM mentors and African-American STEM protégés by: a) telling the stories of African-American STEM mentors through specifically eliciting their personal stories and situated knowledge, b) examining what obstacles mentors say (and anticipate) their protégés confront and how they help them deal with them, and c) increasing awareness of actionable mechanisms (e.g., programs, strategies, policies) that could be targeted in mentoring underrepresented racial minorities to help reduce the number of African-American undergraduates who leave STEM fields.

Data Collection

For this pilot study, data collection and analysis followed the same process as the larger dissertation study. Participants signed Institutional Review Board (IRB) consent forms and were interviewed twice on two separate occasions with at least a week and no more than three months in between the first and the second interview. Two interview protocols were developed from questions sampled and reframed from a research study conducted by Reddick (2011)¹⁵ (see Table 1). The first interview focused on learning about the participants' life history and the

second interview focused on helping a participant reflect about their mentoring relationships with their African-American undergraduate protégés. Each interview lasted approximately 45 to 60 minutes.

Table 1. Interview Question Examples

<p>Interview #1: Life History</p> <ol style="list-style-type: none"> 1. How long have you been mentoring undergraduate students? <ol style="list-style-type: none"> a. Why did you choose to mentor this population? b. Are there others that you mentor also? If so, what are their grade levels/professions? 2. What were the key reasons, people, experiences, or circumstances that led you to become a mentor? <ol style="list-style-type: none"> a. Was it part of a formal program or did it happen informally? b. Who initiated the mentoring relationship? c. Was this someone you knew, related to you, someone you didn't know? d. When did you realize you wanted to be a mentor? e. How did you realize that you wanted to be a mentor? f. How has this influenced the person that you are today? 3. When you think of your experiences as a mentor in an academic setting, how would you describe your mentoring approach?
<p>Interview #2: Reflection about mentoring</p> <ol style="list-style-type: none"> 1. Give me one or two examples of some of the academic or personal obstacles that your African-American undergraduate protégés have told you that they encountered. <ol style="list-style-type: none"> a. What are some obstacles that you might anticipate he or she may encounter in an academic or personal context? b. Why do you think these obstacles will occur? c. Have they happened to you and if so, how did you handle them? 2. Now, give me an example of one of the <i>most</i> common ways that you provide assistance to your African-American undergraduate protégés? <ol style="list-style-type: none"> a. I think I understand what you mean by X, but for the purpose of this study, can you elaborate on what you mean by X. b. Why do you think this is the most common way?

Data Analysis

Information was gathered about the participants' background such as degrees, work experience, honors and awards, and other personal characteristics to create a backdrop and contextual setting to complement the interview data document. After conducting the two interviews, the interview audio files were transcribed and a methodical narrative analysis approach was used to open code the data (see Table 2). Emergent themes were then summarized from the data. Polkinghorne's¹⁶ narrative analysis method was used to analyze data and shape the dissemination of findings as a personal narrative supported by quotes from the interview data. Pseudonyms were used in place of participants' actual names and identifiable information in the transcripts was replaced with ellipses (...) or unidentifiable information in parentheses.

Table 2. Polkinghorne’s (1995) Narrative Analysis Method Criteria

Narrative Analysis Method Criteria
1. Include descriptions of the cultural context in which the storied case study takes place.
2. Gather and configure the story and attend to the embodied nature of the protagonist.
3. Develop the story’s setting being mindful of the general cultural environment and person embodied and significant others in affecting the protagonist’s actions and goals.
4. Recognize that the cultural setting, body, and others provide limits and context.
5. Consider the historical continuity of the characters.
6. Keep in mind that the narrative analysis outcome is the generation of a story.
7. Remember the narrative analysis must make the research plausible and understandable.

Narrative Results

The following paragraphs detail examples about the personal, professional, and mentoring experiences and relationships of “Dr. Laura James”.

Personal and Professional Experiences

In her personal and professional experiences, Dr. James saw her family members’ influence on their students as educators. As an undergraduate engineering student, she recognized a discrepancy between the presence of African-American engineers and faculty in the overall population.

