

BOARD # 360: EDU Core—Engineering Systems Change for Equity: A Focus on Change Processes

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Knitting the knitters: Building and sustaining leadership teams for equity-oriented institutional change

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In recent decades, there has been increasing interest in systems change as a means to accomplish important improvements in the quality, inclusiveness, and equity of outcomes in science and engineering higher education [1]-[3]. This emphasis on systems change recognizes the limitations of change efforts that solely target individuals as the nexus of change. For example, instructors seeking to improve student outcomes in critical STEM courses or majors can apply research-based instructional strategies shown to lead to stronger learning and persistence [4], [5]. Yet, while professional development programs can help individual instructors to plan and implement significant changes to their teaching (e.g., [6]), the changes these instructors can make may be limited by systemic factors, such as scheduling, classroom spaces, and collegial expectations for content “coverage” [7], [8]. Moreover, when such changes are made by individuals acting on their own, the population of students benefitting from such changes is limited to those enrolled in a small subset of courses. Indeed, uneven use of research-based teaching across sections can introduce new inequities into learning and assessment opportunities. Similarly, efforts to increase the representation of women in academic STEM by supporting individuals’ career development with grants or workshops may assist individual women scholars, but do little to address the entrenched structural and cultural barriers that women face in the academy [9], [10].

In response, many have turned to systemic approaches that directly address root causes of the issue and place the onus to change on the organizational unit—an institution, department, or college. For example, public and private funders have developed programs to support efforts to tackle challenging STEM education problems at the systems level. Examples from the National Science Foundation (NSF) include ADVANCE, addressing gender equity on STEM faculties [11], WIDER (Widening Implementation and Demonstration of Evidence-based Reforms) program, and Institutional and Community Transformation efforts within Improving Undergraduate STEM Education (IUSE). From the private sector, examples include Inclusive Excellence, formerly supported by the Howard Hughes Medical Institute, to make undergraduate STEM education more inclusive, and the American Association for the Advancement of Science's STEM Equity Achievement Change program, SEA Change. In engineering education, systems change approaches have been fostered by lessons learned about change from the NSF-funded Engineering Education Coalitions of the 1990s and early 2000s [12], and, more recently, by NSF’s Revolutionizing Engineering Departments (RED) program, with its clear and explicit focus on organizational and cultural change. Many of these programs emphasize the need to improve experiences and strengthen outcomes with particular attention to intersectional equity for groups who have been historically underserved in STEM education, including women, people from racial and ethnic minority groups, disabled people, queer people, and other groups.

When we interact with STEM practitioners working on these projects, however, we find great interest in these approaches but a relative lack of knowledge of how to go about such systems change. Motivated by these experiences and grounded in our prior study of ADVANCE projects [13], [14], we are conducting research about processes of institutional change in higher education. The study will contribute new scholarly knowledge about institutional change efforts, especially those seeking to increase equity in STEM learning and careers, and will also offer research-based advice to people leading change projects along the lines of those listed above.

A Systems Approach to Change

Most often, a systems change approach involves not one activity or intervention, but a portfolio of interventions, each acting as a lever for change at one or more levels of the institution. In past work, we documented the nature, variations, and outcomes of specific interventions [13], [14]. In that work, we also noticed that change projects seemed to demonstrate increased coherence and impact when these levers worked together. To explore this apparent synergy, our current study examines strategic processes that help to connect individual interventions and amplify the overall coherence and impact of systems change projects. We call these “scaffolding processes” to recognize their role in supporting, strengthening and connecting interventions. They interact with, but are distinct from, the interventions themselves. Our study seeks to make these often-unseen processes explicit, to provide better understanding of their role in change projects, and to help change teams identify and leverage them.

We also recognize that institutional systems have similarities but are not universal; they depend on the institution’s mission, history, location, culture, and internal organization, and on its relationships and positioning within larger state, regional or national ecosystems. Thus, there is no simple set of steps or strategies that can be followed without regard for nuances of the institutional context. Rather, our study aims to characterize scaffolding processes and their importance, so that leaders can adapt and enact them in their own institutional setting.

