Hashtag #ThinkBigDiversity: Social Media Hacking Activities as Hybridized Mentoring Mechanisms for Underrepresented Minorities in STEM

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Hashtag #ThinkBigDiversity: Social Media Hacking Activities as Hybridized Mentoring Mechanisms for Underrepresented Minorities in STEM

In the spirit of "hack-a-thons" that build solutions to develop tools or fill gaps in knowledge, we leveraged resources from the National Science Foundation's Alliances for Graduate Education and the Professoriate (AGEP), NSF ADVANCE, and NSF Louis Stokes Alliance for Minority Participation's Bridge to the Doctorate (LSAMP-BD) programs to co-develop "hacking diversity in STEM" events for underrepresented minorities (URM) in STEM. These "hacking diversity" activities were carried out at the PROMISE AGEP's Summer Success Institute, an annual STEM conference, serving conference participants, as well as external viewers online. The events included "hacking challenges" and solicited responses to issues experienced by distinct levels of participants: incoming graduate students, continuing graduate students, postdocs, and faculty. The 2015 and 2016 hacking activities, resulted in thousands of responses across social media platforms, and our activity-specific hashtag was a trending topic. Assistance from the MIT Media Laboratory, and other national hackathons, influenced the activities' structure. The activities for students served as a hacking "intervention" to improve underrepresented graduate students' perception of community, and retention at both the course-level and dissertation stages. The sessions for postdoctoral fellows, faculty, and administrators looked at issues that hindered career advancement. The crowd-sourcing, dynamic activities engaged URM STEM mentors who served as coaches, in-person and online.

A content analysis of the student data showed broad themes including tackling student isolation, issues of time management, managing expectations of family members, understanding expectations of academic advisors, and success strategies for completing the dissertation. The sessions for faculty and professionals yielded suggestions for professional advancement, and solutions to issues affecting career-life balance. As an example, the career-life balance activity for women in engineering was carried out over Twitter with a 2-hour international discussion session online that preceded a two-hour in-person conference session at an engineering conference. This session with women in engineering as the lead coaches online, yielded the following themes: attention to stress triggers, ways to achieve balance, and professional efficiency. The most important outcomes were part of the in-person discussion that grew out of the online discussion two-hours prior, where Latina and African-American women engineers within positions of power discussed ways that they were challenging norms to develop new professional structures to improve strategies for younger women and others from other underrepresented minorities. These structures included developing career-development groups to work on materials to advance careers, influencing family leave policies, and deciding to verbally champion issues that affect students and peers in faculty and higher-level academic administrative meetings.

This paper will share ways that these structured social media hacking activities, designed for mentoring and coupled with in-person connections, have leveraged social science theories of sense of belonging and building cultural wealth. Further, these hybridized hacking activities, deliberately designed to mentor underrepresented minorities in STEM, access a virtual form of Oldenburg's (2001) "third place" which layers progress within the alternative space of the hacking activity (purposely located away from the academic institution). This paper will show results from content analysis of responses with our activity-specific #ThinkBigDiversity hashtag, and will suggest ways to develop similar, impactful activities to mentor and retain underrepresented minorities in STEM.

Background

The process of building cultural wealth in STEM fields involves leveraging support across multiple areas of the disciplinary community. Framing the hacking activity using Oldenburg's (2001) notion of "Third Place" creates an area in the STEM community where discussion of culture can thrive outside of normal disciplinary conventions, where too often culturally-meaningful STEM experiences are marginalized. During the hacking activity, discussion of culture was facilitated by cultural challenges experienced within STEM communities (i.e., doctoral programs, the postdoctoral experience, faculty, STEM professionals). The hacking activity served as an intervention by identifying cultural elements associated with these challenges and discussing strategies for addressing and successfully managing them. This process created opportunities for sustained programmatic support that allowed examination of participants' perceptions of cultural aspects that aligned with and supported their understanding of STEM disciplines (Felder, Parrish, Blockett, and Collier, 2016).

Yosso's (2005) cultural wealth model provides guidance for understanding cultural elements unique to STEM communities through six types of capital: aspirational, linguistic, familial, social, navigational, and resistance. While it's important to acknowledge that each type of capital may have been addressed on some level, *navigational capital* emerged as a recurring key theme among continuing graduate students, postdocs, and faculty at these activities. Navigational capital refers to skills and abilities to navigate "social institutions," including educational spaces. Yosso asserts that navigational capital can empower STEM communities to maneuver within unsupportive or hostile environments; perhaps known by Oldenburg (2001) as the "first or second places" (the home and institutional community). The building of navigational capital occurred through responses to key questions focused on an acknowledgement of challenges and an awareness of existing opportunities and resources within the STEM community available for support.