Coming from a family of educators

Growing up in the south, Dr. James says she was “molded by educators” as her parents and grandparents were all educators. When she was younger, Dr. James says she remembers running into her grandmother’s prior students when they went to town. In these encounters, the students would acknowledge and recognize that they had taken heed of some part of her schoolteacher grandmother’s advice. She says:

“So in my teaching philosophy statement, my, one of my first statements talks about as a child I was molded by educators so, parents, grandparents, they were all educators. And so, we’d always go somewhere, so let’s say a town, it was a small town in (a southern state). Whenever we’d go to town, so I had a unique experience. And so, we lived in (a small southern city) with my parents. But on the weekends, we’d go to (...) county. One of the smallest, ruralest counties there is in America. And so, the town would be (...) like 45 minutes away, (...). So, when we’d go to town, there’s always, I mean, cause my

grandmother taught 42 years, and granddaddy did something similar. And so, we'd always go and they'd always find someone they knew, they would run into. And so, you would always hear the things, "If it wasn't for Ms. James doing such and such and such and such, (...) she told me that if I shined my shoes, and I went out and acted like I had some sense, I could actually be something. And I took that to heart." So, you hear these, over and over again, and it was always funny."

A lack of African-American female engineers and African-American faculty

As a freshman, Dr. James attended a historically Black college or university (HBCU) where she majored in engineering. All of her classmates were African American or of African descent. At the National Society of Black Engineers (NSBE) events, she recognized a difference in the gender makeup of African-American engineers. Specifically, the gender makeup at her HBCU didn't resemble the larger population - there were more African-American male engineers in comparison to the overall population. Also, she noticed that the majority of professors at her HBCU were not African American and remembered how during her exit interview she was encouraged to become "one of those faces that you want to see". She says:

"(...) I guess places I went during (my) college career, I kinda began to see some differences and understand some of the differences when I attended my first NSBE conference. And so, in attending NSBE, you kinda notice, like there are lots of African-American males here, a lot more males than there were females. And so, to start to kinda think, um, that the gender makeup at an HBCU was, within engineering, was different than that of the larger population. So that was kinda, where I did start to notice, where some differences might have been. So, other than those markers, I guess one other piece (is that) a lot of the professors (at my college) were not African-American and actually I only had within engineering, I only had five (that were African American). So, even just within (my area) there were, I guess four of those were in (my area), and so, um, that was also something that became apparent to me and then I distinctively remember, at our (...) senior exit type of focus group, one of the questions that came up from my peers was, you know why are there not more African-American professors present. And so, one of the non-African American professors said, that you all have to go out and get PhDs and then once you get those, be willing to come back to the HBCUs to be those faces that you want to see. And so, it really started to kinda open my eyes to what the, the mainstream or what other engineering settings may look like."

Mentoring Relationships and Experiences

As a freshman undergraduate, Dr. James began a lifelong tenure in multiple memberships with various student engineering organizations. In these organizations, she participated in various leadership roles on several committees and was deliberate about helping other freshman transition into engineering. According to Dr. James, this point in her life marks where she began her years of formal and informal mentorship. Today, as an engineering faculty member at a large Midwestern university, Dr. James continues to engage in mentoring relationships through her informal mentoring relationships with engineering undergraduates and her work with a peer mentoring program she helped to initiate that pairs incoming graduate students with current

graduate students. Dr. James develops relationships with her protégés so that they are more open to sharing which can open the door to them accepting her guidance. In her mentoring relationships and experiences, she: (1) works to develop personal relationships with her mentors and protégés, (2) recognizes that mentoring is not a one-size-fits-all process and that protégés need different mentors, (3) serves as a resource for her protégés, and (4) helps her protégés to realize there are multiple pathways to success.