Drawing from our study, we present initial findings about one such strategic process: building and sustaining a change leadership team. We consider issues of recruiting and attracting team members, dividing efforts across team members while ensuring accountability, working in ways that “walk the [equity] talk,” and developing leaders who serve as organizational catalysts as they enact the project’s interventions. The leadership team members become knitters of the change project as they become intertwined through their work; metaphorically, they weave themselves as change leaders into a single fabric. For this analysis, we focus on a subset of research questions related to building and sustaining a change leadership team:

1. What characteristics and capacities are important to consider when developing a leadership team for an equity-directed institutional change project?
2. What do change teams do to integrate individual members and become a cognitively complex team?
3. How does the specific process of building the change team support the change project?

Conceptual frameworks

Prior scholarship has recognized the importance of a systems approach to transformational organizational change in complex institutions such as universities and colleges, where issues cut across multiple organizational levels and multiple subcultures that vary across levels and units [14]-[19]. Such an approach requires the use of not a single tactic or intervention, but rather a suite of interlinked interventions that influence multiple levels of the institution and that address both structures and cultures. By ‘structures,’ we mean organizing features such as policies, procedures, roles, and workflows that determine how decisions are made. By ‘cultures,’ we mean sets of formal and informal norms, values, and conventions that shape how people interact, what is valued, and what behaviors are expected or disapproved.

In addition to this body of theory about organizational systems, we draw on the work of scholars such as Acker [20], [21], Bird [22] and Ely and Myerson [23], who show how institutional structures give rise to intersectional inequalities. For example, implicit bias [24] influences evaluations of faculty performance, and is embedded in processes for hiring, retaining, and promoting faculty, selecting people for leadership roles, and rewarding them with awards, titles, and money. To interrupt bias in such evaluative structures may require changing procedures, creating and promulgating new policies, educating people, revising patterns of language and behavior, and developing new accountability structures [14]. Intersectionality theory [25] orients us toward attention to the multiple and overlapping (or “intersecting”) identities through which individuals experience academic life, including experiences of oppression. That is, while our primary analytical lens is gender, we bring into focus through our research questions and methods the recognition that “...gender by itself is insufficient to determine either a superordinate or subordinate position” [26], and instead must be complicated by interlocking axes of identity such as race, ethnicity, dis/ability, nationality, and others. Returning to the example of evaluating faculty performance, typical institutional evaluative structures implicate gender oppression (i.e., sexism) simultaneously with other forms of oppression and privilege.

For this analysis in particular, we are informed by prior scholarship about leadership and leadership teams in higher education. In their review of literature, Lester and Kezar [27] point out that, for decades, the work on leadership in higher education has focused on individuals who hold formal positions of leadership. This approach to leadership is hierarchical, often sees these individual leaders as heroic, and emphasizes authority as based in a formal institutional position. However, in recent years, these authors note, interest has increased in approaches to leadership, often called shared leadership, that emphasize involving a wider group of stakeholders to enhance problem-solving and creativity. Building on this growing interest in shared leadership, Bensimon and Neumann [28] studied presidential leadership teams, consisting of senior-level administrators appointed and convened to advise and engage with institutional presidents in decision making. They asserted that such team-based leadership is especially relevant and effective in higher education where shared governance and faculty autonomy are embedded in

institutional culture. They note that these teams are generally understood as advisory bodies to presidents, “not necessarily as agents of change” (p. 106).

In their own study of leadership, by contrast, Lester and Kezar [27], [29] focus on what they call “grassroots” leadership teams, which they define as groups that emerge from the grassroots level of the institution, sharing a common goal and vision. Typically, these grassroots teams are comprised of faculty and staff, without administrative influence or formal leadership appointment or authority, but who come together over their shared interests [29]. Further, they specify, for grassroots teams, “their active engagement in working together to build a team identity... separates a team from a collective or network” [27].