This work advances higher education research focused on transforming educational environments to support historically marginalized communities in academia where institutional

structures perpetuate legacies of exclusion (Harper & Hurtado (2007); Hurtado, Milem, Clayton-Pedersen & Allen, 1998; Museus & Jayakumar, 2012; Museus, Yi, & Saelua, 2017). Such legacies undervalue the positive influence of racial and cultural experiences of students; complicating their academic success, doctoral degree completion, and transition into the professoriate (Felder, Stevenson, Gasman, 2014; Felder, Parrish, Blockett, & Collier, 2016).

Social media hacking activities provide discipline-focused interactions within the context of STEM to facilitate strategies that improve educational outcomes for underrepresented students in the following areas: identifying and strengthening research, managing coursework and academic experiences, mentorship, productivity, collaboration, and establishing authority. Based on findings from the Council of Graduate School's national benchmark Doctoral Initiative Study on Minority Attrition and Completion, these activities are aligned with guidance regarding implications for practices designed to support underrepresented students by encouraging their engagement and participation (Okahana, Allum, Felder & Tull, 2016).

Hypothesis/Pilot

Based on the work of Oldenburg's (2001) "Third Place" (also known as "alternative space") and Yosso et. al's cultural wealth (2005), the hypothesis of our work is that the social media platform functions as a "third place," (virtual as it is), and that a level of meaningful mentoring can take place in that space. As an initial pilot to test the hypothesis, we developed a session with women in engineering in 2015 at an annual "WEPAN - Women in Engineering Proactive Network" conference, with collaborators from four universities from various regions of the country. Building on earlier collaborative NSF ADVANCE grant funded success around mentoring women in STEM, this panel aimed to showcase potential projects to support the career advancement of women of color in STEM through the creation of a Global Scholar's Network.

The literature suggests, participation in formal and informal mentoring networks is a critical mechanism through which individuals accumulate the global academic capital necessary for career advancement (Kram, 1988; Noe, 1988; Carvalho and Maus, 1996). Further, women faculty, often due to their underrepresentation, the resulting isolation, and gendered structural barriers, have less access to mentoring relationships than their male counterparts. Women of color faculty, as a result of racial and gendered barriers, are even less likely than women from majority groups to have access to domestic U.S. mentoring networks and the critical international mentoring networks necessary for advancement.

In our efforts to expand women of color's access to and participation in international mentoring networks for career advancement, we wanted to move beyond discussing the barriers and towards developing tangible actions that we could take to address these roadblocks for engagement. We learned from one of our collaborators, an assistant professor in computer

science, about how hackathons are used in the fields of computer science and engineering to harness collective energy to rapidly creative innovative prototypes. Like many other areas of computer science and engineering, women are underrepresented as participants in hackathons. Although there is little literature that exists that examines the culture of hackathons, anecdotally, on the Internet women cite feelings of constant security and/or gender stereotypes as reasons for their absence. While one of our projects worked to create more inclusive hacking spaces on the technical side, we also saw other opportunities for the hackathon model. Indeed, we were inspired by the collective energy and collaboration of these hacking events and the resulting technological breakthroughs. We saw potential for adapting this model to collectively and rapidly hack ideas that would break down the barriers preventing women of color in STEM from fostering the global mentoring relationships that are critical to career advancement.

Since we were not hacking prototypes, but rather ideas, we decided to name our adaptation as a "Big Think" and created a special hashtag, #ThinkBigDiversity. This hashtag captured perfectly what we were trying to accomplish--collectively hacking big, spontaneous ideas to broaden participation of women in international mentoring relationships. To pilot our initiative, we added an additional activity to the conclusion of our WEPAN panel. We asked the audience work in groups to hack solutions to the following "fill-in-the-blank" statement, "*Women from diverse groups can leverage opportunities for global engagement by*_____*."* We encouraged the audience to post the best solutions from their groups as responses via Twitter or our dedicated blog space, and then to vote on their favorite solution from other groups. Through this activity we not only created more energy in the room from our audience, transforming them into active and engaged change agents, but we were also able to broaden participation to individuals outside the women in engineering conference. Indeed, this activity allowed a global level of engagement in providing access to women of color in STEM to international mentoring relationships. Indeed, through the activity we were tapping into a collective wealth of information and perspectives to drive solutions to our problem. Following the success of the #ThinkBigDiversity hashtag at the women in engineering conference, we saw other opportunities channeling this energy into hacking solutions for broadening participation for underrepresented minority students in the STEM pathway to the professoriate.

