More than an intervention: strategies for increasing diversity and inclusion in STEM

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Abstract

Purpose – This paper aims to provide insight into the strategies used by leaders of graduate school preparation programs for science, technology, engineering and mathematics (STEM) to recruit and retain graduate students of color within STEM fields.

Design/methodology/approach – This paper is a qualitative multiple-case study using a snowball sample and semi-structured interview protocol. Twenty interviews were conducted.

Findings – Graduate program leaders use particular strategies to increase diversity and inclusion within graduate STEM education, and these strategies are strongly influenced by their institutional context. The most common strategies include collaboration, mapping the political terrain, evaluation, mediation, persistence, persuasion, networking in and outside of the institution, strategic planning, bargaining and negotiation, reaching out to the greater campus, and coalition building and developing allies.

Research limitations/implications – All of the institutions in this study were public research institutions. Further inquiry is needed on more diverse types of institutions.

Practical implications – The results of this study can be used by institutional and STEM program leaders who wish to increase diversity and inclusion.

Social implications – This research study raises awareness about an under-studied group of leaders, as well as the importance of considering context when developing strategic plans for increasing diversity and inclusion for STEM.

Originality/value – This study is unique because while graduate school preparation programs have become an important strategy for addressing diversity in STEM fields, research on these programs usually focuses only on student outcomes. This study provides rare insight into what is required to implement, sustain and expand these kind of diversity programs.

Keywords Diversity, Education, STEM, Graduate school preparation programs

Paper type Research paper

The need for more historically underrepresented people of color in graduate education in the science, technology, engineering and mathematics (STEM) fields has been well documented (Figueroa and Hurtado, 2013; George and Malcolm, 2011; The Whitehouse, 2013). Increasing racial diversity in graduate STEM education strengthens the pipeline for racial diversity in STEM careers and academia. In fact, President Obama's 2014 budget allotted US$325 million to expand and enhance National Science Foundation (NSF)'s Graduate Research Fellowship program and US$487 million for graduate training programs for the National Institutes of Health (The Whitehouse, 2013). Many interventions have proved to be effective, but graduate school preparation programs

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(GSPPs) are more comprehensive because they incorporate other interventions such as mentoring, tutoring, advising, a supportive cohort, financial support and research opportunities. Despite their success, there is hardly any information about how to successfully implement and sustain a STEM GSPP. This is problematic because programmatic memory that is not passed on weakens sustainability and the potential for replication.

Using a snowball sample and semi-structured interview protocol, this qualitative multi-case study examined what strategies leaders of GSPPs use to increase diversity and inclusion in STEM. The findings highlight their tactics as well as how institutional context shapes what strategies they choose.

Literature review

GSPPs are structured programs designed to increase student-of-color participation by providing preparatory course work, summer immersion and research experiences, mentors and intensive program advising (Simpson, 2003). For underrepresented students of color, these programmatic interventions have been shown to increase interest in graduate school, self-efficacy, application to graduate school, acceptance into graduate school, awareness about the graduate school experience and engaging in research at the graduate level (Peteet and Lige, 2015; Simpson, 2003). Unsurprisingly, national support for STEM GSPPs has expanded (Matthews, 2011; The Whitehouse, 2013); however, these programs are usually only examined for their impact on student outcomes. It is important to remember that GSPPs (and other interventions) are not autonomous and can be severely weakened or disappear entirely when funding dwindles and/or their leaders leave (Erickson, 2010). If these types of programmatic interventions are to be sustained and scaled up, more inquiry must be done on the persons who implement and manage them.

Graduate program leaders (GPLs) are faculty and administrators who design and manage STEM GSPPs. They have an intimate understanding of the programs they manage; yet, they are mostly invisible in the literature on diversity and STEM. For example, Tsui's (2007) meta-analysis of the scholarship on strategies for increasing diversity in STEM focuses entirely on effective student-centered interventions for increasing diversity. At the other end of the spectrum, Williams' (2013) seminal book on diversity leadership emphasizes the role of senior administrators in achieving large-scale institutional transformation. These examples underscore a dearth of scholarship on practical strategies for mid-level administrators and faculty who wish to use interventions like GSPPs to increase diversity and inclusion in STEM.