We share the growing interest in leadership teams in higher education, and we are informed by both the work of Bensimon and Neumann [28] and Lester and Kezar [27], [29]. However, our work focuses on leadership that is distinct from either presidentially appointed teams contributing to formal institutional leadership processes or grassroots teams operating from the ground up but without any formal authority or administrative platform. We have observed that leadership teams handling institutional change projects (especially those with a focus on equity and inclusion) typically involve some combination of individuals with formal positional leadership and those without such roles but with grassroots experience and credibility. Also, leadership teams managing change projects often have some approval or imprimatur from senior-level leaders, while also having grassroots interest within the institution in advancing the change goals. Recognizing these differences from other types of leadership teams, we are interested in these equity-focused change teams as a unique form of higher education leadership teams. We concur with Lester and Kezar’s view of leadership as socially constructed, where all team members contribute and have their own experiences of the team’s work, even as they develop a team culture with norms, values, and shared understandings that shape their work. Thus, in our study, we are interested in the nature of these change teams as unique entities, and in their social interactions with each other and with their institutional constituencies.

To guide our analysis of this unique type of leadership team, like Lester and Kezar, we draw in particular on Bensimon and Neumann’s [28] conceptualization of the functions of university presidential teams. In analyzing how presidents make decisions with support from their leadership teams, Bensimon and Neumann identified three types of team functions: utilitarian, cognitive, and expressive. These authors considered teams that enact all three functions to be cognitively complex, “real” (not illusory) teams whose functions went beyond mere information delivery (see also [30]). Briefly, the *utilitarian* function is how the core work is accomplished—necessary jobs are done, decisions are made and coordinated. The *cognitive* function takes advantage of the team as a social group of thinking people, who by working together expand the range of available ideas and perspectives that can be applied when defining problems, crafting and evaluating possible solutions, and responding to crises. On presidential teams, the *expressive* function involves providing mutual support, offering counsel, and reflecting campus perspectives so that the president understands how others see them. Here we adapt Bensimon and Neumann’s

functions to center on the change project itself instead of on a singular leader; thus, the expressive function includes work to refine and articulate the project messaging, communicate with stakeholders, find common cause with other organizational allies, and manage resistance to the project or its goals. Providing mutual support among the change team members is still important, especially in the face of resistance. In Table 1 we generalize their language so that it applies to change project teams.

Table 1: Three functions of change teams (adapted from [28]; [27])

Function	Characteristics	Activities
Utilitarian function	Task-oriented	Deliver information, coordinate, plan, run programs, make decisions
Cognitive function	Sense-making, creative, innovative	Ideate, question, challenge, evaluate, learn
Expressive function	Connective, supportive, symbolic, story-telling	Reinforce group connection, articulate message, provide support & counsel

Finally, we draw on prior work about feminist academic leadership in service of institutional equity goals. Research has documented how feminist leaders in particular center concerns about equity, inclusivity, and intersectional social justice in their values, practices, professional goals and interactions [31]. They “walk the talk” through enacted values of transparency, collaboration, inclusivity, empowerment of others, and attention to power. In so doing, they often focus on process as much as outcomes, ensuring that they live out their personal commitments to equity in their leadership roles and concomitant decisions. In these ways, we suggest, feminist-oriented change teams may enact the cognitive and, especially, the expressive functions of teams (Table 1) as they engage in specific organizational change activities.

Research Methods

To develop this knowledge, we draw on the expertise of change leaders and their collective experience in driving institutional change in STEM higher education. We use established qualitative methods of data gathering and analysis, adapted for the specific focus of our study. Our study sample is comprised of institutional change projects, especially those engaging in equity-directed change projects, each represented by leaders and core participants in those change efforts. While we began this line of research with a focus on change projects to foster gender equity on STEM faculties, funded by NSF ADVANCE Institutional Transformation awards, we have broadened our study sample to include examples of similar efforts supported by ADVANCE Adaptation awards and also STEM education change projects, typically supported by NSF IUSE awards, that have different change goals but comparable scope and complexity. These projects are long, typically 5-7 years with grant support, and often some years in the making even before a grant proposal is funded. With aims to improve equity in experiences and

outcomes in STEM and supported by STEM-focused funders, their change goals encompass multiple STEM departments or colleges, but many also seek change across the institution as a whole, aided by the support of senior institutional leaders and contributions of institutional resources. The study design and procedures were approved by the Institutional Review Boards for all three institutions where the investigators are located.

