

## **Developing a National Research Agenda: A Data Collection and Community Engagement Model**

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Julie P. Martin, Ph.D. is an associate professor of Engineering and Science Education at Clemson University. Her research agenda has focused on diversity and inclusion in engineering education. In particular, her NSF-funded CAREER work has investigated how social relations—operationalized as social capital—influence student academic decisions and success, especially for underrepresented and underserved students. Her CAREER research supports the need for continued proactive outreach, educational and support systems that have the potential to form “resource-rich” networks in which students receive information and resources in routine exchanges. Dr. Martin’s current projects evolve her prior research on social and cultural capital away from a normative state that requires students to conform to the mainstream institution of engineering education in an effort to promote experiences and systems that affirm/are inclusive of people from diverse backgrounds. In addition to research, she is deeply interested in STEM education policy, and held a Science and Technology Policy Fellowship with the American Association for the Advancement of Science (AAAS) in 2012-2013. Dr. Martin has held a variety of national leadership positions during her decade-long involvement in ASEE and Women in Engineering ProActive Network (WEPAN). In 2016, she won the ASEE Educational Research and Methods Division Distinguished Service award.

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# **Developing a National Research Agenda: A Data Collection and Community Engagement Model**

## **Introduction**

This paper summarizes a recent effort to create a research agenda for an underdeveloped area of study in the scholarship of STEM higher education: The underrepresentation in engineering education of persons identifying as LGBTQ or disabled, as low-income or first generation college-goers (LIFG), or as veterans. While women and persons of color have routinely been the subjects of such studies, the experiences of the above-mentioned marginalized groups are still only rarely highlighted in STEM research. Through a meeting of around eighty researchers and practitioners, the authors sought to make the impediments to and value of such expanded research foci clear, and to outline specific directions such research might take. Above all, the organizers of this working conference, *Who's Not at the Table?: Building Research Capacity for Underserved Communities in Engineering* (NSF grant #EEC 1551605) that ran over one-and-a-half days in fall of 2016 at Clemson University, sought to support an open and iterative collective effort: To bring the voices of those concerned with such study into a systematic and productive encounter.

Part of this project centered on the selection of participants eager to reflect on the directions their research had taken and might take in the future, and to assure that a wide range of student and faculty subject-populations would be represented in our conversation. A focus on intersectional analyses, stressing the shifting and contingent nature of identity, meant that participants would be asked to consider the most fundamental features of their work and the conditions of “diversity” study and publication. We selected participants who seemed excited about such challenges. We also established an advisory board of individuals interested in these approaches and willing to lead the work of this group, and brought in an evaluator who would recognize our cross-subject concerns and iterative intentions. Both the content and structures of the meeting were intended to allow indeterminacy regarding identity categories; we sought to support open, intersectional conceptualizations including sexuality and ability, and LIFG or veteran statuses. Yet, we also made a priority of practical outcomes in the form of new research emphases and formats. In hopes of ongoing connections and collaborations following the meeting, we recognized identifiable next steps would need to be articulated. This paper captures both features of our work on this meeting as reflected in the exercises, pacing, and immediate outcomes of the meeting.

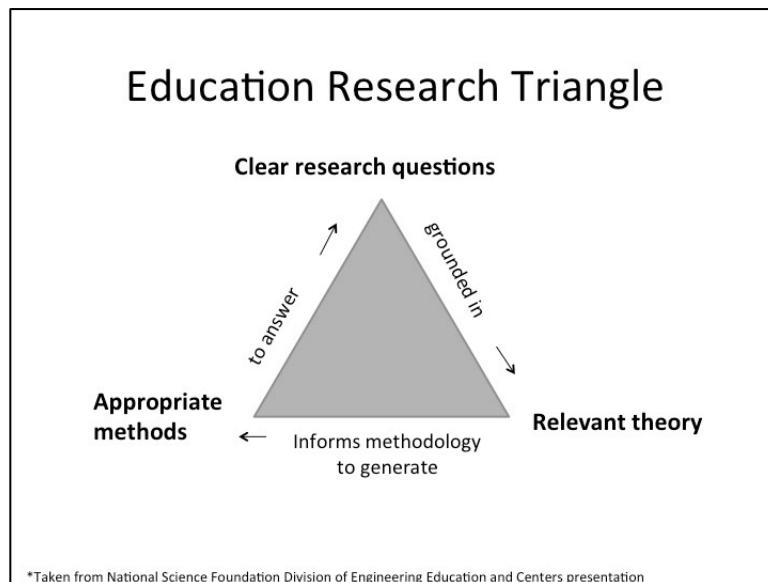
The remainder of this paper is structured as follows: first, we provide an overview of the model we developed to engage the community in developing a research agenda, then we outline how we developed and organized sessions of this working conference to collect necessary feedback (data), and finally we detail how we moved from collecting ideas and feedback from participants to engaging them in the analysis of this data as the first steps of the research agenda creation.