Develops personal relationships with her mentors and protégés

As a mentor, Dr. James approaches her mentoring encounters with her mentors and protégés as personal relationships. In these relationships, she focuses on connecting and engaging with her protégés and mentors around their interests. When asked about what advice about mentoring African-American undergraduates she would share with other mentors, Dr. James says:

“I’d say the first piece is treating it as it’s a personal relationship. And personal as in assuring that the people you are mentoring still feel like people when the mentoring session or relationship is over. Um, so finding out something, something that they’re willing to share that they have an interest in. I’ve found that it goes with the cliché that people only care how much you know when they know how much you care. So, really finding out or tapping into something that people have an interest (in), something interesting about them. And then, being very diligent about either asking about or inquiring about (it) because it could be nothing more than letting the person tell you about it. You know, I had a meeting with one of my mentors about two weeks ago and he’s in a wine tasting class. So, I knew where, historically where it was located, so now he’s told me he’s moved. He went to kinda tell me what was going on. Well, that was important to him. And so, the, I think this semester or next semester, he’s going to do the beer (class) (...). So, I remember watching on television that you have to be able to grow hops to do this. So I said ok. This is a way he can tell me and I can become very literate in this in just an exchange of information. But, at least I’m making connections to things I’ve heard and things of interest to him. So, I think for an audience, making those connections. And then whatever it is you have to share, people are a lot more open to receiving it once they know it’s not either a task or “ok, this is all the ten minutes I’ve got and this is what you get and we just go on”. So once they see, you know, this is something you really are interested in, you have a passion for, they’re a lot more open to sharing with you. And then the more you know about that, I think the more you can provide them with some insightful guidance versus things that are very textbook or things that are very generic, but not applicable to them.”

Similar to her interactions with her own mentor, Dr. James strives to have conversations around her protégés’ interests in an effort to see and connect to them holistically. She says:

“Ok. I guess one thread that usually binds and I think this is just with people in general, there are things that people are passionate about or things that they have an interest in. And so, certainly within the first few encounters, I make it an effort to kinda probe for those things. And so, let’s just say it’s someone who has an interest in sports (...), you know, the family is usually also a very, very big one as well. So, if it’s family, if it’s music or some sport or hobby, whatever it is, and then making sure that even just in our exchanges that we

have conversations around those. So when I think about I have a number of students who've done band, (I'll say to them) "And so, so how was the half-time show? So wow, it was hot out there." So, it's really helping to kinda connect where this is not just essentially a whatever the main topic that we will get to, it's more so looking at them as a holistic (person) (...)."

Mentoring is not a one-size-fits-all process and protégés need different mentors

Dr. James' mentoring approach involves recognizing that everyone is different and she may use different communication styles to attend to the various personalities of her protégés. In describing her mentoring approach, she says:

"Ok, one of the things that I think I've been pretty unique with is understanding pretty early on that everyone was different. And so, there's not a one-size-fits-all in, in no stretch of the imagination. There are some (protégés) that just maybe having a conversation once every six months or once a year would be enough. Others, it's (...) more intensive, sometimes daily, sometimes weekly, uh, interaction. So, I think that piece, really understanding that when I think about a number of different people, they were all very different. There's some similarities, but because they were different, there's not been one approach that has just been what I've gone for or the way that I approached it. (...) But really understanding that just from an informal perspective and then from there, understanding what's the best or most appropriate approach based on the type of communication, the type of personality that the student may have."

In addition to recognizing that protégés need different mentoring styles, Dr. James also recognizes that it is important that protégés have multiple mentors and that mentors need to be knowledgeable about existing resources. She says:

"So, you're never gonna have a mentor that has everything that you would ever need. That's why it's important to have different mentors. But the other piece too, mentors have to be very knowledgeable about what resources are out there, you know, where can you direct a person. I may not have what it is that you need, but let's start you (...) down a path to getting to the thing that you need."