One exception is a recent dissertation study by Davis (2014) which examined strategies used by faculty, staff and administrators to increase enrollment and graduation for underrepresented students of color in STEM. This study highlighted the importance of examining how faculty and administrators secure support and resources for implementing and sustaining interventions in STEM. Using Kezar and Eckel (2002)'s theory of transformational change, Davis examined what strategies were used to support institutional transformation. However, higher education institutions are inherently siloed, with multiple competing goals and agendas across disciplines and departments. A framework for inquiry on those focused on increasing diversity and inclusion specifically within STEM should support the purview of their goals. Towards this end, I have chosen Kezar's theory on diversity leadership strategies.

Conceptual framework

Kezar's (2008) study examined how college presidents the politics of their institution to secure support for their diversity and inclusion agenda. The focus of this study is not on institutional transformation *per se*, but on the specific strategies used by leaders to meet their goals. Kezar identified several strategies leaders use, including mapping the political terrain, building coalitions of advocates and allies, persistence, bargaining and negotiation. She also found that leaders must understand their environment, including the constraints and opportunities for collaboration. While Kezar's study reveals many of the challenges leaders face in this area, her definition of leadership is very narrow. Diversity leaders like GPLs are positioned differently within their institutions and may face very different challenges. Therefore, using Kezar's Theory of Strategies for Diversity Leadership, I developed the following research questions to glean insight into what strategies GPLs use and how institution context influences their tactics:

RQ1. How do GPLs implement, manage and sustain their GSPP within their institutional context? (a) What resources do GPLs draw on regularly? (b) What challenges do they encounter? (c) How do they engage with the resources and challenges to reach their diversity and inclusion goals?

Methods

A qualitative multiple case study design was chosen because qualitative inquiry embraces the experience of the world as told by others and allowed me to see context through the eyes of those who were situated within specific institutions (Creswell, 2012). It also enabled me to gain insight into if and how different campus environments shaped the type and extent to which certain particular strategies were employed. Finally, a multiple-case design increased the trustworthiness of my results, while providing further opportunities to check and revise any developing insights I may have gained from this inquiry (Yin, 2009).

Site and sample selection

I selected three different GPLs in charge of STEM GSPPs designated as a NSF Alliances for Graduate Education and the Professoriate (AGEPs) program (Table I). AGEP supports alliances among doctorate-granting institutions throughout the country. These alliances are expected to develop and implement strategies and infrastructure, including GSPPs, that will work on all levels of the student-of-color pipeline, including recruitment, retention and advancement (American Association for the Advancement of Science, 2011).

Data were triangulated by using interviews, archival data (e.g. reports, news articles) and anecdotal feedback about each program. After identifying the initial three GPLs, snowball sampling was used to identify additional participants. Snowball sampling is a method of identifying participants through contact information that is provided by other informants. I conducted a total of 20 interviews across three sites. Collecting data from a number of sources provided a more robust and comprehensive picture of the strategies these used within their program and respective campuses. All persons were interviewed once.

	Case study number 1 Gilbert University	Case study number 2 Blossom State	Case study number 3 Eastwood State University
Institutional type and size	Large public research university; several branch campuses	Large public state research university; two branch campuses	Medium-sized public research university, state-wide system
Geography	Metropolitan	Rural	Metropolitan
Graduate STEM programs	Biology, chemistry, computer science, earth science, math and physics	Applied Math-Statistics, Astronomy/ Planetary Science, Marine, Biological, Chemical, Physics, Engineering Sciences, Population Health and Clinical Outcomes Research	Marine, Biological, Chemical, Physics, Medical, Engineering Sciences and IT
Ranking	Moderate-to-low (except for math, which ranks in the top quarter)	Moderate to high	Top five among US research universities in production of IT degrees and certificates
Demographics	Much less diversity at graduate level. Most diversity is present in non-STEM-related fields	51% African American; 47% Hispanic; 2% Pacific Islander	45% of the students earn degrees in STEM, 50% of them are Black
Institutional support for diversity and inclusion	Diversity is an espoused goal. Little institutional support for the AGEP GPSS. Program is understaffed and has no additional funding	Several diversity initiatives and a center for improving diversity and inclusion. High support for AGEP GSPP, large staff. Pockets of resistance, especially within STEM departments	High comprehensive and financial support for diversity and inclusion. High support for AGEP GSPP, large staff