## Overview of model

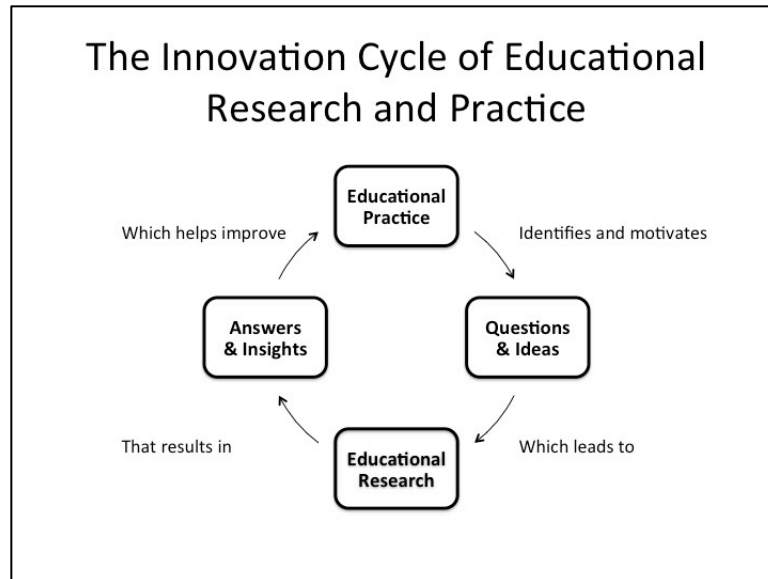
The working conference was constituted of a number of sessions shaped around exercises conducted as individuals, in small-groups format, and by the group as whole. We were pleased to note that many lively conversations occurred in planned breaks and social events we had included on the program, with shifting perspectives and new collaborations emerging for many of the participants along the way. In this paper, we report only on the formally structured aspects of the event. We developed five threads (themes); all components of the conference schedule (including pre-conference communication and during-conference activities) were aligned with these threads. The five threads were informed by the theory-methods-research questions triangle (figure 1) along with Booth, Colomb, and Williams's (2008) innovation cycle of educational research and practice (figure 2).

Conference threads:

1. What theories inform your work?
2. What research methods inform your work?
3. What research questions inform your work?
4. What educational practices or experiences inform your research?
5. What are the things you wish you knew to do your educational practice better?



**Figure 1.** The triangle conveys three key elements of educational research at each point: clear research questions, relevant theory and appropriate methods. These formed the first three conference threads.



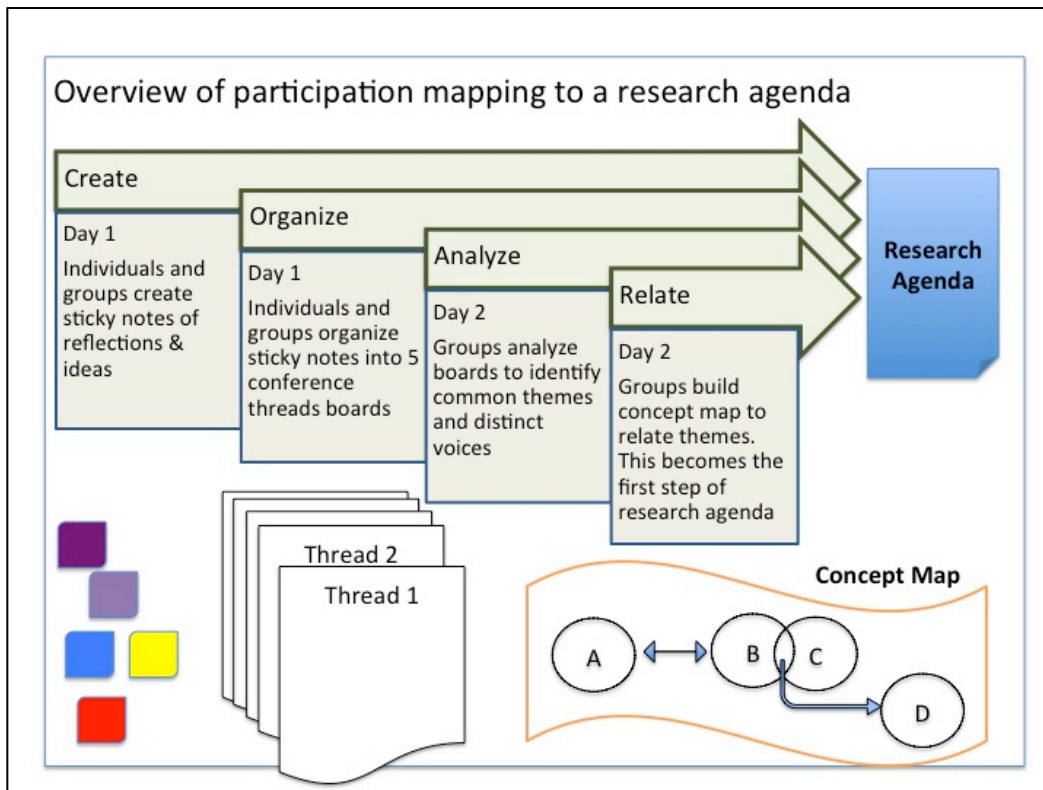
**Figure 2.** Educational practice identifies and motivates questions and ideas, which lead to education research. Educational research results in answers and insight that then help to improve educational practice. The connection between educational practice and research informed the final two conference threads. One can enter this cycle at any stage.