Serving as a resource for students

In addition to directing protégés to the appropriate resources, Dr. James has also learned ways to help protégés cope with challenges. One particular lesson Dr. James learned is how to help people cope when they are far from home. In these situations, she supports them to the extent that she can emotionally and directs them to the appropriate resources. She says:

"(...) one of the parts (...) looking at where undergraduates have lost significant others in their careers so whether it's a mother or father, a grandparent, a sibling. And so, being able to help them through that process whether it's (...) financial challenges, you know, how do you help undergrads through those. And so, I guess those have been learning lessons for me as well. (...) particularly when it's not as if you're just one state over, two

states over, you're continents away. How do you kinda help them deal with (that)? So, certainly (I) have become very knowledgeable of what are the resources that are available or around. So whether it's something at (name of center) which is the psychological center where they can deal with grief. Getting to know what are the ins and outs of the bursar's office when it comes to some of the financial pieces. And so, those are things coming into the situation that I was aware of, but these things happen and so how do you kinda keep a pulse on what's going on there. And so, if we've been meeting two or three times a week and now, if we go two weeks and you're not doing the same things or doing things you once were doing, you know, kinda keeping a pulse on some of those things. And I think that's where having more of the personal side of it, understanding enough of those things to be able to kinda help guide the student through those. But also, realizing that some of these things are outside of my expertise, so the role changes where I can go as a support, so if you're going to go to grief counseling, I can go with you to grief counseling, but I can't lead the grief counseling session."

There are various pathways to success

Based on her own experiences and observing the experiences of others, Dr. James advocates to her undergraduate STEM engineering protégés, the many ways engineering opens up various career pathways. She says:

"So, I guess one is understanding that there is not any one given path that will lead to, I'll put this very loosely, success. (...) So I would really want students to understand that there's not one path that leads (...), this will get you right to where you're trying to go, with engineering. And so, really using the engineering or the critical thinking skills that you would gain through an engineering curriculum to be able to catapult off to whatever it is that you want to do. And that doesn't have to be what one may typically know as an engineer. I mean, engineering is across the board a very diverse way of looking at things. And so it doesn't say your title will be in ten years "engineer" and that doesn't have to be and so really getting them to kinda see that. Because I do see that's one of the things that's pretty interesting to me. I do see a number of (...) engineers that I come in contact with who have very (...) different career paths that they want to go off on."

Discussion and Conclusions

Growing up, Dr. James saw people who were educators. She even talks about hearing the repeated stories about how her grandmother helped her students. This may have positively influenced Dr. James' perspective about being an educator. Also, Dr. James' experience in seeing the effects of her relatives as educators may speak to the importance of African-Americans having and seeing others as examples of what having an education can do for them and what being an educator can mean.

As a mentor, Dr. James develops personal relationships with her protégés by serving as a resource for her protégés. In her attempts to seek to be a resource for her protégés through being aware of services and options available to her protégés, her experience may provide some insights into the needs of protégés to be able to go to their mentors' for guidance to the resources

that they need. Also, in her mentoring relationships, she wants her protégés to recognize that there are various pathways to success. This may suggest that mentors need to assist their protégés by helping them to strategize ways to use their STEM degrees to launch them into various career opportunities. Overall, this pilot narrative study is useful in that it provides insights into how a mentor's experiences may connect to the ways that she mentors.

Future Research Recommendations

Based on the themes from the narrative results, future research may examine the impact of seeing others attain education and helping others as educators in influencing the success of students. Also, future research should examine how African-American STEM mentors develop their personal relationships with their protégés. Specifically, researchers should examine how different mentors implement different methods and strategies to help their protégés. Also, methods should be investigated in regards to what are some ways that mentors are resources for their protégés and how mentors can learn how to be better resources for their protégés.

Research Contributions

This research is intended to examine the narrative experiences of an African-American STEM PhD mentor as part of a larger dissertation research population. From this pilot narrative, we gain information about the experiences and insights that help to indicate what aspects should be further examined in the dissertation population of ten STEM mentors. In examining the experiences of this small, yet very important population, this research addresses several areas of the African-American college experience and mentoring.

Acknowledgments

This research was funded in part by a Bilsland Fellowship (academic year 2014-2015), Purdue University, West Lafayette.

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