We gather several types of data about these projects. To start, we built background understanding by gathering documents about specific change projects, such as project websites, reports and publications, augmented by sources shared by project leaders. When these documents were rich and complete enough to build a coherent picture of the project, we developed a project summary in a template form that allowed us to compare across projects and select some for deeper study.

We then drew on focus group and workshop methods in developing our primary method of data collection, which we call Structured Expert Enquiry Dialogues or SEEDs [15], [32]. SEEDs emphasize structured dialogue between our research team and a group of carefully selected experienced change leaders and observers, and draw on participants' expertise about their own change work and institutional contexts. Through a collaborative enquiry process, we generate insights that are useful to us as researchers and to project team members as change agents.

We have conducted two types of SEEDs, which differ in the focus of the discussion and the people gathered for the SEED. Campus SEEDs involve a group of 4-7 people who have worked together on a change project at a particular institution, and these SEED sessions focus on one team's work on their own project. A typical Campus SEED included a principal investigator (PI) or project director, co-PIs or other leaders from the faculty or administration, an evaluator or researcher, and a project coordinator (in general, we refer to all of these people as 'leaders' unless it is important to specify their individual role). Topical SEEDs involve 3-5 people from different change projects or roles (scholars, PIs, evaluators), who together focus on a particular scaffolding process, such as using data strategically, forming strategic alliances, or building a change leadership team. Some Topical SEEDs included people from ADVANCE projects pursuing gender equity on STEM faculties, and others included people from STEM education projects with goals to improve STEM instruction and student success. For all SEED groups, we provided prompts in advance to help participants reflect and generate examples to illustrate their knowledge. In follow-up surveys, respondents recognized benefits to participating, highlighting commonalities and variations among their change leadership experiences—in concord with our intention to make this a generative experience. Finally, we have used individual interviews to fill in gaps in our data and to include people who can comment on broader issues in organizational change rather than about a specific change project, such as evaluators, people from funding agencies, and leaders from higher education societies or advocacy organizations.

Together, these sources of qualitative data enable us to develop a rich and nuanced picture of each change project, to make conceptual connections across projects, and to describe the range and variety of processes that change projects may deploy in diverse institutional settings. To date, we have analyzed documents from over 20 institutions, and completed Campus SEEDs

with 13 institutions, 13 Topical SEEDs on five topics, and two individual interviews. To date, over 120 people from 60 institutions have participated in the study. Because the unit of study is institutions, rather than individuals, we do not describe individual participant demographics here, though we worked hard in sampling and invitations to ensure that a variety of institution types and individual voices were represented. For this analysis, we draw mainly on the Campus SEEDs and on three Topical SEEDs that centered leadership teams. We use an earlier data set, from 19 ADVANCE IT campuses, for comparative purposes [14].

To analyze our data, we coded SEED transcripts using NVivo qualitative analysis software to tag passages responsive to our research questions, using a combination of grounded theory to capture emergent topics and our prior coding scheme on institutional transformation [14]. To retain a holistic perspective, we read each transcript multiple times to identify emerging themes, developed analytical memos, and engaged in multiple reflective conversations among the researchers. As we re-read transcripts for different themes, we used triangulation and constant comparison to ensure trustworthiness and consistency in data interpretation, develop credible, evidence-based conclusions, and ascertain how context influences our understanding of individual sites and conclusions across sites [33].

Findings

In this analysis, we focus on building and sustaining a change leadership team, taking an inward-looking view of these teams with attention to their positionality, formation, and aspects of how they work together. What change teams actually do to lead change—to instigate, manage and communicate about the change effort itself—will be the subject of future analyses.

In reviewing our data on building and sustaining a change leadership team, we have come to recognize the special positioning of change teams. They are special types of teams: not teams that support a president or provost, made up of people who themselves hold roles of positional authority, like those studied by Bensimon and Neumann [28], nor grassroots teams of people with special interest in an issue and a drive to work within their institution to address it, like those studied by Lester and Kezar [27], [29]. Because these projects have long time horizons and transformational, equity-directed goals, change teams benefit from participation of grassroots leaders with a passion for the issue and a vision of how things can be improved. Yet because their change projects require systemic interventions to achieve their goals, we find that change teams also need positional authority, or at least access and influence to those in authority, so they can initiate needed changes to policies or practices. A team that is strictly grassroots in origin may not have the needed organizational power and authority, and a team that is strictly administrative in origin may not have the needed vision and drive.