As a condition of attendance to the working conference, we as organizers required attendees to participate in directed discussions ahead of the event. We asked participants to engage with the five themes prior to the conference by contributing to online discussions devoted to each of the five questions using Slack.com as an online communication platform. Using the Slack.com platform, we established an individual online conversation (what Slack.com refers to as a “channel”) dedicated to each separate thread. We engaged our advisory board members in the online dialogues by designating one member as a “champion” of each online conference thread discussion. The organizers posted the thread question to its respective online discussion channel, and then the advisory board “champions” were responsible for monitoring the pre-conference feedback provided by the participants. Engaging participants in the five threads ahead of time helped assure that they came to the conference with some knowledge of how the conference would be organized, and were primed to contribute almost immediately

During the one and one-half day conference, we engaged participants in creating, organizing, analyzing and relating information relevant to the desired research agenda topic. We built a process that allowed them to contribute to the work of the first steps of building a research agenda. Throughout the event, we harnessed participants’ knowledge via (1) collecting data in the form of ideas and thoughts written on sticky notes, (2) collecting written report outs from small group discussions during each session on worksheets we provided to participants,

At the beginning of the conference, we provided participants with pads of sticky notes and hung large poster boards labeled “Thread 1: What theories inform your work?”, Thread 2: *What research methods inform your work?*, and so on, as well as additional uncategorized boards that did not reflect a specific thread. We hung a set of the boards on each wall of the event room and these boards remained posted during the entire first day.

The overview of our process is depicted in **Figure 3**. The process begins with the participants creating individual sticky notes reflecting a single idea, question, reaction, etc. that occurred to them during discussions. Participants would immediately adhere their sticky note to a poster board reflecting the thread the idea most closely related to. This process continued throughout all of the sessions on the first day and resulted in a large collection of participant-produced sticky notes at the end of Day 1. On day 2 the participants were given a subset of the sticky note collection and were asked to analyze the notes. The conference ended with participants working together to create concept maps that outlined relationships between the ideas reflected on the sticky notes.



**Figure 3.** Overview of the process of developing a research agenda using participant-produced ideas.

We began the conference by informing our participants about how their input would be incorporated into the creation of a national research agenda. We did this by displaying **Figure 3** and providing the following instructions to participants:

- There are four phases to our work: create, organize, analyze and relate. As you participate in each activity, you are helping us to get closer to developing the research agenda.
- Your active participation is essential to meeting our goal! Each and every idea you contribute will be used in the creation of the research agenda.
- On Day 1, individuals and groups will put their ideas and reflections on sticky notes—these are located in your packets and around the room. Please put only 1 idea per sticky note! Participants with visual

impairments can use electronic devices to record their ideas and a member of the conference team will transfer them to sticky notes.