Hackathons conjure up images of caffeinated male college students competing all night to prove their programming worth in order to snag that dream job at a dot-com startup. In reality, hackathons are a rapid and innovative way to create industry prototypes and are a promising tool for software engineering departments to foster internal and external collaborations (Raatikainen et al., 2013). On average, women, an underrepresented group in computer science and engineering only comprise 11% of participants in technical hackathons (Briscoe & Mulligan, 2014). Although there is little literature that exists examining the culture of hackathons, anecdotally, on the internet, women cite feelings of constant security and/or gender stereotypes as reasons for their absence.

In the pilot at the women in engineering conference, women discussed issues of career-life balance, and shared strategies for overcoming barriers to success. In addition to this event at the women in engineering conference, other hackathons in the Caribbean (SHILAC) and at Brown University (Hack@Brown), have had success with creating interdisciplinary, inclusive, and welcoming events that formed a basis for our experiments. After seeing that women could come together in a hybrid environment, in-person and online, to be peer mentors and solve problems via Twitter when coached, we wanted to use this method of an alternative space to create more cultural wealth online for the purpose of expanding the platform for mentoring.

Experiment/Method

To build upon the literature for cultural wealth and third spaces, and the pilot with a "hybrid" in-person and online peer mentoring session at the women in engineering conference, we developed a new experiment for this study that used crowdsourcing to capitalize on opportunities to engage people who would be at our next event, as well as people who would not be present, but could engage in the online volunteer activity. The event was the PROMISE AGEP Summer Success Institute (SSI), a graduate student conference that included three sets of stakeholders: new/incoming graduate students, continuing graduate students, and alumni at the postdoc, professional, and professoriate levels. We developed a hacking intervention to invite solutions for retention at the graduate student level, as well as at the postdoc and professional level. The same special hashtag that we used during the women in engineering conference, #ThinkBigDiversity, was used for our two day conference for graduate students. Our PROMISE SSI conference was held in August 2015, and the data used in this paper covers the two days. Over the course of the two days, we had more than 1000 tweets (including 518 top tweets) that utilized the special hashtag. We used the Keyhole social media analytics software package to gather and separate the tweets.

Participants in the two-day conference were separated into three groups, in three rooms, according to their levels of education for 90-minute "hybridized" mentoring challenge sessions. The three groups were as follows: 1) Challenge Area 1 - First Year/New/Incoming Graduate Students, 2) Challenge Area 2 - Continuing Graduate Students, and 3) Challenge Area 3- Postdocs, Professors, and Professionals. Each group had sets of "coaches" in their respective rooms to help them answer the questions that were posed by the challenges, displayed here in Tables 1, 2, and 3. Each group was given the same set of instructions. The instructions for group 1 is given as an example below, referring to Table 1:

> *Within your group, identify ONE of the challenges below. Part 1: You will tweet 1-2 issues and discussion points surrounding that ONE challenge. These are your QUESTIONS. Part 2: You will then identify 3-5 solutions or strategies, and tweet them. These are your ANSWERS. Protocol: Use the special hashtag in every Tweet. This is*

Group 1. Refer to every Question AND Answer using a "1" in the following format:
Q1.1 - Group 1, Discussions of issues/QUESTIONS related to Challenge 1: Time Management
Q1.4 - Group 1, Discussions of issues/QUESTIONS related to Challenge 4: Isolation
A1.1 - Group 1, Discussion of strategies/ANSWERS to Challenge 1: Time Management

Similar instructions were given to groups 2 and 3, except that their protocols used challenge identifier formats such as "Q2.x" for questions in group 2, and "A3.x" for answers in group 3. Groups were instructed to think about sets of both questions and answers that would accompany their challenges.

Table 1. Challenge area 1: Mitigating risks in the first year- eyes on the prize - First year/new/incoming graduate students.

Challenge	Description
1) Time Management	Graduate students have to balance research, courses, experiments, clients, subjects, and teaching. They also need self-care, attention to sleep and exercise, and those things that offer emotional or spiritual renewal.
2) Understanding your professors' expectations	Faculty expect students to follow their instructions, and want student to follow through with expectations that are explicitly stated. There are also expectations that aren't explicit, but students need to be aware of unwritten rules, silent cues, body language, and implications. Students should seek to understand issues that are related to the field, even if they aren't discussed in class. Professors expect that there will be an independent desire to learn more about the topic, above and beyond what may be taught. Students are expected to understand the research and historical context of the field, and be in the process of mastering the practice or techniques that define the lab or research group.
3) Differences between undergraduate coursework and graduate work	Students often joke that during their undergraduate years they could wait to study until the day before the exam, or write a 10 page paper overnight. Graduate school coursework requires a much more rigorous approach that necessitates depth of understanding of the theory, review of the literature, pilot experiments, and analysis of discussions. This process can take several days, which prohibits starting at the last minute.
4) Isolation	Graduate students often work alone due to shyness, discomfort with a

