

ADVANCING UNDERGRADUATE STEM REFORM THROUGH MULTI-
INSTITUTIONAL NETWORKS: THE ROLE OF FORMAL BOUNDARY SPANNERS

By

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ABSTRACT

ADVANCING UNDERGRADUATE STEM REFORM THROUGH MULTI- INSTITUTIONAL NETWORKS: THE ROLE OF FORMAL BOUNDARY SPANNERS

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Multi-institutional STEM reform networks have become a popular way to address the challenges facing undergraduate STEM education. Despite an intuitive sense that networks are effective educational reform pathways, few empirical research studies investigate their impact. Many have argued that institutional representatives, serving as boundary spanners, are key to securing the benefits of interorganizational membership. Boundary spanners are individuals who connect their organizations to the external environment and gain valuable external knowledge and resources to support local organizational performance.

The purpose of this qualitative study was to explore the inter- and intra-organizational boundary-spanning roles of institutional representatives at one multi-institutional higher education STEM reform network. The Center for the Integration of Research, Teaching, and Learning (CIRTL) is a network of 43 universities that seeks to prepare graduate students to be effective teachers so they can go on to positively affect undergraduate STEM education.

Using a case study design involving qualitative social network maps and semi-structured interviews, this qualitative study addressed three primary research questions: (1) what inter- and intra-organizational connections do formal, institutional representatives of a multi-institutional STEM reform network have (in relation to the network) and for what purposes, (2) how, if at all, do these formal institutional representatives engage in and make sense of inter- and intra-organizational boundary-spanning roles to help advance the network's reform agenda locally,

and (3) what individual and organizational attributes help or hinder their boundary-spanning activities?

Institutional representatives maintained several types of interorganizational connections related to network operations, network contributions, collaboration, and knowledge exchange. Due to these connections, they *found* numerous individual and institutional benefits and worked with their local teams to *translate* network gains for local implementation. They *diffused* network-related information to and *gained institutional support* from administrative and academic units and stakeholders. There were multiple individual and institutional attributes that influenced boundary-spanning behaviors. At the individual level, factors such as commitment, institutional role, role alignment, and managerial skills shaped how local CIRTl leaders engaged in boundary-spanning roles. Organizational factors such as institutional alignment with the purposes of CIRTl, programmatic infrastructure, and a decentralized organizational structure likewise played a major influencing role on boundary-spanning activities. In summary, this study demonstrated the complexity and integration of four primary boundary-spanning activities of institutional representatives in service to local STEM reform. They were able to inform campus groups and units, advance a dialogue of the importance of preparing future faculty, and influence local policies and practices.

This dissertation is dedicated to my family, friends, and colleagues who always believed in me and supported me through this long journey.

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Chapter 1: Introduction

For well over 100 years, education reform in the United States has been constant, evolving, and ubiquitous, often mirroring the cultural, economic, and political undertones of the present national landscape (Altbach, Gumpert, & Berdahl, 2011; Thelin, 2011). For instance, the Morrill Act of 1862 reflected a strong push for practical education related to agriculture and industry and resulted in multiple Land-Grant Universities, which, even now, often advocate an applied educational mission (Altbach et al., 2011). In 1957, the Russians successfully launched Sputnik, which strengthened America's resolve to win the Space Race by refocusing educational energies on science, technology, engineering, and mathematics (STEM) across K12 and postsecondary levels (Thelin, 2011). More recently, both the impetus for and outcomes of educational pursuits often reflect a complex interconnected world (Friedman, 2007), where solutions to national and global problems require multi-institutional and multi-sector engagement (Bryson, Crosby, & Stone, 2006). This has resulted in many educational reform efforts that rely heavily upon networks and consortia to address educational problems and deficiencies (Eddy, 2010). The same is true for other sectors, where organizational success is often linked to how well an organization interacts with external stakeholders and engages in mutually beneficial and collaborative partnerships (Agranoff, 2008; Holmqvist, 2003). Given the heavy focus on multi-organizational interaction, there has been a greater focus on key individuals that link their organization with the external environment, namely, boundary spanners (Aldrich & Herker, 1977; Brion, Chauvet, Chollet, & Mothe, 2012). These individuals are an important conduit for resources, knowledge, and innovation to flow into their own organization (Katz & Tushman, 1981), yet their role in multi-organizational education reform, especially higher education, is not entirely clear.

Arguably, boundary spanning and education reform could be examined in many ways and within the context of numerous reform agendas. To narrow my study's focus, I limited my analysis to undergraduate STEM education reform, which, as discussed below, is an important national concern. My study specifically explored (1) institutional representatives who acted as boundary spanners in a higher education multi-institutional STEM reform network and (2) their inter- and intra-organizational boundary-spanning roles related to local campus STEM reform.

Undergraduate STEM Education Reform

Despite a strong national drive to reform undergraduate STEM education (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2007; National Research Council, 1995, 1999, 2003ab, 2010, 2012; National Science Foundation, 1996; PCAST, 2012) through the adoption of evidence-based teaching practices (Brewer & Smith, 2011; Henderson, Beach, & Finkelstein, 2011; Kober, 2015; PKAL, 2002; Singer, Nielson, & Schweingruber, 2012), large scale efforts to improve teaching in undergraduate STEM education have had limited success (AAU, 2014; Austin, 2011; Borrego & Henderson, 2014; Brownell & Tanner, 2012; Kezar, Gehrke, & Elrod, 2015; Kober, 2015). Most change initiatives have not been able to scale up teaching innovations due to (1) a strong focus on individual classroom teaching practice that emphasizes a “development and dissemination change model” (Dancy & Henderson, 2008, p.1; Fairweather, 2009; Kezar, 2011a); (2) the lack of attention to additional variables that could affect the adoption of teaching practices such as departmental culture, promotion and tenure, doctoral socialization, and external influences (Austin, 2011); and (3) the inability of research communities that study undergraduate STEM instruction to communicate and coordinate efforts (Beach, Henderson, & Finkelstein, 2012). This has led many to push for more systemic approaches to STEM reform that take into account

faculty, departmental, institutional, and external characteristics and that emphasize the interconnectivity between colleges and universities (AAU, 2014; Austin, 2011; Coalition for Reform of Undergraduate STEM Education, 2014; Elrod & Kezar, 2015; Henderson, Beach, and Finkelstein, 2011; Kezar, 2014).

In response to calls for systemic reform, STEM networks have become a common change strategy (e.g., BioQUEST Curriculum Consortium, PKAL, POGIL, SENCER, and STEM Education Coalition). For my dissertation study, I targeted multi-institutional higher education networks, which are a specific kind of network that have begun to surface within the past ten years to engage systemic STEM reform related to teaching and learning. For example, the Center for the Integration of Research, Teaching, and Learning (CIRTL), which was the focus of my dissertation study, is a network of 21 research-intensive universities that seeks to improve undergraduate STEM education by better preparing future faculty as effective teachers (CIRTL, n.d.). Other examples include the Bay View Alliance (BVA, 2015a) and the American Association of Universities' Undergraduate STEM Education Initiative (AAU, 2015b), both of which desire to change the culture of academic departments to improve teaching. In each of these three networks, the underlying assumption is that member institutions share and co-create best practices and work together to address the specific reform goal of the network. However, despite the millions of dollars that have been invested, little empirical evidence is available to test the assertion that a networked approach to STEM reform is productive (Kezar, 2014). Furthermore, we know relatively little about the mechanisms by which a multi-institutional STEM reform network influences local change efforts. Thus, it is necessary to understand how these networks function as a change lever and to determine their utility as a funded initiative.

Institutional Representatives

Even though the unit of membership of multi-institutional networks is the organization, these networks are built upon individuals' network connections and relationships (Provan & Lammaire, 2012). Many have argued that organizational representatives are key to securing the knowledge sharing benefits of interorganizational membership (e.g., Agranoff, 2008; Ahuja, Soda, & Zaheer, 2012; Brass, Galaskiewicz, Greve, & Tsai, 2004; Holmqvist, 2003; Toivianinen, 2007). These benefits are partially realized because organizational representatives in multi-institutional networks perform an important boundary-spanning function. Boundary spanners are individuals who connect their organizations to the external environment and gain valuable external knowledge to support local organizational performance (Aldrich & Herker, 1977; Brion et al., 2012; Katz & Tushman, 1981; Leifer & Delbecq, 1978). To facilitate knowledge transfer, boundary spanners must also translate what they learn externally for local implementation (Brion et al., 2012; Katz & Tushman, 1981; Tushman & Scanlan, 1981ab). In short, multi-institutional networks are dependent upon key individuals who act as boundary spanners between the network and their local organizations, engage in knowledge exchange, and translate the knowledge they receive for local organizational use.

The role of organizational representatives has important implications for multi-institutional STEM networks. Universities may indeed be members of networks, such as the Bay View Alliance and CIRTL, but only a handful of individuals from each institution actually participate in the network and serve as formal institutional representatives. For example, at each CIRTL institution, only an institutional leader and administrative co-leader are named as representatives for their institution and regularly participate in network events (CIRTL, 2013b). In this capacity, CIRTL institutional leaders and administrative co-leads act as boundary

spanners by connecting their institutions to the larger network and potentially facilitating knowledge exchange. Thus, to understand the impact of multi-institutional STEM reform networks, it is necessary to examine how institutional representatives use their interorganizational boundary-spanning roles to benefit their respective campuses.

Boundary spanning does not end with interorganizational representation and participation. The purpose of a STEM reform network is to produce change, which is intimately dependent upon institutional representatives engaging their campuses in organizational learning and change based upon what they glean from network participation. We know from the literature that individuals in organizations play an important role in organizational learning (e.g., Crossan, Lane, & White, 1999; Knight and Pye, 2005), especially through their network connections within an organization (Brands, 2013; Brown & Duguid, 1991; Gherardi, Nicolini, & Odella, 1998; Phelps, Heidl, & Wadhwa, 2012; Tsai, 2001). Individuals can also play a key role in organizational change as change agents (Eddy, 2010; Fullan, 2006; Lester & Kezar, 2012), a function that is likewise advanced through their connections within an organization (Aarstad, Selart, & Troye, 2011; Dyer & Nobeoka, 2000; McGrath & Krackhardt, 2003; Mohrman, Tenkasi, & Mohrman Jr., 2003; Stevenson, Bartunek, & Borgatti, 2003; Tenkasi & Chesmore, 2003). From this, we suspect that institutional representatives in multi-institutional networks may use their campus connections to influence organizational learning and change. More specifically, based upon boundary-spanning literature and the decentralized nature of higher education institutions (Bess & Dee, 2008a), it is likely that institutional representatives span intra-organizational boundaries to (1) diffuse the knowledge they gain through network participation (Aldrich & Herker, 1977; Katz & Tushman, 1981) and (2) to gain the support of campus units

and stakeholders to promote intended reforms (Brion et al., 2012; Faraj & Yan, 2009; Joshi, Pandey, & Han, 2009; Marrone, 2010).

In summary, multi-institutional networks potentially provide member institutions opportunities to share, develop, and collect best practices related to STEM reform. While membership is based at the organizational level, institutional representatives of multi-institutional STEM reform networks connect their college or university to the network and potentially perform four boundary-spanning behaviors to engage their campuses in organizational learning and change: (1) *finding*, locating knowledge and best practices through STEM reform network participation; (2) *translation*, making sense of what they learn for their unique institutional context; (3) *diffusion*, sharing what they learn across their institution; and (4) *gaining institutional support* to advance local STEM reform.

However, institutional representatives are not simply a product of network participation and related intra-organizational connections. These boundary spanners likely have many other roles, responsibilities, and connections within and outside of their institution that influence their participation in a STEM reform network and their subsequent boundary-spanning behaviors. The phenomenon of boundary spanning related to STEM reform network participation is not simply a linear progression of finding knowledge, translating it, sharing with campus colleagues, and gaining institutional support. Instead, boundary-spanning activities are dynamic and interconnected with an institutional representative's professional life. Thus, it is important for the reader to understand that I am not framing boundary spanning in terms of simple cause and effect. For simplicity, I describe distinct boundary-spanning behaviors but, in actuality, these behaviors could occur simultaneously and are likely influenced by many other factors beyond network participation and the specific reform agendas of STEM reform networks.

Purpose of the Study

While undergraduate STEM education reform is a national priority, the adoption of evidence-based teaching practices over the past few decades has been limited. In response, there have been many calls for systemic reform. Multi-institutional higher education STEM reform networks have been one of the mechanisms used to address systemic teaching reform, but there is limited research that supports or contradicts the usefulness of networks as a lever of change in higher education or how these networks influence member institutions (Kezar, 2014). Some examples exist that investigate multi-institutional STEM reform networks, (e.g., Borrego, Adams, Froyd, Lattuca, Terenzini, & Harper, 2007; Kezar & Gehrke, 2014; Pfund, Mathieu, Austin, Connolly, Manske, & Moor, 2012), but overall, there is a relative dearth of literature that explores institutional impact as a result of network participation. Given the large amounts of funds that have been invested to develop and sustain these networks (e.g., the current CIRTl grant is \$5 million), it is increasingly important to determine how multi-institutional STEM reform networks impact local institutional efforts to reform undergraduate STEM education.

As I argued above, formal institutional representatives acting as boundary spanners are potentially one key mechanism by which networks affect member institutions. They are the bridge between the network and their institution and serve as a potential path for the network to influence member institutions' local STEM reform efforts through the transfer of knowledge, best practices, and ideas. Despite their potential role in facilitating the impact of STEM networks at the local level, little empirical evidence exists that examines the unique role of boundary spanners in STEM reform networks. We know that multi-institutional STEM reform networks' membership base is built upon formal institutional representatives, but we do not know exactly what institutional representatives gain from network participation through their boundary-

spanning role, how they make sense of what they receive, how they diffuse that knowledge across their campuses to initiate organizational learning and change, and how they engage other campus stakeholders to gain the necessary support to advance local STEM reform specific to the mission of the network. We also do not know what individual or organizational attributes support or challenge the various manifestations of boundary spanning and how these boundary spanners make sense of inter- and intra-organizational roles and responsibilities. In short, the purpose of my study was to explore the inter- and intra-organizational boundary-spanning roles of institutional representatives in relation to local STEM reform. My study did not address the larger, more systemic issues surrounding the improvement of undergraduate STEM education. Instead, it focused on one mechanism (i.e., boundary-spanning individuals) by which local STEM reform could be influenced. Thus, the intent of my study was not to address or solve every aspect of the problems facing undergraduate STEM education, but to concentrate on how multi-institutional reform networks affect their member institutions through formal institutional representatives that connect their campus to the interorganizational initiative. I addressed the following research questions:

1. What inter- and intra-organizational connections do formal, institutional representatives of a multi-institutional STEM reform network have (in relation to the network) and for what purposes?
2. How, if at all, do these formal institutional representatives engage in and make sense of inter- and intra-organizational boundary-spanning roles to help advance the network's reform agenda locally? Specifically,
 - a. What do they gain from network participation and interorganizational *finding* behaviors?

- b. How do they *translate* network gains for application at their institution?
 - c. How do they *diffuse* network gains across their institution?
 - d. How do they *gain support* from local stakeholders to advance the STEM reform target of the network?
3. What individual and organizational attributes help or hinder their boundary-spanning activities?

The Significance of the Study

My study has both scholarly and practical significance. First, it addresses a gap in the higher education literature by examining one way that STEM reform networks potentially influence local institutional reform efforts. As demonstrated above, networks are a popular reform strategy but there is relatively little research that has been conducted to examine the implicit and often unstated belief that these networks are an effective change strategy. This does not mean that they are necessarily unsuccessful as a change lever, just that more research needs to be conducted that determines how networks impact member institutions and to what degree. My study examined how institutional representatives in multi-institutional networks facilitated the impact of the network through their boundary-spanning roles. This is by no means the only way the network could impact a member institution, but institutional representatives potentially play a major role in obtaining knowledge from the network, implementing that knowledge to advance local STEM reform efforts and seeking support from campus units and stakeholders.

My study also potentially addresses gaps in the boundary-spanning literature and informs general efforts to reform teaching and learning. For instance, while the boundary-spanning literature has adequately defined the various types and purposes of boundary-spanning behaviors (e.g., Aldrich & Herker, 1977; Ancona & Caldwell, 1999; Brion et al., 2012; Faraj & Yan, 2009;

Katz & Tushman, 1981), there is relatively limited research that examines (1) how individual boundary spanners make sense of multiple boundary-spanning behaviors; (2) how they make decisions to engage in finding, translating, diffusing, and gaining institutional support; (3) what the execution of various boundary-spanning behaviors looks like in actual educational reform practice; (4) the interconnectedness (or lack thereof) of boundary-spanning behaviors; and (5) how individuals prioritize boundary-spanning behaviors in light of organizational structure and responsibilities. By better understanding the mechanisms of boundary spanning, my study advances our general understanding of how boundary spanning is used to promote organizational change and education reform. While the context of educational reform may change, the mechanisms and nuances of boundary-spanning behaviors are potentially transferrable to any organizational change or education reform setting. Thus, my study advances the literature surrounding boundary spanning and its role in the change process.

Second, my study has practical significance for multiple audiences. STEM reform networks could use my study's findings to explore how they may impact member institutions. Colleges and universities could use the results of the study as a means to guide their selection of institutional representatives for multi-institutional networks and to locate and address barriers that prevent boundary spanners from having greater effectiveness on campus. Institutional representatives could use the study's findings to explore their own boundary-spanning roles and identify ways to improve their success. Funding agencies and donors may be interested in the study since it presents empirical evidence of STEM reform network impact and may widen their evaluation lens by enhancing their understanding of the complexity of how networks influence local STEM reform. Overall, I argue that by increasing our understanding of the mechanism of

change, practitioners and scholars will be better able to identify areas of investment and thereby increase the impact of multi-institutional STEM reform networks.

Dissertation Organization

In this chapter, I discussed STEM undergraduate education reform and the rise of networks as an instrument of change. I focused on multi-institutional networks and the role of formal institutional representatives in enacting the impact of the network on their local campuses through boundary-spanning behaviors. I offered several research questions that provide the undergirding structure for the rest of my dissertation.

In Chapter 2, I explore the literature related to undergraduate STEM education and boundary spanning using social network, interorganizational, and intra-organizational perspectives. My main argument is that institutional representatives potentially affect local STEM reform through four primary boundary-spanning roles (*finding, translation, diffusion, and gaining institutional support*). I also present a conceptual framework built upon the four boundary-spanning behaviors, the 4I framework of organizational learning (Crossan et al., 1999), and Henderson et al.'s (2011) four categories of STEM reform.

In Chapter 3, I describe my research methods, which consisted of an embedded multi-case design at four institutions within the CIRTl Network. In Chapters 4 through 7, I present detailed case analyses for each of my four participating universities that focus on the types of inter- and intra-organizational connections of the institutional representatives in the CIRTl Network and boundary-spanning implications. In Chapters 8 and 9, I provide a holistic analysis of the four primary boundary-spanning behaviors contained in my conceptual framework. In Chapters 10 and 11, I report findings related to the individual and institutional characteristics that

help or hinder boundary-spanning behaviors. Lastly, in Chapter 12, I summarize major findings and conclude with several overarching implications.

Chapter 2: Literature Review and Conceptual Framework

In the previous chapter, I argued that formal institutional representatives in multi-institutional STEM reform networks are a potential means by which a network has an impact on local STEM reform efforts. An institutional representative connects their college or university with the network and serves as a formal boundary spanner. Even though there is limited literature related to my specific topic, sufficient literature exists, as theory and research, in the boundary-spanning and organizational literatures to propose the potential mechanisms by which an institutional representative in a STEM reform network could influence local change.

However, it is important for the reader to note that improving local STEM education is not purely a factor of boundary spanning. Instead, boundary spanning (and its potential impact on local reform) is one aspect of a much more complicated STEM reform phenomenon. This suggests that the four proposed boundary-spanning behaviors I discussed above do not necessarily operate as a simple cause and effect relationship. For convenience, I identify and organize the underlying boundary-spanning behaviors and their influence on local STEM reform, but I acknowledge that boundary spanning is likely nonlinear and changes over time to reflect current individual and organizational needs.

In this chapter, I use the literature to (1) further contextualize undergraduate STEM education reform and the role of networks, (2) define boundary spanning and its social network foundations, (3) investigate the role of an individual in the interorganizational knowledge exchange process to demonstrate the importance of the boundary-spanning behaviors of *finding* and *translation*, and (4) examine the role of an individual in organizational learning and organizational change within higher education institutions to demonstrate the importance of the boundary-spanning behaviors of *diffusion* and *gaining institutional support*. Thus, the overall

purpose of my review of the literature is to make a strong case for how formal institutional representatives in STEM reform networks may use four boundary-spanning behaviors (*finding, translation, diffusion, and gaining institutional support*) in relation to local STEM reform efforts.

STEM Education Reform

Improving STEM education has been a national priority for multiple decades, due to STEM's positive impact on the national economic and scientific climate (NAS, NAE, & IM, 2007; NRC, 1995, 1999, 2003ab, 2010, 2012; NSF, 1996). Multiple national reports have been issued to address significant and consistent problems in STEM undergraduate education, especially concerning the recruitment and retention of STEM students. For instance, the Committee on Undergraduate Science Education of the National Research Council (1999) published a report that indicated a pressing need to increase the number of undergraduate STEM students to keep up with the "increasingly technological world" (p. 1). Another major report published by the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine (2007) titled, *Rising Above the Gathering Storm*, likewise noted problems associated with the pipeline from K12 education, a lack of interest from undergraduates in STEM careers, and significant amounts of attrition from STEM majors. In a more recent report, the President's Council of Advisors on Science and Technology (PCAST) (2012) argued that an additional one million STEM graduates need to be produced over the next decade but insufficient recruitment and retention practices have led to a lack of quality STEM graduates. The lofty goal of an additional one million graduates is even more problematic when we consider that less than 40% of students who intend to pursue a STEM degree never complete it (The Coalition for Reform in Undergraduate STEM Education, 2014).

Teaching reform has been a popular mechanism to address the shortage of STEM graduates, since improved teaching is believed to prevent attrition, attract more students, and produce better-trained graduates (e.g., Brewer & Smith, 2011; Henderson et al., 2011; Kober, 2015; Nielson, 2011; PCAST, 2012; PKAL, 2002; NRC, 1995, 2003ab; Singer et al., 2012). Given the emphasis on teaching, there has been considerable effort in defining effective STEM instruction. For example, Singer et al. (2012) and Kober (2015), in connection with the National Research Council, produced lengthy reports describing discipline-based education research and a wide array of associated pedagogical practices that promote student learning. The Association of American Universities (2014), as part of its Undergraduate STEM Education Initiative, advocated that improved teaching is at the core of systemic reform and defined multiple effective teaching practices related to learning goals, instructional practices, and assessment. Multiple professional peer-reviewed journals, such as *Life Science Education*, *Journal of College Science Teaching*, *Journal of Engineering Education*, and the *Journal of Chemical Education*, also demonstrate a dedication to improving STEM teaching and learning. Thus, there has been considerable work in advancing and defining good STEM teaching.

Faculty Adoption Barriers. However, even though much has been done to define good STEM teaching, the adoption and implementation of research-based pedagogical practices has not been widespread, despite decades of effort (AAU, 2014; Austin, 2011; Besterfield-Sacre, Cox, Borrego, Beddoes, & Zhu, 2014; Borrego & Henderson, 2014; Brownell & Tanner, 2012; Dancy & Henderson, 2008; Henderson et al., 2011; Hora, 2012; Kober, 2015). Adoption of effective teaching practices is impeded by a lack of time, insufficient training in pedagogy, insufficient institutional incentives (e.g., tenure and promotion), and conflicting professional identities since STEM faculty are socialized to be researchers, not teachers (Brownell & Tanner,

2012). Hora (2012), in an attempt to better understand the cognitive decision-making processes of faculty adopting improved teaching practices, found that organizational features including campus governance, budgets, policies, power dynamics, and peer influence can prevent or promote successful adoption. Dancy and Henderson (2008) added additional constraints including the expectation for content coverage, student resistance, and classroom size and layout. Austin (2011) argued for even more contributing factors that prevent or promote the adoption of improved teaching practices. At the individual level, this includes prior experience of teaching and learning, doctoral socialization, discipline, career stage, appointment type, and motivation. Contextual factors include: institutional structure and culture, departmental culture, and external pressures such as employers, government agencies, accrediting bodies, and scholarly associations. In short, there are multiple barriers (e.g., individual characteristics, departmental and disciplinary dynamics, institutional context, and external influences) that impede the adoption of effective teaching practices in STEM.

Reform Barriers. Efforts to implement reforms have likewise encountered challenges. One of the major problems is that reform efforts typically follow a “development and dissemination change model,” where an innovative teaching practice is developed, tested on a small scale, and then pushed to individual faculty with the expectation that they will see its usefulness and adopt it (Dancy & Henderson, 2008, p. 1; Kezar, 2011a). This approach has not produced widespread reform because of its inability to successfully scale up innovations within and between colleges and universities, its overreliance upon individual classroom teaching practice, its implicit assumption that isolated reform can be applied in a cookie cutter fashion without taking into account unique local institutional context, and the multiple other variables that affect the adoption of pedagogical practices (Austin, 2011; Kezar, 2011a; Fairweather,

2009). In addition, Beach et al. (2012), based upon a comprehensive review of the STEM reform literature, found that there are multiple groups trying to improve STEM undergraduate education through research (i.e. disciplinary-based STEM education researchers, faculty development researchers, and higher education researchers) but these research communities do not typically communicate with each other, often do not build on prior research, and frequently present a lack of sufficient evidence to support their findings. The lack of synergy between the major research communities prevents scholars and practitioners from building on the past and produces reform redundancies. In summary, prior reform efforts have not led to widespread change due to a “development and dissemination change model,” an overconcentration on classroom instruction, and lack of interconnectivity between reform communities.

Systemic Change. In response to adoption and reform challenges, many practitioners and scholars have begun to advocate for interconnected and multi-faceted solutions. For example, Anderson et al. (2011) outlined seven key reforms necessary to change the culture of science education at research universities. They include: educate faculty about research on learning, provide awards and research support for outstanding teachers, require teaching performance for tenure and promotion, create discussion groups, create cross-disciplinary programs in college-level learning, provide support for ongoing effective science teaching, and engage multiple campus leaders such as department chairs, deans, and presidents. Henderson et al. (2011), through their extensive literature review, identified four primary categories of reform: disseminating teaching practices (curriculum and pedagogy), enacting policy, developing reflective teachers, and creating a shared vision. The authors found that most reform efforts they reviewed typically only focused on one reform category and suggested that change agents involve multiple categories for more productive change related to the adoption of improved

teaching practices. They argued that simply informing faculty of improved teaching practices is not enough; it requires faculty involvement in developing solutions, a shared vision across campus for the need for STEM reform, and supportive institutional policies.

Other authors have likewise argued for a multi-pronged change strategy by advocating a systems approach to STEM education reform (AAU, 2014; Austin, 2011; Coalition for Reform of Undergraduate STEM Education, 2014; Elrod & Kezar, 2015, Kezar, 2014), which necessitates interconnectivity between STEM reformers both nationally and within a single campus. This sentiment is evidenced by the following quote:

This type of work cannot be completed in isolation and will require maximizing and leveraging relationships with multiple stakeholders in the STEM education reform process. It will likely require intense ground work in multiple STEM departments within a single institution and the formation of coalitions across multiple departments and universities. (Talanquer, 2014, p. 817)

In addition to a focus on interconnectivity between actors, systems theory argues that we live in an interconnected world whereby action in one part of the system can have effects (good or bad) across the rest of the system (Senge, 1990). Applied to STEM reform, systems theory suggests that change must be applied to many points within the system to achieve desired success and that change in one part of the system may have intended or unintended consequences for other system components. Thus, while prior reform efforts focused too heavily on one aspect of the system (i.e. classroom practice), the current STEM reform community advocates for the use of multiple and interdependent change levers to bring about systemic reform.

For example, Austin (2011), taking a systems approach, argued for a mix of both top-down and grassroots change initiatives that take into account a faculty member's individual

characteristics, background, and their position relative to departmental, institutional, and external context. She identified five change levers within the system that could be used to improve teaching, namely, alterations to the rewards system and work assignments, professional development, institutional leadership development, national societies and networks, and the preparation of future faculty.

The Coalition for Reform of Undergraduate STEM Education (2014) convened a two-day workshop in 2013 of key individuals and organizations across the country dedicated to STEM reform to discuss how to achieve systemic and transformational change. They highlighted seven key goals to producing systemic change:

(1) promote systemic change in institutional culture, (2) support department-wide implementation of evidence-based practices, (3) support faculty development and leadership, (4) support continued examination and adoption of successful curricular approaches, (5) expect institutions to address systemic change through measurable indicators and evaluation, (6) expect institutions to plan for sustained change, and (7) strengthen teacher preparation programs. (p. 5)

Similarly, the Association of American Universities (2014), as part of its Undergraduate STEM Education Initiative, created a framework for systemic change in undergraduate STEM teaching and learning. The framework contains three layers, namely, pedagogical practices, scaffolding, and cultural change. The purpose of the framework is to (1) define what good teaching looks like; (2) scaffold the implementation of teaching practices through professional development, providing faculty with accessible teaching resources, collecting and sharing data on program performance, and alignment of future facilities planning; and (3) bring about institutional culture change through leadership commitment, the establishment of teaching

excellence measures, and the alignment of incentives with the expectation of teaching excellence.

In each of these examples, a systems lens was used to frame STEM reform. This is due to the complexity of the multiple moving parts involved in STEM education, such as faculty characteristics and dispositions, defining good STEM instruction, professional development, departmental culture, institutional policies, and responding to external pressures. Such complexity requires a multi-faceted change strategy that addresses many layers of the system simultaneously, since, as demonstrated above, prior reform efforts mostly targeted individual classroom instruction and have yet to produce the level of change required to meet national priorities (Fairweather, 2009). Therefore, the STEM reform community has advocated for a more comprehensive and systems-based approach to STEM reform, an approach that requires a greater degree of interconnectivity between research communities, practitioners, and colleges and universities. The desired outcome of improving STEM instruction remains constant, but scholars and practitioners have started to alter their perspectives on how to accomplish widespread change. One such change strategy consists of the use of regional and national networks to increase the reach of best practices and to promote the cross-pollination of ideas between organizations, higher education institutions, and individuals.

Networks as a Change Lever. In light of the shift to a systems approach, networks have been increasingly used as a change strategy. These networks operate under two basic assumptions: (1) a network of stakeholders will be able to collectively accomplish what they could not accomplish alone (Bryson, Crosby, & Stone, 2006), and (2) the sharing of best practices and collaboration across multiple institutions and stakeholders will help bring about widespread change (Austin, 2011; Fairweather, 2009; Kezar, 2011). For example, a networked

approach is apparent in the Coalition for Reform of Undergraduate STEM Education and the AAU's Undergraduate STEM Initiative, since both projects utilized a network in developing and disseminating their systemic change strategies. The Coalition pulled together a wide array of stakeholders to determine the best way to accomplish systemic reform. The AAU's Undergraduate STEM Education Initiative used a STEM network to "support and link AAU institutions grappling with similar challenges and barriers in reforming and improving STEM teaching and learning for undergraduate students" (AAU, 2015b). Other networks, such as the Center for the Integration of Research, Teaching, and Learning (CIRTL) and the Bay View Alliance (BVA), likewise advocated that widespread change can occur through communities of likeminded individuals and institutions working together to tackle complicated issues (BVA, 2015a; CIRTL, 2013a). In summary, networks have been increasingly used as a means to collectively address STEM reform in contrast to small-scale reforms that have had limited success.

STEM Reform Networks. There are three major types of STEM reform networks: individual-based, multi-stakeholder, and multi-institutional. The first type consists of a network of individuals who join a network for their own benefit and are not formally representing their institution or organization. There are multiple examples of this type of STEM reform network. Examples include: Project Kaleidoscope (PKAL) (PKAL, n.d.), SENCER (Science Education for New CIVIC Engagements and Responsibilities) (SENCER, n.d.), the Process Oriented Guided Inquiry Learning (POGIL) project (POGIL, 2014); and the BioQUEST Curriculum Consortium (n.d.). In each of these examples, the network operates as a community of practice, consisting of individuals who have a common purpose for STEM education reform and who work collectively

to share and develop best practices that are applicable for members' work contexts (Wenger, 1998).

The second type of STEM reform network consists of multiple sectors, including government units, higher education, primary and secondary education, and the private sector. These networks are typically found at the national, regional, or state level. For instance, at the national level, the STEM Education Coalition is composed of “500 business, professional, and education organizations” and “works aggressively to raise awareness in Congress, the Administration, and other organizations about the critical role that STEM education plays in enabling the U.S. to remain the economic and technological leader of the global marketplace of the 21st century” (STEM Education Coalition, n.d.). At the state level, a few examples include the Arizona STEM Network, Washington STEM, the California STEM Learning Network, and the Minnesota STEM Network. These networks consist of a wide array of stakeholders, such as government, businesses, donors, and educational institutions, that work together to advance STEM education. The benefit of a multi-stakeholder approach is that it combines multiple stakeholders to address systemic STEM education reform across the educational pipeline whereas individual-based networks focus on a particular node within the pipeline or system. Multi-sector and individual-based networks serve different purposes but ultimately have the same underlying goals. Together they demonstrate the strong presence of a networked approach in STEM reform.

The last type of network is the focus of my dissertation. Multi-institutional STEM reform networks consist of member organizations of the same type. For my dissertation study, I focused on multi-institutional STEM reform networks comprised of higher education institutions. All three types of STEM reform networks are worthy of study, but they cannot all be studied at the

same time given their distinct characteristics. Multi-institutional higher education STEM reform networks provide a unique lens to study systemic change through a networked approach, due to their organizational unit of membership and the historical use of higher education consortia to address education reform (Eddy, 2010). In this section, I describe three examples of multi-institutional networks and discuss how institutional representatives in these networks potentially influence local STEM reform efforts through boundary-spanning roles.

Examples. As noted above, the AAU's Undergraduate STEM Education Initiative uses a network of 26 universities that are dedicated to advancing the Framework for Systemic Change in Undergraduate STEM Teaching and Learning (AAU, 2014). The project specifically targets culture change within STEM departments to increase faculty adoption of effective teaching practices (AAU, 2015b). The network connects campuses to provide opportunities for university leaders to share what they have learned on their campuses related to culture change and to find ideas and resources they can use on their campus.

The Bay View Alliance, while not specifically STEM, is a network of nine universities that seeks to improve faculty adoption of effective teaching practices by likewise targeting departmental culture change (BVA, 2015a). The BVA is an "improvement community" and provides opportunities for member institutions to share best practices and to explore targeted investigations through research action clusters. These clusters are composed of sub-groups of member institutions that examine such topics as improved learning in entry-level courses, the development of intellectual skills, and using academic analytics to support and catalyze transformation (BVA, 2015b).

The Center for the Integration of Research, Teaching, and Learning (CIRTL), which was the focus of my dissertation study, is a higher education network of 21 research-intensive

universities that seeks to improve undergraduate STEM education through the preparation of future faculty. The network originated with three institutions, expanded to six, and then recently (2012) grew to 21 institutions. CIRTl's mission is "to enhance excellence in undergraduate education through the development of a national faculty committed to implementing and advancing effective teaching practices for diverse learners as part of successful and varied professional careers" (CIRTl, 2013a).

To achieve their mission, CIRTl has three core ideas that they believe are necessary to prepare future faculty as effective teachers (CIRTl, 2013c). First, teaching as research constitutes an effort to weave scientific methods into the assessment and improvement of teaching, which is very similar to the scholarship of teaching and learning (Hutchings & Shulman, 1999). The second core idea is learning through diversity, which stresses the importance of diverse demographics, backgrounds, skills, ideas, and disciplines in advancing student learning. Lastly, learning communities emphasize the benefits of group dynamics in communally pursuing learning goals and the creation of knowledge. The core ideas constitute the specific concepts that CIRTl wants to engender in doctoral recipients on track for faculty careers. Furthermore, it is the specific knowledge and skills that CIRTl wants to diffuse into current professional development opportunities for doctoral students and postdocs. To accomplish both goals, CIRTl provides opportunities for universities to collaborate with other institutions to generate and spread innovative approaches to graduate student professional development that will prepare future faculty with crucial pedagogical skills.