- Once you have written an idea on a sticky note (or a number of ideas on a number of sticky notes), please post them on the poster boards located on each wall of the room labeled with each of the five conference threads: What theories inform work?, What research methods inform your work?, What research questions inform your work?, What educational practices or experiences inform your research?, What are the things you wish you knew to do your educational practice better?
- If you think your idea might fit under more than one of the conference threads, please make duplicates and post it more than once.
- Throughout Day 1, we will amass a large number of ideas on sticky notes during the sessions and reflection time built into the schedule.
- During Day 2, all participants will help begin the process of analyzing and relating the ideas by working in groups developing concept maps and creating reports describing themes found in the sticky-note data and as well as spotlighting distinct or individual voices

Thus far, we have outlined the general steps through which we moved our participants from idea generation to refinement and analysis. In the following section we have shared an outline of our conference's schedule. We acknowledge that our approach presented here is by no means the only method to successfully leverage the engagement of conference participants to develop a research agenda, but believe that other researchers planning similar events may desire a more detailed account of how we carefully structured conference sessions around the process presented here to engage participants, incorporated the pre-conference conversations into in-person dialogues, and encourage participant idea production throughout each session.

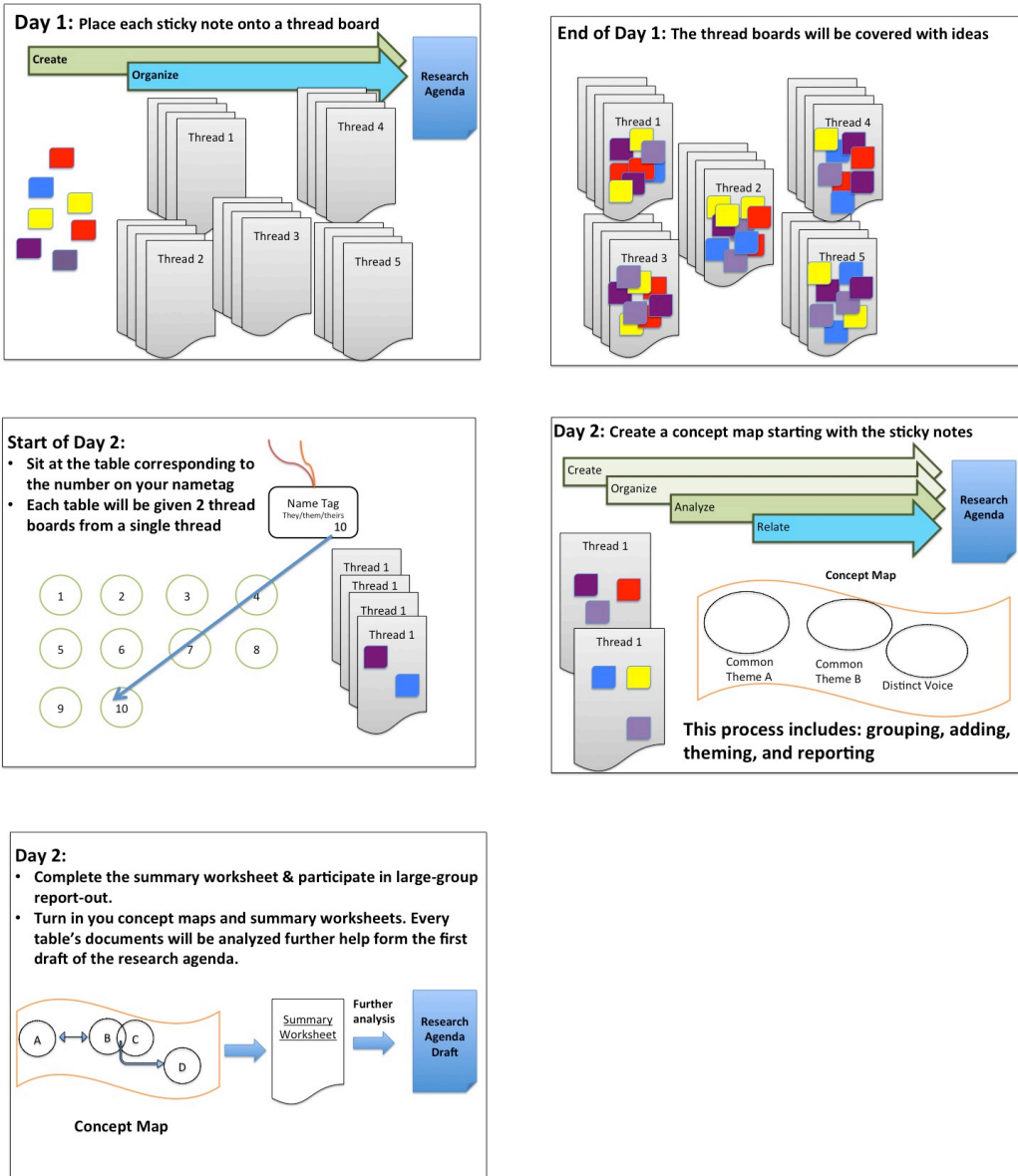
**Table 1.** Summary of conference schedule with brief description of session events.