	group, or lack of invitation to join a group. Some students choose to work alone in an attempt to prove worthiness, without realizing that those around them regularly collaborate and share knowledge.
5) Expectations from family and obligations to the community	Graduate students, particularly those who don't have family members who went to college, often struggle with a guilt that comes from concern about being perceived as being part of the "bourgeoisie," or aspiring to be affluent while leaving others behind. Students can also struggle with the demands of family members who rely on them for financial stability or care-giving of others in the family (e.g., siblings, grandparent). Others face their own emotional needs to be at home more often, or their desires to make deeper and more frequent connections to the community and social justice needs of people in their neighborhoods.

Table 1 was used as a hacking activity for incoming/first year graduate students during the PROMISE SSI. The aim of this intervention activity was to bring attention to the risks students may encounter in their first year, in order to discuss solutions to mitigate them. Participants were instructed to identify one of the challenges, and tweet issues or discussion points related to it with the challenge identifier and the special hashtag.

The continuing graduate students were given the challenge area of "Getting it Done and Moving Forward!" with challenges and descriptions posed in Table 2. Their challenge sheets included the examples to follow, explaining the "Q2.x" and "A2.x" structure for the tweets:

> *Q2.1 - Group 2, Discussions of issues/QUESTIONS related to Challenge 1: Research area*
> *Q2.5 - Group 2, Discussions of issues/QUESTIONS related to Challenge 5: Organization*
> *A2.3 - Group 2, Discussion of strategies/ANSWERS to Challenge 3: Access to Mentors*

Table 2. Challenge area 2: Getting it done and moving forward! - Continuing graduate students.

Challenge	Description
1) Identifying, Strengthening your research area	Some graduate students struggle to identify their research areas or strengthen their research ideas. Consider the following questions: Why is this research area important to you, the field, and what are the potential societal benefits? Visualize what and where you would

	like to be in 5 years, and figure out what you need to do to get there. - You must set concrete academic/professional development goals: short-term (per semester), medium-term (1 or 2 years), long-term (4-5 years). Where would like to be in 5 years, and figure out what you need to do to get there.
2) Managing Coursework, Academic experiences	Graduate students should work toward being one step ahead of current assignments. Consider ways/opportunities to work with faculty members in your department on research/programmatic projects that align you're your research/career interests. They should participate in professional activities that are common for people who have completed their doctorate. - For example, do some peer reviewing, give conference talks, contribute chapters to books, demos, write or assist your advisor in writing grant proposals; take charge in planning a seminar, meeting, workshop within the department or outside; teach some classes in a course.
3) Access to Mentors	Some graduate students find that although there is a formal mentoring program in their department, they have not found it easy to access advice or help. Others report that there is not a formal mentoring program and they too do not find it easy to access advice or help. Identify 3-5 strategies for identifying mentors inside and outside of your program.
4) Building Research Productivity, Momentum	Graduate students may struggle with building their research agendas and developing productivity and/or momentum for moving their research forward. Managing, work, courses, research projects, and personal life can be challenging. Develop 3-5 strategies to facilitate productivity/momentum in building your research agenda.
5) Organization	Graduate students need to carefully organize the elements of their academic careers. This includes managing relationships (academic and personal), documents, resources, and time. One must pay attention to timelines and milestones that are set by the department.

The aim of the continuing graduate students' intervention activity was to bring attention to the challenges preventing students from progressing in their graduate work. Participants were instructed to identify one of the challenges, and tweet issues or discussion points related to it with the challenge identifier and the special hashtag.

The third group of postdocs, professors, and professionals had the task of thinking about how to consider the professoriate within one's lifetime. The instructions and samples for this group's "Q3.x" and "A3.x" structure was as follows:

> *Q3.1 - Group 3, Discussions of issues/QUESTIONS related to Challenge 1: Faculty Peer Mentors*
> *Q3.4 - Group 3, Discussions of issues/QUESTIONS related to Challenge 4: Collaboration*
> *A3.1 - Group 3, Discussion of strategies/ANSWERS to Challenge 1: Faculty Peer Mentors*

Table 3. Challenge area 3: Engaging as a professor in the academy within your lifetime - Postdocs, professors, and professionals (PP&P)