The AAU, Bay View Alliance, and CIRTl networks may differ with respect to structure and mission, but they all provide member institutions, through multi-institutional interaction, opportunities to share and develop best practices related to STEM education reform. This is not

surprising since interorganizational networks have been found to have positive effects for member organizations (Ahuja, 2000; Barringer & Harrison, 2000; Dyer & Nobeoka, 2000; Gulati et al., 2011), especially through knowledge exchange (Easterby-Smith et al., 2008; Greve, 2005; Huggins, Johnston, & Thompson, 2012). However, limited empirical evidence exists that investigates the impact of multi-institutional networks in higher education and the benefits that member institutions gain through network participation. There have been calls for more research on networks within higher education (Kezar, 2014) and the utility of higher education consortia in addressing education reform is well established (Eddy, 2010), but there is little available literature to definitively demonstrate the change prowess of multi-institutional STEM reform networks. One way to explore this gap in the literature is to focus on the primary participants in these networks to explore if they facilitate network impact through boundary-spanning roles.

The Organization of Higher Education Institutions. Before elaborating on the importance of individual network members, it is necessary to describe the organizational context of higher education institutions. This is crucial since the boundary spanners discussed in this dissertation are located in colleges and universities and not in the organizations that are frequently used in studies of organizational learning and change. This is not to say that these literatures are not applicable, just that great care must be taken to ensure that the setting of higher education is considered. Higher education institutions often adopt various fads found in other organizational contexts without properly vetting them or applying them to a higher education setting, which often leads to their failed implementation (Birnbaum, 2001). Thus, to properly discuss boundary spanning in a higher education setting, I first provide a short description of major higher education organizational features.

Higher education institutions are complex organizations that are accountable to external pressures (environmental), coordinate disparate organizational units and experts (structural), meet the needs of a diverse organizational membership (interpersonal), and balance centralized and decentralized purposes of the institutions (cultural) (Bess & Dee, 2008a). Kezar (2001) summarized many of the features of higher education institutions. Some of these features include: loose coupling, shared governance, a unique academic culture, competing goals and mission of campus stakeholders, interdependency between organizational components, and competing values among professional and administrative systems (p. vi).

Two of these features are particularly relevant to my dissertation study. First, the loosely coupled nature of higher education institutions allows for semi-autonomous behavior between colleges, units, and divisions (Birnbaum, 1991; Boyce, 2003; Clark, 1983; Weick, 1991). Given the decoupled nature of administrative and academic units on campus, multi-institutional network members, in efforts to diffuse what they learn from the network and gain institutional support for the network's reform foci, potentially span multiple intra-organizational boundaries. For instance, to influence the adoption of improved teaching practices, a boundary spanner may develop connections with many different colleges and associated departments on campus where each department has its own unique culture and disposition.

Second, shared governance splits decision-making responsibilities between administrators and faculty. Administrators take the lead in organizational operations and the faculty are in charge of teaching, service, and research roles (Bess & Dee, 2008a). This implies that members of multi-institutional STEM reform networks must develop connections and relationships with at least two different groups of people across campus with distinct decision-making authority. Using departmental culture change again as an example, a boundary spanner

could work with department heads to develop a teaching professional development program and help upper administrators to see the need to prioritize teaching improvement in the distribution of funds to academic units. Both actions are aimed at the same reform target, but involve different approaches based on decision-making authority.

Summary. In summary, higher education institutions are complex loosely coupled organizations with distinctive lines of decision-making authority. Thus, to understand the role of boundary spanning in the pursuit of STEM reform, it is necessary to realize that not only do institutional representatives connect the network to their institution, they must also navigate a complex organizational environment through intra-organizational boundary-spanning roles to implement what they gain from network participation. In the following sections, I more thoroughly define both inter- and intra-organizational boundary spanning and how they relate to a higher education context.

Defining Boundary Spanning

Boundary spanning can loosely be defined as the act of an individual or group extending beyond an organizational boundary to influence or be influenced by either side of that boundary. Liefer and Delbecq (1978) defined an organizational boundary as “the demarcation line or region between one system or another, that protects the members of the system from extrasystemic influences and that regulates the flow of information, material, and people into or out of the system” (p. 41). This definition implies an open systems perspective of organizations, where the organization has ongoing bi-directional interaction with the environment (Scott & Davis, 2007). In this sense, the organization acts as an organism, providing both output to the environment and drawing upon resources to nourish the organization and keep it alive (Morgan, 2006).

Drawing upon open systems theory, most of the early literature viewed boundary spanning as a major knowledge, information, and innovation-sharing link between the environment and the organization, a link that helped maintain a competitive edge and organizational longevity (e.g., Adams, 1976; Aldrich & Herker, 1977; Liefer & Delbecq, 1978; Organ, 1971; Tushman, 1977; Tushman & Scanlan, 1981ab). For instance, Aldrich and Herker (1977) argued that boundary spanning consisted of two distinct roles, information processing and external representation. With respect to information processing, boundary spanners gain access to external knowledge, interpret what is relevant for their organization, and transmit that knowledge into their organization. External representation involves “buffering, moderating, or influencing the environment” (p. 218), thereby increasing the organization’s legitimacy.

Newer literature likewise emphasized the unique importance of boundary spanning in mediating the organization’s relationship with the external environment (e.g., Brion et al., 2012; Miller, 2008; Sturdy & Wright, 2011; Williams, 2010, 2013). In short, boundary spanning is the act of extending beyond organizational boundaries to extract environmental knowledge resources and to legitimize the organization to the environment. Given that the purpose of my study was to explore boundary spanning in light of the impact of STEM reform networks on member institutions, I only focused on the flow between the environment and the organization. While colleges and universities may seek outbound interactions with the environment through a boundary spanner, I elected to study only the inbound component of what an individual boundary spanner gains through network participation and how they implemented that knowledge locally. From this perspective, the literature demonstrated four boundary-spanning behaviors of interest, namely, *finding*, *translation*, *diffusion*, and *gaining institutional support*. In following sections, I briefly describe each boundary-spanning behavior and then draw upon the

interorganizational network, higher education consortia, communities of practice, organizational learning, and organizational change literatures to demonstrate the potential ways that institutional representatives use boundary spanning to influence local STEM reform efforts.

Finding. The first boundary-spanning behavior consists of finding ideas, best practices, innovations, and knowledge through interactions with the external environment. Aldrich and Herker (1977), as noted above, stressed information processing, which is highly dependent upon a boundary spanner's ability to access knowledge through external relations. Likewise, Tushman and Scanlan (1981ab) and Tushman (1977) found, through a quantitative study of employees' work-related communication at a research and development firm, that boundary spanners' external connections were a key part to information transfer and the innovation process. Overall, the act of scanning, acquiring, and searching for relevant knowledge and information is an extremely common and important boundary-spanning trait (Ancona & Caldwell, 1992; Brion et al., 2012; Faraj & Yan, 2009; Marrone, 2010). Applied to my study, I argue that institutional representatives in multi-institutional networks have access to knowledge through interaction with institutional representatives at other colleges or universities.

Access to knowledge is only one part of the boundary-spanning behavior of finding. The word "finding" has a sense of active searching or implied motivation to seek out knowledge within the network. In both the boundary spanning and interorganizational network literatures, the most common finding motivation relates to searching for knowledge that will help an organization to innovate, survive, or increase profit (e.g., Agranoff, 2008; Aldrich & Herker, 1977; Larsson, Bengtsson, Henriksson, & Sparks, 1998; Powell, Koput, & Smith-Doerr, 1996; Tushman, 1977; Tushman & Scanlan, 1981ab). In this sense, a boundary spanner is looking for ways to help their home organization (or smaller subunit), which is highly dependent upon if

there is an expressed need within the organization (March, 1991; Lavie, Stettner, Tushman, 2010). However, boundary spanners are not simply an extension of their organization. For instance, an institutional representative may be motivated to engage in the network because of a moral commitment to improving instruction, despite an institutional culture that devalues teaching. In addition, the same individual may be a part of many other STEM reform initiatives locally and nationally, which may shape what they need from network participation.

The nature of what knowledge is desired or shared can also impact finding behaviors. Easterby et al. (2008) argued that knowledge tacitness, ambiguity, and complexity could hinder interorganizational knowledge transfer. In addition, knowledge applicability is another major factor in facilitating interorganizational learning (Greve, 2005). Applied to STEM reform networks, finding behaviors are likely influenced by how well knowledge available in the network aligns with the type of knowledge that institutional representatives are seeking. Furthermore, finding behaviors are likely highly dependent upon the perceived applicability of knowledge, though this will surely change based upon individual and member institutional context and motivations.

In summary, the boundary-spanning behavior of finding is a function of knowledge availability, the needs of the home institution (or subunit), individual motivations and commitments, and the nature of knowledge.

Translation. Finding behaviors only become valuable after a boundary spanner is able to interpret the information they receive for their local organizational context (Aldrich & Herker, 1977; Russ, Galang, & Ferris, 1998; Tushman & Scanlan, 1981ab). For instance, Katz and Tushman (1981) stated that “gatekeepers gather and understand outside information, and subsequently they translate it into terms that are more meaningful to their locally constrained

colleagues” (p. 104). I argue that given the complex organizational features of higher education institutions (Bess & Dee, 2008a; Birnbaum, 1991), translation is particularly important for institutional representatives. They may find potentially useful knowledge through network participation, but the transferability of that knowledge is constrained by their own unique institutional culture and structure. In addition, translation is dependent upon their initial motivations to find knowledge within the network (i.e. personal or organizational) and is further influenced by their other activities and responsibilities outside of direct network involvement. Thus, institutional representatives make sense of what they gain through network interaction based upon institutional context, their campus roles and responsibilities, and other related experiences and activities.

Diffusion. The boundary-spanning literature also emphasizes the need to diffuse the information and knowledge received from the environment into the organization to promote organizational learning (Hazy, Tivnan, & Schwandt, 2003), which is highly dependent upon the boundary spanner’s social network ties (Byosiene, Luethge, Vas, & Salmador, 2010; Gherardi et al., 1998; Phelps et al., 2012). For instance, Tushman and Scanlan (1981a) found that boundary spanners needed to be “communication stars” both externally to collect information and internally to share that information through their formal and informal connections in ways that would benefit the organization. Therefore, boundary spanners potentially initiate the diffusion of innovation process (Rogers, 2003) and are a prime catalyst for funneling novel information into the organization. Specific to multi-institutional networks, institutional representatives collect knowledge from the network; make sense of it in light of their local context, their motivations and interests, and their institution’s knowledge needs; and then share that information with campus units and stakeholders. In light of Henderson et al.’s (2011) categories of STEM reform,

knowledge gained from network participation could be used to distribute best practices. It could also be used to initiate ongoing conversations with campus stakeholders to develop reflective practitioners and create a shared vision, which is congruent with the role of individuals in organizational learning (Crossan et al., 1999). In short, institutional representatives engage their campus (academic and administrative units) through the knowledge they gain from network participation, which has the potential of producing organizational learning and change.

Gaining Institutional Support. Boundary spanners also engage in intra-organizational activities to gain political positioning (Brion et al., 2012), to persuade or act as ambassadors (Joshi et al., 2009), secure resources and support (Faraj & Yan, 2009), and protect their team from organizational pressures (Ancona & Caldwell, 1992; Brion et al., 2012; Brown & Schwab, 1984; Joshi et al., 2009; Marrone, 2010). Institutional representatives in multi-institutional networks may maintain connections across their campus to secure support for their STEM reform efforts, to influence the development of institutional policy, and persuade campus leaders to take STEM reform more seriously. Thus, while diffusion involves the sharing of what they learned from network participation, gaining institutional support consists of advocating for the necessary perquisites to make intended STEM reforms more efficacious.

Role Complexity. Lastly, the boundary-spanning behaviors described above contain inherent risks of role ambiguity, stress, and conflict because boundary spanners have to simultaneously interact in multiple organizational contexts (Boardman & Bozeman, 2007; Friedman & Podolny, 1992; Johlke & Duhan, 2001; Organ, 1971; Stamper & Johlke, 2003). Institutional representatives in multi-institutional networks maintain inter- and intra-organizational roles and connections and are therefore prone to these same challenges. In addition, it is logical to assume that for most of these network members, their network

responsibilities are but one part of their professional identity. Regardless of passion or zeal for improving undergraduate STEM education, time is a limited resource. While available literature points to potential challenges related to the role complexity of boundary spanners, it is not clear how institutional representatives in STEM reform networks make sense of their multiple roles, responsibilities, and the challenges they face from interacting with the network and local campus constituents. Further, it is not apparent how they make decisions on which boundary-spanning behaviors to engage in given time and resource limitations. As noted above, finding behaviors are a product of knowledge availability, applicability, and individual and organizational motivations/need, but why institutional representatives engage in *translation*, *diffusion*, and *gaining institutional support* on their campuses is understudied. We can safely assume that interest in STEM reform could be a driving factor, but it is not known how these individuals decide which boundary-spanning behaviors to advance and at what times.

Furthermore, it is highly unlikely that an individual boundary spanner will be actively involved in all possible boundary-spanning behaviors (Friedman & Podolny, 1992). In light of the rise of collective team leadership in higher education (Bensimon & Neumann, 1993; Kezar, Carducci, & Contreras-McGavin, 2006; Lester & Kezar, 2012; Pearce & Conger, 2002), a more likely result is that each institutional representative will take ownership of some but not all of the boundary-spanning roles across the network and within their college or university. Thus, it is necessary to study the local campus network representatives collectively to understand how multi-institutional networks are influencing local STEM reform through multiple boundary spanners serving complimentary and even potentially conflicting roles.

Summary. In this section, I defined boundary spanning and four key behaviors that could be used by institutional representatives to advance local STEM reform. The behaviors include:

finding external knowledge, *translating* it for local use, *diffusing* knowledge across the organization, *and gaining institutional support*. In addition, I showed that boundary spanners could experience role ambiguity from inter- and intra-organizational roles and responsibilities and that multiple institutional representatives possibly share boundary-spanning duties.

Social Network Foundations of Boundary Spanning

Boundary spanning is intimately tied to social network theory since it is based upon the presence of inter- and intra-organizational ties and connections. In this section, I review two core concepts that are crucial to understanding boundary spanning, namely, (1) strong and weak network ties and (2) social capital.

Network Ties. Kadushin (2002) argued that there are two primary motivators for social network interaction - cohesion and brokerage. Cohesion is motivated by desires for safety and is accompanied by close ties between network members. Brokerage is motivated by desires for efficacy and involves a desire to push beyond the safety of dense and closed networks into new possibilities. With these primary motivators in mind, there are essentially two major types of social networks ties: strong (cohesion) and weak (brokerage). There are strong advocates of strong ties (e.g., Krackhardt, 1992) and weak ties (e.g., Burt, 1992; Granovetter, 1983), though arguably they each play very different roles in social systems.

Granovetter (1973) defined tie strength as, “the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie” (p. 1361). Given this description, many argue that strong ties are an effective means of promoting knowledge sharing and creation within organizations, especially tacit knowledge (e.g., Ahuja, 2000; Krackhardt, 1992; Lowik et al., 2012; McFadyen et al., 2009). The underlying assumption is that close tight-knit relationships are more likely to produce individuals who share information

and work collaboratively. This assumption has important implications for institutional representatives in networks, both between members in the network and between institutional leaders and their respective colleges or universities. Strong direct ties likely increase knowledge flow between network members and the diffusion of that knowledge across local campuses.

However, Granovetter (1973) argued that strong ties often produce redundant information in a social network, whereas weak or indirect ties are seen as important bridging agents between disparate social networks and for individuals to access diverse knowledge sources (Burt, 2004, 2005). Weak ties are, therefore, very useful in searching for new information (Hansen, 1999) or to screen information before it enters an organization (Ahuja, 2000). Using the concept of weak ties, Burt (1992) proposed structural hole theory, where structural holes are defined as the gaps between actors within a network. Burt argued that actors bridge these gaps through weak ties and gain increased social capital and a competitive advantage over other firms. Institutional representatives in multi-institutional networks span a structural hole through a weak tie between their institution and the network, whereby their college or university gains access to novel information through their boundary-spanning role. In addition, institutional representatives may have weak ties across their campuses to maintain limited connections to campus stakeholders and networks that could be influential in STEM reform efforts.

Weak ties and strong ties are not at odds; they serve different purposes in a social network. Tiwana (2008) argued that strong and weak ties complement each other; strong ties promote information flow but at the cost of redundancy and weak ties provide brokerage opportunities but are less effective when it comes to knowledge transfer. Other authors have followed a similar sentiment (Ahuja, 2000; Byosiére et al., 2010; Rost, 2011). Applied to the case of multi-institutional networks, institutional representatives serve as intermediaries between

the network and their institution, eliciting the benefits of both weak and strong ties. They maintain a weak tie between the network and their institution, utilize strong ties in the network and across their institution to facilitate knowledge transfer, and likely have other weak ties across campus to tap into key individuals and networks to advance STEM reform efforts.

Social Capital. Many definitions, across several disciplines, exist for social capital (Bourdieu & Wacquant, 1992; Burt, 1992; Coleman, 1988; Putnam, 1995), which are often linked with either securing network closure (e.g., Coleman, 1988, 1990) or spanning structural holes/brokerage (e.g., Burt, 1992, 2004, 2005). Adler and Kwon (2002) defined social capital as “the goodwill available to individuals or groups. Its source lies in the structure and content of the actor's social relations. Its effects flow from the information, influence, and solidarity it makes available to the actor” (p. 23). Eddy (2010), applying social capital to higher education consortia, argued that the density of ties, the centrality of an individual in their network, information sharing, and trust work together to produce social capital. Significant social capital can also be gained by bridging disparate social networks (Burt, 1992). By spanning structural holes, individuals increase their access to new information resulting in a “vision advantage” (Burt, 2004, p. 351). The general idea behind social capital is that because of an individual’s network connections and the resources that flow through these connections, they gain a stronger position to influence others within their social networks.

There are two implications for boundary spanners. First, institutional representatives in multi-institutional networks span a structural hole and potentially gain social capital. They can use their network position and the knowledge that flows from this connection as a means of leverage on their campus, since it is potentially easier to make the case for STEM reform if you say other peer institutions are involved in similar actions and are even funded by prestigious

organizations such as the National Science Foundation. Second, the social capital that institutional representatives have on their campus could advance STEM reform. Since social capital is dependent upon “the structure and content of an actor’s social relations” (Adler & Kwon, 2002, p. 23), an institutional representative with few campus connections will be less likely to spread the knowledge they gain through network involvement versus someone with extensive links and clout across the college/university. Thus, social capital, derived from pre-existing network connections and the benefits of spanning structural holes, will impact the way an institutional representative uses their network connections to influence local STEM reform.

Summary. The previous section identified four primary means by which an institutional representative and boundary spanner may influence local STEM reform, namely, *finding* knowledge from the network, *translating* that knowledge for local implementation, *diffusing* that knowledge within their campus, and *gaining institutional support*. In this section, I demonstrated the social network foundations of boundary spanning, focusing on network ties and social capital. Strong ties facilitate knowledge transfer, weak ties provide access to diverse knowledge and networks, and social capital permits influence within a social network. I argued that boundary spanners potentially utilize strong ties, weak ties, and social capital in pursuit of influencing STEM reform efforts on campus.

While the literature demonstrated hypothesized behaviors, there is very little that specifically explores boundary spanning within the context of STEM reform networks. The extant literature provides a strong foundation by which to explore how institutional representatives may potentially influence STEM reform, but there is no empirical foundation by which to draw precise conclusions. Thus, my study addresses an important gap in the literature by exploring key boundary-spanning roles and behaviors related to STEM reform of institutional

representatives. In the following sections, I explore the four boundary spanning behaviors through interorganizational and intra-organizational dynamics.

Interorganizational Boundary Spanning

The previous section provided a detailed description of boundary spanning and key boundary spanning behaviors. In this section and the next, I demonstrate how the four boundary spanning behaviors are manifest both inter- and intra-organizationally. In this section, I frame multi-institutional STEM reform networks as (1) higher education consortia, (2) interorganizational networks, and (3) communities of practice. My goal is to show the role that individuals play in garnering the benefit of interorganizational interaction and subsequent knowledge exchange through the boundary-spanning behaviors of finding and translation.

Higher Education Consortia. Multi-institutional STEM reform networks can be classified as a higher education consortium, which consists of colleges and universities that join forces with other higher education institutions or with external organizations (e.g., K12, businesses, government) to accomplish what a single college or university could not effectively do alone (Eckel & Hartly, 2008; Eddy, 2010; Flora & Hirt, 2010). They provide numerous benefits for member institutions, such as knowledge exchange and organizational learning (Burley, Gnam, Newman, Straker, & Babies, 2012), resource distribution (Eddy, 2010), and shared responsibility for programmatic delivery (Flora & Hirt, 2010). Consortia, both within business and higher education literatures, are known by many different names (e.g., partnerships, collaborations, strategic alliances, interorganizational networks) and are formed for varied purposes (Eddy & Amey, 2014; Gulati & Gargiulo, 1999). There are many types of higher education consortia (Eddy, 2010), but I limit my discussion to education reform consortia.

The purpose of education reform consortia is to bring about systemic change, since “current systems are ineffective in obtaining desired levels of student outcomes and partnerships provide a means to achieve these goals” (Eddy, 2010, p. 4). Examples of education reform consortia in STEM include the international Conceive-Design-Implement-Operate (CDIO) initiative in engineering (Kahn, Goodhew, Murphy, & Walsh, 2013); the Collaboratives for Excellence in Teacher Preparation (CETP) program (Lawrenz, Huffman, & Gravely, 2007); and the Math and Science Partnership (MSP) program (Brown & Borrego, 2013; Clifford & Millar, 2007). In these examples, educational institutions collaborate through ongoing dialogue between institutional representatives to collectively address their consortia’s target reform. Such dialogue and interaction in higher education consortia promote knowledge exchange between consortia members and local organizational learning (Adams, 2007; Borzsony & Hunter, 1996; Burley et al., 2012; Sternberger, 2005). Put simply, reform-based consortia advance STEM education through an interorganizational network that seeks a common goal and engages in regular interaction that facilitates the flow of resources, support, and knowledge.

Interorganizational Networks. Multi-institutional STEM reform networks, in the broadest sense, are a form of interorganizational network. Interorganizational networks have complex and dynamic structures, offering many benefits to members based upon network connections (Ahuja et al., 2012; Barringer & Harrison, 2000; Hardy, Phillips, & Lawrence, 2003). Gulati, Lavie, and Madhavan (2011), in a simple but powerful framework, argued that interorganizational benefits are tied to the degree of reach, receptivity, and richness of participating organizations; Reach refers to the extent of social relations, receptivity connotes the ability of an organization to access resources, and richness relates to the depth of benefits gained. To fully maximize the benefits of interorganizational membership, organizations must learn to

effectively increase their reach, receptivity, and richness, a task predicated by effective knowledge exchange.

Many authors have found positive knowledge exchange benefits associated with interorganizational networks (e.g., Agranoff, 2008; Ahuja et al., 2012; Barringer & Harrison, 2000; Hardy et al., 2003; Huggins, Johnston, & Thompson, 2012; Kraatz, 1998; Larsson, Bengtsson, Henriksson, & Sparks, 1998; Powell, Koput, & Smith-Doerr, 1996). Others have modeled how knowledge is exchanged. For instance, in the heterogeneous interorganizational learning model, Greve (2005) focused on three factors: infectiousness, susceptibility, and social proximity. A source organization's ability to offer infectious knowledge is based upon how easy the knowledge is to share, its perceived degree of success, and the organization's social status. Receiving institutions are able to gain knowledge based on their motivation to locate knowledge and the social channels available between the two organizations. Easterby-Smith et al. (2008) presented a similar model where "donor firms" share knowledge because of their motivation to teach, ability to see the value in the knowledge they are offering, and "inter-organizational transfer capability" (p. 679). Recipient firms are dependent upon their ability to receive knowledge and their motivation to learn.

Absorptive capacity is one of the key concepts embedded within both of the models described above. Absorptive capacity, a concept coined by Cohen and Levinthal (1990), is defined as an "organization's ability to recognize the value of external information, assimilate it and apply it" (Priestly & Samaddar, 2007, p. 87). This concept is directly tied to an organization's disposition towards explorative and exploitative behaviors, where exploration refers to searching for new knowledge and exploitation consists of organizations utilizing the knowledge they already have (March, 1991; Lavie, Stettner, & Tushman, 2010). An

organization's ability to develop absorptive capacity is also intimately tied to the degree of receptivity and transparency within a knowledge sharing relationship (Larsson, Bengtsson, Henriksson, & Sparks, 1998), which is directly connected to the degree of trust between organizations (Easterby-Smith et al., 2008). The general argument is that if two organizations develop a trusting relationship they will be more likely to share knowledge.

The Role of Individuals in Interorganizational Networks. While interorganizational knowledge exchange is typically described at the organization-organization level, organizations cannot act as independent entities and, instead, are amalgamations of individuals. The concepts of reach, receptivity, and richness (Gulati et al., 2011); infectiousness, susceptibility, and social proximity (Greve, 2005); absorptive capacity (Cohen & Levinthal, 1990); and exploration and exploitation (March, 1991) can all be applied to individual organizational members. I argue that an organization as a distinct unit does not share knowledge with another organization in an interorganizational network; it is the people in each organization that have formal and informal connections to spread ideas, best practices, and knowledge and to develop interorganizational trust.

In support of this claim, Provan and Lemaire (2012) stated, "Despite the name, organizational networks are built around the connections and relationships established and maintained by individuals" (p. 643). Ahuja et al. (2012), in their detailed analysis of organizational networks, likewise argued that individuals' network ties are a major component of interorganizational dynamics. Bell and Zaheer (2007) found that organization-level connections did not produce knowledge flow; instead, individual-level connections were the major source of knowledge exchange. Other authors similarly demonstrated the importance of the individual in interorganizational networks (Agranoff, 2008; Akkerman, Tornenvlied, & Schalk, 2012; Brass et

al., 2004; Easterby-Smith et al., 2008; Holmqvist, 2003; Toivianinen, 2007). Overall, the interorganizational knowledge exchange literature is firmly rooted in the role of individual network ties as the connective tissue that links organizations together.

The main takeaway is that a smaller set of organizational members participate in interorganizational relations and are the means by which information is found within a network and filtered into their respective organizations. Essentially these individuals occupy the boundary between the network and their organization and carryout the boundary-spanning behavior of finding. Multi-institutional STEM reform networks, as an example of an interorganizational network, are linked together by a group of individuals who participate in network activities and who have local organizational responsibilities (i.e. boundary spanners). Such individuals are potentially the “reach” of their institution, an avenue of “exploration,” or a means of establishing trusting relationships with external stakeholders. To fulfill this role, boundary spanners must also be able to translate what they receive from the network for local institutional context (Aldrich & Herker, 1977; Russ et al., 1998; Tushman & Scanlan, 1981ab). In short, boundary spanners gain access to diverse knowledge on behalf of their institution and translate it for local application.

However, besides broadly establishing the importance of the individual in interorganizational knowledge sharing, the literature does not adequately describe how institutional representatives in multi-institutional STEM reform networks engage in knowledge exchange, what knowledge they gain from network participation, and how they make sense of what they gain for local use. Thus, we can only confidently assume that institutional representatives in these networks play a key connective role, but there is no empirical evidence to demonstrate what they receive from network participation and how they translate what they learn for use at their college or university.

Communities of Practice. Multi-institutional STEM reform networks can also be viewed as communities of practice (COP). Stemming from Lave and Wenger's (1991) work on legitimate peripheral participation, Wenger, McDermott, and Snyder (2002) defined communities of practice as groups of individuals that unite under a common purpose, work and interact regularly, and share, develop, and record experiences and tools relevant to their mutual work context. Multi-institutional STEM reform networks as COP offer institutional representatives a shared sense of purpose, provide access to knowledge relevant to individual institutional work contexts, and promote learning cycles that facilitate the boundary-spanning behaviors of finding and translation (Brown & Duguid, 1991; Wenger, 2000, 2010; Wenger et al., 2002).

The knowledge sharing benefits of COP are well documented. Hemmasi and Csanda (2009) found that COP were especially good at communicating tacit knowledge and provided employees with access to "the ideas, knowledge, and best practices" (p. 274). Similarly, in a qualitative case study, Retna and Ng (2010) discovered that COP support knowledge sharing, creation, and its subsequent use in an organization. Many other authors have likewise found a consistent link between COP participation and effective knowledge creation, transfer, and management (e.g., Anand, Gardner, & Morris, 2007; Bogenreider & Nooteboom, 2004; Kirkman, Mathieu, Cordery, & Rosen, 2011; McDermott & Archibald, 2010; Storck & Hill, 2000; Zell, 2001). If multi-institutional STEM reform networks are COP, then they provide institutional representatives with access to diverse knowledge that can be applied to their specific work contexts. Thus, institutional representatives engage the boundary-spanning behavior of *finding* to locate relevant information for their college or university.

Similar to the interorganizational network literature, effective knowledge exchange in COP is dependent upon the connections and relationships between COP members (Wenger et al., 2002). As discussed above, strong ties are vital to knowledge sharing and creation within organizations (e.g., Ahuja, 2000; Krackhardt, 1992; Lowik et al., 2012; McFadyen et al., 2009), whereas weak ties bridge disparate social networks and provide individuals access to non-redundant information (Burt, 2004, 2005). Arguably, COP are dependent upon strong dense ties amongst members to facilitate knowledge sharing. Multi-institutional STEM reform networks, as COP, likewise are reliant upon strong, dense ties amongst its membership to facilitate knowledge sharing related to the specific reform agenda of a network. Thus, for institutional representatives to gain the most from network participation, they must develop relationships and connections across the network to collect and share relevant information (Wenger et al., 2002).

However, access to knowledge is not enough. COP members must be able to translate it for use in their specific work context. This task is especially necessary when we consider the interorganizational dynamic of multi-institutional STEM reform networks. Despite common work practice (i.e. advancing STEM reform), organizational diversity potentially prevents the direct application of knowledge gained from the Network, since organizational operations and structure may differ substantially. In short, COP/Network members must make sense of what they collect from the community and apply it for local implementation.

Summary. In this section, I examined multi-institutional STEM reform networks through the lens of higher education consortia, interorganizational networks, and communities of practice to further highlight the boundary-spanning behaviors of finding and translation. Higher education reform consortia, interorganizational networks, and communities of practice provide a strong knowledge exchange benefit, which is highly dependent upon the role of individuals and their

associated network ties. Through these networks, individuals are able to find useful information for their local context and then translate it for their own local use.

However, given the lack of specific research related to my topic, it is still unclear what types of knowledge institutional representatives gain through network participation and how they make sense of what they gain given the organizational features of higher education institutions. Thus, my study reduces the gap in the literature by better understanding the boundary-spanning behaviors of finding and translation specific to multi-institutional STEM reform networks.

Intra-Organizational Boundary Spanning

The previous section examined the interorganizational aspects of boundary spanning. In this section, I explore the intra-organizational boundary-spanning behaviors of *diffusion* and *gaining institutional support* by focusing on organizational learning and change literatures. My primary goal is to show the key role that individuals play in organizational learning and change. However, it is important to remind the reader that intra-organizational boundary spanning is not just a linear extension of finding and translation behaviors. While *finding* and *translation* behaviors are important and likely define what is shared with campus stakeholders, many other factors (e.g., primary work role, involvement in other STEM reform projects, pre-existing campus connections) could influence *diffusion* and *gaining institutional support*. For simplicity, I present the major dimensions of each intra-organizational boundary-spanning behavior, but it is not my intent to argue for a cause and effect relationship between the four boundary-spanning behaviors. It is possible that a linear flow could occur (e.g., an individual finds knowledge, translates it, and then diffuses it to campus stakeholders), but a much more likely scenario is that the four boundary-spanning behaviors are far more intertwined and non-linear and boundary

spanners choose to engage in various boundary-spanning roles over time based upon current motivation and need.

Organizational Learning. Several authors have addressed organizational learning within a higher education context (e.g., Bauman, 2005; Bensimon, 2005; Boyce, 2003; Burley et al., 2012; Kezar, 2005). Given the depth of organizational learning, I focus my review on the role of the individual in the organizational learning process and how it relates to the boundary-spanning behavior of diffusion. Huber (1991), through an extensive literature review, summarized four major components of organizational learning, namely, knowledge acquisition, information interpretation, information distribution, and organizational memory. The general idea is that organizations must locate knowledge, make sense of it, distribute it, and make it permanent. I argue that individuals can play a part in each of these four major categories of organizational learning. I have already shown that individuals are crucial for finding knowledge gained from external networks and the importance of translating that knowledge for local implementation. In this section, I make the case for the role of knowledge distribution. While I focus on the individual in organizational learning, I acknowledge the complexity of the phenomenon and that individuals are not the only mechanism at play in organizational learning. I argue that individual boundary spanners are one source of learning for a college or university related to STEM reform and that they *diffuse* information into their organization.

Cognitive Lens. Disagreement exists in the organizational learning literature with respect to the location of learning, especially in relation to the application of anthropomorphic qualities to organizations (i.e. do organizations learn or the people within the organization?). A central aspect of this debate centers on a contrast between cognitive, behavioral, and socially oriented learning paradigms (Easterby-Smith, Crossan, & Nicolini, 2000). The cognitive and social-

learning approaches are the most relevant to my dissertation, but it is important to note that cognitive and socio-cultural theorists often link learning to behavioral changes (e.g., Argyris & Schön, 1978; Crossan et al., 1999; Huber, 1991). In terms of cognition, many have emphasized the cognitive foundations of organizational learning, which is dependent upon the ability of an organization to acquire and use knowledge (e.g., Fiol & Lyles, 1985; Huber, 1991). Crossan et al. (1999), as part of their 4I framework of organizational learning, stressed the importance of the individual cognitively and subconsciously intuiting potential learning gains from their environment and then interpreting or making sense of their intuition through the development of cognitive maps. These cognitive maps are then spread amongst organizational groups through an integration process. If enough organizational members adopt the map, it becomes institutionalized. Specific to higher education, Bensimon (2005) similarly argued that individuals play a key role in organizational learning by developing and advancing cognitive frames. The main point is that organizational learning, as viewed from a cognitive perspective, involves individuals internally processing information and then sharing their learning with organizational members.

Summary. Institutional representatives in multi-institutional STEM reform networks potentially develop cognitive maps and frames through their network involvement or through the boundary-spanning behaviors of *finding* and *translation*. In essence, these individuals engage in learning both cognitively and socially given their network connections, which could be used to advance organizational change.

Organizational Change. By gaining access to knowledge, making sense of it, and diffusing it across campus, institutional representatives in multi-institutional STEM reform networks potentially use their learning to affect organizational change. In short, organizational

learning is essentially a vehicle to bring about organizational change (Boyce, 2003). In this section, I examine the organizational change literature and the boundary-spanning behavior of gaining institutional support. It is important to note that my study was not focused on the outcomes of organizational change or STEM reform. Instead, I was concerned with the process of gaining institutional support, which so happens to align with organizational change behaviors.

A few key authors have advanced the discussion of organizational change in higher education by demonstrating the applicability of the change literature derived from business and management (Kezar, 2001, 2014), proposing best practices related to change in higher education (Eckel, Hill, Green, & Mallon, 1999; Kezar, 2014; Kezar & Eckel, 2002), and identifying future work that needs to be done (Kezar, 2011a, 2014). In each of these foundational works, the role of the individual is paramount; they act as change agents at a top-down (e.g., Eckel, Hill, Green, & Mallon, 1999) and/or grassroots (e.g., Kezar, 2011b) level(s) and utilize their campus connections to influence change.

Top-Down Change Agents. Organizational change, as a planned activity, often requires a top-down positivist approach (Bess & Dee, 2008b). In higher education consortia, the role of change agents is to “envision the benefits of the partnership for all partners and to trumpet them as they persuade others of the project’s merits” (Eddy, 2010, p. 28). At the local level, change agents must be familiar with the change process and help organizational members make sense of the change through effective communication (Fullan, 2006). They must also attempt to acquire resources, reach consensus across campus, and address tensions (Austin, Ahearn, & English, 1997), suggesting a need to be well connected to organizational constituents (Battilana & Casciaro, 2012; Eddy, 2010; Quardokus & Henderson, 2015).