Day 1		
Session 1	Welcome, conference norms, the importance of reflection and feedback	We started the conference by displaying Figure 3 in order to give participants a holistic perspective of the process and emphasize that each person's ideas were valuable to the creation of the draft research agenda.
Session 2	Backwards Brain Bicycle video	Next, we showed the group a closed-captioned video from Youtube: <a href="https://www.youtube.com/watch?v=MFzDaBzBIL0">https://www.youtube.com/watch?v=MFzDaBzBIL0</a> . The purpose of the video was to send a message to conference participants that during the next day and a half, we expected them to challenge their most familiar perceptions. The video suggests that such challenges may require support, but that both that effort and attempts to provide support can be very fruitful in the search for self-understanding. We also analyzed the video from anti-ableist perspectives, noting its attainments and shortcomings.
Session 3	Research-practice cycle and theory- methods- research questions triangle	We reminded the participants of the five conference threads by discussing the relationships among ideas in <b>Figure 1</b> and <b>Figure 2</b> .
Session 4	Panel of Champions: 5 Conference Threads	We used a panel session format in which the advisory board champions summarized the feedback participants had already contributed to each via the advance discussion of the five conference threads on Slack.com. We knew that all participants would not necessarily have something to add to all five Slack.com channels, so this panel discussion helped to orient the group to the larger conversation. Additionally, we asked each champion to add their own insight to the conversations that had occurred online prior to the conference.
Session 5	Conference Threads break out sessions	In order to allow participants to think deeper about a particular thread, we included breakout sessions, lead by the corresponding advisory board champion. We encouraged participants to consider options to contribute something they already knew to a discussion, or perhaps learn something new when selecting one breakout session to attend.
Session 6	Conference Threads large group report out	Advisory board champions (or another member of the breakout group) reported salient points from their discussion to the entire group in order for the entire group to put their own breakout session in context of the five themes.
Session 7	Reflection time	We intentionally built in time throughout the conference for personal reflection in order to allow participants to soak in the conversations, new information, and make connections between ideas.
Session 8	Small group activity: Craft a Proposal Title	We asked participants to work collaboratively with the others at their table to craft a proposal title for a research or implementation project related to our research agenda topic. We reminded them to use the threads of theories, methods, questions, practices, and experiential knowledge. The purpose of the activity was to incite a focused intellectual effort while also freeing participants from familiar constraints, such as the conventions of "appropriate" research scale, scope, format, or language, and from any deference to existing scholarship. We instructed participants to ignore any concerns about budget, disciplinary fit, and experimental design and instead challenge the normally unrecognized limits to research. We intended for this

		to be a playful exercise that nonetheless revealed the rarely acknowledged conditions of research.
Session 9	Large group report out: Craft a Proposal Title	The groups reported their ideas to the larger group.
Session 10	Poster session & reflection time	Prior to the event, we requested that each participant create a mini (small format) poster following a template that we provided. We instructed participants to use the poster to answer prompts about their own research interests, desired collaborations, and other information that would assist with networking with other participants during this highly interactive session. We organized the session in three, 30-minute parts and assigned participants to locate near their posters during the 30-minute block that corresponded the first letter of their last name. We encouraged individual reflection before and after the event by specifically allotting time in the conference schedule.
Day 2		
Session 11	Data Analysis & Concept Mapping small group activity	Our goal for Day 2 was to engage participants in beginning the process of analyzing and relating concepts that would contribute to our research agenda. We accomplished this through a small group (6-8 people) exercise, which is depicted in Figure 4 and explained in the accompanying text. Prior to the meeting, we assigned each participant to a table number with the intention of creating groups with diverse perspectives; we included the table assignments on participant nametags.
Session 12	Data Analysis & Concept Mapping: report out to large groups	We used the report-out time allotted for small groups to talk about their concept mapping experience and results to observe commonalities and differences in group experiences, make connections across ideas, and ensure that uncommon or divergent ideas were included in the larger discussion along with the more common, recurrent themes.
Session 13	Pulling it All Together	This overview of the previous day and a half framed the groups' epistemic and institutional innovations developed over the course of the meeting. Amy Slaton summarized unexpected approaches to familiar research techniques that had come to light at the conference as well as major reconceptualizations of what might constitute (and who might best evaluate) rigorous, inclusive STEM education research.
Session 14	Electronic evaluations	We built time into the schedule for our conference evaluator to give electronic evaluations before participants departed. We asked participants to bring an electronic device to this session so that they would be able to fill out the evaluation in the conference room.