Indeed, we found in prior work that early ADVANCE Institutional Transformation (IT) projects were commonly led by senior STEM women who were “fed up” with academic patriarchy and wanted to change their institution for the better, so that women behind them would not go through what they did. These women fit the profile of grassroots change leaders [29]: they understood the issues, wrote compelling grant proposals, and did impressive work to spearhead

programs and support younger women. They often developed strong buy-in and grassroots support from faculty, which were essential to making cultural change in practices such as hiring and mentoring. Yet they and their teams did not always have the positional leverage to make structural changes that could cement new practices into policy, address faculty-wide concerns such as family leave and flexible work assignments, and outlast their ADVANCE grant. Some realized this lack in hindsight. Their experiences show how the composition and operations of change leadership teams matter, shaping whether and how a team can get the work done, secure needed resources, influence structures and cultures, and leave a lasting, positive impact.

Selecting and recruiting change team members

Keeping in mind this recognition about teams' institutional positioning, we first consider findings about selecting and recruiting members of change leadership team. Our respondents' advice makes sense in the light of a team's dual needs for the authority necessary to accomplish structural change, and for the credibility with the grassroots constituencies necessary to forward cultural change. Some respondents suggested to "start with people you know," which offered advantages of cohesion and the ability to build on prior, successful, working relationships, while others began with an open call for volunteers who wanted to do the work, so that the team was not too insular.

Both invitation tactics were ways to identify people who were interested in the change goal and had passion for the work, as was self-identification. Indeed, STEM women have continued to be important on change teams as grassroots leaders: "Hell, yeah, I was gonna come and help in any way I can to make this successful." While it was important to have people who could do the work, genuine interest in the goal seemed to be at least as important. Said one speaker,

Caring about it makes the big difference, and people deciding to spend time on what you're trying to achieve together. ... That first team should really be people who care enough about this so that, when you're meeting together, they're giving true input. The quality of the input matters.

Indeed, several respondents had noticed that when people were assigned or 'voluntold' to join the team, they were not equally committed to the project's change goal or its chosen theory of change, and might not last with the team or engage wholeheartedly. In addition to motivation, some leaders found it useful to identify specific kinds of contributions that would be needed, and search for people who could take those roles, while others suggested finding the people and developing roles around them – a "structured evolution" by which specific roles emerged to mesh the project's circumstances and individuals' interests and skills. Speakers broadly agreed that role clarity was important, while recognizing that the team would need to build shared understanding of the project's goals and approaches before moving forward in individual roles.

In addition to motivation and interest, respondents also named a variety of specific capacities—knowledge, skills, or campus connections—that were useful for equity-directed change teams. Examples included people with expertise in relevant knowledge domains (e.g., higher education,

gender, education policy); people who were well connected to different constituencies on campus; people experienced in working with campus governance bodies such as the faculty senate or union; and people with expertise on the research methods and data sources the project would use. “Worker bees” were essential to move forward on various utilitarian functions, and “vision people,” including some with diverse and even dissenting points of view, were essential to ensure that the cognitive functions of the team were well served by lively discussion and creative problem solving. Moreover, respondents noted, certain personal characteristics were helpful. Particularly valued were people who were comfortable working with others, respectful of others’ views, and willing to learn, and ‘low ego’ people who recognized the importance of monitoring their individual goals and interests in light of others’ priorities.

In large change projects, such as ADVANCE Institutional Transformation projects, three specific roles were called out as useful: a liaison to (or in) the institutional research office who could procure and analyze institutional data (typically a different skill set than academic research); an internal evaluator, who could carry out formative and summative evaluation; and a project coordinator or office manager. While this latter role varied in description and scope, most projects found it important to have an organizer-in-chief, someone with some institutional history and good communication skills, who understood the range of project activities, was familiar with institutional processes, and could develop rapport with faculty and work closely with the project leader to provide “essential glue.” Teams also called out the importance of the project leader, ideally someone who was visionary, supportive, trustworthy, and well-connected, someone who “holds the pieces together,” a “champion” who knows the “inner dynamics” of the institution and has relationships and leverage to communicate with senior administrators.