Challenge	Description
1) Faculty Peer Mentors	Although there may be a formal mentoring program in the department, some new faculty have not found it easy to access advice or help. Others report that there is not a formal mentoring program and they do not find it easy to access advice or help. Mentors can be lifelong, or short-term. Mentors for an academic career can be cultivated years in advance of applying for a position. Identify some strategies for identifying mentors inside and outside of your department/school. Who are your faculty aspirants?
2) Departmental Environment	Some new faculty report that some department members try to immediately bring them into longstanding, ongoing senior faculty tensions or conflicts. Newcomers are always uncomfortable about these efforts, because they recognize that their own best interest cannot be served by getting involved with interpersonal conflicts that did not involve them. But they worry about how to address these pressures without offending potentially powerful senior colleagues who are new to them.
3) Writing	Academic writing can be a difficult and lonely process. Junior faculty members must have regular feedback on their drafts from colleagues in their fields. It helps them not only develop and organize their thoughts, but also establish a productive and realistic writing schedule. At the same time, they are often reluctant to seek out feedback from busy senior colleagues.
4) Collaboration	Newly arrived faculty often struggle with making productive connections with collaborators. The new assistant professors are sometimes assigned to senior faculty who actually act as

	"gatekeepers," preventing connections, or who do not actively assist in creating connections. There is a pervasive sense among the junior faculty that their senior colleagues are too busy to assist with the interventions necessary for helping them launch successful collaborations.
5) Transitioning into an academic position after working in another sector	Money, career/life balance, and finding funding are among reasons why people say that they don't want to pursue a faculty career. Many professionals outside of academe later realize that they have to write grants in their current jobs, provide training seminars, and serve on committees – all of which are tasks that they thought that they were leaving behind by avoiding the professoriate. How can one begin to transition?

The aim of this intervention activity was to engage these professionals as professors in the academic environment. Participants were instructed to identify one of the challenges, and tweet issues or discussion points related to it with the challenge identifier and the special hashtag.

Results

While each group generated hundreds of tweets from the in-house activity, several participants who were not present in-person at the event participated using their respective twitter accounts, creating the hybrid event. There were more than one thousand tweets generated during the two conference days, however, the 518 "top" tweets were used for this study's content analysis.

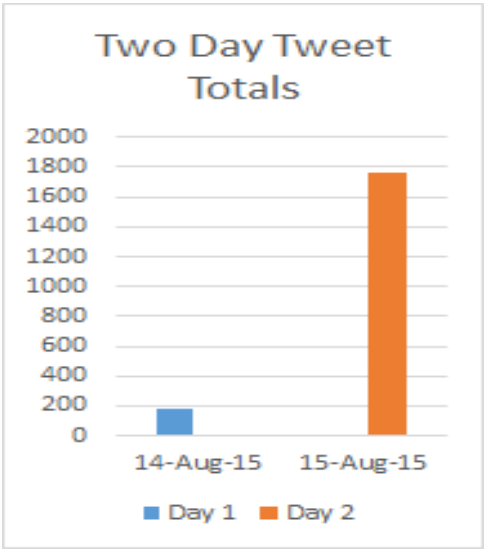

Figure 1. Total tweets with the hashtag #ThinkBigDiversity, generated over the course of the 2015 PROMISE Summer Success Institute, a 2-day conference.

Top Tweets are identified by an algorithm in Twitter that looks for relevance based on keywords, similarity, popularity, retweets, replies, and other factors. Figure 1 shows the total number of tweets for the two-day PROMISE Summer Success Institute (SSI) conference. The first day of the conference included an evening orientation program for speakers, and a session for a small number of advanced doctoral students. The second day of the conference is considered the primary day for activity, and the Twitter activity for the #ThinkBigDiversity hashtag garnered more than 1500 tweets, including re-tweets.

Tables 4, 5, and 6 show the results of the 518 distributed top tweets for each of the groups of stakeholders: incoming students, continuing students, and postdocs/professors/professionals (PP&P). The tables show the numbers of tweets per topic area, the likes, and the average number of followers reached by the tweets for the given topic, produced by our activity.

Table 4. Data for challenge area 1: first year/new/incoming graduate students.

	Total Tweets	**Total Likes**	**Avg. Followers**
Time Management	11 (44%)	24 (50%)	312
Understanding your professor's expectations	5 (20%)	6 (12.5%)	4
Differences between undergraduate coursework and graduate work	5 (20%)	6 (12.5%)	998
Isolation	3 (12%)	6 (12.5%)	154
Expectations from family and obligations to the community	1 (4%)	6 (12.5%)	353
GROUP TOTAL	25	48	