## Building Blocks for Creating a Research Agenda



**Figure 4.** Our process for creating a collaborative research agenda, images can be seen in greater detail in the appendix.

The goal of the activity on Day 2 was for groups of participants to develop a concept map using the data collected throughout Day 1. Before the conference, we pre-assigned individuals to work together as small groups of 6-8 people on Day 2 in order to maximize diverse thoughts and perspectives. At the beginning of the second day we instructed participants to go their pre-assigned table number listed on their nametag. Each group (i.e. each table) was then given two poster boards corresponding to one of the five threads filled with sticky notes created on Day 1. We also provided each table with a large sheet of butcher paper on which the group could physically rearrange and organize the sticky notes, draw visual connections, and make notes to record their concept maps. To move from having many, many ideas contributed by conference participants to a concept map created by each team, we gave the following assignment:

- Assign a scribe, a reader, and a time-keeper for your group.
- You are tasked with helping to begin the analysis of the data collected from conference participants.
- Your “data” consists of multiple sticky notes containing ideas and reflections recorded by participants on Day 1. Your concept map may include themes and distinct voices that are not necessarily related to each other. Or, you may find that they are related and wish to draw lines or another indicator of how they are related. You will explain these relations (if any) in your summary worksheet.
- You will then use the concept maps to develop themes from your concept map and report out.

In order to provide some structure to this potentially amorphous exercise, we made suggestions for how each group may want to spend their time creating their concept map. Some groups used these to frame their task, while others developed alternative or emergent methods for creating a concept map. Our suggestions were as follows:

- Grouping ( $\approx 20$  min)— The reader will read aloud the content on sticky notes you have been assigned. Discuss how to group sticky notes into “like” concepts. Move sticky notes so that like ideas share the same physical space. Your concept map is starting to form! Be sure not to lose individual ideas or “invisible” voices in the process of mapping— everything is significant, and it’s important not to lose these ideas as you go.
- Adding ( $\approx 10$  min)— Spend 10 minutes individually adding additional elements to the groupings your table just created. Ask yourself: Now that I see how concepts are developing into themes, what is missing?
- Theming ( $\approx 15$  min)—Develop names for the themes or categories that are emerging in your concept map. Decide if and how the themes are related to one another.
- Reporting ( $\approx 15$  min)—As a group, decide what you will report out in the next session. The scribe will record the group’s ideas. Ask for one person at your table to serve as the reporter during the next session when each group will summarize their report to the large group.

At the end of the exercise, each table reported out about their concept map. We have included copies of the handouts we created to guide participants in this process to both create and summarize their concept maps in the appendix of this paper, and will make them available for download free-of-charge online (website under construction). As facilitators, we pointed out commonalities and differences between the concept maps and wove them together during the report-out session. To end the conference, Amy summarized her observations of the event and the work the group had accomplished (Session 13). The summary suggested how the questions, suggestions and concerns that emerged at the conference might line up with conventional STEM research practices, and whether change along such lines seemed likely. It reflected on institutional, funding and larger cultural conditions in which STEM research is undertaken and the position of our findings within those.

We collected all the concept maps and the summary worksheets from each group. These are currently driving the remainder of our analysis process, from which we are drafting the research agenda. We plan to share drafts of the research agenda with participants who indicated they would like to read, comment on, and/or contribute to the resulting research agenda.

#### Participant Assessment of The Conference

In this paper we have presented a model for engaging the research community to leverage their collective knowledge and experience in the development of a national research agenda through a workshop or conference. We now demonstrate the participants' perceptions of the effectiveness of this model by offering an overview of the feedback we collected from our participants after the event.