Table I.
Profile of cases

Analysis

Dedoose qualitative software was used to organize and sort coding. I applied thematic coding directly from my conceptual framework and the literature review, followed by open and axial coding to capture new emergent themes. Triangulation was used by supplementing the GPL interview data with the interviews with trusted staff and administrators, as well as program documentation to get a wide spectrum of perspectives about the role of the GPL and the context in which they work.

Findings

Graduate program leaders must understand their institutional context

GPLs must *know* their institutional environment to be effective in increasing diversity and inclusion. "To know" one's institutional environment means more than familiarity with the institution's various actors and resources. The GPLs in this study all revealed a deep understanding of their environment through their descriptions about the dynamics of campus relationships and the historical behavior associated with people, departments and the institution itself. They described their understandings about what institutional resources were available – and to whom. They also described what was unavailable, who controlled those resources and the relationships those persons and departments had with others, including STEM disciplines and diversity initiatives (Interview numbers 1, 14 and 23). This knowledge assisted them in making choices in how they chose to approach different persons and in how they executed their responsibilities. Eastwood's GPL gave some insight into learning her environment when she explained her first month on the job:

> So there were little things like, "Okay, well, can you get me a list of the grad students first so I'll know who they are and I can tell that this program exists?" And then, "Excuse me". It was about setting up programs, getting to know the campus, administrators, who does what, where so that we could actually start to have something (Interview number 23).

Blossom State's GPL expressed the following understanding about her institution:

> I think every environment is different but in Blossom State's case, I think, we are a very young institution. We are not like other institutions that have a long 200-year history. We're not in a metropolis. We're not even in a college town […] It's a little bit hard to foster a sense of community in an environment like this. People go home on the weekends […]. [We're] is not going to be in the same place in fifty years. I mean were talking about potentially being the university that takes over big portions of mega competitor. But in the process of journeying into there I think that you work harder and more against the grain to develop that sense of community (Interview number 14).

Based on their accumulated knowledge about the campus, GPLs make decisions about who to network and collaborate with, which institutional meetings to gain access to gather information and represent their program, who in the institution has shown a history of, and interest in, supporting diversity initiatives, and which persons and departments have been less supportive or more resistant towards diversity initiatives (Interview numbers 1, 11, 12, 13, 14, 23 and 24). Learning about one's institutional environment and how to navigate that environment requires strategy.

Graduate program leaders use several strategies to increase diversity and inclusion

The second finding that emerged was that GPLs use strategies to learn about, navigate through and harness resources from their institutional environment to increase diversity and inclusion in graduate STEM education. In fact, all of the GPLs felt that *being strategic* is an essential to their role. GPLs use a number of strategies to increase awareness and secure continuing support for their diversity and inclusion goals and activities, and many of these strategies are similar to the types of strategies Kezar (2008) found in her study. I also discovered that GPLs also use some that were not listed. Table II lists all of the strategies that emerged, both those identified by Kezar and those that emerged from my data.

Mapping the political terrain. Before a GPL can make decisions about what tactics they will use to accomplish their goals, they must learn as much as they can about their environment so that they can harness resources and identify where they can find allies and non-allies. The most straightforward and deliberate strategy accomplishing this task is *mapping the political terrain*, which is the process of learning about the relationships, tensions, potential allies and potential opponents that reside in different departments and offices. In essence, it is learning about the politics of an organization and about the external forces that shape the politics of that organization.

GPLs map the political terrain by reading about the institution; taking note of the structural representation of diversity among students, faculty and staff; talking to people informally and formally (i.e. networking); observing how people interact, talking to and about one another; understanding external policies and practices that may impact the institution; and meeting with people in similar positions in and outside of the institution, sharing stories about issues that emerge as a result of this work.