With respect to planned change process, Kotter (2012) presented eight steps that must be addressed by change agents: establishing urgency, creating a guiding coalition, developing vision and strategy, communicating the change vision, empowerment for broad-based action, generating short-term wins, consolidating gains and producing more change, and anchoring new approaches in the culture. At each stage, a change agent uses their organizational position, connections, and social capital to advance local change.

Institutional representatives in multi-institutional STEM reform networks will each have a different combination of these attributes, but those with formal decision-making authority (e.g., graduate dean or director of a center for teaching excellence) may be better able to lead planned change initiatives, though the scope will be dependent upon their formal role. These individuals could share what they learn from network interaction to increase the urgency of addressing undergraduate STEM education across campus. They could also develop campus connections in an attempt to create a guiding coalition, which is quite similar to a community of practice (Wenger et al., 2002). In short, they could use information gained from network participation to engage Kotter's planned change process. These network members could play an active role in leading a whole change effort or, more likely, help to advance one or more aspects of the planned change process related to improving undergraduate STEM education. Such involvement could include advocating for policy change, securing funding for a teaching development program, or gaining other organizational support that could help the organizational learning process as described above or influence their campus units to take STEM reform more seriously.

Grassroots Change. In contrast to top-down change agents, grassroots change leaders can also influence local change efforts. Instead of operating at the top of the organization, grassroots leaders start from the bottom up and slowly affect change through their social

networks (Kezar, 2011a; Kezar & Lester, 2012). Members of multi-institutional STEM reform networks could gain institutional support through years of working with individuals at the grassroots level to increase the importance of STEM reform, build campus communities energized for change, and over time, attempt to change the culture of the institution.

Furthermore, grassroots and top-down change agent approaches are not at odds; both are needed to bring about organizational change (Bess & Dee, 2000b; Seymour, 2002). Whereas top-down change emphasizes formal processes, a grassroots approach is situated in the lived realities of campus stakeholders. This suggests that both types of change agents are needed and play complementary roles. The type of change agent will ultimately depend on the formal institutional title, network position, and social capital of the institutional representative. The major takeaway is that institutional representatives of multi-institutional STEM reform networks could potentially serve as top-down and grassroots change agents, using their campus connections to perform the boundary-spanning behaviors of *diffusion* and *gaining institutional support*.

The Importance of Social Networks. The social networks of organizational members are key to both organizational learning and change. Many have established the importance of social networks of organizational members in advancing learning (Brands, 2013; Gherardi et al., 1998; Hansen, 1999; Phelps et al., 2012; Tenkasi & Chesmore, 2003; Tsai, 2001). For instance, Araujo (1998) argued that learning within an organization is much more than knowledge stored in individuals' minds and instead is represented by overlapping knowledge domains across the organization. In addition, Dyer and Nobeoka (2000), in their classic study of Toyota, discovered that strong ties promoted intra-organizational knowledge diffusion and organizational performance. As discussed above, strong and weak ties across and within organizations perform different functions, especially as related to knowledge exchange. Conceivably, individuals first

intuit and interpret their own learning and then share what they learn via social network connections to integrate and institutionalize across the organization (Crossan et al., 1999). The act of sharing or diffusing can take two forms and is dependent upon the characteristics of the recipient (Rogers, 2003). Individuals can simply package what they have learned and send it out or they can engage network connections to develop ongoing dialogue and learning with organizational members through communities of practice (Brown & Dugid, 1991; Gherardi et al., 1998; Wenger, 1998). In short, individuals through their intra-organizational connections can become an organizational learning catalyst.

Organizational change is likewise dependent upon campus connections and relationships. For instance, Mohrman, Tenkasi, and Mohrman Jr. (2003) found, through a study of eight organizations, that organizations with active and flexible social networks fared much better in a planned change process than organizations with hierarchical implementation change methods. This is because “fundamental change requires changes in organizational schemata and behaviors. Because these are deeply embedded in social communities, change is necessarily a collective process that entails sense making and learning” (p. 303). The authors found that knowledge exchange within various levels and types of social networks within the organization (e.g., interunit, intraunit, “cross-functional,” “cross-level,” etc.) created spaces for the formation of new combined organizational schemata and the successful implementation of planned change. Similarly, Tenkasi and Chesmore (2003) found, through a study of units within an international corporation, that strong dense ties between implementers of change and change recipients were strongly associated with successful planned change.

To maximize organizational learning and change efforts, Quardokus and Henderson (2015) and McGrath and Krackhardt (2003) both argued that understanding or mapping an

organization's social network is key to leveraging the strategic benefit of network connections toward productive organizational learning and change. Stevenson et al. (2003) argued that certain individuals within organizations take on a knowledge brokerage role and thereby gain considerable influence within the organization. Related to knowledge brokers, Aarstad, Selart, and Troye (2011) found that advice-seeking structures within organizations serve as a significant pathway for developing shared mental models across the institution since organizational members often ask the same individuals for advice and, therefore, impart their individual mental models to others within the same organization. Put simply, there are extensive and influential social networks within institutions and there are key members of organizations that serve as knowledge brokers, have leverage within the organization, and that homogenize mental models across the institution.

Summary. The campus connections and relationships of institutional representatives in multi-institutional STEM reform networks are vital to enacting the boundary-spanning behaviors of *diffusion* and *gaining institutional support* to bring about organizational learning and change. Once network members *translate* knowledge gained from network involvement, they can promote organizational learning by *diffusing* what they have learned across their campus. They can also use their learning and campus connections to become top-down and grassroots change agents. The main point is that through their social networks, these individuals are able to bring new information and ideas into their respective campuses and influence the institutionalization of STEM reform. However, given the limited research that explores social networks in higher education (Kezar, 2014), it is not clear what network roles these individuals play on their campus, who they are connected to, and how those intra-organizational connections facilitate or

influence organizational learning and change, if at all. Thus, my study explored their campus connections and how such connections influenced local STEM reform efforts.

Conclusion

A review of the literature demonstrated four boundary-spanning behaviors that could influence how a multi-institutional STEM reform network impacts local STEM reform. The higher education consortia, interorganizational network, community of practice literatures demonstrated the importance of the boundary-spanning behaviors of *finding* and *translation* in bringing about the knowledge sharing benefits of connecting a multi-institutional network to their campuses. Next, the organizational learning literature showed how individuals play a key role in advancing organizational learning through knowledge *diffusion*. The organizational change literature demonstrated the importance of individuals acting as change agents (top-down and grassroots levels) to *gain institutional support* for STEM reform. Lastly, I showed that social networks are key to advancing both organizational learning and change.

However, despite the strength of the literature in showing how boundary spanners may influence local STEM reform, there are many unknowns with respect to what boundary spanners gain from network participation, how they make sense of what they gain from the network, how they share that information with campus stakeholders and for what purposes, and how they use their campus connections to gain support for local STEM reform efforts. In addition, the literature suggests that boundary spanners may experience role challenges and distribute boundary-spanning responsibilities amongst multiple institutional representatives. Yet, it is unclear on how these boundary spanners manage and distribute their boundary-spanning responsibilities and associated challenges. Thus, my study sought to better understand boundary-

spanning behaviors and how individual boundary spanners make sense of their responsibilities in relation to network participation and local STEM reform efforts.

Conceptual Framework

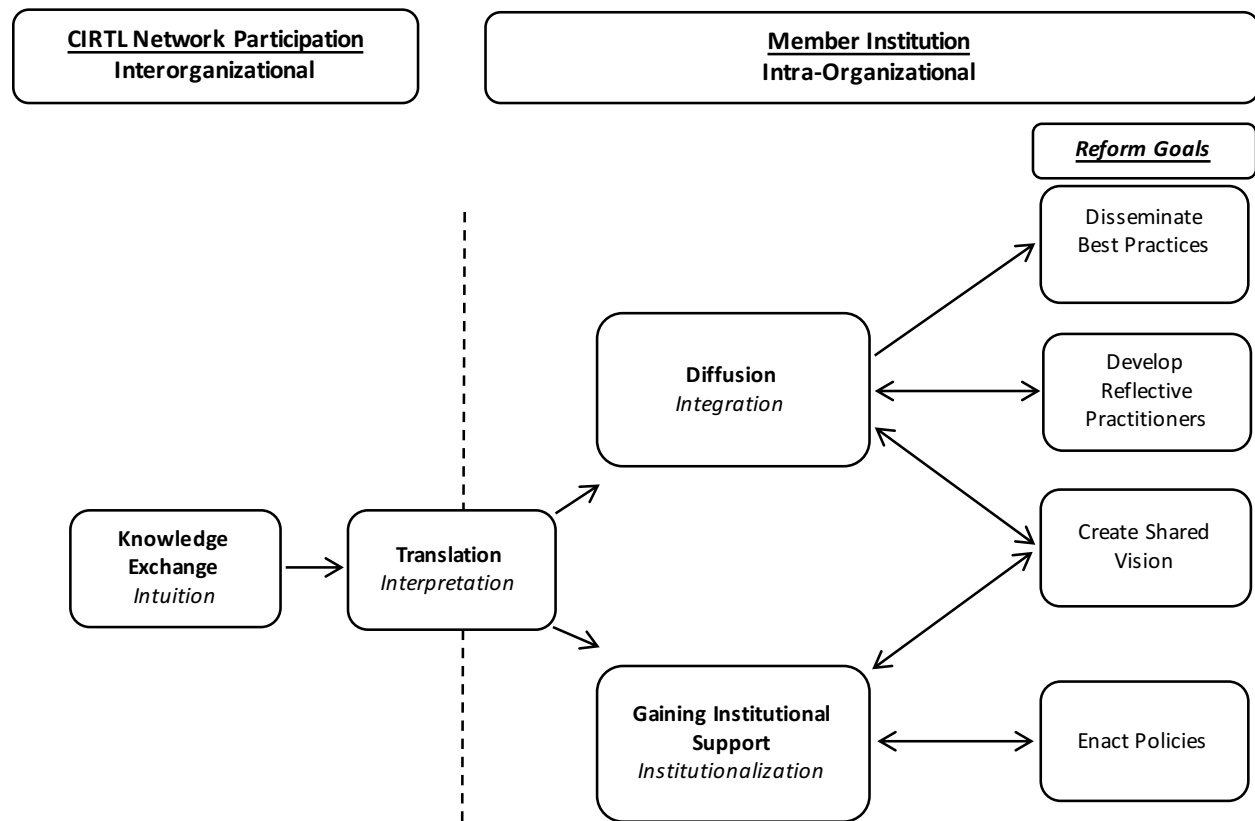
As demonstrated above, inter- and intra-organizational boundary spanning potentially plays a significant role in the acquisition of external knowledge, the translation and diffusion of that knowledge for local implementation, and the garnering of support from campus stakeholders for local STEM reform efforts. From this perspective, boundary spanning is uniquely tied to organizational learning; network members learn outside of their institution through the network, process what they learned for local use, and share their learning with campus stakeholders. To advance a study of boundary-spanning behaviors of institutional representatives in multi-institutional STEM reform networks, I use organizational learning as the primary lens for my conceptual framework combined with the four primary boundary-spanning roles that I defined above, namely, *finding*, *translation*, *diffusion*, and *gaining institutional support*. I also include Henderson et al.'s (2011) four categories of STEM reform as an organizational change target.

Crossan et al.'s (1999) 4I framework of organizational learning is at the heart of my conceptual framework because it clearly articulates the individual's role in the organizational learning process and the interconnections between learning that occur at the individual, group, and organizational levels. In addition, each of the four main boundary-spanning roles aligns with a corresponding component of the 4I framework. Thus, the four boundary-spanning roles and the elements of the 4I framework together explain a potential means by which a multi-institutional network influences local STEM reform through boundary spanning (See Figure 1).

The 4I's of Crossan et al.'s (1999) framework are as follows: intuiting, interpreting, integrating, and institutionalizing. Intuiting consists of subconsciously perceiving "patterns and

possibilities” (p. 526) that initiate the learning process. While Crossan et al. (1999) framed intuiting as a subconscious act, I purposively take their perceiving “patterns and possibilities” concept and combine it with the boundary-spanning behavior of *finding*, which could be both subconscious and conscious. Because institutional representatives interact and participate in the network, they are exposed to knowledge that they intuit to be of potential value to their institution. The intuition process can still be a subconscious act, but I argue that it can also be a conscious act if they are actively seeking knowledge for use on their campus (i.e., they have an explorative disposition). In either case, the main idea is that through network exposure, institutional representatives pick up ideas, best practices, and other knowledge that may have relevance to their institution and could advance the four categories of STEM reform.

Figure 1: The 4I Organizational Learning Framework and Boundary-Spanning Roles



Interpreting is defined as “the explaining, through words and/or actions, of an insight or idea to one’s self and to others” (Crossan et al., 1999, p. 525) and is directly related to the boundary-spanning role of *translation*. Whereas intuiting is the realization of knowledge’s potential relevance, interpreting is the active translation of that knowledge for local campus application. Crossan et al. (1999) argued that interpreting consists of individuals creating mental maps to flush out “feelings, hunches, or sensations” (p. 528). Related to boundary spanning, interpretation or translation connects the boundary spanner’s network and intra-organizational roles by pulling network knowledge into their organizational context. Crossan et al. (1999) also noted that integrating possesses a social learning dimension where the individual engages organizational members to help define their cognitive map, which acts as a bridge to the integrating function defined below. In summary, interpreting and the boundary-spanning role of translation involves network members making sense, both individually and with organizational members, of how knowledge gained from network participation could be implemented on their campus.

The next two I’s in the 4I framework were intended to be at the group (integrating) and the organizational levels (institutionalizing). However, even though integrating and institutionalizing are not solely individual processes, individual boundary spanners can still affect learning at these levels. Crossan et al. (1999) defined integrating as “the process of developing shared understanding among individuals and taking coordinated action through mutual adjustment” (p. 525). I argue that the boundary-spanning role of *diffusion* is the primary means of influencing the integrating aspect of organizational learning. Once network members have successfully translated knowledge gained from network participation, they are able to share that knowledge with their campus in two ways, unidirectional and bidirectional. In the

unidirectional sense, network members disseminate what they learned with individuals and groups on campus, which directly aligns with the reform category of disseminating best practices (Henderson et al., 2011). In a bidirectional sense, network members directly engage campus stakeholders in an ongoing dialogue, infusing what they learn from the network to advance individual and group conversations and to strategize the best ways to move forward with reform efforts. This process helps to develop reflective practitioners and can be used to generate a shared vision of STEM reform on campus (Henderson et al., 2011).

Crossan et al. (1999) defined institutionalizing as “the process of ensuring that routinized actions occur” (p. 525) across an organization, which is accomplished after enough groups across the organization develop a shared understanding and engage in collective action. I argue that institutionalizing is well aligned with the boundary-spanning role of *gaining institutional support*. Boundary spanners maintain connections across their campuses to support the structural elements necessary for organizational learning to occur. Such efforts are directly aligned with the change category of enacting policy, since the purpose of institutionalizing or gaining institutional support is to advance the proper institutional characteristics and policies to embrace permanent changes in STEM education (Henderson et al, 2011). I argue that this process is also bidirectional since boundary spanners likely engage campus stakeholders in discussions of policy change over time versus a simple and singular policy alteration. In short, through the boundary-spanning behavior of gaining institutional support, institutional representatives potentially influence the institutionalization of STEM reform and associated campus structures/processes.

Interpreting (translation), integrating (diffusion) and institutionalizing (gaining institutional support) are embedded within local college or university structure. CIRTL institutional leaders and administrative co-leaders represent many campus units, ranging from

faculty, to upper administrators, and administrative staff. Their particular position may affect how they interpret, integrate, and work to institutionalize what they gain from CIRTL participation. Depending upon their position, they may have more or less access to various academic or administrative units on campus. This does not dissuade the potential of forming new connections with campus stakeholders, but it does mean that each leader and co-leader is already entrenched within their own corner of the college or university. Thus, when reviewing the conceptual framework diagram, it is necessary to envision the boundary-spanning behaviors of *translation*, *diffusion*, and *gaining institutional support* in light of each individual leader's or co-leader's unique institutional context and their respective real or potential contact with multiple academic and administrative units on campus to advance STEM reform.

In light of individualistic campus connections, it is necessary to conclude with a description of what drives *finding*, *translation*, *diffusion*, and *gaining institutional support* behaviors. As cited above, Henderson et al. (2011) identified four distinct categories of STEM reform, namely, disseminating teaching practices, enacting policy, developing reflective teachers, and creating a shared vision. Combined, these change categories are argued by the authors to address the current deficiencies in STEM undergraduate education such as recruitment, retention, and the quality of graduates. I propose two slight variations to the four categories. First, I propose that “disseminating teaching practices” should be changed to “disseminating best practices.” This change expands the definition of best practices to include curricula, pedagogical techniques, and practical solutions to address the other three reform categories (e.g., strategies to influence institutional policy or ways to advance a shared vision across campus). Second, I propose to change “develop reflective teachers” to “develop reflective practitioners,” since boundary spanners may engage or influence campus communities beyond

faculty, including upper administrators, professional development practitioners, and other staff. The four categories of STEM reform are a simple yet powerful way to organize the types of reform activities that boundary-spanning behaviors may contribute.

Summary

My conceptual framework includes a combination of two major components. First, the elements of the 4I Framework are used to describe the organizational learning that occurs through four boundary-spanning behaviors. Second, Henderson et al.'s (2011) four categories of STEM reform provide the target for organizational learning and change. I used my conceptual framework to structure data collection instruments and guide data analysis to explore the role of boundary-spanning behaviors in advancing local STEM reform.

Before moving on to the next chapter, it is necessary to point out that while the literature demonstrated four important boundary-spanning behaviors, I was open to the possibility of additional boundary-spanning behaviors emerging as I conducted the study. In short, my framework was a useful tool but I did not intend it to be a restrictive lens to prevent additional insight.

Chapter 3: Research Methods

In previous sections, I demonstrated that formal institutional representatives in multi-institutional STEM reform networks potentially influence local change efforts through the four boundary-spanning behaviors of *finding*, *translation*, *diffusion*, and *gaining institutional support*. My conceptual framework showed that each of the four boundary-spanning roles aligns with a specific component of the 4I framework for organizational learning (Crossan et al., 1999), namely, intuiting (knowledge exchange), interpreting (translation), integrating (diffusion), and institutionalizing (gaining institutional support). I argued that boundary spanning and the organizational learning that it advances is an individual-specific phenomenon, since no two boundary spanners will likely have the exact same mix of network involvement, institutional role, institutional context, and formal and informal connections across their campus. However, even though boundary spanning may be an individually experienced phenomenon, it is possible to understand more generally how the four specific behaviors occur in relation to STEM reform through the lived experiences of individuals. Thus, the purpose of this study was to gain a better understanding of how individuals make sense of their boundary-spanning roles so as to inform efforts to improve the impacts of STEM reform networks in higher education. Specifically, I explored the following research questions:

1. What inter- and intra-organizational connections do formal, institutional representatives of a multi-institutional STEM reform network have (in relation to the network) and for what purposes?
2. How, if at all, do these formal institutional representatives engage in and make sense of inter- and intra-organizational boundary-spanning roles to help advance the network's reform agenda locally? Specifically,

- a. What do they gain from network participation and interorganizational *finding* behaviors?
 - b. How do they *translate* network gains for application at their institution?
 - c. How do they *diffuse* network gains across their institution?
 - d. How do they *gain support* from local stakeholders to advance the STEM reform target of the network?
3. What individual and organizational attributes help or hinder their boundary-spanning activities?

Research Approach

I approached my study through a pragmatic world view where “researchers emphasize the research problem and use all approaches available to understand the problem” (Creswell, 2009, p. 10). From this perspective, I simultaneously used prior research to shape my study’s design and data analysis, while at the same time allowing for new insight to emerge naturally to accommodate multiple individually constructed realities based upon personal experiences and unique social context (Glesne, 2011; Guba & Lincoln, 2005). Overall, using qualitative methods, I focused on both existing knowledge that framed my study and the lived experiences of institutional representatives in a multi-institutional STEM reform network and the meaning they made of their boundary-spanning behaviors (Miles, Huberman, & Saldana, 2014).

My study also relied heavily upon social network theory, since boundary spanning is rooted in network concepts such as structural hole theory and brokerage (Burt, 2004), social capital (Adler & Kwon, 2002), and network ties (Granovetter, 1973; Krackhardt, 1992). Whereas the majority of social network analysis focuses on quantitative methods (e.g., Borgatti, Everett, & Johnson, 2013), many have studied social networks in a qualitative way (e.g., Bidart &

Lavenu, 2005; Heath, Fuller, & Johnston, 2009; Jack, 2005; Smith, 2014; Tonge, 2009). A qualitative social network analysis can complement quantitative methods and provide valuable insight that is not available through quantitative means, including the exploration of how individuals make sense of network structure and their network ties (Brink & Benschop, 2014; Coviello, 2005; Edwards, 2010; Fuhse & Mutzel, 2011; Hollstein, 2011; Jack, 2010). Boundary spanning in STEM reform networks is not fully defined, though the literature review above pointed to potential ways that it may influence local reform efforts. Given the exploratory nature of this study, it makes sense to first understand the network dimensions of boundary spanning before attempting to measure it quantitatively. This study could inform future efforts to measure boundary-spanning behaviors, mediating and moderating variables, and key STEM reform outcomes. However, to develop good instruments, it is necessary to better understand the phenomenon of boundary spanning in relation to STEM reform, which can be best accomplished through qualitative methods.

Case Study Design. To examine my research questions, I conducted multiple case studies. Case studies are well suited for research domains that are under-studied, are highly compatible with the constructivist paradigm, and provide the deep exploration of a phenomenon (Baxter & Jack, 2008; Yin, 2014). Given the lack of research related to the specifics of my study, a case study approach was a logical methodology since it advances our understanding of how inter- and intra-organizational boundary spanning is used to affect local STEM reform efforts.

There are many different kinds of case studies, each with their own methodological considerations (Stake, 2005; Yin, 2014). Since there is a minimal amount of empirical research that investigates boundary spanning in undergraduate STEM reform, my case study was primarily exploratory and descriptive because my main goals were to explore and describe what

boundary-spanning behaviors were occurring and how they impacted STEM reform efforts (Yin, 2014). My case study was also instrumental (Stake, 2005), since I wanted to understand the broader phenomenon of boundary-spanning behaviors of institutional representatives in multi-institutional networks. To compare cases of boundary-spanning behaviors and to increase the confidence in my study's findings (Miles et al., 2014), I used a multiple embedded case study approach, which consisted of better understanding cases by examining smaller component parts or subunits (Yin, 2014). As my cases (or units of analysis), I selected four institutions that were members of the Center for the Integration of Research, Teaching, and Learning, a network of 22 research-intensive universities dedicated to improving undergraduate STEM education through the preparation of future faculty as effective teachers. Within each of the four institutions, I identified subunits for each case, which were the two to three formal institutional representatives who acted as boundary spanners, connecting CIRTL to their home university. Data collection focused on these individuals, as subunits, allowed me to build a holistic understanding of how boundary spanning was manifest at each of my cases. This was important since it was unlikely that a single individual would fully engage in all of the four boundary-spanning behaviors in the pursuit of STEM reform. Instead, based upon prior research within the CIRTL Network (Hill & Austin, 2014), we know that institutional representatives play complementary roles because of their formal positions and associated campus networks. Thus, to understand how participation in STEM reform networks affects institutional STEM reform through boundary spanning, it was necessary to examine the boundary-spanning behaviors of each institutional representative.

Case Selection. I selected institutional members of the CIRTL Network based upon three criteria: (1) the amount of time that the institution has been in the Network, (2) how engaged the institutional leaders and co-leaders are in the Network, and (3) the institution's depth of CIRTL

programming on campus. First, the amount of time in CIRTl was important because institutional representatives, depending on their CIRTl tenure, may behave differently due to their familiarity with other CIRTl members, the nature and extent of local programming for doctoral students and postdocs, and their motivation to seek out knowledge. For instance, newer members could be less familiar with CIRTl members, have less developed programming, and likely be more motivated to seek out knowledge to build their local offerings. I purposively selected two institutions that were part of the original six (pre-network expansion in 2011) and two that joined in 2011. This allowed me to compare findings between established institutions in the CIRTl Network and those that are relatively new. Second, I purposively selected institutions where institutional leaders and co-leaders were active in the Network, meaning that they regularly participated in meetings (monthly online meetings and bi-annual in person meetings) and were involved in committee work. Since my goal was to examine boundary-spanning behaviors, it was important to select individuals that were more likely to have strong interorganizational connections to CIRTl because those that lack strong connections would have less impetus for *translation*, *diffusion*, and institutionalizing boundary-spanning behaviors. Third, I selected institutions based upon a range of programmatic depth. As noted above, CIRTl seeks to improve undergraduate STEM education by better preparing future faculty as effective teachers. Their change strategy is strongly tied to the development of local CIRTl programming for doctoral students and postdoctoral scholars. It was important to have a range of programmatic depth to see how boundary spanning has helped or hindered CIRTl's programmatic-focused change strategy.

To identify research sites, I consulted the executive director of CIRTl to identify how long institutions have been in the Network and which institutions were active as defined by

meeting and committee participation. I also used publicly available CIRTl data collected in the summer of 2015 that shows the extent of local CIRTl programming. The mix of institutions included (assuming high network engagement): (1) a long-standing member institution with highly developed local programming, (2) a long-standing member institution with moderate-low local programming, (3) a newer institution with high local programming, and (4) a newer institution with moderate-low local programming. In summary, I selected a range of CIRTl member institutions to promote the comparison of boundary-spanning behaviors based upon institutional context.

Participant Selection. The primary research participants were individuals that served as institutional representatives in the CIRTl Network. These individuals acted as a formal boundary spanner between their institution and the reform network. CIRTl defines two types of institutional representatives: institutional leader and administrative co-leader. In two of my cases, there were more than two institutional representatives. Having more than one local CIRTl leader often occurs when an upper administrator is recorded as the institutional leader but does not actually participate in the Network. In these cases, institutions will tap a third individual to be an institutional representative who is not officially one of the two leaders defined above. In addition, there are a few instances where an individual is not one of the two leaders defined for an institution, but they play an active role in the central CIRTl leadership team and local campus dynamics. Thus, I first selected the formal representatives based upon the current list of institutional leaders/administrative co-leaders and then assessed what other institutional representatives were active based upon Network participation and institutional role. My significant involvement in the CIRTl network on the research and evaluation team over the past four years aided this process.

In addition to formal institutional representatives, I selected individuals at each university with whom an institutional leader or co-leader mentioned that they had an intra-organizational network connection or that could provide greater insight into the institutional leader's or co-leader's boundary-spanning behaviors related to CIRTTL (e.g., Provost, graduate dean, etc.). Participant selection for this part of the study is further explained below.

Data Collection

Data collection consisted of a social network mapping exercise and semi-structured interviews. Having participants visually map their network connections as part of an interview process was an effective way to understand the complexity of their social networks (Hogan, Carrasco, & Wellman, 2007; McCarty, Molina, Aguilar, & Rota, 2007). In preparation for semi-structured interviews, institutional CIRTTL leaders received a large sheet of white paper with a self-addressed envelope. In same packet, they received specific directions on how to complete the mapping exercise (Appendix I), an example mapping exercise (Appendix II), and two worksheets where they could brainstorm inter- and intra-organizational connections they had in relation to CIRTTL (Appendix III, IV). Participants were also emailed the directions, example map, and connection worksheets in case they preferred to complete the activity electronically.

The main purpose of the mapping exercise was to have participants map their interorganizational connections related to CIRTTL and their intra-organizational connections (within their office and across campus units, colleges, and departments) that they had over the past year related to CIRTTL's mission. For each connection, they were instructed to describe the type of connection and what purpose it served in their local STEM reform efforts.

After they returned their network maps, I scheduled a 30 to 45-minute interview, using the telephone or video conferencing software, to clarify the connections they recorded, including

the type of connections and respective relationships to STEM reform efforts. I structured these interviews according to the connection questions found in the mapping exercise directions (Appendix I). Interviews were audio recorded and transcribed verbatim. My primary goal was to create detailed participant maps prior to the interview in order to free up more time to discuss the meaning that participants made of their social networks and boundary-spanning behaviors.

Next, I conducted 45-90 minute semi-structured interviews (the interview protocol can be found in Appendix V) using the telephone or video conferencing technology. Each interview was audio recorded and transcribed verbatim. I designed the interview protocol based upon my conceptual framework and research questions. I used participant social network maps to explore what boundary-spanning roles they had, paying particular attention to the four key boundary-spanning behaviors of *finding*, *translation*, *diffusion*, and *gaining institutional support*, but allowing for additional behaviors to surface. I also encouraged participants to expand or modify their network maps that resulted from the network mapping exercise. Next, I asked questions about how each boundary-spanning behavior affected local STEM reform efforts, using Henderson et al.'s (2011) four categories of STEM reform to frame the discussion. Lastly, I asked questions about key personal or organizational attributes that helped or hindered boundary spanning, challenges that participants encountered, and how participants managed their inter- and intra-organizational boundary-spanning roles.

I used participants' defined campus connections (i.e. network alters) to identify additional semi-structured interview participants. I used a similar interview protocol (see Appendix VI) to understand campus constituent perspectives of: (1) an institutional or administrative co-leader's boundary-spanning behaviors, (2) how boundary spanning influences STEM reform, (3) individual or organizational attributes that help or hinder boundary spanning, (4) challenges that

institutional leaders or co-leaders have encountered, and (5) how leaders or co-leaders manage their role complexity. I customized the interview protocol based upon the participant's familiarity with the institutional leader or administrative co-leader and their participation in CIRTl. I asked six primary questions and then expanded into sub-questions if their responses warranted it. In addition, the protocol purposively focused on their observations of behavior and what may influence behavior, but did not ask them to assess internal thought processes of CIRTl leaders and co-leaders. This data was combined with CIRTl leader/co-leader data to triangulate findings.

Data Analysis

Data consisted of the following: (1) participant network maps for each institutional leader and administrative co-leader, (2) transcripts of participant interviews discussing their network maps, and (3) interview transcripts with institutional leaders/co-leaders and their campus connections.

I used thematic analysis to examine both participant social network maps and semi-structured interviews. Thematic analysis is a flexible tool that helps to make sense of large amounts of "messy" qualitative data (Boyatzis, 1998; Braun & Clarke, 2006, 2012; Joffe, 2012). I used Braun and Clarke's (2006) six steps of thematic analysis to guide my work; the six steps are as follows: familiarizing yourself with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and writing up the report. My overall analysis goal was to generate specific themes that address the research questions and explain how boundary spanning facilitates the impact of multi-institutional STEM reform networks.

First, with respect to completed participant social network maps, I reviewed the materials sent by each local CIRTl leader, which mostly consisted of handwritten maps on a large sheet of

white paper, but in a few cases participants sent completed electronic connection worksheet documents (See Appendix III, IV). Next, I recorded each individual's network connections and verbatim responses into a spreadsheet. Each row consisted of a single network connection (i.e., network alter) and (1) the level of connection (interorganizational, intra-organizational, or inter-unit), (2) the type of connection(s) (e.g., funding, advice seeking, etc.), and (3) how that connection influenced STEM reform. I also recorded information about each participant such as (1) institutional position, (2) gender, and (3) length of time in the CIRTTL network in a separate spreadsheet. I then read through participant responses regarding the types of connections and how STEM reform was influenced and identified codes, paying special attention to four boundary-spanning behaviors (i.e., finding, diffusion, translation, and gaining institutional support) and Henderson et al.'s (2011) STEM reform categories. I then identified, reviewed, and defined themes so as to articulate the types of connections and potential STEM reform influences. Next, I went back to the spreadsheet and assigned themes to each connection and noted the frequency of connections, connection types, and STEM reform influences, subdivided by participant characteristics to examine potential trends.

Second, I constructed diagrams for each campus' local CIRTTL connections, combining the two or three local CIRTTL leaders' mapping exercise results (See Figures 2-5). First, I searched each campus' website to locate local CIRTTL leaders and their named local CIRTTL connections and identified their campus unit affiliations. I then positioned each network node (i.e., local CIRTTL leaders and their on-campus CIRTTL connections) within their primary campus unit in the diagram. Next, I added the types of connections (through different types of lines) between the local CIRTTL leaders and their named on-campus contacts. The reader will see (in Chapters 4 through 7) that each map looks slightly different. For example, the map at Green

University follows the three major types of intra-organizational connections defined in Chapter 4. However, the map for Serenity University was more complicated, which caused me to split up academic support connections into two types: advisory board membership (the numbers indicate how many board members from each college) and graduate learning communities. The case of Lorimer University was also slightly different in that they had advisory board members who served as links to gaining institutional support from academic units and helped with local CIRTl programs. Lastly, the case of Midwestern University was also complex and I opted, for purposes of diagram readability, to show connections to the advisory board as connections for gaining administrative support and local CIRTl programs. Overall, it was not possible to create four perfectly parallel diagrams, since the institutional context and the number of named campus connections strongly influenced how each map took shape. I created the sociograms based upon readability, the specific context of each case institution, and the three major intra-organizational connection types described in Chapter 4. I constantly used these diagrams to contextualize interview responses and make sense of the “big” picture at each of the four case institutions.

Third, with respect to interview data, I familiarized myself with the interview transcripts and identified codes based upon the key questions and constructs in the interview protocol, the results from the network mapping exercise, my conceptual framework (e.g., boundary-spanning behaviors, STEM reform categories), and any emergent codes that I observed in the dataset. I then uploaded the interview transcripts into NVivo and coded the entire dataset. Once initial, structural coding was completed, I exported each code into a separate Microsoft Word document and searched for themes. I then compared resultant themes across the dataset and identified additional codes for emerging themes. Next, I performed additional coding in NVivo to refine themes and collate evidence for each theme. Lastly, I compared the themes generated in the

participant mapping exercise with interview data themes and made revisions to the types of connections and how they may influence local STEM reform.

Fourth, I compared the experiences of CIRTl institutional/administrative co-leaders within an institution. I used the participant mapping spreadsheet and interview transcripts to compare the number of connections, types of connections, how STEM reform efforts are affected, institutional roles, gender, length of time in CIRTl, and other individual characteristics. My goal was to examine similarities and differences to see how institutional and co-administrative leaders complement or contradict their boundary-spanning behaviors. This was particularly important because it is not likely that a single leader or co-leader performed all four boundary-spanning behaviors equally (Friedman & Podolny, 1992), which suggested the need to understand how the mix of boundary-spanning behaviors occurs within a particular campus. Lastly, after I completed the comparison of within institutional dynamics, I compared boundary-spanning activities across each university to examine similarities and differences, with a particular focus on institutional characteristics, length of time in the CIRTl Network, and programmatic vitality. This analysis allowed me to examine how institutional context potentially shapes boundary-spanning behaviors and the subsequent benefit to local STEM reform.

Reliability

Assessing the quality and value of qualitative research comes with its own set of quality assurance standards that are different from quantitative work (Merriam, 2002). While there may not be complete agreement on what “quality” means in qualitative work (Glesne, 2011; Merriam, 2002; Yin, 2014), there are a few key categories by which to assess quality. Below, I specifically discuss how I will address concerns regarding credibility, reliability, and researcher positionality.

To increase the credibility of my study (Merriam, 2002), I relied on data triangulation by interviewing CIRTl institutional leaders' network alters to confirm and contradict their perceptions of boundary-spanning roles. I also employed peer review by utilizing the expertise of my dissertation committee to ensure that my methods and findings are congruent with existing knowledge. To promote the reliability of my findings, I maintained an "audit trail" regarding participant selection, data collection, and data analyses (Merriam, 2002; Yin, 2014). I kept my research materials extremely organized to easily recall evidence for decisions I made throughout the course of the study.

Lastly, I fully disclosed my background, assumptions, biases, and prior relationships, which could impact how I planned the study and collected and analyzed data, a task known often as reflexivity (Glesne, 2011). First, I am a white male and have some background in STEM (originally an engineering major), but nothing current or extensive. Second, for the past four years I have been a graduate research assistant for Dr. Ann E. Austin who, until recently, was a co-PI of the CIRTl NSF grant. I have worked with Dr. Austin on the research and evaluation team of the CIRTl Network, which has consisted of such things as semi-structured interview studies and the analysis of annual data from institutions. I regularly attend online and in person CIRTl meetings and have had many interactions with the proposed participants of this study. In addition, I believe in the overall mission of CIRTl, which is to prepare future STEM faculty as effective teachers to improve undergraduate STEM education.