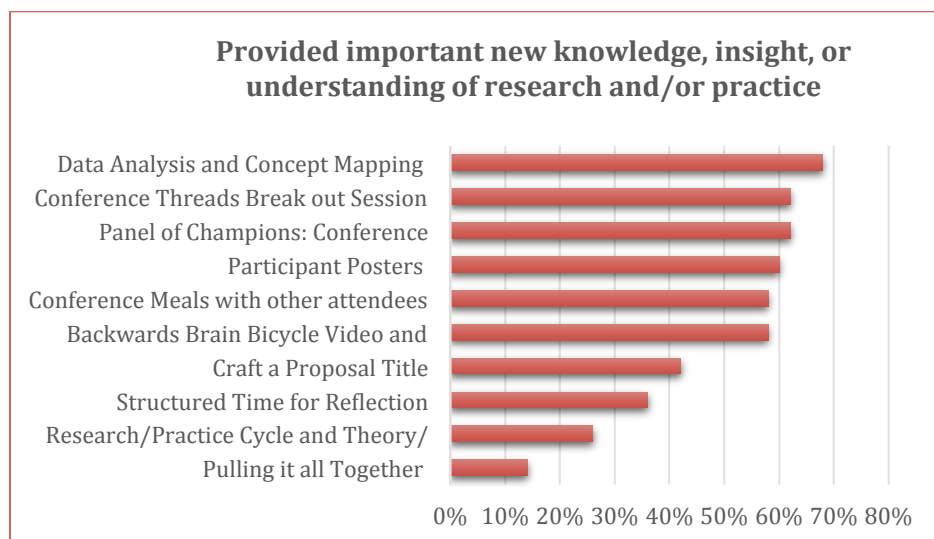
A key dimension of this model is intentional reflection and evaluation on the part of the organizers as well as the participants. Internal and external evaluation was interwoven into each stage of our event, particularly while choices were made about the focus, structure, and content of our sessions as they were carefully crafted to help us and our participants co-construct the initial framework for a national research agenda on broadening the participation of underrepresented populations in engineering.

A major goal of our event was to create an environment and culture where all participants felt encouraged to share their insights and felt that their contributions were valued. Many components of our model were intentionally designed to incorporate and value all input equally; the data created by the participants was elicited and analyzed in a way that communicated to them that all input was welcome and valuable. For example, participants created sticky notes of their ideas anonymously – they did not include their name or indicate their professional background. This placed focus on the ideas themselves rather than on the credentials of creator of the sticky note thus communicating that we the organizers saw the input of our fellow researchers, practitioners, administrators, etc. as all being equally legitimate. We also presented and spoke of each conference thread with equal weight so that one type of knowledge or

experience was not given preference over another (i.e. ideas related to practice were treated the same as those related to theory).

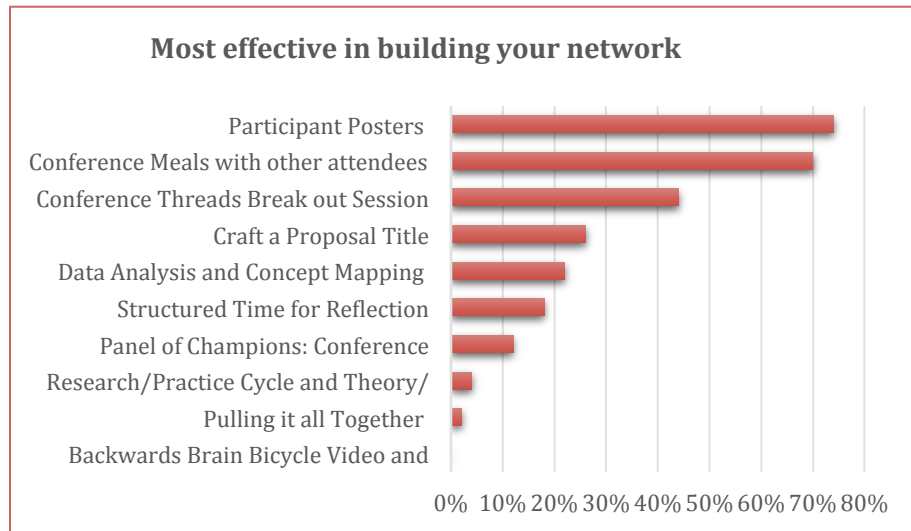
It was important to us to assess the extent to which our participants felt that the conference process we created was inclusive, valuable, and allowed them to contribute their own diverse ideas. These goals are reflected in the evaluation questions we posed to participants. To assess whether our conference model and structure assisted or impeded our goals the evaluator asked questions related to (a) extent to which individual sessions provided opportunity for contributions to conference goals (b) extent to which individual sessions affirmed the value of participants' input (c) extent to which individual sessions provided new knowledge, insight or understanding for the participant (d) overall session impact. Below, we present our participants' feedback to these four questions.