GPL strategy	Description
Mapping the political terrain (Kezar, 2008)	The process of learning about the relationships, tensions, potential allies and potential opponents that reside in different departments and offices on and off campus
Networking outside of the institution	Making connections and building relationships with key actors and constituents outside of the institution
Bargaining and negotiating (Kezar, 2008)	The act of trying to ask for support or resources, making compromises and offering support or services in exchange for support or resources
Persistence (Kezar, 2008)	Continued commitment to a cause or task despite obstacles
Coalition building and developing allies (Kezar, 2008)	Actively seeking out, and building relationships, with persons who can lend support, advocate for, and work on the behalf of the GSPP
Collaborating (Kezar, 2008)	To partner with someone on a project or activity in order to produce a mutually agreed-upon goal
Strategic planning (Kezar, 2008)	Purposeful brainstorming
Networking within and outside of the institution	Making connections to raise visibility of the GSPP program or building relationships for other goals such as fundraising and collaboration
Evaluation	As a strategy, to conduct assessment or engage in scholarly inquiry with the intent of showing effectiveness and significance

Table II.
Strategies GPLs use

Blossom State's GPL gave some insight on the process of mapping the political terrain here:

> I think it's really understanding, the playing field […] I got them together on a regular basis. I started to kind of understand their personalities. I started to understand […] you're going to get along, close to, with some more than others […] but I think that, after what people knew, this is the person that I'm going to have to deal with (Interview number 14).

Collaborating. One of the primary reasons GPLs reach out to the greater campus is to develop collaborative relationships with others. Collaborating was one of the most popular strategy is among the GPLs in this study, particularly for Gilbert University and Eastwood State. After making connections with people in and outside of the institution, GPLs identified persons with similar goals that they could partner with to share resources or produce products that would meet the needs of everyone involved. Perhaps, one of the most significant reasons GPLs use collaboration is because it can also serve as a tactic for initiating other strategies, such as coalition development and building allies, expanding one's networks within and outside the institution and bargaining and negotiation. Collaboration can also be used as a strategy for creating new funding sources, such as collaborative grant writing (Interview numbers 1, 4 and 23), as well as for creative cost-saving like sharing resources and sponsoring programs (Interview numbers 1, 12, 14, 21, 23 and 26). Collaboration can also be used as a strategy for building relationships with faculty and departments. One of Blossom State's GSPP staff members describes how the GPL has been able to use collaboration in this way:

> I think in the humanities she also has voice that is also very strong. She has been able to do it in the time that she started the operation that was, in '99, to generate the network of collaborators that had helped the program grow and that she used it to basically support and grow the way she normally does leadership here (Interview number 12).

Collaboration can also be used for sharing or expanding the execution of certain responsibilities, such as recruitment and advocacy (Interview numbers 1, 2, 6, 15 and 26). As one faculty advisor from Gilbert University explained:

> [The GPL] helps me sometimes. I'll go to a meeting that's [she] has sponsored […] sometimes we'll both attend the meeting that, for example, there's an annual, joint meeting between the National Society of Black Physicists and the National Society of Hispanic Physicists. That's a great recruitment forum […] frequently we'll be at a couple of meetings a year, to the same meetings, and we kind of work together, we kind of work the system together, or I may steer some students over to her, take over, vice versa (Interview number 3).

Persistence. One tactic that emerged more from the GPLs' colleagues rather than the GPLs themselves was the strategy of maintaining a continued commitment to a cause or task despite obstacles. Persistence was mentioned much more as a strategy by both Gilbert and Blossom State's GPLs, and much less by Eastwood's GPL. Many of the GPLs were described as being "committed" and having a great work ethic (Interview numbers 2-7, 11, 12, 13, 21 and 24-27). Some faculty marveled at how the GPLs did all of the things they did despite some of the challenges, such as insufficient and unstable funding and inconsistent student motivation (Interview numbers 4, 5, 15, 16, 26 and 27). GPLs were repeatedly described as hard workers who "kept at it until the things they wanted to see came to fruition (Interview number 6). One faculty advisor at Gilbert University said that in light of the economic climate and their institution's lack of

support, "for [the GPL] to be able to still have the program running after all these years is pretty impressive" (Interviews, personal communication, May 9, 2012). Also, many of the Gilbert GPL's colleagues admired her ability to sustain the program, commenting on the sparse institutional funds (Interview numbers 2, 3, 4, 5 and 6). As one professor stated:

> Maintaining the program [is challenging] […] especially in today's climate where funding is severely cut […] I mean, for her to be able to still have the program running after all these years is pretty impressive (Interview number 6).