My prior involvement with the CIRTl Network aided the study considerably, since I knew many of the institutional leaders and co-leaders already and had a good rapport with them. In addition, through prior research and my work on the research and evaluation team, I already had a good sense of how member institutions operated, struggles they had, and the benefits they

felt derived from Network participation. However, my multiple years of experience in CIRTl and dedication to the mission of the Network could have also led me to predetermined findings or to not see the wider phenomenon at work. Thus, I constantly reflected upon my positionality within the CIRTl Network and was cognizant of potential impacts on data collection and analysis.

Chapter 4: CIRTl at Green University

As noted in Chapter 3, my first research question was: what inter- and intra-organizational connections do formal, institutional representatives of a multi-institutional STEM reform network have (in relation to the network) and for what purposes? Before investigating the breadth and scope of the four boundary-spanning behaviors found in my conceptual framework, I analyzed the types of connections that local CIRTl leaders and co-leaders at my four case institutions had with respect to CIRTl. Not only did this address research question one, it also helped answer a major component of research question two by describing which inter- and intra-organizational boundaries these leaders span and how they may engage in the boundary-spanning behaviors of *finding*, *translation*, *diffusion*, and *gaining institutional support*. In addition, this analysis yielded insight into what factors help or hinder boundary-spanning activities in response to research question three.

For Chapters 4-7, I primarily used the qualitative social network mapping exercise data and the first round of interviews with leaders and co-leaders to examine inter- and intra-organizational connections. I also used the rest of my interview dataset as a means of comparison or to clarify particularly complicated connections. In my analysis, my goal was to allow inter- and intra-organizational connection types to surface naturally through an emergent coding design, since it was doubtful that all connections related to CIRTl were boundary spanning-specific. Thus, while my examination of the four boundary-spanning behaviors (see Chapters 8 and 9) was directly related to and based upon existing literature, my analysis of the types and purposes of inter- and intra-organizational connections was intended to be organic. I also used the results from the broader thematic analysis of the interview dataset to inform any implications

about how local CIRTTL leaders engaged in boundary-spanning behaviors and what factors may help or hinder those activities.

With respect to interorganizational connections, I found, through my analysis of the qualitative social network maps, that local CIRTTL leaders reported four major types of connections with members from other CIRTTL universities and the central administrative team: (1) network operations, (2) network contributions, (3) collaboration, and (4) knowledge exchange. First, *network operation* connections were defined as local CIRTTL leaders interacting with other CIRTTL members to help run various facets of the Network, which could relate to participants holding leadership positions, serving and leading committees, engaging in discussions about improving the Network, and communicating with the central administrative team about procedural matters. Second, *network contributions* consisted of connections with CIRTTL colleagues related to what online, cross-network programming member campuses provided to the Network. Third, *collaboration* referred to engagement with CIRTTL members outside of regular Network operations, which could include special projects, grant proposals, or coordinated programming. Lastly, *knowledge exchange* related to specific interactions where leaders and co-leaders either offered knowledge to colleagues in CIRTTL or identified tangible or intangible knowledge that could be beneficial to their local CIRTTL efforts. For each local CIRTTL leader described in Chapters 4-7, I used the four interorganizational connection types to frame their Network participation and finding behaviors.

Through my analysis of intra-organizational connections, I found that local CIRTTL leaders engaged in three main types of connections within and outside their home campus unit: programmatic, administrative, and academic. First, *programmatic connections* involved leaders and co-leaders working with various campus stakeholders (typically in the graduate school or

teaching and learning center) to plan, implement, and evaluate local CIRTl programming. Second, *administrative connections* consisted of local CIRTl leaders keeping upper administrators informed of local CIRTl activities and either maintaining or gaining their support. Third, *academic connections* involved efforts to gain support for local CIRTl programs from stakeholders in academic units such as academic leaders (e.g., deans, department chairs), faculty, graduate students, and postdoctoral scholars, which included advertising local opportunities and convincing academic leaders and faculty to recognize the value of preparing future faculty in effective teaching practices. In Chapters 4-7, I used the three intra-organizational connection types to organize the cast of characters involved in local CIRTl efforts and to frame local CIRTl leaders' boundary-spanning behaviors.

While the types of inter- and intra-organizational connections do not have a one-to-one relationship with the four boundary-spanning behaviors found in my conceptual framework, they definitely overlap. For instance, local CIRTl leaders' interorganizational connections most directly related to the boundary-spanning behavior of *finding*. Through their various types of interactions in the Network, they were able to glean individual and institutional benefits (as described in Chapter 8), which could influence local CIRTl programming. Furthermore, programmatic connections (i.e., planning, delivering, and evaluating CIRTl programs) aligned with the boundary-spanning behaviors of *diffusion* and *translation*. Leaders and co-leaders shared what they found from the Network with their local CIRTl team and worked with them to translate CIRTl for their home campus. In addition, both administrative and academic connections were intimately tied to the boundary-spanning behaviors of *diffusion* and *gaining institutional support*. Leaders and co-leaders regularly shared CIRTl-related information with administrative and academic stakeholders to keep campus leaders informed of local CIRTl

efforts and to advertise local programs. They also actively sought out ways to secure buy-in from key campus leaders and faculty. In short, most intra-organizational connections related to CIRTl were congruent with the four primary boundary-spanning behaviors.

However, inter- and intra-organizational connections were not always synonymous with boundary-spanning behaviors. For example, a leader or co-leader may interact with fellow CIRTl colleagues in ways that have no direct bearing on their local programs, such as working on a Network committee. Of course, such a connection could eventually be a mechanism for *finding* behaviors, but it is not a boundary-spanning behavior in itself. Likewise, a leader or co-leader may interact with other CIRTl team members to implement a CIRTl program (e.g., answer a student's question about a technology glitch), but this does not necessarily mean they are *diffusing* CIRTl knowledge or are engaged in *translation* behaviors. My point is that establishing the types of connections is the first, broader step in laying the foundation for understanding how local CIRTl leaders and co-leaders engaged in boundary-spanning behaviors. Even though not all inter- and intra-organizational connections are boundary spanning specific, they did still provide valuable insight into the larger context in which local CIRTl leaders and co-leaders operated. Thus, in the next four chapters, I assess the connective landscape of local CIRTl leaders and thereby provide insight into how their connections relate to the four boundary-spanning behaviors found in my conceptual framework.

The purposes of Chapters 4 through 7 are to: (1) examine the types and purposes of local CIRTl leaders' inter- and intra-organizational connections related to the Network, organized by *programmatic*, *administrative*, and *academic* connection types; (2) investigate how local CIRTl leaders and co-leaders engaged in the four boundary-spanning behaviors; and (3) illuminate the characteristics of local CIRTl leaders and institutional contexts that affected boundary-spanning

activities. In each chapter, I describe a single case institution to demonstrate the nuances of participating universities with respect to inter- and intra-organizational connection types and boundary-spanning behaviors. Specifically, I (a) provide an overview of the university; (b) describe local CIRTl leaders' local role and interorganizational CIRTl connections; (c) discuss local CIRTl leaders' *programmatic*, *administrative*, and *academic* connections (and relevant institutional dynamics); and (d) provide a chapter summary that discusses overarching themes in response to my research questions. In this chapter, I report findings related to Green University, which joined the CIRTl Network during the expansion in 2011.

Green University: An Overview

Green University (GU) is a research-intensive public doctoral university located in the Northeastern region of the United States with a student population just over 37,000. GU has many STEM programs and graduates over 400 STEM doctoral students per year across multiple disciplines. Based on my case sampling frame, GU represented a campus that recently joined CIRTl and that had low-moderate programming. Local CIRTl programming and activities were delivered through the center for teaching and learning on campus with local CIRTl leadership from Betty in the School of Public Health and Tom in the Graduate School.

When GU joined CIRTl, the goal of the local CIRTl leaders was to connect the campus around a common purpose of preparing future faculty and expanding offerings available to graduate students. The following quote from GU's initial local CIRTl plan demonstrated this sentiment:

We propose to use scholarly teaching and the CIRTl core ideas as a common objective to connect current GU STEM learning communities that seek to prepare future faculty...
By fostering connections among GU graduate students, postdocs, faculty and their peers

at local national laboratories through low- and high-engagement summer institutes, workshops, seminars, and classes, the GU learning communities will extend and improve networks invested in developing a robust understanding of how STEM undergraduates learn. Specifically, we will expand, focus, and connect current [center for teaching excellence] learning communities...and develop, promote, and maintain a social-network forum for international graduate students and post-doctoral fellows.

In addition, based upon an internal CIRTl document in 2013, the leader and co-leader mentioned that there were “seven STEM program/communities at GU” spread across multiple colleges and it was their intent to “connect these disparate groups by prioritizing scholarly teaching as a significant part of their professional development activities.” Ultimately, their goal was to create:

...a robust, interconnected GU-CIRTl STEM learning network that recognizes the similarities and differences among the STEM disciplines and capitalizes on its diversity to foster a rich view of integrating teaching and research.

As of yet, local CIRTl activities have not lived up to these ambitious goals, mostly due to organizational transition. GU has had some recent success in forming a cross-unit advisory board, which was a significant step in achieving their original goals. However, a little over six months ago, one interviewee described the local GU CIRTl programming as, “kind of a mom and pop shop for future faculty programming. We don’t have a large faculty advisory board. We don’t have a large number of people...we don’t have a ton of voices within CIRTl.” Thus, as compared to other case institutions, GU struggled the most in helping their CIRTl program develop and mature over the past five years. This was further complicated by the fact that efforts to integrate an ethos of improved teaching across campus were rather new, especially since GU

historically valued “research over teaching” and because quality teaching was not yet “embedded in the DNA of the institution.” GU has attempted to make inroads at improving the quality of teaching on campus, but there was much work to do.

From recent internal evaluation data, GU reported four programs related to CIRTl on campus. According to internal CIRTl evaluation documents, GU reported about 250 individuals who participated in CIRTl programs during the 2014-2015 academic year and another 150 in 2013-2014. The main programs consisted of a teaching preparation program for international teaching assistants (TAs); a teaching certificate program aligned with the three CIRTl outcome levels of associate, practitioner, and scholar; a teaching fellows program designed to promote teaching and learning intervention projects; and a newly designed teaching-as-research learning community. The teaching and learning center delivered all programs with the exception of the teaching certificate program, where there was some collaboration with one of the colleges at GU.

Overall, while there have been recent strides forward, the current structure and functioning of GU’s local CIRTl learning programming has had limited growth and development. In the next section, I provide a more detailed description of the local CIRTl dynamic at GU.

The Cast and Local CIRTl Dynamics

Below, I describe the local CIRTl leader (Betty) and co-leader (Tom), their on-campus roles and interorganizational connections in the CIRTl Network (based upon the four types of interorganizational connections described above). Next, I report findings related to the local CIRTl leaders’ on-campus *programmatic*, *administrative*, and *academic* connections and conclude each sub-section with a discussion of observations and implications for boundary-spanning behaviors. For interview transcript attribution, I use general descriptors such as

participant, interviewee, and respondent to refer to the faculty members, administrators, staff members, and graduate students who I interviewed.

Local CIRTTL Leaders

Leader: Betty. Betty was an associate dean and full professor. She was one of “the consistent voices on campus for the importance of faculty development, graduate student development and excellence in teaching.” She had “a smattering of different leadership roles,” which earned her the respect of campus colleagues to the point that “if she calls a meeting, people will actually attend the meeting and at least respond to the email and not just ignore it outright.” Participants described her as “personable...warm and genuine,” “quite capable,” “thoughtful, gentle seeming demeanor,” and a “great leader.”

As the local CIRTTL leader, “Betty oversaw the local CIRTTL [activities] at GU.” Interviewees identified her as the “content person,” or the individual responsible for “embedding the CIRTTL pillars into our own...future faculty preparation programs on campus” and overseeing programmatic delivery. When Betty joined CIRTTL, she was the interim director of the center for teaching and learning and used her position to advocate for the preparation of future faculty, translate CIRTTL into existing center offerings, and “establish a good relationship with the Graduate School to fund the CIRTTL project.” Eventually, GU leadership created a new expanded teaching and learning center, and due to internal politics and the nature of her interim position, Betty was forced to formally leave the center and take residence in her primary academic unit. Currently, she still interacts, collaborates, and coordinates with administrators and practitioners in the new teaching and learning center, but she no longer has direct oversight over those administering local CIRTTL programs.

Interorganizational Connections. With respect to national CIRTl Network connections, Betty participated very little in network operations, aside from some involvement over procedural matters with the central administrative team and offering comments in meetings (online and in person) to help improve Network functioning. Betty has taken the lead on their institution's network contributions and because of that role, she maintains regular communication with the Network's national lead on cross-network programming. She also collaborated with a few CIRTl colleagues to develop cross-network programming and has worked with another CIRTl member to provide additional programming for students on her campus. Lastly, she exchanged knowledge with CIRTl colleagues to help her local CIRTl efforts, especially in relation to "on-campus operations" and "strengthening our online learning community."

Co-Leader: Tom. Tom was an assistant dean in the graduate school and was a recent hire at GU, charged with revamping the graduate school. He had a background in the private sector and politics, which provided a unique lens for local CIRTl efforts. A participant summarized the value of his background and current role:

So he's not a faculty member...he's a staff member on the campus. And so he brings a unique professional development perspective that is quite useful in our thinking about how to best present these programs...he facilitates communications with the graduate dean, but also with the graduate directors and associate deans for academic affairs across the campus. So as we're thinking about potential partners or potential roadblocks or any of those sorts of things, he has the temperature of the campus and the various colleges on campus that can be very useful in helping us move these programs forward.

Whereas Betty was in charge of the programmatic aspects of local CIRTTL activities, Tom played a major role in background operations, campus relations, and funding decisions that support local programming. “Not only did I provide the funding, but I’m sort of giving it, saying this is with the graduate school’s blessing.” As one respondent put it, “Tom is the critical link in the graduate school to getting our programs supported and marketed to students.” Part of this is because, as Tom put it:

I have earned the credibility, the dean has figured out that I can understand the politics of the campus and I can understand how to get things done and he is, he knows that when I tell him to step back, that’s the right thing to do. If I tell him to go forward, he trusts my judgment.

Despite Tom’s strong position within the graduate school, he expressed some limitations because of his non-faculty background:

I’m not a faculty, nor do I have a master’s in science. I have a master’s in public administration, a bachelor’s in history...I’m not on the faculty, only came to the university 2 ½ years ago so my networks in terms of faculty are rather limited.

Not having a faculty background has not slowed his attempts to make inroads with academic units in support of CIRTTL. The nature of his position provided many opportunities to interact with diverse stakeholders across campus, including faculty. However, it took a few years for him to gain sufficient traction with academic units so they would take an active interest in CIRTTL. Until recently, “nobody...stepped forward to become...a member of the advisory board.”

Interorganizational Connections. In terms of Network operations, Tom was an active member of Network committees and a regular voice in Network meetings when discussing the future direction of CIRTTL. He did not have any connections related to network contributions

(Betty was responsible for that role) nor did he report collaborative connections outside of a few recent grant proposals. However, he recorded several instances of knowledge exchange relationships related to (1) his attempts to discover the best ways to recruit faculty and/or identify faculty on his campus that could have a keen interest in CIRTl and (2) attempts to glean best practices from existing programs.

Section Summary. Betty and Tom had somewhat complementary connective roles to the national CIRTl Network. Betty oversaw network contributions. Tom was more active in network operations. Neither did much with respect to collaboration. Both gained knowledge exchange benefits in their attempts to improve their local CIRTl programs. These interorganizational connections had direct implications for the boundary-spanning behavior of *finding*. The most obvious is that, through CIRTl participation, Betty and Tom accessed knowledge from CIRTl colleagues to help improve their local CIRTl efforts. Betty, through her strong connection to cross-network programming, also identified and diffused online programming opportunities for local CIRTl participants at GU.

What was less clear was how Tom's network operation connections and the lack of collaborative connections of Tom and Betty influenced *finding* behaviors. Tom's committee involvement in the CIRTl Network may have allowed him to develop deeper connections with CIRTl colleagues who could have valuable information for his local CIRTl efforts. In contrast, the minimal amount of collaborative connections may have limited exposure to relevant information or additional resources for their local programming. The major point is that access to cross-network programming and explicit knowledge exchange are only one aspect of *finding* behaviors. Instead, *finding* also represents the connective potential of network participation, which is expressed through the development of numerous strong ties. By maintaining multiple

interorganizational connection types, local CIRTl leaders are more likely to build relationships with CIRTl colleagues, which can turn into knowledge exchange or other resources. Thus, the boundary-spanning behavior of *finding* was a product of the depth and extent of local CIRTl leaders' connections in the Network.

With respect to intra-organizational ties, Betty's and Tom's formal positions at GU played a major role in their local CIRTl efforts. Both individuals had the respect of campus constituents and possessed considerable social capital, mostly in relation to their formal positions. Betty was at GU much longer and developed a positive reputation across multiple colleges and units. When Betty was interim director of the teaching and learning center, she was able to use her position to integrate current programming with CIRTl concepts and use CIRTl to advance international student development. When the teaching and learning center expanded, she left the center, but was still able to maintain ties with the new center leadership to help guide local CIRTl efforts. However, given her new role as associate dean, she no longer had any administrative authority over local CIRTl programs and instead had to rely upon her connection to CIRTl and her professional reputation to advise, not directly lead, local CIRTl efforts.

Even though Tom was a recent hire at GU, he actively sought out key stakeholders affiliated with graduate student education and gained much gravitas across campus because of his capabilities and willingness to listen. Tom used the office of the graduate school to gain audience with campus stakeholders and fiscally incentivize the teaching and learning center to continue CIRTl programming. Administratively speaking, he was well attuned to the culture and political climate of GU and was able to navigate rather complex institutional dynamics. Yet, the lack of a faculty background somewhat hindered his ability to gain audience with academic

units. In summary, despite a few limitations, the positions and reputation of Betty and Tom were strong prerequisites for being effective intra-organizational boundary spanners.

By examining the formal roles and reputations of Betty and Tom, there was strong evidence to suggest that intra-organizational connections and subsequent boundary-spanning behaviors were strongly intertwined with institutional authority and social capital. When an individual becomes a formal institutional representative in the CIRTl Network, they bring their professional reputation, experiences, connections, and current and prior institutional titles. These components form the foundation of their intra-organizational connections and influence the ways that they are able to engage the boundary-spanning behaviors of *translation*, *diffusion*, and *gaining institutional support*. Thus, institutional role and reputation are key components in securing multiple connection types and engaging in boundary-spanning behaviors.

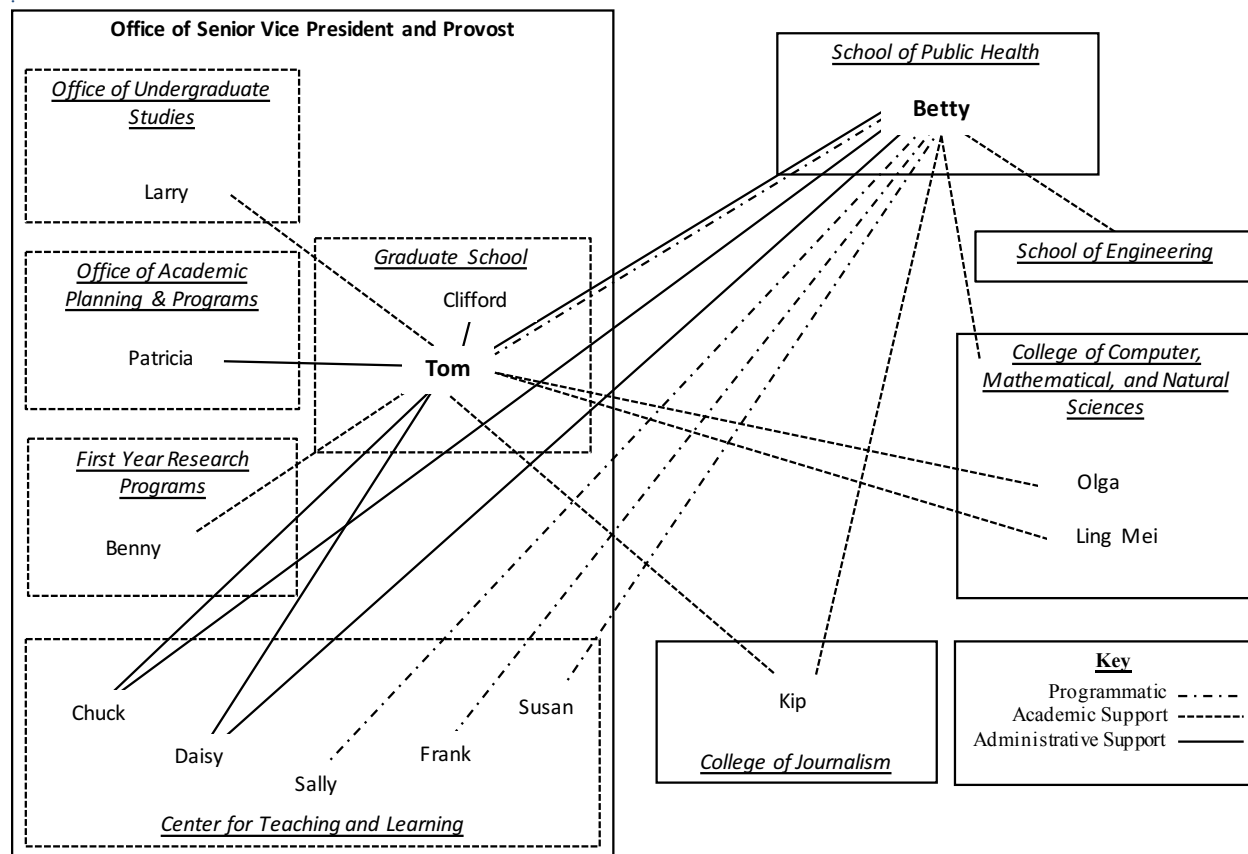
However, Betty and Tom both expressed difficulties in trying to gain the support of academic units (as described below), despite their positional status and authority, social capital, and subsequent intra-organizational ties. This suggests that position and reputation alone are insufficient mechanisms to advance local CIRTl programs. Other factors, as evidenced in the GU case, such as institutional climate, the extent of decentralization, and disconnected programming also contribute to a leader or co-leader successfully creating intra-organizational connections and engaging in the boundary-spanning behaviors of *translation*, *diffusion*, and *gaining institutional support*. Yet, despite the influence of multiple factors, my data clearly demonstrated the importance of institutional role and reputation.

In the next three sections, I explore the *programmatic*, *administrative*, and *academic* connections of Betty and Tom in relation to their local CIRTl responsibilities, institutional roles, and social capital.

Programmatic Connections

As a reminder, intra-organizational connections consisted of local CIRTLL leaders interacting with campus constituents to plan, deliver, and evaluate local CIRTLL programming. The teaching and learning center implemented all local CIRTLL programs. There were three primary individuals at the center who were responsible for programmatic delivery: Sally, Frank, and Susan. While Tom had some periphery connections with these individuals, Betty was their primary CIRTLL connection. I briefly describe each of these connections.

Figure 2: Local CIRTLL Leaders' Intra-Organizational Connections at GU



Sally. She was the assistant director in the teaching and learning center and “provided direct oversight of several graduate programs that formed the core of our CIRTLL programming at GU” When GU joined CIRTLL, she worked with the longstanding director of the center who

wrote the application to join the CIRTl Network. When the director stepped down, Betty took the position of interim director, inherited the CIRTl project, and became Sally's supervisor. Sally was the co-leader of local CIRTl efforts with Betty before they brought on Tom in the graduate school. She played an active part in "trying to figure out how we could match up with what CIRTl wants and how CIRTl might actually make an impact on our campus." She was very familiar with CIRTl and helped shape the current local CIRTl offerings. Betty summarized Sally's role:

So Sally is probably the equivalent to Tom within the teaching and learning center. She's the on the ground person working closely with the graduate assistants, she knows the programs in and out, so if I need to get something done, if I'm having some sort of technical hurdle, an issue with student recruitment, or something like that, I'm going to go to Sally first...She often co-facilitates many of these graduate programs.

Currently, Betty interacted with Sally in the capacity of disseminating information about cross-network CIRTl opportunities and providing input and guidance on CIRTl programs. Thus, Betty's connection with Sally was a crucial link in her ability to share what she gained from Network participation and to influence the direction of local CIRTl programming.

Frank and Susan. Frank was a graduate assistant, funded by the teaching and learning center, who ran most of the graduate student-level programming, including the CIRTl-related programs such as the college teaching certificate program and teaching-as-research learning community. While he often worked with Sally, he reported to the director of the teaching and learning center (Chuck). When Betty was the interim director, Frank met with her regularly throughout the week to discuss CIRTl programs. Currently, he and Betty connect a few times a

month where Betty provides input and ideas or requests data for reports to the central CIRTl administrative team.

Funded by the CIRTl grant, Susan was a graduate assistant who ran the international teaching fellows program. Like Frank, when Betty was at the teaching and learning center, they met frequently. Now, she and Betty only interact a few times a month to talk about the program and for Betty to provide guidance and insight. Susan elaborated:

She used to be the leader of CTE so we met every day basically and then after two years, she changed her job, she left us...so she's not working here anymore. We do not meet as often as before, as we used to be.

Overall, like Sally, Betty's connection to Frank and Susan represented another pathway to diffuse national CIRTl information to those responsible for local CIRTl programming and to influence the direction of programmatic decisions. However, despite Betty's maintaining connections with Sally, Frank, and Susan, several participants cited challenges associated with Betty no longer working at the teaching and learning center. Betty mentioned:

I used to direct the teaching and learning center, so that allowed for very frequent interaction as we were building out and CIRTlizing these programs. Now I've stepped out of that role, so I don't have direct supervision of these GAs. It's more of an informal, all right how are things going, what are the sorts of problems you have, are you running into questions.

Both graduate assistants working on CIRTl programs likewise expressed concern with Betty not having any formal ties to CIRTl programming:

I would say that's impacted...her work drastically because...if she worked in CTE...we could talk to each other more often, right, and she could maybe put more time in this. But

right now, she's working in another position and I'm staying here. I'm still working [for the teaching and learning center]...but I'm paid by CIRTTL. So I'm doing CIRTTL work but Betty is not here...my boss is not here...Every week we need to report what did you do for the previous week and what's your plan for the next week. When I talk about CIRTTL, [the teaching and learning center staff] don't care because it's not their work...This is CIRTTL's work. CIRTTL is Betty's work. Betty is not here...I think CIRTTL's work would be better [at GU] if Betty [would have] stayed.

I feel like [Betty's leaving] de-emphasizes CIRTTL in general, in the [teaching and learning] center. Because the person who knows the most about it and was really pushing for it is no longer there. So I feel like CIRTTL's sort of a, more of a resource now than a driving force.

In short, Betty maintained cross-organizational ties to those in the teaching and learning center who implement local CIRTTL programs. However, she no longer had formal authority to direct and lead local CIRTTL programs. This had rather significant implications for executing local CIRTTL programs, since the person "who knows the most about" CIRTTL was no longer in the unit that delivers CIRTTL programs. Furthermore, as the next section will show, there were also implications for Betty's role in gaining the support of the current leadership at the teaching and learning center to perpetuate ongoing affiliation with CIRTTL at GU.

Section Summary. Unlike Tom, Betty reported direct ties with those responsible for local CIRTTL programs. The teaching and learning center was identified early on as a logical candidate for CIRTTL program delivery, since it already provided teaching professional development for graduate students. When Betty was the interim director she oversaw center staff

to accomplish CIRTl-specific goals, translated CIRTl into existing offerings (with the help of center staff), and promoted local CIRTl offerings on campus. During that time, she also developed a strong relationship with the graduate school that resulted in financial security for local CIRTl programs. This relationship continued with Tom, who became a strong advocate for CIRTl within the graduate school. In short, when Betty worked at the center, she engaged in the boundary spanning behaviors of *translation*, *diffusion*, and *gaining institutional support*. She translated CIRTl into existing offerings, advertised local CIRTl programs, and gained support from the graduate school to fund local CIRTl initiatives.

However, when Betty left the center, she lost direct oversight of local CIRTl programs. Despite her absence, she maintained ties with those directly responsible for CIRTl programming, even though she lost decision-making authority. In her current role, she still engaged in the boundary spanning behaviors of *translation*, *diffusion*, and *gaining institutional support*, albeit in different ways. She diffused CIRTl-related information to Sally, Frank, and Susan and made them aware of any changes at the national level that may influence local offerings. She also helped translate CIRTl by providing insight and advice, which may affect teaching and learning center staff members' programmatic decisions. With respect to gaining support, one of Betty's most important roles was to convince current center leadership of the utility and need for CIRTl at GU (as evidenced in the administrative connection section below). This was particularly important when we consider that for the most part, local GU CIRTl programs were somewhat static, which was likely a direct result of shifting priorities of the new leadership in the teaching and learning center. Without Betty's direct oversight, CIRTl was now in the background and was just a "resource" amidst many other opportunities for graduate

students. Thus, Betty had to cross a major intra-organizational boundary and convince center leadership of the value of CIRTL.

This section demonstrated how institutional role and position shaped boundary-spanning activities. In addition, proximity to the unit responsible for local CIRTL programs was another important consideration, especially with respect to decision-making authority. Boundary spanners with programmatic decision-making authority can be quite direct in *translation*, *diffusion*, and even *gaining institutional support* activities. In contrast, boundary spanners who are disconnected from the programmatic center have to rely on their ability to influence campus stakeholders. This is not to say that boundary spanners with programmatic authority do not have to influence campus constituents, but such influence is much more targeted on gaining external support than influencing the creation, improvement, and implementation of programming. A boundary spanner disconnected from programmatic decisions has to both influence programs and gain external support. This does not mean that both leader and co-leader have to be at the center of local programming (e.g., Tom was not directly tied to programmatic delivery), but my data suggested that it was extremely valuable to have at least one of the formal leaders invested with programmatic decision-making authority.

Administrative Connections

Administrative connections consisted of local CIRTL leaders informing campus administrators about local CIRTL activities and gaining or maintaining their support. The main administrative channels available to Betty and Tom stemmed from their involvement with the teaching and learning center and the graduate school. As mentioned above, Tom maintained upper administrative connections with the graduate dean and used his position to garner conversations with other upper administrators. Betty utilized her reputation and affiliation with

the former teaching and learning center to maintain connections with the administration of the new teaching and learning center. However, there were ongoing tensions within the graduate school that resulted from having a “lame duck” graduate dean and within the teaching and learning center that resulted from disinterest in continuing CIRTl participation.

Clifford and the Graduate School. Clifford, the graduate dean (Tom’s supervisor) and associate provost, paid for GU to be part of the CIRTl Network and “provided direct funding to the teaching and learning center for the graduate programs.” The graduate school was under the office of the senior vice president and provost. Tom and Clifford “communicated regularly regarding the activities of CIRTl.” During these meetings, Tom kept him informed of local CIRTl programs and occasionally asked for input and guidance. Betty had minimal interaction with Clifford. When she did interact with Clifford, it was through infrequent meetings to discuss funding or when Betty sent CIRTl update reports. Furthermore, Clifford talked about CIRTl in institutional leadership circles, but these instances were rather limited and typically were used as an example of the graduate school’s outreach efforts.

Clifford stepped down as dean in the summer of 2016 and, as a result, “his focus on what’s going...on a day-to-day basis was minimal” for the remaining months of his tenure as dean. He intended to stay on in the position “but wasn’t going to be allowed to and since he’s an English professor and not STEM.” Essentially, CIRTl was not “on the top of his list,” leaving Tom to pick up the slack and find champions on campus to support the CIRTl initiative since “[Clifford was] not going to champion it.” In short, “he’s sort of a lame duck and does not necessarily play well with the other people on the campus.” Therefore, while financial support remained steady, the brunt of advocating for CIRTl at the upper administrative level fell

squarely on Tom's shoulders. Thus, Tom became a major administrative decision-maker and a source of institutional support for local CIRTTL programs.

Daisy, Chuck, and the Teaching and Learning Center. Daisy was the executive director of the teaching and learning center and Chuck was the director who took over Betty's former job responsibilities. Like the graduate school, the teaching and learning center was under the office of the senior vice president and provost, where Daisy was also an associate provost. Tom's connection with Daisy and Chuck was limited to the funding relationship with the graduate school and the associated leverage that stems from that dynamic. Furthermore, their relationship was not particularly strong. Tom explained:

I don't have the respect [of] the people who are in the [teaching and learning center], who are running the programs, that were working for Betty. The people that work, the staff in the [teaching and learning center]...they've written me off... because I don't think that we are on the same wavelength...and on the even personal level, is not strong there.

This is not to say that there was "bad blood" between the graduate school and the teaching and learning center, but it did suggest that there was some misalignment between the two units.

Betty took a more direct role in securing the support of the teaching and learning center since "she knew that political environment" because of her prior interim director role. To complicate matters, "the leadership within the teaching and learning center was questioning GU's role in CIRTTL." So, Betty was "tasked with trying to figure out what the elements are in the teaching and learning center that are negative or neutral" and demonstrating CIRTTL's value to the teaching and learning center. However, this had been a challenge, as Betty explained:

...the teaching and learning center went through this major revision in the last year and I think the new overall director...is trying to find where to leave his mark and where to

push the teaching and learning center and these graduate programs are fine and all but they're already fine. They're good. They've been doing a lot of good...the success of how we've been able to transition these programs and CIRTLe these programs haven't provided a clear evidence for the need for CIRTLe. You know, so I do think that it tends to [be] white noise and he's looking at other areas to improve.

Betty had to advocate the continuation of CIRTLe even though she does not have administrative authority or direct presence within the center, which limited her persuasiveness. Thus, she engaged in the boundary-spanning behavior of *gaining institutional support* by leveraging her former role in the teaching and learning center to convince the new center leadership of the value and importance of CIRTLe.

Patricia. In addition to connections with the graduate school or the teaching and learning center, Tom connected with another associate provost (Patricia) about CIRTLe as part of his other job responsibilities. However, these interactions were minimal, as expressed by Patricia, “every once in a while Tom will come and kind of tell me some of the things that he's doing and he has talked a little bit about CIRTLe and his increasing involvement in that.” Tom considered this an important connection since Patricia was “the number two person to the provost.” He “talked to her about CIRTLe, what we're doing with CIRTLe, and future faculty and...she gave me ideas of people to talk to. So she does some introductions for me.” Despite Patricia's central role, Tom has not directly translated this connection into local CIRTLe impact. However, it demonstrated that Tom was actively seeking out other upper administrators to raise awareness about local CIRTLe programming and to advance efforts to *gain institutional support*.

Section Summary. Tom and Betty both maintained important connections with the two administrative units that most directly influenced local CIRTLe programs. However, they

performed the boundary-spanning behavior of *gaining institutional support* differently because of the nature of their formal institutional roles. Tom, while dealing with a “lame duck” graduate dean, had to take on many responsibilities during the transition and had to spend time rebuilding the image and stature of the graduate school. During his time at GU, he had the ear of the graduate dean and occupied a position of considerable authority in supporting CIRTl activities. In essence, support from the graduate school was in his backyard, making the boundary spanned fairly small. In addition, his position allowed him to gain increased social capital and opportunities to rub shoulders with other upper administrators at the university. However, these connections have not yet translated into vibrant and expanded local CIRTl efforts, though a new advisory board is a major leap in the right direction.

The teaching and learning center was also in a state of transition, whereby the current leadership was questioning the utility of being involved with the CIRTl Network. Betty had some success in convincing Daisy and Chuck that CIRTl was useful, but the support was still tenuous at best. This was further complicated by the fact that CIRTl grant funds will be dissipating rapidly within the coming year and the teaching and learning leadership will have to decide to continue to fund CIRTl-related staff (including the graduate student employees) to run CIRTl programs. There was some financial leverage from the graduate school, but given the state of flux of both units, it was not yet clear how Betty and Tom would produce an institutionalized model of CIRTl programming that was not dependent upon CIRTl grant funds.