The group of First Year/New/Incoming Graduate Students produced 25 (4.8%) of the 518 top tweets data set. These responses generated 48 “likes” during the hacking activity. A basic analysis of the statistics for each challenge corresponding to the order of the challenge is shown in Table 4. The first topic, *Time Management*, had 11 corresponding tweets (44% of the group’s tweets) which received 24 likes, and was the most tweeted and liked sub-topic for group 1. The second challenge area for group 1, *Understanding Your Professors’ Expectations,* had 5 corresponding tweets (20%), and 6 corresponding likes. The third challenge, *Differences Between Undergraduate Coursework and Graduate Work* was tweeted 5 times (20%) and

received 6 likes. The fourth challenge, related to *Isolation* created 3 tweets (12%) and received 6 likes. The fifth, and final challenge for this group, *Expectations from Family and Obligations to the Community* created 1 tweet (4%) and generated 6 likes. This group engaged in an hour of oral conversation, and the coaches in the group reported that there was a great deal of in-person discussion for all of these topics. However, once the group began to use their electronic devices, there were certain topics that resonated with the group and resulted in tweet generation.

Time management appeared to be the most popular "tweeted" topic for group 1- the new/incoming students, with 44% of the total top tweets. A sub-theme within the topic of time management was organization. Many of the questions around time management centered on how to balance graduate school life with outside obligations. One tweeter posed the question, *"How does one balance getting a STEM degree with employment, having a social life along with your own personal life?"* Tweeted replies included, "Plan ahead of time use a schedule," while another participant posted, "Write down your schedule." Planning and writing are key to organizing one's time and ensuring new and continuing students are able to reach goals and keep their tasks in order.

The topics of "understanding professors' expectations" and "differences between undergraduate and graduate work" were tied as the second most popular topics in this challenge group, each comprising 20% of the tweets, or 40% total when tabulated together. Although they were parsed out as separate topics, they link together one theme --the importance of communication. One tweeter posted the following related to understanding professors' expectations: *"communicate with your professor as much as possible."* Regarding "differences between undergraduate and graduate work," one participant tweeted, *"...make sure prof knows your face, office hours are a must, talk to advisor."* The topic of isolation also fell into the sub-theme of communication. The graduate experience can often be a lonely journey and the few tweets related to this topic encouraged new students to engage with others and to reach out for support. The two questions related to seeking strategies for coping with isolation were met with supportive responses to seek opportunities to meet other diverse students.

"Expectations from family" and "obligations to the community" generated one answer tweet in the top tweets. There was no question related to this topic that was posted, but that did not take away from the impactful message to select the input from family and community members that would help students focus on positive relationships and support. The tweet from this subcategory encouraged new graduate students not to "feel guilty" for having high aspirations and to "stay in touch with family and close friends." Table 5 shows the "top tweet" results from the group of continuing graduate school.

Table 5. Data for challenge area 2: Continuing graduate students.

	Total Tweets	**Total Likes**	**Avg. Followers**
Identifying/Strengthening your research area	6 (4%)	12 (5%)	151
Managing Coursework/Academic Experiences	0 (0%)	0 (0%)	0
*Access to Mentors**	41 (30%)	56 (234%)	1358
Building Research Productivity/Momentum	86 (63%)	166 (70%)	154
Organization	3 (2%)	3 (1%)	288
GROUP TOTAL	136	236	

Table 5 shows that within the full 518 top tweet data set, the continuing/current students had 136 responses (26.3%). These tweets from group 2 generated 236 likes in the timespan of the hacking activity alone. The following information provides a breakdown of the statistics for each challenge corresponding to the questions for this group in Table 2 and the responses in Table 5. The first topic, "identifying a research area," had 6 corresponding tweets (4.4% of the group's tweets) and received 12 total likes. The second challenge, "managing coursework experiences" had no corresponding tweets, and thus no other data for this challenge can be reported. The third challenge, "accessing mentors" was tweeted 41 times (30.1%) and received 56 total likes. The fourth challenge, "building research momentum" received the greatest number of tweets and likes for this group at 86 (63.2%) and 166, respectively. The fifth, and last, challenge, "organization," received 3 tweets (2.2%) and an equal number of likes. The majority of tweets from the current graduate students were based on "building research productivity." Further, the average "like per tweet" was the greatest for the challenges focused on graduate research.

The topic of greatest interest to this group, with sixty-eight percent of their tweets, was research. Research-focused outputs culminated from the discussion on both "building a research topic" and "moving this topic forward to degree completion." The tweets from the first and fourth challenges overlap with each, highlighting that graduate student's momentum to complete their

research starts with the topic itself, and the student's personal connection to it. For example, a tweet from the first challenge asked *"How do you get started with your research and how do you maintain your momentum, especially with setbacks?"* highlighting the direct connection between all stages of graduate research. An example of the same connection from the fourth challenge stated, "*Use you intuition and pay attention to your interests when picking a topic."* Other tweets for building the research topic, focused on the resources that graduate student have to find inspiration for a research topic, such as reading journals and following scientific organizations. Other tweets corresponding to "building research momentum," included advice related to work-life balance, being organized, communicating with mentors and peers, developing a schedule, and celebrating milestones.