What was mentioned less frequently – but did emerge – was the uncertainly of funding from the NSF (Interview numbers 1, 2, 6 and 7). The program's grant money was only meant to last two years, and, at the time of these interviews, neither the GPL nor her assistant was certain whether the NSF program would be offering renewals or new grant funds (Interview numbers 1 and 2). Despite this looming possibility, both the GPL and her assistant were determined to see that the program sustained. In the words of a staff member:

> We try and do the things ourselves […] we find that it's hard to find somebody who's committed to do that type of work. We work all the time. She works on the weekends, too (Interview number 2).

Bargaining and negotiation. Another strategy that emerged in a more subtle way was the use of bargaining and negotiating. Although none of the GPLs actually said that they engaged in bargaining and negotiating, they described using the tactic of asking for support or resources, making compromises and offering support or services in exchange for support or resources (Interviews number 1, 14 and 23). Bargaining and negotiating involves either compromise or an exchange to come to a common understanding or agreement about an issue. Blossom State's GPL provides an example of bargaining how much funding they can secure for their students:

> I'll give you a classic example: the [Brinkley Fellowship] that you saw today. The way it works is that the departments have to admit the students first. After they admit the student they can nominate them for the [Brinkley] Fellowship, and if the student wins the [Davis] Fellowship, now they don't have to really pay for the students as much as they would have had to if they didn't win the [Davis] Fellowship. So the departments are like, "We would take more student-of-color students if you would have the nomination". We knew we were going to have the [Davis] Fellowship, and then we wouldn't have to accept them if they didn't win. And then we say that's why we make sure they've been accepted first […] for us, it's a different game. It's a game of "you want the student or not," "you're willing to invest in student or not". It happens to be that if you show you want to be invested in a student, we may help subsidize and fund that student through the fellowship. So it is always an interesting battle for how we will really increase the number of underrepresented students (Interview number 14).

Blossom State's GPL also uses negotiation as a tool for mediating between students and advisors about academic issues and conflicts that arise (Interviewee number 15). In fact, Blossom State's GPL engaged in bargaining and negotiating significantly more than Eastwood and Gilbert University's GPLs. Interestingly, Gilbert University's GPL engaged in bargaining and negotiating the least.

Networking outside of the institution. GPLs network outside of the institution with a number of constituents to accomplish many goals. Networking can be used to gain knowledge about resources, persons and opportunities that will help their students and

bolster the GSPP overall (Interview numbers 1, 2, 3, 4, 5, 11, 12, 14, 21, 23 and 25). Recruitment, fundraising and collaboration all require the GPL to make connections outside of the program. GPLs also use networking to learn from other GPLs and similar diversity leaders about challenges and issues that may emerge on the job (Interview numbers 1, 2, 14, 23 and 25). As there is typically no one there to train the GPL, and there are no explicit instructions about what strategies to use, they must network with others to learn this information. All three of the GPLs reported using this strategy often; however, it was most mentioned by Gilbert and Eastwood State's GPLs:

> So she's good at getting coordination with other institutions. And she's always thinking about new institutions. So we're involved with – you know we – I think our AGEP got extended to even [other institutions]. And then this next proposal, she's bringing in [an elite Ivy institution], and so she's always out there looking for partners (Interview number 5).