My data showed that Tom and Betty engaged in administrative connections in service to the boundary-spanning behavior of *diffusion* by keeping institutional leaders up to date with CIRTl activities, and of *gaining institutional support*, by securing administrative buy-in within the two primary CIRTl-related campus units. It was clear that institutional role and proximity to

key decision-makers were major components in securing administrative support. Tom and Betty, by the nature of their current and former roles, were able to gain audience with key campus constituents. Tom was a major decision-maker in the graduate school and could leverage his position to gain audience with other upper administrators. Betty, on the other hand, had to position her social capital to make a cogent case with Daisy and Chuck that CIRTl was worth pursuing. Thus, the boundary-spanning behavior of *gaining institutional support* at CIRTl institutions can take on at least two forms, both of which are likely necessary to build a local CIRTl program. First, at least one leader needs an administrative, decision-making position in one of the units directly related to CIRTl so they can use that position to connect with other key decision-makers within the unit. At the same time, one or both of the local CIRTl leaders need to be adept at crossing organizational boundaries to make the pitch for the value of local CIRTl programming and ongoing Network involvement, without necessarily drawing upon positional authority.

Academic Connections

Finding Faculty Supporters: Olga, Ling Mei, Kip, and Larry. In light of Tom's non-faculty background and the difficulty of advancing local CIRTl programs, he diligently tried to find faculty members to champion CIRTl on GU's campus. For instance, he stated:

I'm sort of taking a different tact now in trying to, I'm inventorying the future faculty programs that are already being done in various different colleges in a greater way, and going, and trying to build a different support network. So I'm meeting with the research deans and I'm working with the associate deans for graduate education and trying a different tact now... So I was trying to find another set of actual working faculty in labs

and departments to sort of form more of an advisory group to preserve CIRTl on this campus.

Below, I discuss a few connections that Tom and Betty had in trying to achieve their goal of obtaining support and buy-in from academic units.

Tom, within the past year, reached out to two individuals in the college of natural science to gain their support of CIRTl programming: (1) Olga, who was the associate dean of undergraduate education in the college of natural sciences, and (2) Ling Mei, who was the associate dean for graduate education and faculty affairs. Until recently, Tom did not have success in garnering their support, which was partly due to an already well-developed teaching and learning center within the college of natural sciences.

In contrast to Olga and Ling Mei, Tom and Betty developed a strong connection to a faculty member (Kip) in the college of journalism. Betty explained:

And so we have had a couple of meetings with Kip and Tom to get more insight into his background with [CIRTl at another campus], but then to start to build what we might call an advisory group. And so I see Kip as one of those people who, if we had an advisory group, this would be the kind of person that we would have in our advisory group. And so, we've chatted with him about some of the other possible people on campus who we could pull in.

However, even though Kip expressed interest, the relationship was still emerging and the lack of a STEM connection could prove problematic in the future.

Lastly, Larry was the assistant dean in the office of undergraduate studies. Tom reached out to him to identify potential faculty that could have an interest in becoming a CIRTl supporter. To date, no substantive connections with faculty resulted from this interaction.

Despite ongoing challenges in securing faculty supporters, there has been some recent success, as noted above, in creating an advisory board with representatives from several colleges on campus. In a recent conversation with Tom, he reported that they finally started to have success in finding interested academic leaders and faculty. Despite not having a faculty or PhD background, he attributed his success to personally meeting with faculty and academic leaders and gaining their support. Slowly over time, he was able to orchestrate, with help from Betty, the convening of a cross-unit advisory board. While the result is unclear, Tom was highly optimistic about what the advisory board could mean for expanding CIRTl programs and increasing participation.

College-Specific Teaching Development Programs. As noted above, the college of natural sciences already had a strong teaching development program. Betty and the teaching and learning center worked with the college of natural sciences' teaching center to deliver the teaching certificate program, but involvement between the two similar teaching and learning-centered units has been rather limited. In addition, the college of engineering has its own strong teaching and learning center. Betty presented at one of their programs and shared some things about CIRTl, suggesting at least some success in diffusing CIRTl across campus. However, overall, except for minor inroads, there were clear silos between teaching and learning units on campus, further frustrating the expansion of local CIRTl programs. In summary:

GU is struggling to expand beyond the teaching and learning center on campus. So

CIRTl is very much housed within that. It's not spread out among the different colleges very well.

The local CIRTl leaders hoped that the cross-unit advisory board would help to bridge these gaps and create a more synergistic campus with respect to preparing future faculty.

Benny. Lastly, Tom reached out to Benny to see about incorporating TAR projects into a program for undergraduate research experiences and position Benny as a champion for the CIRTl cause. Benny was the director for this program in the office of the senior vice president and provost. Tom and Betty both met with Benny to discuss the possibility of working together to incorporate some of CIRTl into his program and they are still exploring the possibility. This connection was another example of Tom trying to gain support from campus colleagues and units in service to local CIRTl efforts.

Section Summary. Betty and Tom generally struggled to secure support from faculty, colleges, and departments. They both made valiant efforts in trying to secure faculty “champions,” but until recently, they have not had much success in getting faculty to buy into the CIRTl cause. The lack of success was no doubt heavily influenced by the fact that at least two of the STEM-centric colleges had their own versions of a teaching and learning center. Even if faculty and academic leaders believed in preparing future faculty as effective teachers, they may not see the practicality of sending their students to the centralized teaching and learning center when they can deliver more specialized training for their students. This tension between centralized and localized professional development efforts rightfully described the decentralized structure of GU. Even if Betty were to take on a major leadership role within the teaching and learning center, she would still have to compete with parallel offerings from the colleges. The teaching and learning center had some success with the college of natural resources (i.e., collaborating on a teaching certificate program), but the college of nature resources did not seem intent on farming out professional development to the centralized unit. Thus, regardless of support from the graduate school and the central teaching and learning center, Betty and Tom had to find alternative ways to integrate CIRTl’s core ideas and content into college-specific

programming. They used their positional and reputational authority to gain audience with the colleges but they did not find all of the mechanisms by which college leaders were swayed to value CIRTL and its impact on students.

In summary, there were inherent challenges in gaining support from academic units, especially with respect to a decentralized campus and parallel teaching programs scattered across colleges. Whereas Betty and Tom were able to rely upon their current or former administrative positions to solicit administrative support, securing academic unit support was much more complicated since each college and even department had different structures, climates, and priorities. Tom eventually realized his goal of locating “champions” through the formation of the advisory board, but it took considerable effort and a few years to successfully identify and recruit faculty and academic leaders. Betty, who is a full professor, seemed to have limited success, which runs contrary to what we might expect given the “birds of a feather” colloquialism and demonstrates that even respected faculty members may find it difficult to translate their disciplinary social capital outside of their college and department. In contrast, Tom, who did not have a PhD, used his formal position, communication skills, and persistent nature to meet with many faculty and academic leaders across campus. This suggests once again that formal institutional roles play a major part in boundary-spanning activities, but also that garnering support from academic units is a long process that requires keen listening skills and a personable demeanor. Thus, the GU case demonstrated how complicated gaining support from academic units is and the interplay of institutional role, dispositional qualities, and persistence.

Chapter Summary

CIRTL Connections and Boundary-Spanning Behaviors

Local CIRTL leaders and co-leaders played an important role in connecting CIRTL to their university by maintaining both inter- and intra-organizational connections. The GU case demonstrated that the two local CIRTL leaders engaged, to varying degrees, in the four major types of interorganizational connections that I described in the introduction of this chapter. Through CIRTL participation, they gained helpful information to grow and develop their local CIRTL programming. They also gained access to online, cross-network programming to increase available offerings for their graduate students. In addition, by attending Network meetings and serving with CIRTL colleagues, they expanded their professional network, which potentially exposed them to new ideas and resources that could later turn into fortuitous opportunities. Thus, the boundary-spanning behavior of *finding* was not solely limited to explicit knowledge transfer, but instead involved the connective potential of multiple strong ties gained through several connection types, which led to implicit and explicit benefits.

For intra-organizational connections, my data analysis showed that the local CIRTL leaders at GU had three primary purposes in connecting with campus constituents. First, Betty had connections with those that helped plan and deliver local CIRTL programs. These connections were directly related to the boundary-spanning behaviors of *translation* and *diffusion*. When Betty was the interim director in the teaching and learning center, she shared CIRTL information and resources with her local team, worked with her team to translate CIRTL for GU, and helped advertise offerings across campus. When Betty left the center, she still *diffused* CIRTL information and resources to those who delivered local CIRTL programs and provided them with advice and insight to *translate* CIRTL for GU and advertise programs across

campus. However, after leaving the center, she was limited to influencing rather than directing the aims and purposes of local CIRTTL programs. In short, the nature and extent of *translation* and *diffusion* boundary-spanning activities were highly dependent upon programmatic connections, whether within the unit responsible for programmatic delivery or across organizational boundaries.

Second, both Betty and Tom had administrative connections that they used to *diffuse* CIRTTL-related information and maintain support for local CIRTTL activities. Tom and Betty (especially while she was interim director) used their formal positions to gain audience with upper administrators, inform them of the status of local CIRTTL programming, and direct or influence support mechanisms. Third, Betty and Tom tried to identify and recruit academic leaders and faculty to champion local CIRTTL efforts and to make inroads into academic units. Until recently, they had minimal success due to a decentralized campus and competing college-specific teaching programs. Overall, the leader and co-leader at GU had multiple connections in relation to CIRTTL and spanned inter- and intra-organizational boundaries to solicit benefits of CIRTTL participation; develop, translate, execute, and advertise local CIRTTL programming; and inform and gain support from administrative and academic units.

The GU case demonstrated distributed boundary-spanning behaviors. While both Betty and Tom participated in *finding* activities through their interaction in the Network, Betty was directly responsible for translating CIRTTL into local programming (with her local team), advertising local programs, and gaining the support from the current teaching and learning center administration. Tom was mainly responsible for diffusing CIRTTL information to administrative and academic leaders and gaining their support for ongoing CIRTTL activities. While this case does not provide a formula for the right mix of boundary spanning, it does suggest potential

benefits of dividing the various boundary-spanning activities among the leader and co-leader to distribute the workload and appeal to particular strengths of each individual. However, while dividing boundary-spanning tasks may lighten the workload of each local CIRTl leader, there is a risk that efforts to *translate*, *diffuse*, and *gain institutional support* could not be in sync as the two leaders pursue their own assignments. In addition, if one leader did not fulfill their responsibilities, then major boundary-spanning activities either are not accomplished or the other leader would have to pick up the slack. Thus, my study suggests that boundary spanners must be able to both strategize the most effective specialization of labor for their campus and then regularly communicate to create synergy between individual efforts.

Individual and Institutional Characteristics

With respect to individual characteristics, my findings showed the importance of formal institutional roles and social capital, since they provided the foundation for intra-organizational connections and boundary-spanning activities. The ability to engage *translation*, *diffusion*, and *gaining institutional support* behaviors were extremely dependent upon positional authority, extant connections across campus, and the respect of campus colleagues. Furthermore, proximity to decision-making centers, whether that was the unit responsible for programmatic delivery or the graduate school, influenced boundary-spanning activities. Boundary spanners with close proximity to decision-making centers can tap into their or their unit's authority to *translate*, *diffuse*, or *gain institutional support* for CIRTl programs. In contrast, those further away from decision-makers must find ways to convince campus constituents of the value of CIRTl possibly without the leverage of positional authority. This is particularly true for gaining support from academic units with institutional autonomy where, regardless of formal position, boundary spanners must be able to navigate numerous, complex college and departmental structures and

climates. In short, the GU case demonstrated that institutional role, social capital, and proximity to decision-makers all have a direct impact on local CIRTTL leaders' and co-leaders' ability to engage in boundary-spanning behaviors.

Lastly, more than any of the four institutions of this study, GU was marked by a culture of transition, both within the graduate school and the teaching and learning center. GU has also historically undervalued teaching and learning and only recently tried to advance teaching and learning initiatives on campus to any great extent. As result, there were many departments on campus that were still entrenched in research-centric cultures. To operate as effective boundary spanners, Betty and Tom had to operate and navigate this challenging organizational space. They had to read and translate the current environment to be able to move forward with on-campus CIRTTL activities. At the same time, they had to complete all of their other work responsibilities that may only slightly overlap with CIRTTL. Thus, to fully understand boundary-spanning behaviors, one must understand the context in which a boundary spanner operates and the resultant effect on their *finding, translation, diffusion, and gaining institutional support* activities. In addition, boundary spanners must be able to read campus dynamics and navigate campus culture, politics, or policies in order to maximize their effectiveness.

The Impact of Boundary-Spanning Behaviors at Green University

The boundary-spanning activities of Betty and Tom played a crucial role in advancing the mission of the CIRTTL Network on their campus. They gained important knowledge and resources from their national CIRTTL involvement and developed numerous connections, across several intra-organizational boundaries, with campus colleagues related to running local CIRTTL programs and gaining support for local CIRTTL activities. However, the impact of their boundary-spanning activities was highly constrained by local institutional dynamics, such as organizational

tensions within the graduate school, changes within the center for teaching and learning, and cross-unit tensions due decentralization. The target reform of providing high quality teaching professional development for future STEM faculty was the focal point and motivation for Betty's and Tom's boundary-spanning activities, but the nature of their success was contextualized by institutional and individual attributes. Thus, the impact of their boundary-spanning activities was not as simple as obtaining knowledge and resources from national CIRTl connections and then directly applying such gains locally. Instead, boundary-spanning impact was multi-faceted and often took the form of soft influence with their campus colleagues rather than hardline directives.

Chapter 5: CIRTl at Serenity University

Similar to Chapter 4, the purpose of Chapter 5 is to explore a single case institution to address my three research questions. In short, my goals are to: (a) examine the types and purposes of local CIRTl leaders' inter- and intra-organizational connections related to the Network, organized by *programmatic*, *administrative*, and *academic* connection types; (b) investigate how local CIRTl leaders and co-leaders engaged in the four boundary-spanning behaviors; and (c) illuminate the characteristics of local CIRTl leaders and institutional contexts that could affect boundary-spanning activities. Specifically, I analyze the case of Serenity University (SU), which joined the Network in the expansion that occurred in 2011.

The outline of Chapter 5 is as follows: (1) I provide an overview of SU; (2) I describe the local CIRTl leaders' local roles and interorganizational CIRTl connections; (3) I discuss local CIRTl leaders' on-campus *programmatic*, *administrative*, and *academic* connections (and relevant institutional dynamics); and (4) I conclude with a chapter summary of overarching themes.

Serenity University: An Overview

Serenity University (SU) is a public, research-intensive doctoral granting institution located in the southern portion of the United States. SU has an undergraduate student population of approximately 35,000 and a graduate and professional student population of about 6,000, with nearly 300 STEM doctorates issued per year. Like GU, SU has been an active member of CIRTl since 2011.

With respect to my case selection methodology, SU represents an institution new to the ranks of CIRTl that has moderate to high programming. From recent internal CIRTl evaluation data, SU reported ten local CIRTl programs. Also, from the same data, SU reported over 500

individuals that participated in CIRTl programs during the 2014-2015 academic year and approximately 300 in 2013-2014. Local CIRTl programming and activities were housed jointly between the Center for Teaching and Learning and the Graduate School.

The initial goal and strategy of SU's local CIRTl activities was to focus on the funding of mini-grants to support the development of learning communities and teaching-as-research projects as evidenced in the following quote:

SU's institutional goals are to reduce attrition of our STEM future faculty, by providing support within communities of learners where they receive training in pedagogy and preparation for the job market. We will create competitive start up mini-grant programs for departments funding the development of...Learning Communities (LCs) for future faculty, CIRTl network courses for future faculty, [and] future faculty Teaching-as-Research (TAR) projects.

The teaching and learning center delivers most programs with many in direct conjunction with the graduate school. The nearly 20 graduate learning communities are "designed to increase belonging and reduce feelings of alienation and inadequacy, providing an inclusive atmosphere for participants from diverse backgrounds." Funded, graduate student TAR projects "prepare future faculty, encourage an institutional cultural shift, [and] help future and current faculty partners to identify and adopt more effective pedagogical methods." In short, while both programs are still in the process of growth and development, SU has been rather successful in enacting their initial vision for their local CIRTl programming.

Participants described SU as a "STEM heavy campus", a "collaborative place," and an institution where "we have always culturally valued undergraduate education." Because SU historically valued "innovation, reform, [and] the scholarship of teaching and learning," joining

CIRTL was “a no-brainer.” One of the major reasons for such a strong congruency between CIRTL and SU was the already “well-established and very successful preparing future faculty program” and longstanding culture of student learning communities on campus. Overall, SU was a prime example of a robust local CIRTL community that had strong, distributed leadership, support from upper administration, and vibrant programs.

In the next section, I provide a more detailed description of the local CIRTL dynamic at SU by exploring the characteristics, institutional roles, and interorganizational connections of the three local CIRTL leaders and their intra-organizational connections.

The Cast and Local CIRTL Dynamics

Local CIRTL Leaders

Generally, participants used adjectives such as enthusiastic, responsive, hardworking, motivated, and personable to describe Arielle, Gertrud, and Rufus. One individual talked about how they all possessed the “ability to be able to tune in and find out what people are interested in, maybe what their needs are and then figure out how they might be able to help those things come to fruition.” Interviewees also mentioned how Arielle and Gertrud had considerable prior experience and had credibility with faculty, administrators, and staff across campus. In short, the three individuals that connected CIRTL to SU and that led local CIRTL programming were well respected and maintained many cross-institutional connections.

Leader: Arielle. At the local level, Arielle was the local CIRTL leader and guided all CIRTL-related activities at SU. She spent half of her time as a full professor in a STEM department and the other half as an assistant dean in the graduate school. As part of her graduate school duties, she was “responsible for our strategies for recruiting graduate students and for what I would describe as the quality of the graduate experience beyond the direct research

academic program.” Her graduate school appointment put her in a prime position to enact and support local CIRTl activities. One participant mentioned:

Her responsibilities with the graduate students and graduate programs leverage nicely with her activities with CIRTl and give her good opportunities to sort of bring CIRTl activities to the attention of both faculty members and graduate students and postdocs.

Another interviewee went on to say:

I think Arielle’s experiences in the Graduate College, working across an entire university full of graduate programs, has probably been a huge asset because she is familiar with programming within departments, with how graduate programs function, with challenges being faced by different graduate programs across the university.

Participants often described Arielle as persistent and committed to improving undergraduate education, which fueled her ability to be “one of those folks who brings people together on campus.” She was an individual who “gets people involved that are really more the reluctant ones, [those that] would prepare future faculty for research only... she’s just absolutely tirelessly out there with the toughest of departments.” Because of her graduate school position and role as a well-respected professor, she was able to gain audience with key individuals in colleges and departments and spread the important message of graduate student professional development.

At the programmatic level, Arielle was the lead in developing graduate learning communities, mentoring the postdoc overseeing the teaching-as-research program, and overseeing evaluation efforts. She “is really like our numbers person...she tracks all the budgetary stuff...she keeps track of how many TAR projects, how many graduate learning communities.” In short, she was deeply involved in many aspects of local CIRTl programming.

Interorganizational Connections. In terms of connections in the national Network, Arielle regularly attended CIRTl meetings (online and in person) and voiced her ideas and opinions with the national group. In relation to network operations, she served on several committees and often engaged in discussions to improve network functioning. In terms of collaboration, she worked with several Network members to write grant proposals and she was currently helping to lead two additional grant proposals. With respect to network contributions, she was responsible for SU's additions to online, cross-network programming and worked with other CIRTl members to develop additional cross-network programs. Most recently, she helped create a workshop for graduate students and postdocs centered on career planning and worked with another CIRTl colleague to create a short seminar series on financial planning. Finally, while she did not explicitly mention instances of knowledge exchange with other CIRTl members, one participant mentioned how Arielle sought out "something that she would like to try at SU" with respect to learning communities, suggesting that knowledge exchange still occurs despite a lack of explicit named connections in her network map.

Supplemental Leader: Gertrud. Gertrud was originally the CIRTl institutional leader for SU and helped write the application to join the CIRTl Network. She stepped down as leader a few years ago, but maintained an active role in leading and guiding local CIRTl efforts at SU. She was the associate director of the teaching and learning center and led "the initiatives related to all of our graduate student programming." Before her role in the teaching and learning center, she was a tenured STEM faculty member. One of her major responsibilities in the center was to lead a longstanding and successful preparing future faculty (PFF) program. Like Arielle, her position was synergistic with CIRTl activities where she purposively attempted to create "a lot of cross-pollination between CIRTl and PFF." Her "position in the teaching and learning center

went a long way to legitimize and institutionalize CIRTTL efforts,” since, “I’ve never known anybody on campus that hears her name and doesn’t associate her with the preparing future faculty program.” Furthermore, her “reputation...both in terms of the quality of her research and the respect she has among her professional colleagues” provided ample social capital to engage campus colleagues in CIRTTL efforts. In short, Gertrud was a connector and maintained ties across the universities. She described her connective role:

The faculty member that I partner with to head the faculty learning community was pointing out the other day that both she and I are middle children...we want everybody to be happy, and so we...are constantly getting people together and trying to...make them be nice to each other... I really enjoy bringing people together. That really gives me a lot of pleasure and that fits my personality and that’s very much supported in my work...I am supported heavily for being a boundary spanner. In fact, I get called the yenta of SU because I like to bring people together.

She went on to discuss how Arielle’s professional world at SU and her world overlap:

I guess Arielle’s world and my world they’re like a Venn diagram, right, so I have all these people that are at a research university that are truly passionate about teaching, and then she has some of those as well...and then she’s got this huge world of people that are not interested in all of teaching, but they’re highly interested in research. And so she brings them into the mix. And so we, together we have a pretty big reach.

In short, Gertrud used her former relationships and her current position to connect and convene efforts to prepare future faculty where CIRTTL was one, albeit important, component. Her efforts and Arielle’s efforts were complementary. They used their existing network connections and the weight of the graduate school and teaching and learning center to advance CIRTTL at SU.

At the program level, Gertrud oversaw Rufus in the teaching and learning center, played an active role in programmatic planning and oversight, mentored TAR students, and often worked with Rufus to deliver programs for graduate students.

Interorganizational Connections. With respect to her national CIRTl involvement and Network operations, Gertrud played two major roles. First, she was a member of the central national leadership team that guides the direction of the Network. Second, she was in charge of creating the new IT infrastructure with a collaborative team comprised of CIRTl members and individuals at SU. In light of network contributions, she did not record any connections because Arielle managed local contributions to cross-network programming. In terms of collaboration, she mentioned how she was involved with a grant proposal with several other CIRTl members. Lastly, she talked about how she provided knowledge to a colleague at a CIRTl institution that was struggling. She also regularly interacted with individuals at meetings who “were people that I often find myself talking to at in-person meetings whether it be in the social part...or about our respective institutions and how we do things there, and compare notes,” suggesting at least implicit knowledge exchange behaviors.

Co-Leader: Rufus. He was the local CIRTl administrative co-leader and a program coordinator in the teaching and learning center. Aside from his other duties with Gertrud on the PFF program, he was responsible for executing CIRTl programs and directly interacting with students. He described his key role in the following quote:

I think my role is vital. I think without me it would be a lot harder for anything to happen, because our leaders are faculty. They have other stuff, they’ve got other fish to fry. And the other grants that are burning down and then other huge things that are super important to the institution and to them personally, and without an administrative person whose full

time job it is to interface with students, I don't think SU would be as successful, CIRTLe-wise... I help make the program really effective because I spend extra time and energy to really help a student figure out what they want to do and what's going to happen next to them. And so the students love us... So me personally, I'm involved a lot like on the ground with the troops. Like inspiring them, helping them, comforting them and so they see how useful it is to them, they honestly love the program.

Other participants likewise understood the important role that Rufus played in local CIRTLe efforts at SU. One interviewee mentioned how Rufus was the lynchpin holding everything together:

Rufus is tremendous when it comes to detail and keeping people moving and so he's probably, I didn't talk much about him, but he's probably the lynchpin to most of SU's activities. Somebody who, he's just a very well organized person who can think both at the big picture level, so what are the overall goals for the project at SU and within the whole network, and then what do we need to do next to make sure we're moving towards those goals.

Overall, while Arielle and Gertrud maintained higher, administrative connections across campus, respondents viewed Rufus as the crucial link in CIRTLe program operations. He spanned important boundaries between graduate students, other staff within the teaching and learning center and the graduate school, and the CIRTLe advisory board to execute CIRTLe programs.

Interorganizational Connections. Whereas Arielle and Gertrud were more involved on the leadership end of network operations, Rufus' connections were centered more on logistics, such as reporting requested information and asking questions about funding, deadlines, and national meetings. He did not mention any network contributions, which did not exclude his

involvement in SU's cross-network programming, but it reinforced Arielle's dominant role on that component. With respect to collaboration, she lined up opportunities for her students to visit other CIRTl campuses and experience their programming. Lastly, while Gertrud and Arielle were less vocal about knowledge exchange connections, Rufus talked about several key individuals who provided guidance and ideas relevant to local programming at SU. For instance, one participant stated, "Rufus was more likely to contact me about more operational issues, sort of how do we get faculty, how might we get faculty engaged, for example. How might we do a better job of that?" Rufus also mentioned how he received inspiration "for how we can track the student experience here at SU" and "how to arrange our marketing."

Section Summary. With respect to interorganizational connections, Arielle, Gertrud, and Rufus were all quite involved in the national CIRTl Network. Arielle was active in Network committees, engaged in collaborative projects with CIRTl colleagues, and was SU's lead on network contributions. Gertrud was heavily involved in central Network leadership and collaborated with CIRTl members. Rufus focused more on relevant logistical information for SU efforts and explicitly engaged in knowledge exchange activities. Like the GU case, the three local CIRTl leaders had complementary national CIRTl connections, demonstrating that it was unlikely that a single leader would be able to engage in all interorganizational connection types simultaneously.

The diversity of interorganizational connection types found in the SU case expands our understanding of the boundary-spanning behavior of *finding*. Explicit knowledge transfer was only one, albeit important, component of these leaders' interaction with the national Network. Instead, they maintained many different kinds of connections that potentially exposed them to alternative viewpoints and implicit knowledge exchange pathways, both directly related to

CIRTL and to other parallel work responsibilities. *Finding* was not limited to the transfer of pre-packaged knowledge gains but represented a rich array of connections (and potential connections) with CIRTL colleagues that influenced local CIRTL leaders' programmatic decisions or that could later be used for specific solutions to local problems. Put simply, the diversity of connection types amongst the three leaders at SU provided their team with many potential knowledge and resource channels that they could access as needed. Thus, my findings suggest that the boundary-spanning behavior of *finding* is not an event but rather a dynamic, ongoing sum of realized and potential connections of multiple boundary spanners.

In terms of intra-organizational connections, Arielle and Gertrud had positional authority due to their formal roles on campus and had the respect of campus colleagues because of longstanding connections. Each were particularly adept at connecting stakeholders across campus in service to graduate education, grants, and other initiatives connected to their work roles or personal interests. Both were also STEM faculty members, which allowed them to run in administrative and academic circles. Arielle's position in the graduate school, combined with reputation as a faculty member, provided superb access to academic units and those that may not have great interest in improving teaching on campus. In contrast, Gertrud's position in the teaching and learning center connected her to those with a keen interest in teaching.

Additionally, while Rufus may have been less visible than Arielle and Gertrud across SU's campus, his programmatic-centric position put him into direct connection with CIRTL supporters (e.g., members of the advisory board) and student participants. In many ways, he was the public face of programmatic output and was well liked and respected amongst those involved in developing, implementing, and participating in local CIRTL programs.

Combined, Arielle, Gertrud, and Rufus drew upon their institutional roles, social capital, and on campus connections to develop a strong local CIRTl program and gain access to administrative and academic leaders. These three items were foundational since it provided the local CIRTl leaders with the structure by which to engage in *translation*, *diffusion*, and *gaining institutional support* activities. Without careful attention to each of these three pre-requisites, it was unlikely that they would have been successful in developing their local CIRTl programming. In short, a local CIRTl leader who has no influential formal role, is not well known or respected across campus, and has few professional connections may find it difficult to engage in *translation*, *diffusion*, and *gaining institutional support* activities. This does not mean that a local CIRTl leader must have all three, but it does show that success is very much a product of these three elements.

Furthermore, the three leaders at SU played complementary roles in advancing local CIRTl programs. As Gertrud said above, their activities were like a Venn Diagram, where each local CIRTl leader used their varied positions, social capital, and on campus connections to influence the planning, implementation, advertising, and support for preparing future faculty programs. We saw the same type of complementary roles at GU, where Tom took the lead on gaining institutional support and Betty was responsible for programming. However, the leaders at SU provided a much better model for a team-based boundary-spanning approach. Arielle wielded the authority of the graduate school to gain audience with academic units. Gertrud, because of her teaching and learning center appointment, tapped into an already rich network of those that care about teaching and learning issues. Rufus utilized his position in the center to tackle programming logistics. All three used their extensive experience and perspectives to shape the local CIRTl effort. They also used their existing reputation and on-campus connections to

share CIRTl-related information and garner support from multiple campus stakeholders and units. Overall, by employing a diversified local leadership team, the leaders at SU extended their reach and made significant strides forward. Thus, the SU case demonstrated the importance of a team of local boundary spanners that can draw upon their individual strengths to diversify and expand local reform efforts.

In the next three sections, I explore the *programmatic*, *administrative*, and *academic* connections of Arielle, Gertrud, and Rufus in relation to their local CIRTl responsibilities and institutional roles.

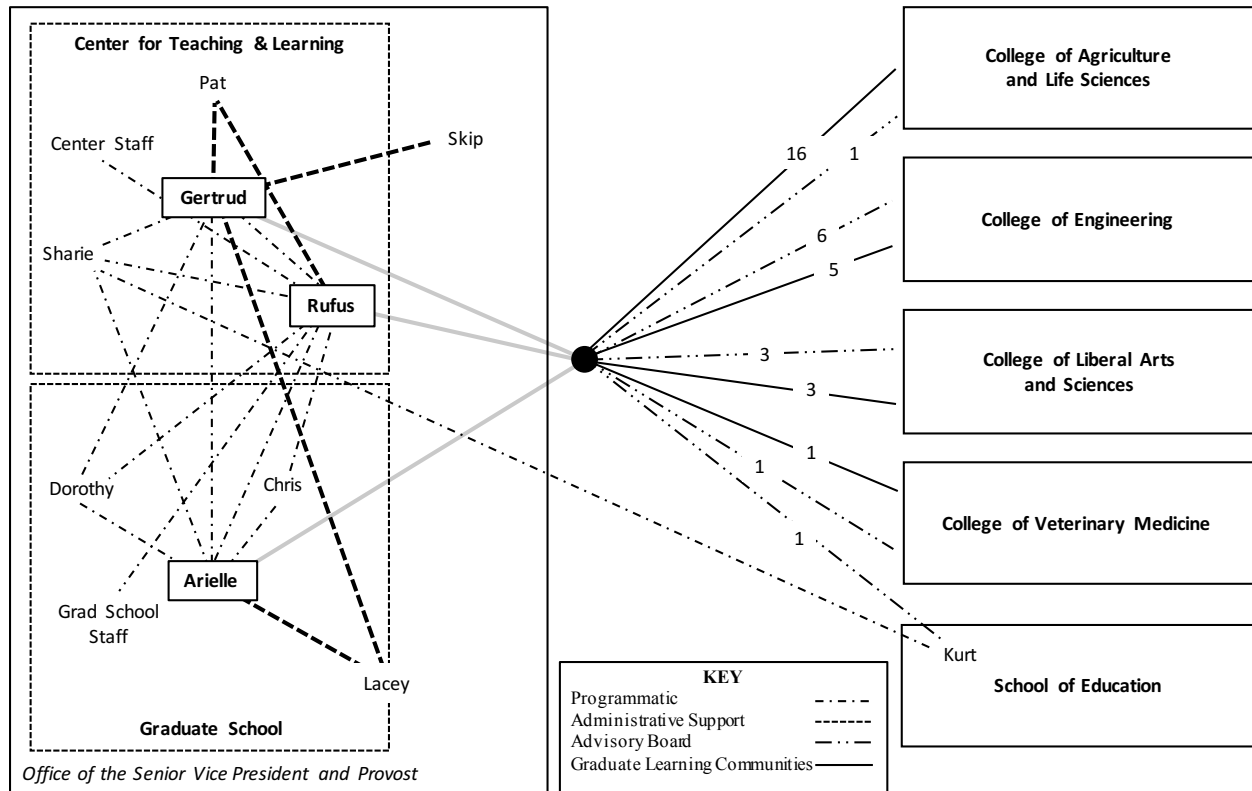
Programmatic Connections

As noted above, the teaching and learning center delivered most local CIRTl programming due to its rich history in running teaching professional development programs on campus. Rufus played a key role in making sure programs operated smoothly by organizing meetings, coordinating funding, and working directly with students. Arielle and Gertrud, while not as concerned with logistics as Rufus, were quite active in supporting and implementing programs. Overall, SU had key staff and resources to successfully develop and implement CIRTl programs.

Furthermore, congruent with the team-based boundary-spanning approach, interview participants were pleased with the local CIRTl team, believed that they worked well together, and thought that they had complementary skill sets and experiences. For instance, Gertrud said, “So it’s, it’s kind of a neat team because we have different strengths, and we have different draws too...I’m in a really privileged position here.” Rufus also talked about how:

I'm really reliant on my team here. Like I really rely on Gertrud and Arielle a lot for advice and inspiration and ideas, and we're bouncing ideas off each other all the time, um, for how to improve.

Figure 3: Local CIRTl Leaders' Intra-organizational Connections at SU



The local SU CIRTl team was not limited to Arielle, Gertrud, and Rufus. Instead, the three local CIRTl leaders were strong proponents of involving multiple individuals across campus so as not to “exclude anybody” from efforts to improve local CIRTl programming. Such inclusivity was evident in the multiple connections that the three leaders had in relation to planning and implementing CIRTl programming.

Advisory Board. All three local CIRTl leaders had frequent interaction with members of the recently created CIRTl advisory board at SU. Board members consisted of faculty members from various colleges and departments (See Figure 3, the number embedded within the

connection line represents the number of advisory board members for the academic unit). The board's primary charge was to review mini-grant proposals related to TAR or graduate student learning communities and decide what "proposals should be funded." Rufus talked about the board's key role in the TAR program:

These people are in our STEM faculty from all over the university that can kind of inform what their students want and need...they know what kinds of TAR projects and stuff are going to be impactful for their area, and they can really provide input on that.

Members of the advisory board come from all of the major STEM colleges across SU, with many from the college of engineering. They were "strategically chosen to cover the different colleges and different roles and had different sets of expertise." Most, if not all, had a prior connection with either Arielle or Gertrud. Arielle discussed:

I don't know if Gertrud, she uses a phrase, which I say, tongue-in-cheek, friend of Arielle, right? These are all certainly people who I knew were interested in graduate education and improving graduate education and were active in various other projects and spread around the different colleges. These are all friends of Arielle.

While the board was mainly responsible for the mini-grant competitions, there was some evidence that they were starting to play a more active role in translating CIRTL for SU, as evidenced by the following quote:

I do know there have been times when Arielle has, when there have been discussions at the advisory board of how are we going to move forward in the sense that how can we make sure that the things that we are taking from CIRTL now, that we can continue to implement them long into the future as the transition to more support by SU as opposed to external grants.

However, while there had been some progress made, “I think we could, we could do better on that with our advisory board, because we get so focused on the grants, but I think that’s someplace where...we just need to keep going on that.” In addition, there were some concerns of varying levels of participation and engagement of advisory board members:

I’ve got engagement all across the board. Some of them respond really quickly and work really hard and do what I tell them to, and come to every meeting, and other ones, they’re a little bit more sporadic with their participation... I need their skin in the game. But I don’t have any skin in the game.

In summary, the three local CIRTl leaders at SU regularly met with the advisory board, mostly to get their input on funding student projects and learning communities. The three leaders kept the advisory board up to date on local and national CIRTl activities and hoped in the future to use board members as potential avenues into academic units. In addition, they recently started to bring the advisory board into their efforts to translate CIRTl for SU. However, there were challenges in engaging all board members equally and board members were limited to “friends” of Arielle and Gertrud. Despite these challenges, the three leaders’ connection to the advisory board clearly represented efforts to engage in the boundary-spanning behaviors of *diffusion* and *translation*.