Assessing mentors was the second most popular topic for those in challenge group two, the continuing graduate students, comprising 31% of the activity and 24% of the follower popularity. Several of the questions posed by participants were connected to ways to find mentors, and how to have confidence when talking to mentors about research. One participant wrote, *"I have no black or Hispanic professors in my department. I want that connection."* This quote and other questions under the challenge support our claim that underrepresented minorities are seeking additional sources of mentorship during their graduate careers. The hacking activity using the #ThinkBigDiversity hashtag revealed that advice provided during this challenge came from both current STEM faculty and graduate student peers in an attempt to help graduate students with their desires for additional mentoring. The advice encouraged students to have confidence and curiosity when interacting with mentors, and generated 71% of the activity under this challenge.

The challenges of "managing coursework" and "organization' did not receive much attention from the participants within this group of continuing graduate students. The challenge on "managing coursework" had no corresponding output for this group. Speculation toward whether these students were still taking courses, or whether there is an assumption that academic courses represent an inherent strength of graduate students may explain why there was no interest shown for these topics during this conference. More data is required to confirm or deny these ideas. The challenge of organization did receive 3 brief tweets, which may also be the consequence of a lack of graduate student concern of their organization skills versus the concern of their research and mentorship.

The conference also featured a breakout session for participants who had already received the highest, advanced degrees in their field. This group, Postdocs, Professors, & Professionals (PP&P), answered questions for challenge area 3: Engaging as a professor during your lifetime. Table 6 shows that this PP&P group produced the fewest tweets within the 518 top tweets dataset. The importance of having faculty peer mentors yielded the most tweets (50% of the group's tweets). Attention to departmental environment and the "Transitioning into an academic position after working in another sector" challenges, did not receive any tweets, as the PP&P

group did not spend time discussing either topic. The third challenge area writing received 3 tweets (19%) and the fourth challenge area received 5 tweets (31%).

Table 6. Data for challenge area 3: Postdocs, professors, & professionals (PP&P)

	Total Tweets	**Total Likes**	**Avg. Followers**
1. Faculty Peer Mentors	8 (50%)	12 (63%)	540
2. Departmental Environment	0 (0%)	0 (0%)	0
3. Writing	3 (19%)	3 (16%)	1413
4. Collaboration	5 (31%)	4 (21%)	270
5. Transitioning into an academic position after working in another sector	0 (0%)	0 (0%)	0
Group Total	16	19	

Challenge area 3 presented the least amount of data for the hacking activity. Most of the participants in this group discussed their challenge topics orally, and did not use devices to record their answers. Most of the interaction in this group took place on paper, with responses recorded on paper and on post -it notes. Gathered data revealed that the topic of "faculty peer mentors" garnered the most tweets, receiving 50% of the total tweets for this group of participants. A question for this group included, "*How do underrepresented faculty members find mentors?*" In the same instance, participants also discussed finding mentorship when you are in an interdisciplinary field.

Collaboration was another theme that appeared within the few tweets that we received from this group of professors, postdocs, and professionals. Attention to this topic was based on having junior faculty in positions where they are in search of opportunities that can lead to publications, in an effort to assist with tenure and promotion requirements. Similarly, seeking opportunities for collaboration offers a sense of community and provides support.

Discussion

The hybridized online and in-person sessions demonstrated active engagement around a group of predetermined topics. The topics in the challenges were chosen to include both aspects of mentoring and cultural wealth. Behavioral changes, e.g., changes due to mentoring can potentially be delivered through social media. Behavioral change can happen in stages. If we

look at The Transtheoretical Model (Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992) as an example, it can be applied to this experiment as an integrative model that examines intentional behavior change, and progression through various stages of change. In addition to stages of change, there are cognitive and affective experiential processes such as "Consciousness Raising" (getting the facts) which occurred through the web and online channels. The hybridized platform provides an opportunity for behavioral processes such as "Self-Liberation" to occur, where commitments are made (Prochaska & Prochaska, 2011). The commitments are those such as strategies for time management (group 1), and building research productivity (group 2) The hybrid model with our specialized hashtag model considered the success of another hybrid "blogging" model that piloted with graduate students and faculty of color (Brown, Tull, Medina, Beadle-Holder, Medina, 2015), where a constructivist, hybrid approach was employed to stimulate participation, and the subsequent dissemination through online blogging and social media influenced thought processes and opened opportunities for the stages of preparation and action. The use of the hashtag through social media outlets to generate posts aimed at "consciousness-raising" can assist participants with moving through precontemplation, contemplation, and preparation stages of activities. In these cases, participants online can choose to passively agree, but build a presence, identity, and connections through social media sites such as Twitter. The PROMISE AGEP has also had engagement with the public through Instagram, another social media platform, where #ThinkBigDiversity has been used to connect graduate students to retention activities.