Networking within the institution. As outlined in the NSF grant guidelines for AGEP, networking create and sustain the alliance among institutions is a key expectations for GPLs. GPLs also use networking to learn more about their institution and the politics inside and outside it. However, networking on campus can also be used as a strategy to create relationships that can raise the awareness about the work of the program among faculty and administrators on campus (Interview numbers 12, 14 and 23), to search for potential allies on and off campus (Interview numbers 14, 21, 23 and 25) and to start relationships that will lead to collaboration and shared resources (Interview numbers 1, 5, 11, 12, 13, 14, 23, 25, 26 and 27). Regardless of their purpose, networking as strategy can build the relationships and community necessary to sustain the program. As one Gilbert University faculty advisor explained about the GPL:

> [She] is not a scientist. And I bet that's unusual […] and what [she] has, that's very special is one [thing]; she knows how to work with scientists (Interview number 5).

As a strategy, networking is also valuable because it can help GPLs learn how to carry out their other responsibilities, to glean what barriers exist in their environment, to find what opportunities are present and to determine with whom they can work to create new opportunities. Because networking is essential to carrying out many of the GPLs' strategies, evidence of its use is apparent in almost every strategy that emerged.

Strategic planning. All of the GPLs in this study described the process of consciously sitting down to plan setting goals, outlining the plan for accomplishing those goals and delegating to whomever they thought could help them in this task (Interview numbers 1, 14 and 23). Gilbert University's GPL described using strategic planning for writing grants as she planned how to reach her goals. As she explained:

> [I]f you say you want to increase the enrollment in other stem fields and you identify the stem fields, look at the current enrollment and you think of ways in which you can increase the enrollment, you have to have a recruitment plan. You have to write a recruitment plan. How you're going to recruit? Where you're going to recruit, what your follow-up strategies is going to be from your recruitment? And you have to put that in the grant because that's what they want so you have to really think through the program to begin with because once you, when you write in the grant and the grant gets reviewed by a review panel and they're not going to fund you if they don't think that it's a viable program.

The Blossom State GPL described her yearly strategic planning as a process that includes her entire staff. She explained it in the following way:

> Every year in the summer we create a plan for the following year […] and what I do is, I ask everyone to tell me in advance what they would like to take care of this year. And if two people want to take care of the same thing, I look to see what kind of things can be traded off […] there are certain activities that are stable activities. Every year, I put them up on the table to be taken by somebody else (Interview number 14).

Interestingly, the GPLs from Blossom State and Eastwood State both indicated that strategic planning is an essential element of their goal to expand the reach of their efforts. The GPL of Eastwood State explains one of her projects to use evaluation in strategic planning:

> So through the AGEP program, with funding from AGEP, we were able to start – well, funding from AGEP and from the PhD completion project. We combined some of those, but we were able to start some initiatives that no other schools want to have – who don't have AGEP. And so in the next round of what we're trying to do now, we're in a planning grant phase for the next year. There's a two-year planning grant to see where we're going to go next (Interview number 23).

Evaluation. Strategic planning also appears to be closely tied to evaluation and is also an ongoing process that is informed by both formal and informal evaluation (Interview numbers 12, 14, 21 and 23). Both the Blossom State and Eastwood State GPLs made use of evaluation as a strategic tool in a few different ways. It was used as a way to gather feedback about program participants and the various methods being used to achieve program goals (Interview numbers 12, 14, 22 and 23). When used in this way, evaluation can assist a GPL in assessing which aspects of the GSPP are working or not. Evaluation can also be used to make informed decisions for strategic planning. The staff member for Blossom State describes how the GPL does this:

> The collection of data is not something that it is normally practiced everywhere. That has been like developing a culture for everybody […] I think [the GPL] has been able to show the benefit of their approach of decision making based on information that they don't doubt about, and those are programs that are science programs. So they really believe in the power of information, but there is a practice they need to be able to maintain regarding the [use] of information (Interview number 12).