While these approaches to gathering a team usually provided some diversity of expertise, thought, and representation from different campus units, demographic diversity on the team was sometimes more difficult to achieve, an issue discussed in particular by ADVANCE teams working on gender equity. In most institutions, a majority of faculty and administrators are white men, especially in STEM and among those with the experience or capacities perceived as necessary. Yet participation of men (of any racial or ethnic background) as core members of an ADVANCE team was fairly rare, even though they were often seen as important for giving the project credibility with other STEM men. On most campuses, white women predominated on these teams. Some speakers noted that “well-meaning white women” tended to be oriented to serving that same population, a critique of ADVANCE also raised in prior work [34]-[36].

Well aware of these concerns, our white study respondents understood that it was important to engage women of color, in particular, but struggled with whether and how to ask them to participate in leadership roles, cognizant that their campus had small numbers of women of color and aware of research documenting the extra service and mentoring expectations often facing these women [37], [38]. There were occasional success stories: some teams engaged women of color as co-investigators from the start; others developed important advisory roles for women of color as the work proceeded. One speaker described a crucial conversation where faculty women

of color told the team they were tired of being invited to participate, then ignored. This lightbulb moment led the team to develop new strategies to gather data from faculty women of color, an effort led by a senior woman of color. They reported to their campus on the issues they uncovered and met with department heads and other leaders, directly involving some of their informants to give their reports gravitas, and eventually secured some positive outcomes for women faculty of color. Other projects likewise found that collecting and communicating data about the experiences of women of color—often through qualitative approaches that literally elevated these women’s voices—was valuable in expanding the change team’s understanding of the issues, ensuring that their work benefited diverse women students or faculty, and helping team members meet women who may like to join the effort as leaders or advisors.

While so far our discussion has focused on the ways change teams identified people who could be effective and helpful as leaders, thus benefiting the team and its work, our informants also described how they ensured that these leaders would themselves derive benefit from their participation. First, it was important to budget resources to pay people who took on leadership roles, via stipends, course buy-outs, summer salary, or other mechanisms that drew on grant funds or other institutional resources. For some administrators, the institution supported their salary and named the project as one of their duties, thus essentially providing released time. Second, it was important to consider up front how to give people credit for this work and communicate it as leadership. For example, some teams sought to optimize everyone’s opportunities for publications and credentials that would be valued in their own units and discussed authorship issues in advance. Professional development was another benefit a change team could provide. Two younger scholars on one project related their initial trepidation when the principal investigator approached them to join the change leadership team. As they grew in their roles, they experienced success, gained confidence, and learned from observing and interacting with experienced faculty leaders, thereby developing respect on their campus and visibility outside it. Overall, teams recognized it was important to bring in people in ways that made sense to them, and to “give [people] power and reward,” not just ask them for work.

Fostering team interactions for cognitive complexity

Once the leadership team was assembled, it was important to spend time knitting the group into a strong and functional team who not only had the skills and capacities to perform the utilitarian functions of the team, but also the shared understanding needed to carry out the expressive functions of the team, and the trust and comfort in innovating, discussing and debating that would support the cognitive functions. Respondents described team-building activities, such as taking time to check in with people at the start of meetings before getting to business, gathering socially off campus, and holding periodic retreats to allow deeper discussions and time to get to know one another. Some teams read and discussed papers; some worked together in explicit ways to flesh out their theory of change; others kicked off their project by participating together in a professional development workshop. Also important were physical quarters, somewhere the team could build and situate a library, for example, and gather together. Some crafted a “safe and

welcoming space” for their faculty participants, where they could meet privately, offer snacks, and even entertain visiting children. Most teams met regularly as a team, weekly or biweekly for 1.5-2 hours at a time, acknowledging this as demanding but also essential to build interpersonal trust, identify synergistic activities, and afford flexibility when crises or opportunities arose.