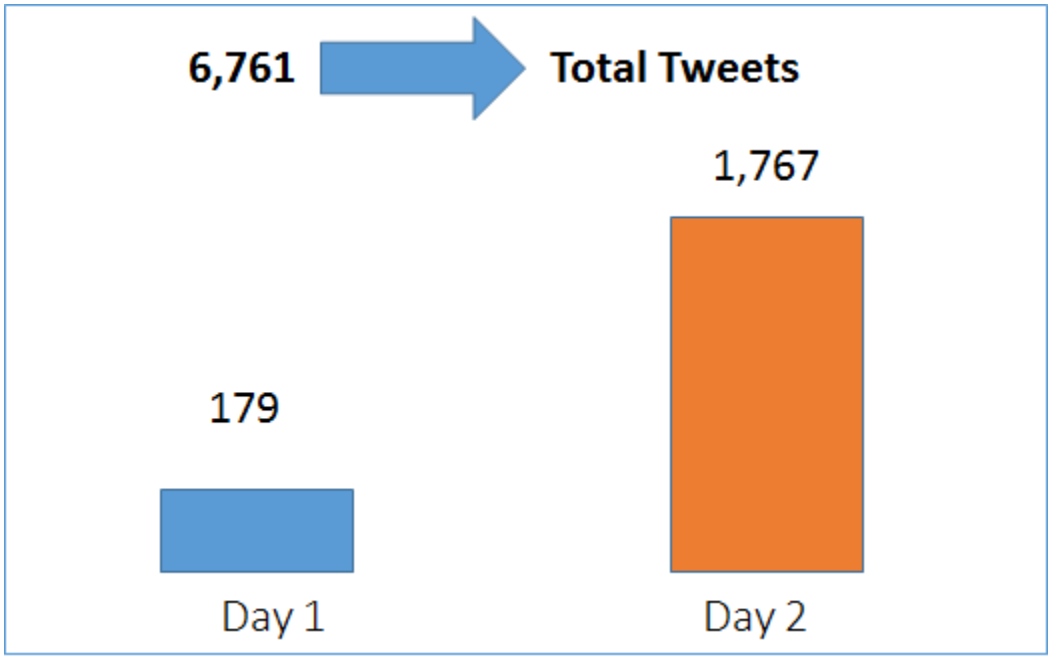

Figure 2: Total Tweets for the #ThinkBigDiversity hashtag, from June 2016 - March 2017, with the subset of the 2015 tweets from the 2-day PROMISE SSI/Conference.

#ThinkBigDiversity on Twitter has an online influence (reach of more 1.9 million) to further encourage retention and support by employing "Hashtagging activism" which can create extended communities, locate support, and build technical capital. Conversations on Twitter are vehicles for consciousness raising activities because the shared dissemination activity among participants can do the work of raising one's own consciousness, providing a way to be in dialogue with others engaged in similar pursuits (Gunn, 2015). The #ThinkBigDiversity hashtag is leveraging its social media experience to disseminate preparation and action through use of a technosocial platform, a method that has been shown to engage large audiences of STEM students (Tull, 2016; Tull, Hester, Lo, & Medina, 2016). It is a method that we recommend to other groups and programs that seek to develop varying levels of a psychological sense of community for their graduate students and underrepresented scholars.

Conclusion and Future Work

In conclusion, the use of a specialized hashtag to engage underrepresented scholars in STEM, provided a platform for discussion of important mentoring topics such as time management, building research productivity, and having peer mentors. The use of a hashtag provided the opportunity to present the mentoring challenges, tips, and strategies to both an internal audience participating in the in-person activities, and with an external audience of participants who were not present at the event. The activity provided opportunities for cultural wealth, including the comfort and openness afforded by the "third space." The social media platform provided participants with an opportunity to engage in self-reflection, solution-gathering, and peer-mentoring. These activities led to additional social media hybridized events in 2016 with plans for more in 2017 which will be examined for more in-depth mentoring advice, and reach potential. Navigational capital and aspirational capital are part of Yosso et. al's (2005) cultural wealth model, and this activity has coached underrepresented STEM scholars through ways to navigate their graduate school and career trajectories with success that can be shared with the public.

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