At the end of the conference, our external evaluator administered online surveys to collect data from participants about their experience in the conference and the value they believed each session had with respect to effectively contributing to the research agenda. The evaluator asked participants to share their opinions on the conference sessions by indicating the name of a specific session or sessions(s) in which they gained important new knowledge, insight, or understanding of research and/or practice in broadening participation in engineering (Woodruff & Li, 2017). As Figure 5 indicates, the largest percentage of participants felt that the culminating sessions, Data Analysis and Concept Mapping, contributed to their new knowledge. The Conference Threads Breakout Session and Panel of Champions were also selected by a large percentage of participants. These evaluations lead us to believe that the way in which we designed various sessions to build off one another was successful. Furthermore, it is important to note the large percentages of participants who responded that the participant poster session and meals helped them gain new knowledge, insight and understanding; this result affirms our decision to build in these less structured times for participants to interact with one another.



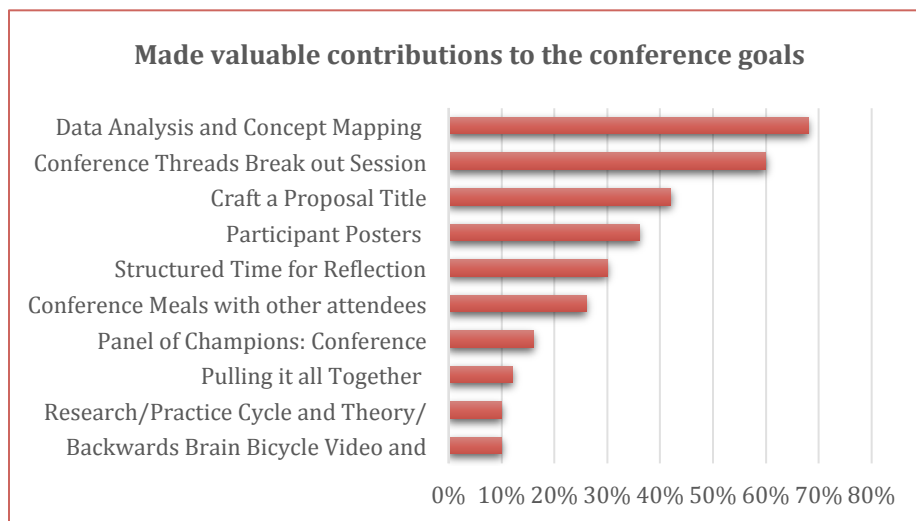
**Figure 5.** Displayed are participant evaluations of specific conference sessions as contributing to gains in new knowledge or understanding.

The evaluations regarding the sessions that participants felt were most effective in building their network (figure 6) follow a similar trend, with the most interactive and least structured agenda items being indicated as contributing the most to building participants' networks. The sessions where the organizers were presenting to participants were indicated the least often on this measure.



**Figure 6.** Displayed are participant evaluations of specific conference sessions as contributing to expansion or creation of networks with other attendees.

Our evaluator also asked participants to identify a session or session(s) in which they made valuable contributions to the conference goals. A majority of participants indicated that they contributed significantly to conference goals via their participation in the data analysis and concept mapping session and during the conference thread break out sessions, as seen in Figure 7.



**Figure 7.** Displayed are participant evaluations of specific conference sessions in which they felt they made valuable contributions to the conference goals.

Taken together, these evaluation results, along with others, indicate that the interactive nature of the working conference successfully engaged the community in a way that will give ownership of the resulting research agenda to a community rather than to a small group of individuals.

### **Future work and plans for dissemination**

The model outlined in this paper offers the research community one approach to engaging others in meaningful ways to develop a national research agenda. In this paper, we have offered a process that begins with community discussions guided by key questions related to the research foci, leveraged individual ideas generated by a diverse range of research/practice experts, and progresses to participant-driven analyses of these ideas as the beginning steps of developing a national research agenda.

We hope that readers find our model, handouts, session schedule, and participant feedback discussion to be helpful in their own efforts to develop national research agendas in other areas. In this paper, we outlined steps we took to engage our participants before and during the event – including the handouts we developed to guide and document participant activities. In the coming months, products of our event will include conference proceedings, a preliminary research agenda that we will again engage researchers in for feedback to review and revise our draft research agenda, as well as our final national research agenda on broadening the participation in engineering education of persons identifying as LGBTQ or disabled, as low-income or first generation college-goers, or as veterans.

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