Sharie. She was a postdoctoral scholar who spent one fifth of her time (bought out by the teaching and learning center and the CIRTl grant) running the TAR program at SU. Before becoming a postdoctoral scholar, she was a former TAR participant at SU. In her current role, potential participants submit proposals for projects to the CIRTl advisory board and “once the proposals are accepted...then I keep track of all the students, how they are implementing their proposal so I do monthly meetings with the students.” At any given time, she had between 25-30

projects at various stages of completion. She regularly met with Arielle, Gertrud, and Rufus to report her progress, coordinate activities, discuss challenges, and make changes to improve the program. The following quote illustrates this dynamic:

I'll update them about what I have done in the previous semester and what changes I want to make this semester or what I'm planning to do the next semester...So that's like when they get my input, then try to improve for the next time. So this is how it's an iterative and continuously improving process. Like we are, every semester, we do something new. We try to do something new, to make it a better experience for the student.

In addition, she worked closely with a social scientist on the CIRTl advisory board (Kurt) who also supervised her activities and provided mentorship and guidance.

Overall, the three local CIRTl leaders worked with Sharie to translate SU's local CIRTl TAR program. Because Arielle, Gertrud, and Rufus were in direct in contact with the concept of TAR from the national Network, they likely diffused helpful information to Sharie in her efforts to execute the program. Thus, the local CIRTl leaders' connection with Sharie demonstrated clear instances of *diffusion* and *translation* activities.

Kurt. As mentioned above, Kurt supervised the postdoctoral scholar in charge of TAR projects. He was also a member of the local CIRTl advisory board and a member of the steering committee for the teaching and learning center. He was an educational researcher and was recently brought into the CIRTl mix to provide a social scientist lens to local program evaluation and TAR projects.

He had several overlapping connections with Arielle, Gertrud, and Rufus to the extent that he was unsure where one activity began and another one ended. Kurt said:

There are times because of the amount of interaction I have with those [them] that I don't know if I'm doing CIRTTL or if I'm doing [something related to the teaching and learning center] or if I'm doing something else. And so I don't, there are times I'm just not sure what we're engaging about, other than kind of good teaching and good learning practices... I don't know when I'm working with them related to CIRTTL and when I'm working with them related to their other interests

In short, Kurt represented an active advisory board member who played an active role in helping to translate CIRTTL for SU and likely received CIRTTL-related information from the three local leaders. However, unlike Sharie's clear-cut connection to TAR, Kurt showed that local CIRTTL leaders' on-campus connections may not always recognize the demarcation lines between CIRTTL and other projects. This suggests that campus constituents may not always recognize local CIRTTL leaders as distinct "CIRTTL boundary spanners." Instead, CIRTTL and non-CIRTTL activities likely operate in a fluidic state, which implies that efforts to diffuse or translate CIRTTL for SU are embedded into the existing roles, responsibilities, and connections of the three leaders.

Dorothy. She was an individual in the graduate school who was in charge of the finances associated with the CIRTTL grant, TAR projects, and graduate student learning communities. She was "a classic accountant. She makes sure that if we are spending something it's obeying SU Rules." Rufus mostly coordinated financial logistics with her and "Arielle made decisions based on her tracking to decide how we're going to spend money." Dorothy represented a basic programmatic relationship that was not strongly tied to any of the four boundary-spanning behaviors of interest. She provided information to the three leaders that could shape translation behaviors, but the connection to her was not in itself boundary spanning-specific.

Chris. He was a graduate student charged with evaluating and analyzing data about local CIRTTL programs. He worked primarily with Arielle and Rufus who mentored him and provided guidance on his data analysis. Other graduate students, prior to Chris, had a similar role in analyzing and evaluating CIRTTL program outcomes. Rufus described the rationale behind having a graduate student working on evaluation:

Arielle wanted to take that [evaluation data] to department chairs and say, there's a lot of interest from your students in this particular topic from your department...you should encourage more people to go, or nobody from your department has gone to these things, but these other graduate students have maybe you should give this a little bit more highlight.

Overall, the purpose for evaluation and analysis efforts was to create evidence-based arguments to convince campus stakeholders of the benefits of and need for teaching professional development. Thus, the connection to Chris provided local CIRTTL leaders with evidence of local programmatic impact, which they used to promote the boundary-spanning behavior of *gaining institutional support*. In addition, evaluation data served as a means for the local CIRTTL team to modify and further translate their programming.

Other Staff. Behind the scenes, several other individuals within the graduate school and the teaching and learning center provided various types of assistance in planning and implementing CIRTTL programming. This demonstrates that Arielle, Gertrud, and Rufus utilized a large pool of people to coordinate programming, both related and not related to CIRTTL. However, these connections do not represent the four boundary-spanning behaviors of interest. A leader or co-leader may cross organizational boundaries to interact with these individuals, but

such interaction is limited to programmatic logistics. Thus, these connections are at best peripheral to boundary-spanning activities.

Section Summary. Arielle, Gertrud, and Rufus had numerous important connections related to planning and implementing local CIRTTL programs. They delegated responsibilities to individuals such as Sharie and Chris to distribute the workload. They also formed an active advisory board to review mini-grant proposals with membership drawn from Arielle's and Gertrud's personal and professional connections at SU. In short, the local CIRTTL leaders involved a wide and diverse set of individuals to plan, implement, and evaluate local CIRTTL programming.

The programmatic connections found in the SU case have three implications for boundary-spanning behaviors. First, similar to the GU case, programmatic connections are likely highly connected to *diffusion* activities. The three local CIRTTL leaders at SU participated in the national Network, which resulted in ideas and programmatic resources. The three leaders shared this knowledge amongst themselves but also with those that are directly involved with CIRTTL programs. Furthermore, the three leaders worked with their local team to market local CIRTTL programs and planned to eventually utilize the connections of the advisory board to diffuse CIRTTL-related information. Thus, leaders and co-leaders engaged in two types of diffusion activities, one to inform the local CIRTTL team and one to advertise programs across campus.

Second, the local CIRTTL leaders were not the only ones involved in translating CIRTTL for SU. Sharie, Kurt, and the advisory board were all involved in making sense of CIRTTL and helping to modify efforts to improve local programs. However, it was clear that Arielle, Gertrud, and Rufus had a much stronger voice in translating CIRTTL for SU, which could be due to their familiarity of CIRTTL content and concepts and their institutional roles and responsibilities

related to preparing future faculty. There have been attempts to expand translation efforts locally, but the extent that local CIRTTL leaders have delegated or involved campus constituents in translating CIRTTL for SU is unclear. The local CIRTTL leaders at SU took the lead role in initially developing the local CIRTTL structure and priorities and then sought out additional team members to make minor adjustments or modifications to better match institutional context. Thus, the boundary-spanning behavior of *translation* consists of both primary and secondary levels, which matches the concept of single and double loop learning (Argyris & Schoen, 1978). At SU, local CIRTTL leaders engaged in the core conceptualization of local CIRTTL efforts (i.e., double loop learning) whereas additional team members participated in programmatic improvement (i.e., single loop learning). This approach has certain benefits in that it allowed the local CIRTTL leaders to control the overall direction of local CIRTTL efforts while at the same time engaging other individuals to improve programs over time. However, there is also a real limitation in that local CIRTTL leaders could limit local efforts to their priorities and interests, which may or may not reflect the needs and context of the institution. Thus, my findings suggest that boundary spanners must weigh the strengths and weaknesses of engaging other campus stakeholders in the core development of CIRTTL programs and their ongoing improvement.

Third, not all programmatic connections represent boundary-spanning behaviors. The SU case showed that some program-specific connections were logistical or procedural by nature and did not fit with boundary-spanning behaviors. These connections could influence how they may *translate* or *diffuse* CIRTTL on campus (e.g., if Dorothy were to give them bad news about the budget), but they were not boundary-spanning activities. Thus, not all connections of a local leader or co-leader, even if connected to CIRTTL, are related to their boundary-spanning responsibilities.

Administrative Connections

Most participants discussed how SU's upper administration supported local CIRTl programming because it aligned with institutional goals and provided added prestige from interacting with peer institutions and a large, nationally funded grant project. "We don't have to sell the upper administration. They are on board just 100 percent." One participant further described administrative support at SU:

But CIRTl does go to the provost. It gets discussed there. It's valued...The current provost is an engineer so he very much understands that STEM undergraduate education at research universities is a big deal. It fits with other activities he has in both the APLU and AAU where he's working on similar kinds of subcommittees and committees that are dealing with some of the same issues.

However, two participants expressed concern that support from the provost was not adequately translated or operationalized at the department level. Yet, overall, SU had remarkable support from campus administration.

Pat. He was the director of the teaching and learning center, a strong supporter of local CIRTl efforts, and Gertrud's supervisor. The teaching and learning center had a "historical connection" with the graduate school in regards to graduate student professional development. In addition, the current graduate dean and associate provost (Lacey) used to supervise the teaching and learning center. Another associate provost (Skip) now occupies that role. Gertrud updated Pat about CIRTl activities and sought his advice and counsel. Pat reported to Skip who then reported directly to the provost. Pat explained:

I share [information about CIRTl] up with our associate provost who is who I report to directly. And then she likely shares it with the provost where it's appropriate. Arielle

would be doing a similar type of a thing where she reports to the associate provost and the dean of the Graduate College who also then reports to our provost.

Participants considered this direct link to the upper administration at SU to be of vital importance. One interviewee said:

Pat is the one who also brings before the provost that CIRTl is really important and vital and to be funded. And so the provost is getting that information from the teaching center but also from the graduate college, because that's where Arielle is. So it's kind of, it's like a two-side approach where they're both saying this is really important and vital and to be funded.

Overall, Gertrud's connection to Pat was a prime example of the boundary-spanning behavior of *gaining institutional support*. She used the connection to update Pat on local CIRTl activities and seek his advice on high-level programmatic decisions. In addition, Pat served as an important intermediary for SU's ongoing CIRTl participation by relating CIRTl to the provost, which also made him a boundary spanner for the CIRTl cause at SU.

Lacey. Lacey was the graduate dean, an associate provost, and Arielle's supervisor in the graduate school. Arielle and Lacey met regularly to discuss graduate student development broadly, which included CIRTl activities. Arielle described Lacey as being a strong supporter for local CIRTl programming. She explained:

Lacey really likes the idea of SU being involved in these multi-university projects. That's a value system, high on her value system...I think because we're sort of a mid-tier rank university. So playing well with other universities is important to her...I think she likes what we're doing. She's a fan of graduate education. She likes the idea of TAR. She thinks there's just so many wins on that.

Furthermore, when Lacey supervised the teaching and learning center, Gertrud talked about the ease by which she was able to secure the \$10,000 in CIRTl membership dues:

When everybody was nervous about paying their dues and everybody was singing the blues about how that's not going to happen. I prepared this whole big thing to go talk to him, and he met me in the lobby and went, "why are we even talking about this. Of course." That's the kind of support.

In short, Arielle's (and previously Gertrud's) connection to Lacey represents another strong example of gaining institutional support from an administrator that already supports the CIRTl cause. Thus, Arielle and Gertrud uses their institutional roles to gain audience with Lacey and keep her informed of CIRTl activities.

Section Summary. The graduate school and the teaching and learning center were strong, well-respected campus units, which gave Arielle and Gertrud ample leverage to advance local CIRTl efforts. Part of this dynamic was that Arielle and Gertrud had the ear of key administrators, such as Pat and Lacey, to maintain support for CIRTl. Furthermore, Pat and Lacey passed on CIRTl information to the provost, which added another level of administrative support at SU. Arielle's and Gertrud's key connections to Pat and Lacey enabled SU to easily pay the \$10,000 per year for CIRTl membership and provided Arielle and Gertrud some latitude to translate CIRTl for SU.

Similar to the GU case, the connections to Pat and Lacey spoke to the importance of local CIRTl leaders having campus positions that provided direct access to key administrators. Without such access, it would have been much more difficult to gain audience with campus leaders and convince them of the value of CIRTl. Even if campus leaders immediately saw the utility of CIRTl, a leader or co-leader may find it challenging to have sufficient face time with

administrators to establish a local program. Thus, having direct access to upper administrators was a significant benefit to gaining administrative support.

However, a major limitation of the SU case was that it does not show what would happen if administrative support did not already exist. For instance, what would happen if a leader and or co-leader were in positions where they reported to upper administrators but the upper administrators were ambivalent to or unsupportive of the CIRTTL cause? In interviewing both Pat and Lacey, it was obvious that they trusted Arielle and Gertrud and gave them a lot of autonomy to run local CIRTTL programs. An unsupportive upper administrator may not allow the same type of autonomy. In addition, an unsupportive administration could affect the ability to pay CIRTTL membership dues, the number of staff available for CIRTTL initiatives, general funding for preparing future faculty programming, and the frequency and content of what local CIRTTL leaders share from their Network participation. Thus, the boundary-spanning behavior of *gaining institutional support* could dramatically change based upon the current receptivity of campus leaders, regardless of local CIRTTL leaders' institutional position and proximity to campus administration.

Lastly, the SU case demonstrated how others beyond the local CIRTTL leaders could perform the boundary-spanning behavior of *gaining institutional support*. Pat, Gertrud's supervisor, and Lacey, Arielle's supervisor, served as key connections to the provost in relating the importance of CIRTTL. Arielle and Gertrud likely interacted with the provost over the years, but they lacked the means of ongoing and direct communication. In contrast, Pat and Lacey regularly met with the provost and could pass CIRTTL information up the administrative ladder. The implication is that other strategic campus constituents can play additional and important intra-organizational boundary-spanning roles to fill in the gaps of local CIRTTL leaders' position

or connective potential. Therefore, boundary spanners might need to be able to assess the limitations of their on-campus connections and seek out opportunities to distribute boundary-spanning responsibilities.

Academic Connections

Despite Arielle's and Gertrud's robust connections on campus and their affiliations with the strongest centralized units on campus, campus decentralization challenged their ability to consistently reach academic units. One participant described this hurdle in the following quote:

We are a decentralized university; the academic colleges have the lion's share of the resources. So central university, Lacey is clearly, can make things happen with dollars, but the budget flow is largely at the academic college level. But they're never going to pay for anything connected with CIRTLL. So they're not going to pay for graduate learning communities or pay for TAR projects because all those things span across the whole university.

The strategy used to gain support from academic departments and colleges had to shift given these dynamics. One participant explained:

It means that central units...need to work much more collaboratively with the academic colleges and programs than they might in a more centralized top/down structure. And there are times when that's frustrating but I think the advantage of it is it forces you to make connections with the right people between the people in central units and in this case, the roles Arielle and Gertrud have, and the people out in the academic colleges and programs and by forcing you to work more collaboratively that way, it means you end up getting buy-in in ways you don't get if it's a more authoritative, top/down, this is how we're going to do it, listen up. Now, it means sometimes it takes longer. It means

sometimes things aren't adopted as uniformly across all our programs... our approach has been let's get to the early adopters and let's show how these results are improving things. And then sometimes, we do it by figuring out quantitative ways to tabulate that to show that the adopters are benefiting in ways that the non-adopters aren't and trying to sort of indirectly convince people via some data.

To bridge the gaps of a decentralized institutional structure, Arielle used her position in the graduate school to gain audience with academic units, especially with those "responsible for graduate education." One interviewee explained:

And I know she has for multiple years now tried to, on a continuing basis, meet with [the directors of graduate education for] every department or even department chairs...she's tried to contact them and set up meetings with them and telling them about their work through, with CIRTL and what they think or feel they can actually offer to our graduate students here at SU and just trying to make a good case for it and recruit essentially the department's interest to buy in into the ideas that are available through CIRTL...Some departments, I want to say, are more resistant than others.

Furthermore, within the decentralized structure at SU, Arielle, Gertrud, and Rufus utilized various tactics for advertising CIRTL offerings on campus. Arielle and Gertrud used their positions and "network[s] at the university to spread the word about CIRTL" and Rufus maintained an up-to-date email listserv to notify students of CIRTL opportunities. In addition, Rufus and Gertrud used opportunities to present in various academic units to wave the CIRTL flag and inform campus stakeholders of the benefits of CIRTL. Furthermore, the local CIRTL leaders used the advisory board as an additional pathway into academic units:

[The local CIRTl leaders have] done a lot of work convincing or trying to convince faculty, directors of grad education as well as graduate students and postdocs that these are valuable activities. And probably the most effective part of this is creating an awareness among faculty that they should be encouraging their graduate students and postdocs to participate in these kinds of activities if that's what they intend for their career to be.

However, despite their efforts, there was still the concern that not enough graduate students and faculty were aware of CIRTl programs and concepts. Arielle explained:

We don't have enough penetration. Most of the future faculty members are not participating in these types of professional development activities while they are graduate students.

In short, Arielle, Gertrud, and Rufus actively used several strategies, usually in connection with their institutional roles, to advertise CIRTl programs and gain support from academic units on campus despite the decentralized structure.

Graduate Student Learning Communities. The graduate student learning communities were another conduit for advertising CIRTl programs and opportunities (See Figure 3, the number embedded within the connection line represents the number of graduate learning communities within the specific academic unit). They represented a major avenue to reach graduate students across the four STEM-related colleges.

Arielle has been the major proponent of these communities well before SU joined the CIRTl Network. She used CIRTl as a platform to grow this initiative to more than 20 different communities with many in STEM-specific colleges. She has been instrumental in recruiting

individuals to lead these communities either through pre-existing connections or due to her role in the graduate school. She said:

I'm meeting with departments or directors of graduate education. And if they have a challenge on degree completion rates...then I talk up and I try to convince them to have a graduate learning community.

A few times a semester, leaders from each community came together in a large meeting to discuss successes and challenges. During these meetings, Arielle, Gertrud, and Rufus had the opportunity to share information about CIRTl and various programming opportunities offered by the Network. However, each community was concerned with career development more broadly, where learning how to teach could be in the background or foreground depending on the community. Still, these communities represent another significant way by which local CIRTl leaders engaged in the boundary-spanning behaviors of *diffusion* and *gaining institutional support* by advertising local and national CIRTl programming and trying to increase buy in from students, faculty, and academic leaders.

Grant Proposals. Lastly, Arielle and Gertrud were strong collaborators in developing grant proposals with campus colleagues. These connections once again speak to the strong integrative ties that they both had across campus that they used to recruit local CIRTl team members, diffuse CIRTl information, and gain support for programs to prepare future faculty.

Section Summary. As described above, Arielle, Gertrud, and Rufus used several strategies to engage academic units. They used their institutional positions and prior connections to gain access to faculty, academic units, and students. Arielle, because of her role at the graduate school, gained audience with the “reluctant” academic units on campus and leveraged top-down change. Gertrud, because of her work at the teaching and learning center, regularly

worked with those that had a stake in improving teaching. Rufus was able to utilize various marketing channels to advertise CIRTl offerings to graduate students. Furthermore, the graduate student learning communities and the advisory board were strong advertising mediums. Overall, the local CIRTl leaders had a diversified portfolio of approaches to reach academic units.

However, despite these efforts, there was concern that penetration into academic units on campus was still rather limited. The lack of success could be due to an on-campus CIRTl network that revolved around Arielle's and Gertrud's campus connections, unequal engagement from their advisory board, or even departments valuing research over teaching. In addition, the heavily decentralized nature of SU's campus was a potential impediment, since, like the GU case, local CIRTl leaders had to navigate many different college and department dynamics, which takes considerable time. Yet, despite these challenges, the local CIRTl leaders at SU were able to secure some of the highest student participation rates across the CIRTl Network, which suggests their multiple strategies to diffuse CIRTl and convince academic leaders, faculty, and students of the value of CIRTl have already paid off.

Arielle, Gertrud, and Rufus maintained multiple academic connections across campus and actively engaged in the boundary-spanning behaviors of *diffusion* and *gaining institutional support*. These leaders' institutional roles, social capital, and existing campus networks heavily influence such boundary-spanning behaviors. In addition, campus decentralization prevented local CIRTl leaders from adopting blanket diffusion and gaining support approaches, since each academic unit was different. Thus, my study suggests that boundary spanners must understand the variability of organizational units, assess which of their formal and informal characteristics would aid them in their boundary-spanning activities, and use a multi-pronged approach to diffuse information and gain support from diverse organizational stakeholders and units.

Chapter Summary

CIRTL Connections and Boundary-Spanning Behaviors

Arielle, Gertrud, and Rufus had numerous inter- and intra-organizational connections with respect to CIRTL. Their connections in the CIRTL Network were complementary and provided opportunities for explicit and implicit knowledge gains. Through their Network involvement, they engaged in finding behaviors that were not limited to simple, linear knowledge transfer. On the contrary, varied Network ties provided them with a rich tapestry of connections that they could use as local need and situation required. Thus, *finding* behaviors were not just about the flow of knowledge. Instead, *finding* was the creation of an interorganizational network with knowledge- and resource-sharing potential. In other words, interorganizational finding activities were not limited to local CIRTL leaders “shopping around” for specific information. Instead, such finding behaviors were part of a more complex social structure (e.g., a community of practice) where members contribute to the community and gain explicit and implicit benefits by ongoing interaction in the community.

With respect to intra-organizational connections, the three local CIRTL leaders at SU interacted with many individuals tied to local CIRTL programs. Through these programmatic connections, they *diffused* CIRTL-related information to their local CIRTL team and worked with members of their team to *translate* CIRTL for SU. Translation activities consisted of broad conceptualization and development or more minor adjustments to fine tune programs over time, suggesting strong links to single and double-loop learning (Argyris & Schoen, 1978). The local CIRTL leaders at SU engaged their local team in *translation* activities, but seemed to limit their participation to programmatic adjustments to meet current institutional context. In addition, Arielle and Gertrud used their institutional positions to keep key campus administrators informed

and maintain their ongoing support for local CIRTl programs. The SU case demonstrated the importance of existing administrative support and that other campus leaders could act as boundary spanners by providing crucial links to upper administration. Furthermore, local CIRTl leaders used an assortment of strategies to advertise CIRTl programs and gain support from diverse academic units and subsequent academic leaders, faculty, students, and postdoctoral scholars. The implication is that boundary spanners must be able to “read” the organizational dynamics in each unit, determine what personal characteristics (e.g., institutional role) are needed to gain audience with academic stakeholders, and use multiple pathways to diffuse information and gain support. Overall, the SU case provided several key insights into inter- and intra-organizational connections and boundary-spanning behaviors.

Individual and Institutional Characteristics

Similar to the GU case, my analysis repeatedly demonstrated the importance of strong institutional positions, positive reputations, and extensive on-campus professional networks. Without these traits, the three leaders in this case may not have been as successful in establishing their local CIRTl program. They may have been able to work together to create a new set of programs or translate CIRTl for pre-existing offerings, but without their connective potential across campus, they would have had difficulty advertising programs and securing administrative and academic support. In addition, without insight from other campus stakeholders, they would run the risk of ignoring crucial campus dynamics or developing programming of little interest to potential participants. As I demonstrated in the GU case, these traits provided the fertile ground for boundary-spanning success. However, it is not enough to just have an authoritative position, good reputation, and numerous on campus connections. The SU case represented a synergistic local leadership team with overlapping and complementary roles. Arielle, Gertrud, and Rufus all

had different strengths, unique institutional positions, and varying on-campus contacts, which enabled them to have considerable success. The implication is that boundary spanning is a distributed activity involving a strong team that shares boundary-spanning responsibilities to maximize organizational coverage and prevent overburdened workloads.

With respect to institutional characteristics that could influence boundary-spanning behaviors, it was quite clear that SU had a supportive upper administration and an institutional culture that valued teaching. They also had a robust and active teaching and learning center and well-established programs for future faculty before joining CIRTL. Arielle, Gertrud, and Rufus were able to translate CIRTL for existing programs and use CIRTL as a resource to expand its offerings for students. Betty and Tom likewise held high-level positions on their campus, but because of a non-supportive campus culture, they had considerably more push back than their SU counterparts. Thus, despite influential positions and established social capital, how strongly the institution values the particular reform agenda, such as preparing future faculty as effective teachers, can significantly help or hinder a boundary spanner.

For example, just like GU, there was a persistent decentralization structure and culture at SU that limited academic units' willingness to collectively improve teaching development for future faculty. Arielle, Gertrud, and to some extent Rufus, were able to use their long history at SU as a lens to read and make sense of institutional dynamics within various sub-units, which is undoubtedly a very important boundary-spanning skill. However, most of the weight of trying to expand preparing future faculty programs rested upon their shoulders and what connections they had or could develop. This would likely change if the advisory board were able to take on more responsibilities; but, for the time being, the reach of CIRTL locally was limited by three individuals' connections and social capital. Luckily, they were in rich supply of both connections

and social capital, but there may be limits on what they alone can accomplish in the face of an extremely decentralized campus. This implies that a decentralized structure warrants the expansion of boundary-spanning activities, especially in relation to diffusion and *gaining institutional support*. Thus, not only should boundary spanners be able to map and understand campus dynamics, they must also distribute the responsibility among multiple individuals to more effectively match the nuances of individual college and departmental climates.

The Impact of Boundary-Spanning Behaviors at Serenity University

Like their counterparts at GU, the local CIRTTL leaders' boundary-spanning activities played a major role in advancing the preparation of future STEM faculty through high quality teaching professional development programs. The three local CIRTTL leaders gained valuable knowledge and resources from the Network and used their positions and existing social capital to translate CIRTTL content into their local professional development programs, diffuse CIRTTL information across their institution, and gain support from administrative and academic units. In short, their boundary-spanning behaviors had direct impact on their professional development programming. Like the GU case, they were also embedded within their local institutional context that shaped the extent and power of their boundary-spanning behaviors. In addition, more so than at GU, they had a strong local CIRTTL team who influenced boundary-spanning activities and how local CIRTTL responsibilities were distributed. Thus, the impact of boundary spanning at SU was contingent upon local CIRTTL leaders' connections, the local CIRTTL team, and the specific institutional context.

Chapter 6: CIRTl at Lorimer University

Just like Chapters 4 and 5, the purpose of Chapter 6 is to explore a single case institution to address my three research questions. In short, my goal is to: (a) examine the types and purposes of local CIRTl leaders' inter- and intra-organizational connections related to the Network, organized by *programmatic*, *administrative*, and *academic* connection types; (b) investigate how local CIRTl leaders and co-leaders engaged in the four boundary-spanning behaviors; and (c) illuminate the characteristics of local CIRTl leaders and institutional contexts that could affect boundary-spanning activities. Specifically, I analyze the case of Lorimer University (LU), which has been an active member of CIRTl for over ten years.

The outline of Chapter 6 is as follows: (1) I provide an overview of LU; (2) I describe the local CIRTl leaders' local roles and interorganizational CIRTl connections; (3) I discuss local CIRTl leaders' on-campus *programmatic*, *administrative*, and *academic* connections (and relevant institutional dynamics); and (4) I conclude with a chapter summary of overarching themes.

Lorimer University: An Overview

Lorimer University (LU) is a public, research-intensive doctoral granting university located in the southwestern portion of the United States. LU has an undergraduate student population of nearly 40,000 and a graduate and professional student population of a little over 10,000, graduating close to 400 STEM doctoral students per year. LU was one of the original universities to join CIRTl and has been an active member, often providing advice and guidance to new members.

With respect to my case selection methodology, LU represents a longstanding CIRTl institution with moderate to high programming. From the most recent internal CIRTl evaluation

data, LU reported five programs related to CIRTTL on campus. From the same data, LU reported about 500 individuals who participated in CIRTTL programs in 2014-2015 and another 500 in 2013-2014. Local CIRTTL programming and activities were housed in the Graduate School.

The ongoing goal of LU's local CIRTTL activities was to advance "the professional development of graduate students and post-docs in the CIRTTL core ideas by offering programs [that]...range from low-engagement (several hours) to high-engagement (semester or longer)." Housed within the graduate school, LU had several CIRTTL programs, which were highly synergetic with other graduate school offerings. LU's teaching-as-research (TAR) program had been in operation for nearly 10 years and was the most visible CIRTTL program on campus. Program participants received expert and peer mentoring to plan, execute, and analyze their teaching and learning (or otherwise known as TAR) projects. Other programs consisted of a specialized teaching assistant (TA) training program that embedded the core ideas of CIRTTL, a college teaching certificate program, and other short seminars and workshops. The local leaders acknowledged that "the number of individuals that can be reached through these programs is relatively limited" and they were actively seeking ways to expand participation at LU.

Participants described LU as "an institution where teaching matters," which is "committed to professional development of graduate students." Furthermore, "there's just this climate of like we can do this, we can do anything, we can be creative, we can be innovative, we're going to do it on our own, [and] we're going to solve problems."

However, due to a research-centric culture, there were "faculty who still don't understand that part of their responsibility is professional development of their students" and are "resistant" to allowing their students to participate in teaching development. The decentralized nature of LU further complicated the local CIRTTL leaders' work because "LU is so spread out and there are so

many STEM disciplines represented in different departments” and similar projects and units did not communicate as effectively as they could. In addition, a few of the participants described how support for improved teaching practices had not yet made its way into tenure and promotion practices.

Despite these challenges, participants were optimistic about the positive changes that occurred on campus over the previous ten years that had enabled CIRTTL programs and concepts to gain traction. In addition, despite a decentralized campus, interviewees noted that the structure and climate of LU supported cross-institutional collaborations. One participant described this feature of LU:

And so I think that one of the reasons that [LU] can do these inter-disciplinary things is they don’t get in the way of it. And faculty who wish to do it, can. I don’t think that they tend to make it, I don’t think they go out of their way to facilitate it, but...the institutional structure is less inhibiting of it than I think institutional structures can be in other places. Thus, the institutional climate assisted the leader and co-leader at LU to span intra-organizational boundaries.

In the next section, I provide a more detailed description of the local CIRTTL dynamic at LU by exploring the characteristics, institutional roles, and interorganizational connections of the two local CIRTTL leaders and their intra-organizational connections.

The Cast: Local CIRTTL Dynamics

To accomplish the goals of this chapter, I first describe the institutional roles and interorganizational CIRTTL connections of the local leader (Ross) and co-leader (Christine) and conclude with a discussion of observations and implications. Next, I report findings related to the local CIRTTL leaders’ on-campus *programmatic*, *administrative*, and *academic* connections and

conclude each sub-section with a discussion of observations and implications for boundary-spanning behaviors. As a reminder, for block quotes, I use general descriptors such as participant, interviewee, and respondent to refer to the faculty members, administrators, staff members, and graduate students who I interviewed.

Local CIRTl Leaders

Collectively, interviewees from LU described Ross and Christine as “collegial,” “personable,” knowing “how to network with the appropriate individuals to leverage knowledge,” “open-minded,” and having the ability to “understand enough about the context of LU and the players across campus” to be effective leaders. Ross and Christine were committed to “helping [students] and making sure that [they] get the best possible opportunity.” In short, their CIRTl and campus colleagues viewed them as effective leaders of local CIRTl efforts.

Leader: Ross. He had a split appointment between the graduate school, where he was an associate dean, and the college of life sciences, where he was a full professor. He joined the staff of the graduate school over ten years ago when he pitched an idea to the graduate dean for a new teaching development program for graduate students. Around the same time, the CIRTl project received its first large grant, and the graduate dean selected Ross to lead local CIRTl efforts because he had “great skills and good characteristics that would fit what we needed in terms of the leadership for CIRTl.” Since then, his role has been to “oversee the development and implementation of the local learning community at LU and work to enhance the local leadership team of faculty, staff, postdocs and graduate students to develop and support the local learning community.” He was the primary conduit for disseminating information about CIRTl locally, since, “CIRTl comes into LU, since I’m the institutional leader, through me and then it gets distributed [to] the Graduate School staff... and...to [the] CIRTl advisory board.”

Respondents mentioned several key character traits. For example, even though Ross was in charge of local CIRTl programming, participants viewed him as highly collaborative and as someone who was constantly trying to “give responsibility to others” to create an active local team. In addition, participants viewed him as enthusiastic, “excited about what CIRTl is and does,” and “ultimately, passionately committed to high quality graduate education.” Overall, his campus colleagues respected him and he was an effective local CIRTl leader.

Interviewees also described Ross as actively seeking connections with campus constituents. For instance, when he first joined the graduate school, he took the time to understand campus dynamics by meeting with colleagues and mapping the political landscape. He explained:

I drank a lot of coffee with a lot of different people to understand that culture because [he couldn't be] an effective person in the Graduate School unless [he knew] who the players [were] and what the rules [were].

He also had a long and rich background at LU spanning academic, administrative, and extra-institutional circles, enabling him to develop connections in diverse campus units. The following quotes demonstrate his varied background:

I've been a graduate program director and I've worked at all levels of graduate education at LU, from the department level, to the college level, to the university level and now at the administrative level...I've taught classes...I have a research program. I have graduate students...so I had the credentials and I understood how graduate education works at LU.

In addition, he used his position in the graduate school to gain “familiarity with more than 100 PhD programs across the campus” and understand “how other disciplines do their work.” One participant discussed this trait:

He's respectful of people's time...he is not someone who's become an administrator and has forgotten what it means to be a faculty member. He's incredibly protective of faculty members' time. And I think that that shows in his work and he gets respect from those departments.

Lastly, he used the stature of the graduate school to break down inter-institutional barriers and automatically "[have] a lot of doors open" to him because "he's got the leverage." Ross described:

So I had the advantage that I had [the graduate dean] as my backer. So when I went to talk to people, when I went to kind of recruit people to do things, I could say I'm representing the Graduate School. So that had, because [the graduate dean] had a lot of clout on campus, the Graduate School had a lot of clout...I represented university administration.

In short, he drew upon his experience and academic and administrative positions to develop strong connections with a wide array of campus units and stakeholders.

In terms of programmatic implementation, Ross actively coordinated his CIRTl efforts with other graduate school staff and collaboratively integrated the concepts and principles of CIRTl into existing and new programs. In addition, he was highly active in the TAR program by chairing the advisory board, mentoring graduate student employees, meeting with students, and assisting evaluation efforts. In summary, Ross was directly involved in all aspects of local CIRTl programs at LU.

Interorganizational Connections. Ross was an extremely active participant in the CIRTl Network for over ten years. With respect to network operations, he has been a member of the core leadership team of CIRTl and has led or been a member of numerous committees. Overall,

he was a well-respected, longstanding member whose thoughts and ideas held much gravitas in general community discussion and planning. In terms of collaboration, he has worked with many members across CIRTl institutions on various projects and most recently has participated in the CIRTl massive open online course (MOOC). Ross was also responsible for providing LU's cross-network contributions to the Network. Lastly, he mentioned some instances of knowledge exchange where he was able to use something from the Network to improve his local programs. However, since Ross and Christine both viewed LU's programming as well developed, there was less indication of regular knowledge seeking behavior, at least related to programmatic improvement.

Co-Leader: Christine. She was a non-tenure track associate professor in the college of engineering with administrative oversight responsibilities for a teaching and learning initiative within the college. Ross brought her into CIRTl several years ago after they attended the same professional development workshop. Participants described her as “approachable,” “straightforward,” student-centered, and “well-respected.” Such respect resulted from Christine being “in an educational support program for a long time” where she was known for STEM education research on campus, which brought about opportunities to “promote CIRTl programs.”

Christine was able to draw upon an “eclectic” background to help spread awareness for instructional reform on campus, but was not able to draw upon administrative authority like Ross in the graduate school. She described this balance:

Well things that have helped me are my very eclectic, non-traditional background in that...I have an eclectic educational background, I have an eclectic work history background. I'm not a tenured faculty member in the standard slot. Those have helped me

because it allows me to be in a lot of different rooms have a lot of different views and lot of different perspectives. They've also hindered me, because I don't have...the usual institutional box that I fit into so that people know where to interact with me on those things...I have to lead by persuasion and I can't lead by fiat or even coercion because I don't have the leverage to do that... I tend to try to look for where I can get some traction, and go and leverage it there so we can get these things done rather than try to fight against stuff where there's not a receptivity toward it.

In short, Christine adopted a much more grassroots approach to instructional reform and spreading the mission of CIRTl, compared to Ross who had administrative authority.

With respect to local LU CIRTl programming, Christine was "one of the three architects of the TAR program," was an active member of the advisory board, mentored students, and was essentially the second in command for the local TAR program with Ross. Overall, in relation to local CIRTl activities, she would "rather put her efforts into actually doing the TAR program then trying to convince people upstairs to do things that they aren't inclined to do." Thus, whereas Ross was highly involved in administrative circles, Christine was primarily engaged in the planning and delivery of LU's local TAR program.