The second way evaluation was used by GPLs as a strategic tool is to show evidence that the program is doing well to current and prospective stakeholders, partners and constituents (Interview numbers 1, 12, 14, 21 and 23). It can be used in this way to maintain and raise funds, increase awareness about the program and, in advocacy, to persuade others to help support the GPL's efforts (Interview numbers 1 and 12). While all three GPLs were required to evaluate as a part of the AGEP grant, Blossom State's and, to a much greater extent, Eastwood State's GPL used evaluation as a strategic tool to gather feedback on program development and advocacy. An example of this was given by one of Eastwood's staff members:

> We wrote a paper and that paper was accepted. Hopefully, we're going to be presenting in July. Basically, the paper is about preparing graduate students in engineering for master's and doctorate programs. And we feature there all the things that we have been doing […] so that's another international projection that [the program] is going to have. That's why I'm saying that I'm sure, in a couple years, it's going to be something (Interview number 22).

Institutional context influences strategy

The strategies GPLs use do not operate within a vacuum. Particular strategies may prove much more effective in certain institutional contexts than others, while some strategies may not be necessary at all in other institutional contexts. In an institution that has not fully embraced diversity or inclusion, a GPL must use certain strategies to mitigate barriers of resistance. For example, Gilbert University's GPL used collaborating outside of the institution to a greater degree because of she found it harder to find in her institution. Conversely, in institution where diversity and inclusion were much more supported and embraced, a GPL may use strategies that require a certain degree of status and power, such as bargaining and negotiating. Both Blossom State and Eastwood State's GPLs used bargaining and negotiating to a greater degree than Gilbert University's GPL. It stands to reason that to bargain and negotiate, a leader has to have enough status, support and resources to be considered a power broker who can leverage returns. Additionally, the amount of support Eastwood State offers allows the GPL a degree of freedom from having to worry about immediate sustainability; thus, she can focus on expanding the reach of her program's recruitment to regions like Puerto Rico (Interview numbers 23 and 26).

Limitations and recommendations

There were some things that were outside of the purview of the study that still need to be given serious treatment in the literature on increasing diversity and inclusion for graduate STEM education. All of the institutions in this study were public research institutions. Further inquiry is needed on more diverse types of institutions such as Historically Black Institutions, which produce a disproportionate amount of graduate STEM degrees. I also recommend that more studies be conducted on establishing rubrics for assessing institutional environment within STEM departments, exploring whether there are other factors that may influence a GPLs' progress in supporting diversity and inclusion goals.

Conclusion

This study demonstrates that GPLs and other similarly situated diversity leaders can influence significant change through the interventions they use in more targeted ways if they are strategic. The common strategies GPLs use to increase diversity and inclusion within STEM: collaboration, mapping the political terrain, evaluation; persistence, networking in and outside of the institution, strategic planning, bargaining and negotiation, reaching out to the greater campus and coalition building and developing allies. The findings here also align with previous studies which show that the strategies leaders use are strongly influenced by their institutional context (Bensimon and Malcom, 2012; Davis, 2014; Kezar *et al.*, 2008; Williams, 2013). GPLs may have to choose particular strategies to navigate around specific institutional barriers related to an institution's disposition towards diversity and inclusion. If a GPL is situated within an institution where diversity and inclusion goals are more institutionalized, they may not have to use strategy to overcome barriers but, rather, to expand upon opportunities. For example, persistence was used as a strategy for both Gilbert's and Blossom State's GPLs much more often than Eastwood State's GPL, underscoring the use of this tactic in the face of *obstacles*. What this means is that GPLs who are in less supportive environments spend a lot of time and energy on tactical approaches that combat or mitigate the

negative impact of their institutional context. This takes time and creativity away from developing and engaging in strategies that can help the GSPP perform better and grow.

This is an exciting time in STEM education; diversity and inclusion is a commonly espoused value, and there are many institutions and organizations committed to promoting these goals. There is also more recognition that significant change does not necessarily start at the top. As Tinto (2012) points out, there is a growing interest in finding leaders in other locations within our institutions. Programmatic intervention programs like STEM GSPPs are rich with leaders and staff that have vast knowledge, networks and collaborative relationships with many disparate communities within and outside of their institutions. They are committed to the goals of increasing diversity and creating STEM programs that are more inclusive. If graduate STEM education is to truly become more diverse and inclusive, we must begin to take a closer look at the strategies used by those who work on the front lines to fulfill the diversity goals their institutions espouse.

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