Succession planning was another aspect of team-building to ensure team viability over time for these multi-year projects, as founding members moved on to new roles, responsibilities, or institutions. Recognizing the likely ebb and flow of involvement, some speakers advised building “deliberate redundancy” into crucial roles. It was not uncommon to recruit and onboard new team members partway through a project, so it helped to anticipate personnel change and see this as a normal course of events. Viewing the team as having “permeable” rather than fixed boundaries made it easier to make space for new people and their interests. To accommodate these personnel changes, teams found ways to make onboarding intentional by sharing background materials and providing new members with a buddy or ample one-on-one time to learn the ropes. Indeed, onboarding could also be an opportunity for people to hone leadership skills as they integrated into the team. For example, one speaker described her strategy to “enact trust to build trust,” giving new team members meaningful project work early on. She looked for lower-stakes tasks as good starting points for less experienced people so they could build skills before taking on larger projects. Another spoke of “building capacity, continually grooming people” to be “representative of a dance” that was the larger project of change.

Finally, speakers described elements of their team philosophy that helped them to build cognitively complex, ‘real’ teams. They took time together to debrief difficulties and celebrate small wins. It was crucial to bring a “generous spirit” to the work and be “comfy with mistakes.” Giving people the benefit of the doubt and showing willingness to learn from one another “lubricates a lot of conversations” and “ease[s] a lot of tensions.” Over time they developed an understanding of what decisions could be organic and what should be formalized, and learned patience with the human side of the change process. One described change projects as cross-country races, not track meets: We “don’t have to get out of the gate so fast all the time.” That is, bringing everyone along together—“going slow to go fast”—would pay off in the long run.

Conclusions

Our study examines the workings of ambitious projects to improve equity in STEM higher education with a focus on the scaffolding processes that may help a team leading such a project to connect multiple interventions, find synergies among them, and achieve stronger, more lasting outcomes. In this analysis, we have considered one such process, the building of a change leadership team that can do this work and persist through challenges, successes, and changes that occur around them. If we view the project as a set of separate strands that must be woven or twined together to make a whole fabric, then the team acts as the weavers or knitters who do this work. This team is not a pre-existing unit, however, but people who come together from across a campus, bringing diverse skills, knowledge, connections, and identities to work on a project they find important to their institution. They represent both grassroots commitment to the issue(s) and

formal authority with leverage on the system. Thus, the team itself must be woven into a whole—the project knitters must themselves be knit into a unit.

Our data shed light on this process, revealing ways that a change team can be assembled and ‘knitted’ into a high-functioning, cognitively complex team. Teams were deliberate in selecting and preparing team members to conduct the utilitarian functions of the team—the work to design, run and coordinate the programs and interventions that were intended to address their broad change goals. The utilitarian function is the most obvious function of a change project team, and attention to this function helps to ensure that the team can indeed do the planned work.

In addition, the data reveal characteristics that teams looked for and sought to develop that would help them enact the cognitive and expressive functions of teamwork. The cognitive function requires that team members not only have relevant expertise and analytical skills but can bring those abilities to bear on sensemaking and problem solving on behalf of the project. They must be comfortable together articulating tentative ideas, giving and taking critique, and weighing perspectives to reach a decision. The expressive function requires that team members share a common understanding of the project goals and its theory of change for how the chosen interventions will accomplish those goals. They must feel ownership of the project, be able to communicate it, and use their skills and networks to communicate it to others; in doing so, they must feel confident that they have the backing and support of the team. How to set up a team to achieve these functions is less obvious, but equally important, we suggest, to ensuring progress in a long-lasting change effort that seeks transformational goals. Failing to do so may result in teams that are fractious or uncommitted, a revolving door of membership. By considering these team functions explicitly in advance, change teams can build their own capacities and attend to the full range of work that will be demanded of them as a group. In future analyses, we will explore further how these team functions played out in doing the utilitarian, cognitive and expressive work of the change project. To close, we quote one reflective leader who mused on how building their change team contributed to achieving their change goals:

...when you start to recognize people for their strengths and what they do well, and then making sure that that that work is allocated toward them, ...believing that they’re going to do it and that you can count on them, and then having the experience of them... stepping up ...and doing a really nice job ...[it’s] coming from a place of strengths. [We’re] picking people who have strings that we need added to the group. ...We have had so many things coming at us, ...and we didn’t have enough people. ...But you know, we depend on each other and people came through it every single time. Nobody, *nobody* dropped the ball.

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