Interorganizational Connections. In contrast to Ross, Christine was less visible in the CIRTl Network, since she allowed "Ross to be the first contact at LU." She mentioned how she occasionally attended online or in-person CIRTl meetings and contributed to "discussions about overall CIRTl Network operations," but she reported no other involvement in network operations, minimal affiliation with network contributions, and no collaboration with other CIRTl members. One participant commented on her lack of presence in the CIRTl community:

I almost got shocked the other day because Christine responded to a message that [the PI] sent out. I mean, I have not seen or heard from Christine in years. She sometimes comes to the meetings and I know she's involved in the [local] advisory board, but really, I have no interaction because she doesn't come to the meetings.

While she may not be an active member in the national community, when she attended meetings, she engaged in “discussions about local programing,” explored ways to scale LU's TAR program, and sought the advice from the national leader of CIRTl about a similar multi-institutional project where she had leadership responsibilities.

Section Summary. Ross was the consistent representative in the CIRTl Network for LU, was an active member of the central CIRTl leadership team, regularly collaborated with CIRTl colleagues, and was in charge of network contributions from LU. Christine, on the other hand, only occasionally attended CIRTl meetings and focused on the local TAR program at LU. Both individuals engaged in knowledge exchange behaviors but because of strong, well-developed local programming, they did not spend much time in recent years extracting knowledge from CIRTl colleagues to guide local operations.

The LU case demonstrated two important implications for interorganizational connections. First, the impetus for Network participation almost fully rested on Ross' shoulders. Unlike GU and SU, there was a lack of complementary interorganizational connections, which implied that Ross was the primary conduit for securing implicit and explicit Network gains. While Christine sometimes attended meetings and attempted to engage in knowledge exchange activities, the lack of rich and ongoing connections likely limited her connective potential. The source of all things CIRTl was mainly limited to Ross, which constrained finding behaviors to what he saw as useful for his institution. The benefit of multiple connections spread out among

two or more local CIRTl leaders is their ability to bring different perspectives, engage in diverse connections, and combine those experiences together when they translate CIRTl for their campus. LU, for better or worse, was primarily dependent upon Ross alone to provide that connective link. Thus, the LU case demonstrated the potential tradeoffs of having a single boundary spanner connecting their institution to a national network.

Second, LU was also unique in that they were longstanding members of the CIRTl Network and had well-established programming. This implied that Ross and Christine may not be motivated to seek out new ideas or information in the Network because their programs are already up and running. This perspective could close off potential benefits that would have otherwise been available. Of course, an argument could also be made that Ross' CIRTl participation has likely had many implicit effects on his thinking and local programs. Thus, the LU case showed that finding behaviors were strongly associated with the perceived needs of the participating institution and that ongoing participation may have other corollary and tacit effects on the boundary spanner over time, further supporting the notion of non-linear network participation gains.

Similar to Chapters 4 and 5, the LU case also demonstrated the importance of institutional roles, personal and professional connections, and social capital. Ross and Christine each had the respect of campus constituents and their positions allowed them to be effective local CIRTl leaders. Due to Ross' dual role, he was able to leverage the office of the graduate school and his full professorship to gain audience with both administrators and faculty. Furthermore, his position in the graduate school placed him in direct contact with likeminded individuals vested in preparing future faculty. Yet, despite the many benefits associated with his graduate school position, the influence and prestige of the graduate school had its limits in helping him gain

audience with academic units. Furthermore, Christine was deeply involved with STEM education research, which put her in contact with many others at LU with similar interests. Yet, she lacked the time, administrative authority, and a full professorship to be a more active agent of change on campus.

Overall, the LU case showed the strengths and limitations of institutional roles in spanning organizational boundaries. Like GU and SU, an administrative role provided great access to many campus units, but authoritative influence was not a guarantee of comprehensive coverage. Decentralization creates an environment where the boundary spanner must make numerous individual connections across campus within colleges and departments to accomplish their reform goals. An administrative role certainly helps, but it still requires extensive time and effort to build connections with individual academic units. In addition, the LU case demonstrated that although a co-leader had the respect of campus colleagues, there were very real limitations to what boundaries she could span because she lacked tenure and administrative authority. She may be able to employ a grassroots, boundary-spanning approach by interacting with likeminded individuals, but more informal social capital can only go so far in convincing the “unconverted.” This does not mean that all intra-organizational boundary spanners require formal authoritative positions, but it does illustrate the importance of formal roles that broaden the reach of a boundary spanner. Furthermore, the LU, GU, and SU cases all showed that those with administrative positions and authority, in most cases, possessed both informal and formal social capital, which was directly linked to their academic and administrative positions and experience. Thus, while administrative positions are not completely necessary to engage in intra-organizational boundary spanning, they certainly help.

In the next three sections, I explore the *programmatic*, *administrative*, and *academic* connections of Ross and Christine in relation to their local CIRTTL responsibilities, institutional roles, and social capital.

Programmatic Connections

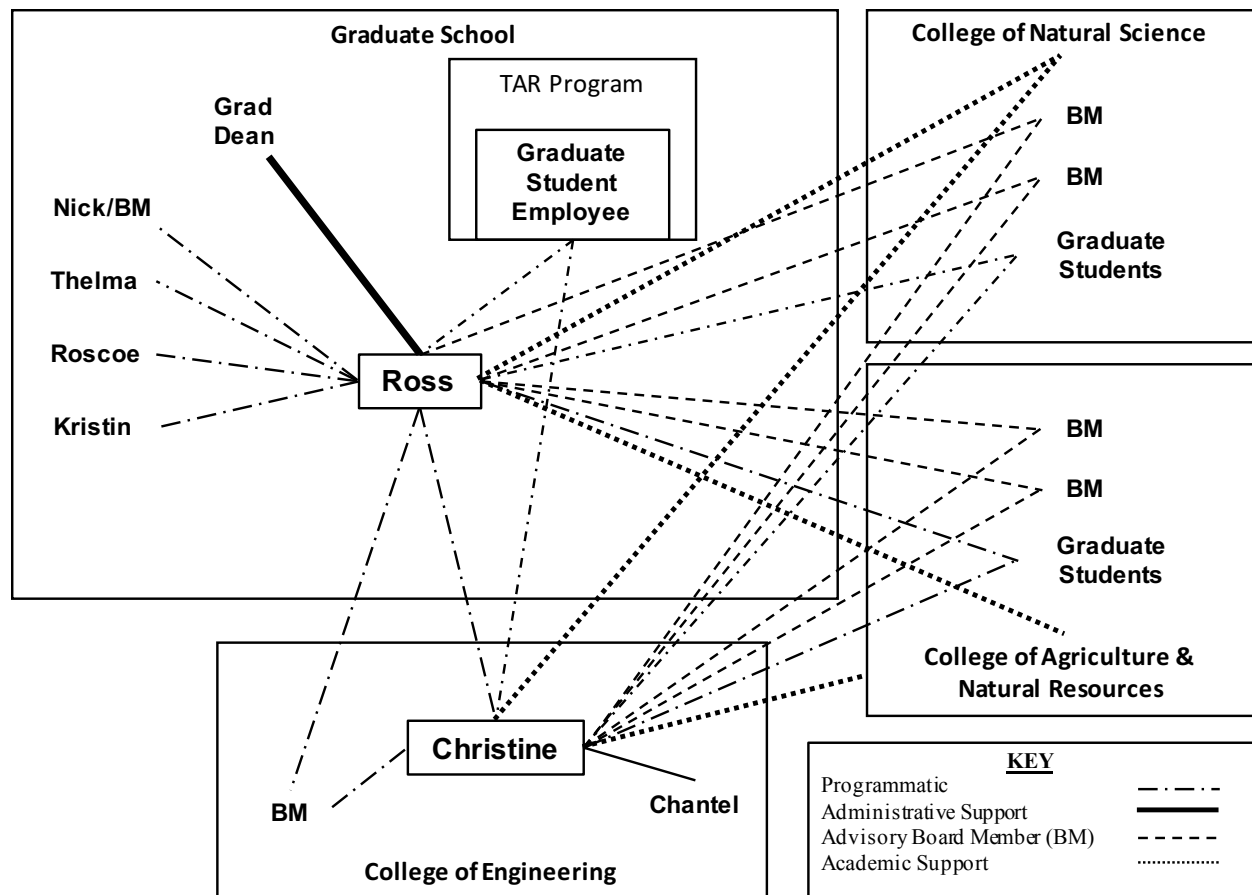
The local CIRTTL leaders at LU reported connections with individuals from the graduate school, the TAR program advisory board, and a graduate student employee. Ross and Christine also talked about connections with a director of graduate initiatives in the college of engineering and with graduate students in the TAR program. As previously mentioned, the TAR program was the most visible and time-intensive program at LU, so interviewees talked about it often.

Graduate School Collaboration. Because of Ross' role as an associate dean, the graduate school was the central hub for local CIRTTL programming. The staff members within the graduate school were strong advocates for graduate student professional development and generated many programs over the years, with CIRTTL being just one of many programmatic strands. So, in general planning efforts related to opportunities for graduate students on campus, "CIRTTL was just kind of part of those conversations" and was embedded into a much larger effort to prepare future academics, researchers, and teachers. Ross mentioned four specific individuals that he regularly interacted with in the graduate school related to CIRTTL programming.

Nick. He was an associate dean in the graduate school, served on the advisory board for the TAR program, and worked closely with Ross on several programs in the graduate school (e.g., college teaching certificate, TA training). Nick described, "So we interact on a continuous basis about how to improve post-secondary teaching for post docs and grad students at LU." Since "his office is two doors down," they met regularly on CIRTTL and non-CIRTTL related

activities. In addition, he contributed to the national CIRTl Network in various capacities over the years outside of his interactions with Ross.

Figure 4: Local CIRTl Leaders' Intra-organizational Connections at LU



Thelma, Kristin, and Roscoe. Ross had three other main connections in the graduate school. First, Thelma was another associate dean who led a major grant program and oversaw the postdoctoral scholar association on campus. Second, Kristin was the director of student life and wellness. Ross recruited both Thelma and Kristin to participate as presenters in CIRTl's cross-network programs. Third, Roscoe worked for Thelma on the large grant project and helped Ross distribute information about CIRTl to that community.

Ross used all of his connections in the graduate school to help design, implement, and evaluate programs for future faculty. His role in the graduate colleges put him in direct

communication with other administrators on campus who shared his passion for preparing future faculty, which provided a great platform to translate CIRTl for local programs. Thus, not only did his administrative position provide institutional authority, his position in the graduate school also placed him in a prime location to *diffuse* CIRTl content, *translate* CIRTl into graduate school programs, and solicit ongoing support for CIRTl participation. The implication for boundary spanners is that institutional placement is key since it provides the connective tissue and resources necessary to advance local reform efforts.

Advisory Board. Beyond the graduate school, Ross and Christine both mentioned connections to the TAR program advisory board. The advisory board was composed of faculty members from a small selection of academic disciplines who were strong supporters of improving teaching and graduate student professional development. The size of the board was approximately 10 people and they met “monthly or bi-monthly.” Their primary responsibilities consisted of reviewing TAR project proposals, providing guidance and direction for the TAR program, helping to incorporate CIRTl concepts at LU, working directly with TAR students to help improve their projects, and disseminating CIRTl information across campus. In summary, the advisory board “did...a lot of the programmatic things, administrative things, [and] running the [TAR] program.”

Ross recruited most of the board members through his on-campus professional connections. He was the primary conduit for updating the board about CIRTl activities and regularly engaged the group in collective decision-making. Christine described:

Ross will often come back to say okay, here’s some...planning things that we need as an institution to provide our perspective and feedback to CIRTl on. So he would then come to us and seek our input from an institutional perspective and how we see the various, our

various views as an institution, what we bring to that interaction and then how should the institution, how should Ross represent the institution to CIRTl in that context.

Furthermore, participants described the advisory board as very collaborative. Even though Ross was the clear leader and Christine the co-leader, they often sought out board member input and “contributions were recognized and valued.” In summary, the advisory board worked with the local CIRTl leaders at LU to plan and execute the TAR program at LU. Ross diffused CIRTl-related information to the advisory board, Ross and Christine worked with the board to translate CIRTl for local implementation, and they both relied on the board to help diffuse information about the TAR program across campus. Thus, the local CIRTl leaders’ connections to the advisory board enlisted the boundary-spanning behaviors of *diffusion* and *translation*.

Graduate Student Mentor. The TAR program employed a graduate student who worked closely with Ross, Christine, and the advisory board to “help the students develop their TAR projects” and plan and lead regular meetings. I interviewed two such individuals: Rubin, who was the current graduate student employee, and Grace, who occupied the position the prior year. Both were former TAR program graduates. Christine described their roles and responsibilities:

They do some of the grunt work. They chase the TAR Fellows down and make sure they’re showing up and they send them the emails, they tell them what to do...they are our inside track on who’s having issues and problems.

Furthermore, one of the graduate students described their role in the following quote:

I’m serving as the student mentor for the TAR program...so specifically with Ross, I meet with him about once weekly just to chat about things related to events going on in CIRTl coming up that I should make the fellows aware of, the plans and details that we

need to work out for TAR student meetings...and then we also have the steering committee meetings with Ross and Christine, and the rest of the steering committee.

In short, Rubin, and formerly Grace, facilitated the TAR program, coordinated with Ross about what CIRTTL content to push to TAR participants, helped coordinate several meetings for TAR students, and regularly participated in the advisory board. The connection to these graduate student employees represented some degree of program translation (i.e., they provide feedback to the local CIRTTL leaders and coordinate the program), but mostly the connection showed how Ross and Christine used these individuals as a means of *diffusing* CIRTTL-related information.

Chantel. The local CIRTTL leaders (Christine mostly) also mentioned a connection to Chantel, who was the director of graduate initiatives in the college of engineering. While not a key programmatic node, Chantel played an important role helping to promote CIRTTL programs in the college. Christine explained, “our weekly CIRTTL blast that we get, I forward up to her, and ask her to send around to the graduate students.” She also interacted with Ross because of overlapping work with graduate school initiatives. Chantel explained:

I see Ross occasionally when I’m at the graduate school a handful of times a year...we are on a first-name basis, but don’t interact heavily. He is involved to a certain extent in the certification for college teaching program. He also does the [TAR] program, so a lot of my interaction with him is by email and a lot of it is forwarding opportunities for graduate students.

In short, Chantel served as a diffusion/advertising node for local CIRTTL opportunities in the college of engineering.

Graduate Students. Lastly, as mentioned above, Ross and Christine interacted with TAR program participants. One student interviewee described the positive impact of their mentoring role:

...so they've become kind of more direct mentors to the actual work I'm doing and I'm on the job market now and they've been really helpful with how to talk about my teaching, how to just in general do the job talk and do interviewing and all that type of stuff.

In short, Ross and Christine were very aware of current and past TAR students and were always trying to find ways to help their students in the TAR program have a better experience. They regularly *diffused* CIRTTL-related information to TAR students and as I discuss below, the CIRTTL student participants were an excellent advertising medium as they *diffused* information about CIRTTL programs with their peers and faculty mentors.

Section Summary. In this section, I discussed the multiple connections of Ross and Christine related to local CIRTTL programming. First, Ross maintained several different ties with those in the graduate school, linked to both implementing CIRTTL programs and graduate student professional development more broadly. These connections represented those to whom Ross diffused what he gained from CIRTTL participation, those he interacted with to translate CIRTTL locally, and those who helped diffuse CIRTTL information across campus. In short, the graduate school was the central node for local CIRTTL activities and Ross used his extensive connections to engage in the boundary-spanning behaviors of *diffusion*, *translation*, and *gaining institutional support*.

However, there were potential limitations of a centralized CIRTTL model. Positioning CIRTTL within the graduate school provided credibility, expert staff, a stable financial base,

centralized resources, and the ability to develop and implement programs for all students across LU. Yet, a centralized approach prevented departments or colleges from taking ownership of graduate student programming and placed much of the burden on the graduate school and individual boundary spanners such as Ross. A more distributed model could spread the workload of preparing future faculty across campus units, soften the effects of decentralization, and expand boundary-spanning behaviors to multiple college- or department-specific stakeholders. In short, there were many benefits associated with a centralized unit model, but some of the challenges related to gaining audience with academic units may be caused or at least exacerbated by the strategy of programming by osmosis, where the graduate school tries to spread programming versus engaging campus units in its creation and implementation. However, many other factors, such as departmental culture and tenure and promotion policies, could likewise affect the success of gaining support from academic stakeholders, suggesting that programmatic positioning is only one, albeit important, component in establishing a local CIRTl program and securing participation from academic units. Yet, overall, the LU case demonstrated the potential strengths and tradeoffs of embedding local CIRTl programming in a strong, centralized campus unit.

The LU case also demonstrated the use of local CIRTl team members who participated in *translating* and *diffusing* activities. As discussed above, the TAR program at LU had an active advisory board who reviewed proposals, guided the direction of the program, worked with students, and advertised the program across campus. Ross fostered a collaborative environment that promoted collective decision-making and they worked together to make the local TAR program a success. However, board members did not have wide representation across academic units and it was unclear how successful they were in diffusing information about CIRTl across campus. The advisory board was mainly limited to the TAR program and only a handful were

actively involved in other local CIRTTL programming. Furthermore, Ross worked with members of the graduate school to holistically translate CIRTTL across multiple local programs and diffused opportunities for graduate students, but the advisory board was not part of those conversations as far as I could tell. In short, Ross used two separate teams in his efforts to *translate* and *diffuse* CIRTTL at LU, which had possible benefits and limitations. On the positive side, Ross was able to specialize local CIRTTL efforts with two distinct stakeholder groups and not overburden faculty members on the advisory board. On the down side, Ross had to potentially spend more time going between the two groups and making sense of their individual priorities in conjunction with local CIRTTL efforts. Thus, the LU case demonstrated the potential benefits and constraints of working with two local teams to participate in translation and diffusion activities.

Ross and Christine had multiple connections related to local CIRTTL programs. Whereas Christine focused only on the TAR program, Ross engaged both the TAR specific community and the graduate school to create and deliver local CIRTTL programming. The local CIRTTL leaders used the advisory board, a graduate student employee, Chantel, and even students to inform and expand their *translation* and *diffusion* activities. Ross spanned the boundary between the graduate school and the TAR program, which demonstrated the need for boundary spanners to be able to span not only large intra-organizational gaps but also inter-team dynamics in efforts to advance local STEM reform. Thus, Ross had to make sense of both his graduate school and TAR program activities to effectively lead the local CIRTTL effort.

Administrative Connections

The Graduate Dean. The success of local CIRTl programs at LU was strongly tied to the support of the graduate dean. The graduate school already had a keen interest in graduate student professional development long before joining CIRTl, which made membership in the Network a logical choice. When CIRTl first launched, Lila was the graduate dean and readily supported LU joining the network. Ross explained:

I mean Lila was enormously supportive of this. She, I mean it didn't take a big sales job after we started the program with CIRTl money to convince her to pick up the tab. And she voluntarily upped the ante by increasing the support for TAR students. Because she just thought this was a really good thing to do.

Lila also talked about her support of the CIRTl initiative:

Because we already made a commitment to help fund, I mean, put real resources into CIRTl, buy a bigger piece of Ross' time from his department to pay for him to be able to focus on that piece...and then use the graduate school's reputation to back up this new idea of CIRTl.

Support at the graduate dean level resulted in visibility at other high level administrative positions. For example, Lila talked about how she kept the president of the university informed about local CIRTl efforts:

And then every once in a while there'll be an opportunity to provide some information to the president, either in her founder's day speech or something else, or when she's going to go off and be at some meeting where there's going to be a lot of presidents who might be CIRTl institutions that we'll just make sure she has a tidbit of information.

Lila retired from the dean position, but was still a strong advocate for CIRTl at LU. The interim dean, Sam, had a longstanding history with Ross in the graduate school planning and executing programs for graduate students. She was also a strong CIRTl supporter.

Over the years, Ross regularly kept the graduate dean (Lila and then Sam) up to date with national and local CIRTl activities and sought their guidance and support. Thus, due to Ross' administrative position, he had direct access to the graduate dean and easily maintained support for local CIRTl programming.

Section Summary. Given Ross' position in the graduate school, local CIRTl activities had strong administrative support. The graduate dean and other staff within the graduate school supported Ross and his involvement in CIRTl. Such support allowed Ross and others to develop programs and consistently run them for many years. Furthermore, the graduate deans (past and current) used their position to share CIRTl with other upper administrators, which led to the continuity of local CIRTl programming. However, Sam was only the interim dean and the provost will appoint a new graduate dean soon. If the new dean was unsupportive or wanted to pursue other initiatives, it could have a large impact on local CIRTl efforts. Yet, because of the long tenure of CIRTl at LU, interviewees were optimistic about the future.

The LU case demonstrated the importance of administrative support and for at least one local CIRTl leader to have some sort of administrative position. LU was also unique from GU and SU because the graduate school, not the teaching and learning center, was the main vehicle for graduate student professional development programs. This was a positive advantage for Ross because he was in close proximity to preparing future faculty efforts on campus and had administrative authority to lead and direct said efforts on campus.

However, the central role and prestige of the graduate school was not enough to encourage all academic units to support and utilize the services offered by the graduate school, including CIRTTL programs. No doubt, Ross' administrative and faculty role provided opportunities to speak with academic leaders, but even his upper administrative role and full professorship were not enough to completely overcome the decentralized nature of LU and academic unit autonomy. Thus, while Ross enjoyed administrative support, an administrative title, and proximity to the unit responsible for implementing local programming, these attributes were not a guarantee of securing support from academic leaders, faculty, and even graduate students and postdocs.

Academic Connections

Ross used his position in the graduate school and the social capital derived from being a respected STEM faculty member to gain audience with leaders in colleges and departments. Furthermore, due to the success of LU's TAR program, "I think departments recognize that we need a resource on campus for people who want to be future faculty...People are starting to sit up and recognize that this is an important thing for people to pursue." Yet, penetration into academic units was not ubiquitous, which was likely due to challenges related to decentralization, tenure and promotion policies, departmental climates, and the limited number of connections that Ross, Christine, and local CIRTTL team members could have across campus. In spite of these challenges, Ross, Christine, and other members of the local CIRTTL team reported several strategies to advertise CIRTTL programs and gain support from academic stakeholders (e.g., department chairs, deans, graduate students).

Advisory Board. One of the advantages of having an advisory board at LU was to be able to utilize their connections to disseminate or advertise programming across campus. For

instance, one participant discussed how the advisory board strategized about how to reach various campus units:

There are strategies to, and we discuss in the steering committee, okay, so how do we reach, we are not having representative of this or that college. How do we reach them better? So okay, it's right, more specifically, we will say, okay I'll contact directly the chair or the dean or just directly in your face email, or that sort of thing.

Another participant talked about how Ross, Christine, and the advisory board waved the flag of CIRTl in their home departments:

Ross and Christine and the other steering committee members, who really kind of fly the flag as a more authoritative person in their own departments around campus, I think that really functions to build support from other faculty members and departments.

However, to remain a viable support-generating mechanism, the size of the board would need to expand and potentially go beyond the professional connections of Ross and Christine. One participant explained:

So I think there is an opportunity to expand the effectiveness by perhaps expanding the steering committee, because that's a way to, when those people are in your unit, then they're talking to people within the unit about the CIRTl programming. But it has been, I don't know if it's been expanded over the years or not. I think Ross has maybe struggled to be able to expand it.

Thus, the local CIRTl leaders attempted to use the advisory board as a means to diffuse CIRTl across campus, but there were inherent limitations with respect to the size of the board, academic units represented, and the fact that most board members were existing contacts of Ross or Christine. This suggests that in developing a *diffusion* strategy, boundary spanners should

consider creating a more diverse and distributed local team in order to use their team members' campus connections.

Faculty. Ross and Christine focused on recruiting faculty for local CIRTl programs who were already “interested in doing this stuff and you work with them.” Christine talked about this rationale in greater depth in the following quote:

My perspective on the really hard core folks that...believe that their job is to reproduce themselves and their view of themselves is I do research and my success is that my graduate student has done successful research and went on to another one to do more. I won't fight that. I'm not going to change that mindset. That's spitting into the wind. I've tried to learn to pick my battles... I don't even tend to try to convert others. I may tend to try correct misperceptions.

The identification of TAR project mentors was a major inroad used to find those that already supported professional or teaching development for graduate students. These mentors, recruited by TAR students or members of the advisory board, often had positive experiences with the TAR project process, became advocates for CIRTl, and shared the TAR program opportunity with other students.

In summary, Ross and Christine sought out faculty who were “kindred souls” that valued teaching and learning improvement. However, this grassroots boundary-spanning approach potentially produced a closed social network that limited the ability to reach those that do not believe in the importance of teaching reform or the preparation of future faculty as effective teachers. Boundary spanners that attempt to gain support from academic units by relying only upon faculty with similar beliefs may have limited success in penetrating colleges and departments that have research-centric climates or do not believe in the mission of CIRTl. Local

CIRTL leaders' connections to likeminded peers represent individual-based connections, which are certainly important in establishing informal ties to various academic units. Yet, boundary spanners must also find ways to develop connections with faculty who have dissimilar views.

Advertisement. Ross and Christine advertised CIRTL programs and opportunities directly to graduate students in three ways. First, they used existing programs as sharing platforms. For instance, one interviewee talked about how Christine shares things about CIRTL in a course she teaches:

...he teaches an engineering course in education, engineering education research, and, um, she refers his students to CIRTL resources and she talks about CIRTL and the existence of that and what is it and how important it is to think about this.

Second, Ross and Christine employed a rich array of email listservs across campus and within specific departments to let students know about upcoming courses and programs both on campus and through other CIRTL institutions. Third, they encouraged current and prior participants to spread the word about local CIRTL program benefits with their colleagues and departments. Former students in the TAR program, in particular, were strong “advocates” or “emissaries” to “recruit new students into [the TAR program] and new faculty.”

In summary, Ross and Christine employed several strategies to contact and invite future faculty to participate in CIRTL offerings. Their efforts aligned with the boundary-spanning behavior of *diffusion* and demonstrated that local leaders are not the only ones involved in diffusion activities (e.g., student advocates).

Section Summary. As noted above, gaining support from academic units was a difficult challenge at LU. This does not mean that Ross and Christine had no success. To the contrary, they built a local CIRTL program that is well-attended and has a nearly ten year history. Yet,

while Ross and Christine were connected to many campus constituents that support teaching improvement and graduate professional development, they were not connected to many of the “unconverted.” This challenge was in no way germane to LU. It speaks generally to the difficulty in expanding local CIRTl programs beyond those that already “drank the Kool-Aid” to those that are neutral or unenthusiastic about having their graduate students focus on something outside of research responsibilities. In short, the LU case showed that despite a strong showing of social capital, positional authority, and graduate school support, boundary spanners face many challenges in expanding local CIRTl efforts into diverse and disconnected colleges and departments. They must first gain access to academic units and then demonstrate the benefit of CIRTl to those with varying beliefs and concerns. The implication is that boundary spanners must be cognizant of the needs and priorities of local units to be able to customize their *diffusion* or *gaining institutional support* boundary-spanning activities. In addition, given the number of unique departments on campus, it is illogical for two local CIRTl leaders to be solely responsible in reaching widespread CIRTl awareness. Thus, it is not just a matter of how they gain audience with academic units, but how they distribute the responsibility amongst members of the local CIRTl team or other campus constituents.

Chapter Summary

CIRTl Connections and Boundary-Spanning Behaviors

Ross was the primary conduit for accessing the diverse benefits of CIRTl participation. He actively contributed to network operations, network contributions, and engaged in collaborative relationships. He also mentioned some instances of knowledge exchange. Christine was mostly absent from the national scene but had some knowledge exchange experiences. Thus, unlike GU and SU, a single boundary spanner (Ross) was the main connection between CIRTl

and LU. Ross was extremely active in the national Network through multiple types of interorganizational connections, which exposed him to implicit and explicit knowledge gains and resources. The major limitation, however, was that CIRTTL participation was mainly filtered through only one person and constrained to their personal and professional aspirations, their perspectives of local CIRTTL programming, and their schedule and time availability. Thus, institutions such as GU and SU may have an advantage by having two or more individuals connected to the national Network, since it diversified network connections and individual perspectives to inform local programs.

Furthermore, despite the potential for extensive Network gains, LU already had a strong, longstanding CIRTTL program, which likely influenced the finding behaviors of Ross and Christine. For instance, even though Ross interacted regularly with CIRTTL colleagues in multiple settings, he may not have been actively searching for knowledge or resources to bring back to LU. Instead, given his tenure in the Network, he may have been more intent in sharing his knowledge and local success with other CIRTTL members. Put simply, the status and needs of his local CIRTTL program affected what he found in the Network and potentially even what interorganizational connections he pursued. Ross' long-term CIRTTL involvement likely led to tacit benefits, but even tacit benefits filtered through institutional context. Thus, the LU case demonstrated the importance of institutional context in shaping what boundary spanners look for and find in an interorganizational network such as CIRTTL. In addition, it showed that network participation and network benefits are not perfectly correlated, since a boundary spanner may be very active in the network but may not regularly engage in knowledge seeking behaviors.

With respect to intra-organizational connections, Ross and Christine had numerous connections related to local CIRTTL programs. Ross maintained ties with the graduate school and

the TAR program advisory board, and engaged both groups in efforts to *translate* CIRTl for LU and *diffuse* CIRTl across campus. Christine was only involved with the TAR program and actively participated in *diffusion* and *translation* activities. With respect to *gaining institutional support*, I found that Ross was the main contact and used his position to maintain ongoing support within the graduate school. He also used his administrative and faculty position to gain audience with academic units, which once again suggests the vital importance of the institutional position of boundary spanners. Ross and Christine also recruited faculty who valued teaching improvement, used the connections of the advisory board to reach academic units, and actively advertised local programs, often with the help of current or prior students serving as program “advocates.”

Overall, the LU case demonstrated an instance of a singular local CIRTl leader who played the dominant role in implementing local CIRTl programs and the co-leader who solely focused on an individual program. Each were actively involved in the boundary-spanning behaviors of *diffusion*, *translation*, and *gaining institutional support*, but the leader had a much wider role and set of responsibilities that extended beyond the scope of the TAR program. This illustrates one potential distribution of boundary-spanning activities amongst local CIRTl leaders and may suggest the need to spread such activities more evenly. However, it was clear from the LU case that Ross tried to distribute some of that responsibility amongst the local CIRTl team (both in the graduate school and the TAR advisory board) to extend the reach of *diffusion*, *translation*, and *gaining institutional support* activities. Still, the case also suggested that Ross was the primary in *finding*, *gaining support*, and potentially even *translation* activities, which further suggests the need for a careful distribution of boundary-spanning roles to expand the reach of local CIRTl programs.

Individual and Institutional Characteristics

Like the GU and SU cases, institutional role and reputation played a significant role in boundary-spanning behaviors at LU. Ross' role as a full professor and an associated dean in the graduate school provided a strong platform by which to engage in CIRTl activities locally. Christine also had the respect of campus colleagues, but did not have any formal role authority, which limited her on-campus interactions. However, as I discussed above, even formal role authority from the graduate school or respect of campus colleagues were insufficient vehicles to reach many academic units. The LU case demonstrated the need for influential institutional roles, a distributed and diverse local CIRTl team, and multiple points of contact within academic units to garner the support necessary for a local CIRTl program. Thus, institutional role and reputation are important pieces of boundary-spanning success, but to penetrate academic units more broadly, local CIRTl leaders must strategize how to engage many campus constituents by utilizing the connections of the local team.

Beyond individual qualities, the LU case also demonstrated the influential role of institutional climate and departmental culture. For instance, LU, as an institution, was a strong supporter of improved educational practices. However, like the other case institutions, desires for instructional improvement and graduate student professional development were weighed against decentralization, outdated tenure and promotion policies, and an entrenched emphasis on research over other faculty responsibilities. Thus, even though Ross and Christine were actively doing everything they could to promote graduate student teaching development, they operated within the university as a whole and its many, multi-faceted components. This implies that boundary spanners must be able to understand the particular dimensions of their institution and

factor that into their motivations and strategies to *find, diffuse, translate, and gain institutional support* on campus.

The Impact of Boundary-Spanning Behaviors at Lorimer University

Similar to GU and SU, the local CIRTTL leaders' boundary-spanning activities influenced the preparation of future STEM faculty and had direct and indirect impact on their professional development programming at LU. Even though local CIRTTL programming at LU was considered highly developed by LU participants, Ross and Christine still gained valuable insight from their national CIRTTL colleagues. They also worked with campus constituents to translate and diffuse CIRTTL for their institution and used their campus roles and reputations to gain support from administrative and academic units. In addition, their boundary-spanning activities were affected by their local institutional context, especially in their efforts to work with those that did or did not espouse the mission and message of CIRTTL. Thus, the impact of boundary spanning at SU was contingent upon local CIRTTL leaders' connections, the local CIRTTL team, and the specific institutional context.

Chapter 7: CIRTl at Midwestern University

Similar to the last three chapters, the purpose of Chapter 7 is to explore a single case institution to address my three research questions. My goal is to: (a) examine the types and purposes of local CIRTl leaders' inter- and intra-organizational connections related to the Network, organized by *programmatic*, *administrative*, and *academic* connection types; (b) investigate how local CIRTl leaders and co-leaders engaged in the four boundary-spanning behaviors; and (c) illuminate the characteristics of local CIRTl leaders and institutional contexts that could affect boundary-spanning activities. Specifically, I analyze the case of Midwestern University (MU), which has been a member of CIRTl for over eight years.

The outline of Chapter 6 is as follows: (1) I provide an overview of LU; (2) I describe the local CIRTl leaders' local roles and interorganizational CIRTl connections; (3) I discuss local CIRTl leaders' on-campus *programmatic*, *administrative*, and *academic* connections (and relevant institutional dynamics); and (4) I conclude with a chapter summary.

Midwestern University: An Overview

Midwestern University is a private, doctoral-granting university located in the central continental United States. MU has an undergraduate student population of over 60,000 and a graduate and professional student population of nearly 15,000, graduating close to 600 STEM doctoral students per year. MU joined CIRTl when the Network expanded to six institutions in 2006 and has been an active member despite local leadership changes over time.

With respect to my case selection methodology, MU represents a longstanding CIRTl institution with low to moderate programming. From recent internal CIRTl evaluation data, MU reported four programs related to CIRTl on campus. According to the same data, MU reported slightly over 200 individuals that participated in CIRTl programs in 2014-2015 and around 200

individuals in 2013-2014. Local CIRTTL programming and activities were primarily housed in the Office of Graduate Studies (equivalent of a graduate school) with a close association with the Center for Teaching and Learning.

MU's local CIRTTL programming goal was, "to develop...a suite of themed learning communities that we believe will be more accessible to our future faculty." Local CIRTTL programming consisted of four major components:

A student-run learning community in teaching and learning; an interdisciplinary graduate student learning community led by STEM faculty that incorporates...workshops, learning activities that promote inclusive teaching strategies, authentic classroom teaching experiences, and peer review of teaching; an interdisciplinary post-doctoral professional development workshop series; and an interdisciplinary TAR learning community.

Within each of these components were various offerings, such as workshops, courses, "invited speakers, round table lunches, social events," and other resources for doctoral students and postdoctoral scholars.

One participant described MU as a campus where "our leadership right now is very encrusted in advancing education and teaching and learning of students" and that "our board of regents puts a high premium on quality teaching of undergraduates." "It dovetails with a movement that we already have on this campus, and that's to prepare our graduate students the best way that we can...So any program that plugs into that priority will probably get good support." In addition, participants talked about how MU already had "a long history of preparing, well, longer than CIRTTL history, of preparing future faculty," which presented opportunities and challenges. One interviewee explained:

I think that's one of the things that we first struggled with. It's was like, well we already have some of this programming going on, and so it isn't really CIRTl because it didn't start with CIRTl. So we want to incorporate it under the CIRTl umbrella because that would allow more visibility, that would allow more opportunity nationally for people who might want to learn from what we're doing. But at the same time, it has to fit into what we're doing. We're not going to create something brand new for CIRTl.

Furthermore, despite the centralized authority of the office of graduate studies (near equivalent to a graduate school) where CIRTl was housed, local CIRTl team members had to work within a "decentralized system," one that put the "emphasis [on] the freedom of individual colleges and departments" and presented challenges in "getting the faculty to buy in" to CIRTl and the importance of preparing future faculty. Overall, MU had an active local CIRTl community and was starting to expand local programming for graduate students and postdoctoral scholars.

In the next section, I provide a more detailed description of the local CIRTl dynamic at LU by exploring the characteristics, institutional roles, and interorganizational connections of the two local CIRTl leaders and their intra-organizational connections.

The Cast: Local CIRTl Dynamics

Local CIRTl Leaders

Interviewees described each of the local CIRTl leaders as well-respected and fundamentally committed to improving the preparation of future faculty at MU. I interviewed Isaac and Tracy, but I did not interview Deanna. Below, I discuss Isaac's and Tracy's unique roles, attributes, and interorganizational CIRTl connections.

Leader: Deanna. She was an associate provost of graduate education in the office of graduate studies. I attempted to interview her for the study, but was unable to secure an

interview. She was “over all of CIRTTL” at MU and “was the mind behind it all.” She was also the key decision-maker and provided support, guidance, funding, and direct access to upper administration. However, she was not down in the “weeds” nor was she directly involved with programmatic implementation. One participant explained:

Her oversight is at a very high level. But of course it’s a key role because...we don’t have a graduate school here, so our office of graduate studies is the equivalent of the graduate school. And she holds the purse strings that help support a lot of these programs...it’s monies through our office of graduate studies that are helping pay our dues [to be in CIRTTL] and really supporting a lot of programs...but she’s not involved on a day-to-day basis.

Because she was a “top administrator,” participants viewed her involvement as a critical link to “ensure that the [CIRTTL] program will not only be institutionalized but disseminated broadly across the campus” because “without her name and support, it probably wouldn’t go anywhere.” In summary, Deanna was a key figure at MU and provided broad oversight and administrative support to advance local CIRTTL efforts.

Interorganizational Connections. Even though Deanna was the local institutional leader at MU, she did not have any interorganizational connection in the national CIRTTL Network except for an occasional email with CIRTTL’s central administrative team. Instead, she delegated formal institutional representation in the Network to Isaac and supported others (such as Tracy) to attend national in person and online meetings.

Co-Leader: Isaac. He was an assistant provost in the office of graduate studies, a full professor in the college of education, and the CIRTTL institutional co-leader. As assistant provost,

his charge was to work “on professional development for graduate students,” of which CIRTl played a major part. He was driven by a:

...sincere interest in preparing graduate students to be the most competitive they can be for their future...so it’s the reason I took this job... better preparing my and other graduate students for their future careers is what helps me, what motivates me to try and keep up with the many demands of the CIRTl Network.

Isaac was the chair of the local CIRTl advisory board and was “one of the major pathways to bring information about the CIRTl Network to the steering committee.” He also reported directly to Deanna, the primary administrative leader connected to graduate education on campus, and served as the primary intermediary between Deanna and the advisory board, as evidenced in the following quote:

So say Isaac attends the national meeting. It would, Deanna would be the first person to have the follow-up. And that would be in a private meeting. I know Isaac and Deanna meet quite frequently about CIRTl...Anything Isaac hears, it goes back to Deanna. But Deanna usually leaves it open for the steering committee to have some input.

In addition, Isaac coordinated programmatic efforts with several individuals on the local CIRTl team within the office of graduate studies and the center for teaching and learning. He played a major role in revitalizing local CIRTl activities in the past four years by expanding the advisory board to include representation from all of the colleges at MU.

Interorganizational Connections. With respect to network operations, Isaac regularly attended CIRTl Network meetings, both in person and online, and provided his input into how the Network should progress. He also played a major role in the planning of a national CIRTl meeting, which consisted of helping to lead the event committee and working with CIRTl

central leadership and other regional CIRTl campuses to plan and implement meeting logistics. He also had an active role in helping to coordinate MU's cross-network programming contributions. Besides collaborating with the other regional universities for the CIRTl meeting and arranging for students from another campus to visit MU, he did not mention other collaborative exchanges with CIRTl members. In terms of knowledge exchange, he mentioned one specific instance where CIRTl colleagues helped him reformulate how MU students reach a certain CIRTl achievement level (i.e., practitioner level). He explained, "So it really did challenge us to come back home and think through, alright, can we, do we think we're meeting the bar?" Overall, while Isaac attended CIRTl meetings, he was not very active with network-level tasks and responsibilities; instead, he focused on campus-level implications from his involvement in the Network.

Supplemental Leader: Tracy. Before the reorganization of the office of graduate studies where Deanna was appointed associate provost, Tracy "was the leader in the office of graduate studies" and the institutional leader of CIRTl for MU. He, too, took a lead role in convening and chairing the initial smaller advisory board. He was an active contributor to CIRTl efforts since 2006 and was a rich resource for Deanna and Isaac because he knew the "institutional history at MU related to CIRTl" and "had seen CIRTl evolve on our campus." He "provided the continuity between the past and future programs in serving as co-administrative lead for our MU CIRTl advisory board." He was also a full professor in a STEM discipline and currently held a 100% appointment in his home department beyond his continued volunteer activities for local CIRTl programming.

Participants described Tracy as showing "commitment to wanting to advance CIRTl" at MU and "actively making connections with people" on campus. Additionally, "he's just a really

mindful person and very gentle in his approach...he does not to me seem like the person who will push something on you...He nudges people along.” Tracy further described his approach in advancing local CIRLT efforts:

I have this vision of...where is the low hanging fruit? Where are the connections that could be made with, with almost no, you don’t have to die in this ditch to win this battle to be able to do this. It’s something that’s going to be win/win for everyone. And so because of that, you have to choose your, your battles wisely. You have to choose what boundaries you want to span carefully. You just can’t span any boundary. You have to span certain boundaries.

In terms of programming, Tracy was an active member of the advisory board and led the local TAR program in conjunction with Marcela (described below) and a graduate student employee in the teaching and learning center. He often met with student participants to “keep them on track” with their projects and provided “one-on-one advice.” He also helped the planning and delivery of a postdoctoral scholar workshop series and the local CIRTL MOOC learning community.

Interorganizational Connections. When MU first joined CIRTL, Tracy consistently attended in person and online meetings. However, he now served as Isaac’s “back-up for meetings that I cannot attend if I’m out of town or traveling.” A few other individuals, likewise, performed a similar role (e.g., Marcela and Quentin described below) in attending network meetings. Besides playing a minimal role in the planning of the CIRTL meeting at MU and working with the CIRTL leadership on a recent Network grant proposal, Tracy had no other interactions related to network operations. He was involved with cross-network TAR programming, the CIRTL MOOC, and worked with another campus to bring their students to

MU. Yet, overall, his interactions in the Network were limited to being a recipient rather than contributor. Lastly, related to knowledge exchange, he mentioned how he has provided knowledge to newer CIRTl institutions, specifically about his experience running the local TAR program. In addition, he interacted with CIRTl members and “incorporated some of the ideas that came out of those discussions into our own program here.” In short, Tracy, in his current role, had minimal interaction with the national Network and instead deferred that responsibility to Isaac.

Section Summary. Isaac was the main connection to the national Network, but others, such as Tracy, Marcela, and Quentin, attended Network meetings and learned about ways to improve local programming. However, in contrast to the other three case institutions, Isaac and other MU constituents were not particularly involved with network operations or engaged in collaborative relationships with other CIRTl members. The impression was that the MU representatives focused on local programming dynamics and did not make great efforts to engage in network-level interactions beyond regular meeting attendance. As I discussed in Chapter 6, LU representatives likewise focused on their local programming and were not frequently seeking out new knowledge from Network colleagues, which was a direct result of long-term CIRTl involvement. However, unlike Ross, Isaac did not engage in network operations or collaborative relationships, which likely limited his connective potential with Network members. As discussed in the past three chapters, interorganizational finding behaviors were not limited to explicit knowledge transfer but were highly dependent upon the range of connections between the two or more institutional representatives. MU had a small handful of individuals who potentially gained knowledge from CIRTl meeting attendance to influence their local programs, but the lack of varied connection types among this core group may have significant limitations for extracting the

full benefit of CIRTTL participation over time. Thus, the MU case demonstrated the potential need for multiple, varied connections to the CIRTTL Network that support implicit and explicit finding behaviors.

The MU case, like the other three cases, also showed the importance of institutional role. The three leaders at MU utilized the office of graduate studies to advance local CIRTTL efforts. When Tracy was in a similar position to Deanna's, he was able to use his administrative authority to create an initial advisory board as well as several key programs that are still active today. Deanna, as an associate provost, held a similar role but maintains higher stature and was more integrated within administrative circles. She was the primary mechanism for securing and maintaining administrative support for CIRTTL. Without her, it was doubtful that MU's local CIRTTL programming would be successful. Isaac, as an assistant provost in charge of graduate student development, also used his position to coordinate programming; combined with the administrative power of Deanna, he strategically placed key academic leaders from all eight colleges in the advisory board (described below). Similar to LU and SU, the office of graduate studies (parallel to graduate schools at the other case institutions) and the resultant administrative positions of Deanna and Isaac (and in the past Tracy) helped move CIRTTL forward on campus by energizing connections between other administrative and academic units. Thus, MU, like each of the other case institutions, demonstrated the importance of boundary spanners who have positions in key campus units directly involved in graduate education and who have formal role authority to gain key administrative support.

However, unlike GU and SU, local leaders were not formally attached to the teaching and learning center, which was the major unit responsible for implementing local CIRTTL programs. Deanna, Isaac, and Tracy used their positions in the office of graduate studies to influence and

develop ties with the center for teaching and learning. Yet, not having a local CIRTl leader embedded in the unit that delivered most local CIRTl programming could potentially cause problems in the future if the two units became misaligned. The local CIRTl leaders at GU addressed this through an active advisory board, which worked in unison to holistically shape local CIRTl programs and included key staff from the teaching and learning center. Yet, without an advisory board, boundary spanners at MU would be in a similar position as Betty at GU, where they would have to lean on their ability to influence across organizational distances instead of relying on formal decision-making authority.

Programmatic Connections

The local CIRTl leaders at MU expressed multiple programmatic connections with individuals in the office of graduate studies, the teaching and learning center, and other academic units across campus. Since I did not interview Deanna, the connections discussed below are a result of Isaac's and Tracy's network maps and interviews.

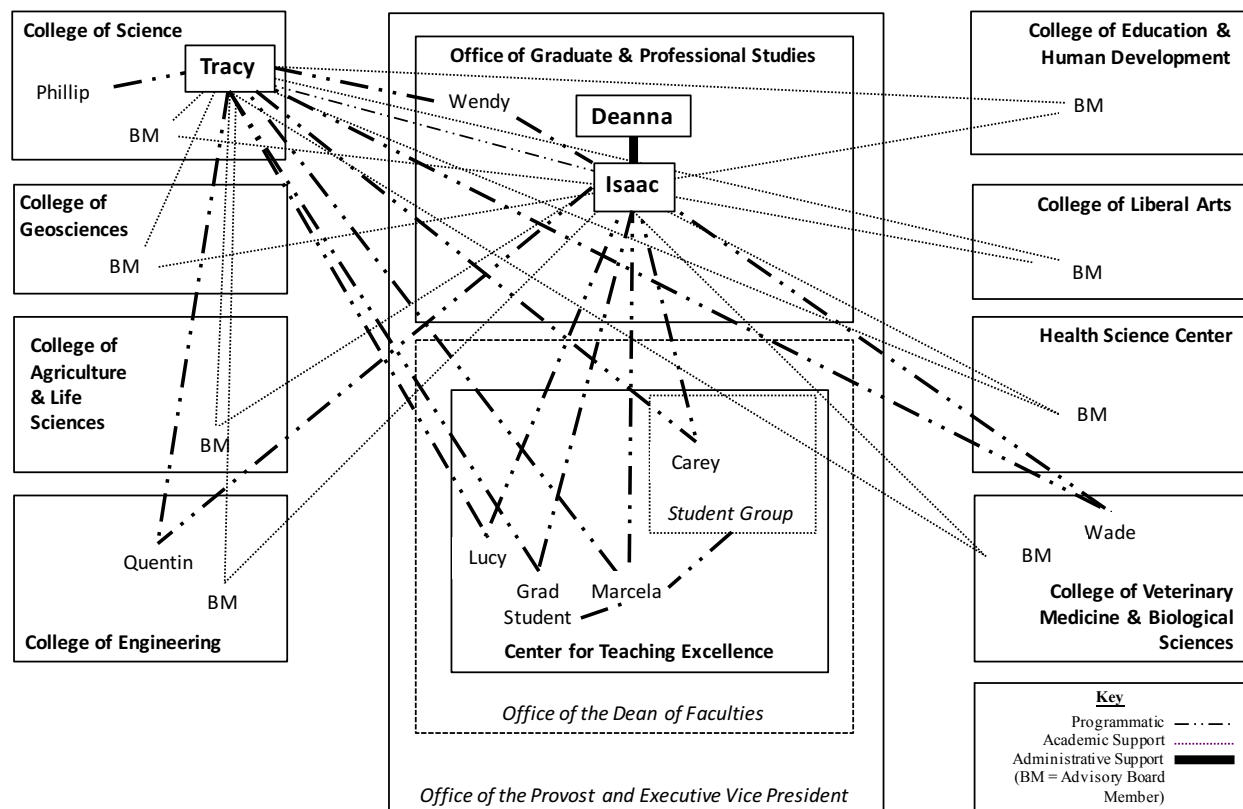
Lucy. Both Isaac and Tracy reported connections with Lucy, who was the director of the teaching and learning center. She reported to the dean of faculty, who reported to the provost. The teaching and learning center was a major venue for CIRTl programs and Lucy's continued support was vital to ongoing local CIRTl activities. She had been a "contributing member of the CIRTl team here for a very long time" (i.e., since MU joined in 2006), was an active member of the advisory board with an active interest in program evaluation, and worked directly with Marcela and the graduate student employee to implement local programs (described below). She also "worked with the office of graduate studies in multiple capacities" outside of CIRTl and had a "pretty good relationship" with Deanna (and Tracy when he was in a similar role), making the synergy between the teaching and learning center and the office of graduate studies seamless.

She provided the support of the teaching and learning center to help plan and execute CIRTl programming and was an important source of guidance and advice for Isaac and Tracy. She helped the local CIRTl leaders *translate* CIRTl for their campus, diffuse local CIRTl offerings across campus, and was the key administrator in the teaching and learning center, whose support was vital to local programming success. Thus, local CIRTl leaders' connection to Lucy represented the boundary-spanning behaviors of *diffusion*, *translation*, and *gaining institutional support*.

Marcela. She was an instructional consultant in the teaching and learning center in charge of teaching development for graduate students and was MU's CIRTl program coordinator. The office of graduate studies was indirectly responsible for the creation of her position (partly due to CIRTl grant funds) and paid for a portion of her salary to work on CIRTl activities. She was a member of the advisory board and was "responsible for the development of workshops/ seminars/course materials and engaging STEM faculty...[and] assisting in implementing evaluation procedures." Due to her responsibilities, she regularly supported Isaac and Tracy in planning and implementing CIRTl programs. She also frequently interacted with Wendy, Lucy, and other members of the advisory board. In addition, she worked closely with Tracy and the graduate student employee to plan and implement TAR programming on campus. Lastly, she was the liaison to the independent, student-run teaching and learning program, into which local CIRTl leaders attempted to incorporate CIRTl concepts and learning outcomes. In summary, whereas Isaac, Deanna, and Tracy were more involved in the "big picture" aspects of CIRTl operations, Marcela was the primary individual coordinating "day-to-day, week-to-week" activities. She was directly involved in translating CIRTl for MU with local CIRTl

leaders and she engaged in diffusion activities by helping to advertise local CIRTIL programs on campus.

Figure 5: Local CIRTIL Leaders' Intra-organizational Connections at GU



Wendy. She worked in the office of graduate studies as a “professional development coordinator” and helped implement all types of professional development for graduate students on campus, including CIRTIL. She worked directly with Isaac and “was basically a [full-time] support staff for CIRTIL programs [with a] primary charge [of] professional development for graduate students. With CIRTIL, her primary role is to support major events and to coordinate the post-doctoral workshops that we have.” Wendy also participated in the local TAR program with Marcela and helped to market and advertise CIRTIL offerings across campus. Thus, she represented another individual who helped local CIRTIL leaders *translate* CIRTIL for MU and helped to *diffuse* CIRTIL out to the rest of the campus.

Graduate Student Employee. Similar to the LU case, I interviewed the current (Jody) and previous (Jenny) graduate student involved with the implementation and advertising of local CIRTl programming, especially TAR. Jenny was the former graduate student employee who worked directly with Tracy and was at MU during the reorganization of the office of graduate studies. She “designed, implemented, and evaluated CIRTl activities” and “helped organize the TAR program, the postdoc programs, and the steering committee.” Jody, the current graduate student working in the center for teaching and learning, was responsible for “contributing to the existing TAR Fellow program as well as working with the office of graduate studies and teaching and learning center staff to integrate a genuine TAR experience into several other existing programs on campus.” Jody was also a member of the advisory board and worked most directly with Marcela, who was her supervisor, and Tracy, given their mutual engagement in local TAR programs. In summary, the graduate student employee was involved in translating CIRTl for MU with the local CIRTl leaders and helped advertise local CIRTl programs.

Advisory Board. When Tracy was in the office of graduate studies, the advisory board consisted of those directly involved in local programming and a few select representatives from a handful of colleges. Since Deanna and Isaac joined the office of graduate studies, they expanded the advisory board to include the associate deans of all of the eight colleges at MU. Beyond the associate deans, Deanna, Isaac, and Tracy, current members included Lucy, Marcela, Jody, a faculty member in charge of evaluation efforts (Quentin), a faculty member focused on expanding and improving TAR programs (Wade), and a representative of the student-led teaching and learning community (Carey). As discussed above, Isaac chaired the board and Tracy served as co-chair; both had regular and ongoing interaction and communication with board members.

One participant described the advisory board as a group of like-minded individuals “who are really committed” to preparing future faculty. The purpose of expanding the board was to extend the reach of local CIRTl programs and other efforts to prepare future faculty. An interviewee explained:

Well the good news is that the folks that we’re working with on the advisory board are all faculty or administrators from around campus that have this shared vision that these kinds of professional development activities is important for our graduate students and our postdocs. And so the expansion of the advisory board here locally has just been a way of expanding the reach of CIRTl programs to like-minded individuals who may not have heard about CIRTl before and so we try to expand the CIRTl activities by reaching out to folks that we see as being likely candidates for getting involved in things of this sort, either because of things that they’ve said or activities that they’ve been carrying out in their own departments.

Other participants talked about the advisory board moving as a “unified front” and worked well together. “So we’re all on the same team, right, we’re all pulling towards the same thing.”

“There’s not a lot of discord amongst the steering committee.”

Interviewees also mentioned how there was an inner circle of advisory board members, consisting of Isaac, Tracy, Wendy, Marcela, Lucy, Quentin, and Wade. This inner circle did not involve the associate deans, since, “that would be too much down in the nuts and bolts for these associate deans.” However, all steering members were involved in the translation of CIRTl for MU as described below:

So there is a lot of that back and forth interaction amongst the, the steering group members to, to modify, to adjust and adapt perhaps things that come from the network and bring it into our local programming.

In short, Isaac and Tracy worked with the advisory board, especially the inner core, to guide, direct, and translate local CIRTl efforts. In addition, the local CIRTl leaders used the associate deans to help diffuse CIRTl-related information into their respective colleges.

Quentin. He was a faculty member in the college of engineering, a member of the advisory board, and was in charge of evaluating local CIRTl programs. His responsibilities included “designing effective evaluation protocols for all of the programs developed locally” and “overseeing analysis and reporting.” Quentin described his role:

I’m merely the evaluation consultant. Which means I try to help develop approaches to evaluate the different programs that we offer on campus and figure out how they fit into the larger scheme of CIRTl things.

Given his role and expertise, he regularly attended advisory board meetings and often worked directly with members of the “inner core,” including Isaac and Tracy, to help *translate* CIRTl for MU.

Wade. He was a faculty member in the college of life sciences and was a member of the advisory board. He had a formal, funded position to help develop TAR programming at MU and, therefore, worked closely with Marcela, Tracy, and Jody.

The rationale in funding the position that Wade occupies was that faculty members need time to be able to devote to activities such as CIRTl. Isaac explained:

Because the key challenge...is finding faculty and staff time to dedicate towards this because it falls kind of outside the usual day-to-day requirements of people's positions, unless of course they are actually funded by specific funds dedicated to this.

Wade was an asset in breaking down walls between academic units and identifying faculty who supported the preparation of future faculty, as evidenced in the following quote:

He...has teamed up with the former director of our teaching and learning center...they've been going from college to college, networking with faculty they know are interested in preparing future faculty to try and instigate the development of more either formal courses or at least workshops.

In summary, Wade played an active role in local CIRTl efforts and frequently interacted with all members of the local MU CIRTl team. He helped local CIRTl leaders *translate* CIRTl for MU, participated in *diffusion* activities, and helped *gain support* from academic units.

Student-Led Teaching and Learning Program. Within the teaching and learning center, MU had an independent, student-led teaching development program that was directly connected to local CIRTl efforts for several years. Isaac and Tracy both had a connection with the former coordinator of this program, Carey, who sat on the advisory board. Marcela and Lucy played an active role in advising this group as part of their center for teaching and learning responsibilities and bridged the gap between CIRTl and the program.

Despite some preliminary success in integrating some of the CIRTl core concepts, there was tension between what local CIRTl leaders wanted and what the leaders of the student-led program envisioned for their program. For instance, in a recent attempt to change the learning outcomes of the program to align with the practitioner status in CIRTl, there was obvious

misalignment between CIRTl leaders and program leaders. One participant described the challenge:

I think we had too many cooks in the kitchen, honestly. I think [we] had a vision of what it should look like. We were trying to do too many things with them. I don't think we came in as a leadership team with a clear enough vision.

Thus, the student-led program represented one type of program that had adopted CIRTl ideals, but was still semi-independent from core CIRTl programming.

Section Summary. MU enjoyed a strong marriage between the office of graduate studies, the teaching and learning center, and an active advisory board. Because of this marriage, Isaac and Tracy interacted with many different campus stakeholders to develop, implement, and evaluate local CIRTl programs. Isaac (and others that attended Network meetings) diffused CIRTl-related information to the local CIRTl team. The local CIRTl MU team consisted of a strong inner group that played the most active role in local programming and associate deans from the eight colleges, who were important conduits for reaching faculty and graduate students. In contrast to LU, MU's board was involved in decision-making for the entire CIRTl effort instead of a single, high engagement program. In addition, having formal academic leaders from all eight colleges on the advisory board was an important step in advancing the mission of CIRTl because there were trickle-down effects related to program advertising and culture change. Overall, while Deanna and Isaac provided overarching guidance, funding, and coordination, the local team, especially the inner core, translated how CIRTl was integrated on their campus. In addition, members of the local CIRTl team helped distribute information about CIRTl across campus and made efforts to gain support from other campus units (e.g., Marcela and Tracy working with the student-led program; associate deans gaining the support from

departments in their colleges, etc.). Thus, MU employed a rather extensive team and distributed boundary-spanning activities.

The MU case demonstrated how formal institutional representatives in STEM reform networks were not the only boundary spanners involved in advancing local reform efforts. Unlike the other cases, there seems to be a much more conscious effort to involve the larger team in translation activities and to distribute responsibilities across members of the advisory board, which prevented the instance where only one or two leaders were responsible for local CIRTl activities (e.g., Betty and Tom at GU; Ross at LU). Other campuses had local CIRTl teams and local CIRTl leaders drew upon their experiences and expertise to guide CIRTl programs. However, the MU case represented an effort to minimize the focus on local CIRTl leaders and instead expand the concentration to the local team. The potential benefits of a team-based boundary-spanning strategy include: a more comprehensive set of campus connections, increased insight into local dynamics, distributed workload to counteract overextended calendars, and wider ownership of local efforts. Thus, while institutional representatives are crucial in securing the benefits of finding behaviors and guiding local programmatic operations, it is equally important to build a strong team to shift the narrative from “this is the leader’s program” to “this is our program.”

Administrative Connections

Both Isaac and Tracy mentioned Deanna as their only connection to gaining administrative support on their campus. Generally speaking, at MU, “our administration here all support CIRTl, which makes things so much easier...it’s solid. It’s pretty much solid.” The major contributor of such support was the placement of Deanna in the office as graduate studies as associate provost. Her position gave her “direct report to the provost” and opened channels

with leaders in colleges and academic units. Deanna (and Tracy when he occupied a similar role) used the office of graduate studies as a bully pulpit to spread awareness and support for CIRTLL activities, especially within academic units on campus. However, if somehow her role changed or a new individual filled the position, it could have dramatic effects on ongoing support from associate deans in the colleges, especially if the new associate provost was not interested in professional development for graduate students. Thus, currently, there were no barriers at the administrative level but this hinged on Deanna's continuity in her current position

Isaac also used his position as an assistant provost to "grease the wheels" at MU. However, although "he's got a title, a leadership title...he certainly doesn't have the name reputation on campus that Deanna does." Tracy, when he had a more formal title in the office of graduate studies, was able to use the position to gain influence among administrative circles. Now, he was limited to prior relationships and his faculty position to encourage change and lacked administrative authority. Thus, Deanna's position played the major role in securing administrative buy-in and support, but Isaac and Tracy's added gravitas provided some additional assistance.

Section Summary. Like other case institutions in this study, the MU case demonstrated the importance for a boundary spanner to possess administrative authority. The other three cases had someone in the graduate school as an assistant or associate dean who reported to the graduate dean. Their title and proximity to the graduate dean provided an excellent position to keep the upper administration informed of local CIRTLL efforts and to continually argue for the importance of CIRTLL. The MU case was a bit different in that one of the local CIRTLL leaders was essentially the graduate dean. This provided direct, hard-lined support for local CIRTLL activities. While it was not clear if there were noticeable differences between having an associate

dean or a graduate dean act as a formal boundary spanner, the MU case showed the potential value in increasing the graduate dean's participation in the local CIRTTL effort. The implication is that if graduate deans participate in, not just know about, local CIRTTL efforts, they may be more likely to buy into and direct more resources to local CIRTTL programming. Thus, boundary spanning may extend beyond just gaining administrative support to engaging administrators in reform efforts.

Academic Connections

Advisory Board. As stated above, bringing the eight associate deans into the CIRTTL advisory board was a major, positive step in gaining access to academic units on campus, since “they seem to have a lot of influence within the college organization.” The associate deans were “our first line of communication” with the colleges and were the mechanism for marketing and advertising CIRTTL programs. Isaac explained:

And so that's one primary means of disseminating, and asking the associate deans to publicize it with their departments and graduate students in their departments, graduate students and faculty in their departments. So that's one key means of communication. In short, the associate deans represented key pathways for informing graduate students and faculty of local and national CIRTTL opportunities. Through the associate deans, the local CIRTTL leaders could both diffuse CIRTTL information and gain support from various stakeholders in academic units (e.g., faculty, academic leaders, graduate students).

Marketing and Making Connections. Deanna, Isaac, and Tracy used their formal positions and social capital to increase participation in CIRTTL programs by “trying to team up with like-minded individuals on campus to leverage and expand the CIRTTL activities.” One individual described their efforts:

Deanna and Isaac are now the CIRTl champions here on campus and reaching out to deans...throughout the university but in particular, in the STEM areas, to broaden access and broaden participation in CIRTl programs. And they often use CIRTl as a sort of a wedge to get people starting to move in the direction of CIRTl programs.

Isaac, Tracy, and other local CIRTl team members gave presentations and met with groups, such as at student orientations, “advisor meetings,” the postdoc association, and graduate student organizations. In short, they tried “to advertise...to different faculties and a lot of TA, teaching assistant and graduate assistants.”

Tracy also mentioned a contact he had with a colleague in his home department to integrate CIRTl into a teaching assistant training program. He explained:

I’ve been involved here locally in my department with trying to transplant some of these CIRTl ideas...Phillip fits in because he’s one of the local departmental folks...who was also very much interested in finding ways of improving the TA teaching preparation and so he had some ideas and I said, well, there’s this CIRTl stuff ...And so building partnerships of that sort with colleagues here in the department is another way of sort of spreading CIRTl.

Thus, Tracy had some success in sharing CIRTl within his home department in contrast to more formalized advertisements from the teaching and learning center or the office of graduate studies.

However, despite efforts to advertise local CIRTl programming through multiple channels, participants discussed challenges with securing the support of individual faculty members. One interviewee explained:

So where we need to improve...is really getting that faculty buy-in beyond the advisory board. Our graduate students have bought in, I mean our programs are packed. We have

good numbers here and no problem. But when it comes into contributing to the CIRTl network, we don't have that faculty buy-in.

Even though local CIRTl leaders possessed administrative authority, they still faced major challenges in trying to convince faculty of the value of CIRTl and importance of allowing their students to participate. Thus, like other case institutions, the local CIRTl leaders and the local CIRTl team had to use multiple pathways and strategies to penetrate academic units.

Section Summary. As noted above, having the associate deans join the advisory board was a major step in spreading CIRTl across MU. When Tracy was the local CIRTl leader, he involved academic leaders from three colleges in the advisory board. When the office of graduate studies was reorganized, Deanna and Isaac used their professional and social standings to expand the advisory board to include academic leaders from the remaining five colleges. Through their administrative positions, they were able to use a top-down approach to expand local CIRTl efforts, which was extremely important in shaping local CIRTl programming dynamics. The implication is that an administrative position with institutional authority creates opportunities for boundary spanners to interact with and influence academic leaders. For instance, when Tracy was in a similar role as Deanna, he was able to meet key academic leaders on campus. Now, as only a faculty member, he did not possess the same authority and was limited to his own department. Of course, he still likely had significant social capital derived from his former role, but he no longer had formal authority. Deanna and Isaac had formal authority, which provided a structured pathway to find other CIRTl advocates in positions of authority and to gain audience with key academic leaders. Thus, the MU case showed the value of having at least one local CIRTl leader with a formal foothold into academic units.

However, despite the formal pathways employed by Deanna, Isaac, and Tracy, they had limited success with individual faculty members, due in part to their high degree of institutional autonomy. One could assume that, as with other research-intensive, doctoral-granting universities, MU struggled to secure faculty buy-in because of existing structures, which do not incentivize faculty to improve their teaching or prepare their students for work other than research. Yet, despite individual faculty support challenges, MU's CIRTl programs were "packed," suggesting that future faculty were indeed desirous of teaching development programs. This demonstrates that gaining support from academic units is multi-faceted. A CIRTl boundary spanner must be able to reach academic leaders, individual faculty, graduate students, and postdocs, all of which have their own interests and goals. Thus, the local CIRTl team must strategize how they will influence each stakeholder group by understanding their perspectives, needs, pressure points, and values.

Chapter Summary

CIRTl Connections and Boundary-Spanning Behaviors

Like Ross at LU, Isaac served as the primary link to the CIRTl Network, though others, such as Tracy, Marcela, and Quentin, attended Network meetings. However, beyond meeting attendance and minimal knowledge exchange and collaboration, local CIRTl leaders at MU had much fewer interorganizational connections with CIRTl colleagues than those in the other three institutional cases. As I noted above, this could have potentially negative consequences since it limits their exposure to new and fortuitous connections leading to implicit and explicit knowledge benefits. Minimal Network connections were likely a result of MU, like LU, being a longstanding CIRTl member that had well-established programs, which potentially influenced local CIRTl leaders' interest in seeking out new information and resources from the CIRTl

Network. However, in contrast to Ross at LU, local CIRTl leaders from MU maintained rather limited connections (as compared to Ross from LU) with CIRTl colleagues. By limiting interorganizational network exposure, these boundary spanners missed out on opportunities to develop professional relationships, collaborate on mutually beneficial projects, and view the preparation of future faculty in new ways. Thus, even if boundary spanners perceived limited ways that the network can fulfill institutional needs, they can still benefit greatly by participating in the multiple types of interorganizational connections.

With respect to intra-organizational connections, the MU case demonstrated the value of a wide, distributed team that shared boundary-spanning responsibilities. Isaac, Tracy, and few other members of the local CIRTl team *diffused* CIRTl-related information to the local advisory board who collectively *translated* CIRTl for MU. Deanna ultimately held decision-making authority, but the local CIRTl team played a major role in interpreting local institutional dynamics and how CIRTl fit into existing efforts to prepare future faculty. In addition, the local team engaged in various efforts to advertise local CIRTl programs and gain support from academic units. Overall, the main contribution of the MU case was to show the value of employing many intra-organizational boundary spanners in service to educational reform. Increasing the number of boundary spanners expands the potential reach across campus by drawing upon the diversity of individual positions, connections, and experiences, thereby reducing workload for the local CIRTl team. However, simply having multiple intra-organizational boundary spanners is not sufficient; coordination is also necessary. The local MU team worked together and held regular advisory meetings to strategize their local CIRTl activities. Thus, the MU case demonstrated the value of not only distributing boundary-spanning

activities among multiple local team members, but also making sure that efforts aligned and built off one another.

Individual and Institutional Characteristics

The consistent theme that permeated each of the case chapters was that institutional role and position were vital to a boundary spanner's success. The MU case added to this finding by showing the potential advantages of directly involving campus administrators (such as the graduate dean) in local CIRTl programming rather than simply keeping them informed of local CIRTl activities. In addition, the MU case showed the importance of identifying who among the local CIRTl team had the best chances of penetrating various campus units because of their institutional role. Furthermore, the MU case, like the LU case, demonstrated that formal authority might not be enough to gain the support of individual faculty members. Instead, CIRTl boundary spanners must come up with ways to customize their diffusion and gaining support activities to meet the particular context and needs of various campus constituents. In short, my study suggests that to be successful, a team of local boundary spanners must strategize on how to utilize the various institutional roles and subsequent connective potential to advance local reform efforts.

With respect to institutional characteristics, MU had strong university-level support for improving undergraduate education and more recently, developed a great interest in graduate student professional development. Because such support for teaching improvement existed, the local CIRTl program team easily incorporated CIRTl principles in several pre-existing programs. However, participants also discussed the decentralized nature of their campus (a trait common to all four institutional case studies) and the challenge of crossing wide divides between various campus units. They had success, but, like my other case study institutions, CIRTl

leaders and other team members still had a long way to go in spanning campus unit boundaries to fully disseminate CIRTTL programming and gain wide institutional support from all key stakeholders. In other words, MU's culture was supportive of CIRTTL efforts while simultaneously the lack of widespread faculty support and decentralized units created large barriers for the local team. Thus, the MU case illustrated that CIRTTL boundary spanners must be able to read the organizational terrain, assess their own strengths and limitations, and potentially recruit other boundary spanners to perform vital connecting functions.

The Impact of Boundary-Spanning Behaviors at Midwestern University

Just like the other three cases, the local CIRTTL leaders' boundary-spanning activities had direct and indirect impact on the preparation of future STEM faculty at MU. Like LU, even though participants from MU considered local CIRTTL programming to be strong and developed, the local CIRTTL leaders still gained valuable insight from their national CIRTTL colleagues to help inform and even improve their local offerings. Like LU, they worked with a large local CIRTTL team to translate and advertise CIRTTL for their campus. They also used their campus roles and reputations to gain support from administrative and academic units for local CIRTTL initiatives. Like the other case institutions, local institutional dynamics also highly contextualized their boundary-spanning activities and shaped the nature and degree of impact that came from their boundary-spanning behaviors. Thus, the impact of boundary spanning at SU was contingent upon local CIRTTL leaders' attributes and connections, the local CIRTTL team, and the specific institutional context.

Chapter 8: Finding and Diffusion

In the last four chapters, I described my case institutions to provide the reader with a detailed picture of each participating university. My goal was to (1) explore local CIRTl leaders' inter- and intra-organizational connections related to the CIRTl Network, (2) examine their boundary-spanning roles, and (3) investigate what factors influence their boundary-spanning activities. The individual case analyses established a foundational understanding of the types of connections, their varied purposes, and detailed descriptions of boundary-spanning activities.

My purpose in the next two chapters is to present findings to answer my second research question, which is focused on boundary-spanning roles. However, unlike the institution-specific findings found in Chapters 4-7, I examine findings based upon data from all four institutions. My findings are a result of a thematic analysis that I conducted using semi-structured interview transcripts of local CIRTl leaders and co-leaders, their on-campus connections, and members of CIRTl's central administrative team. While I remained open to finding additional boundary-spanning behaviors not included in my conceptual framework, my analysis revealed that local CIRTl leader boundary-spanning activities were strongly aligned with the behaviors of *finding*, *translation*, *diffusion*, and *gaining support*, which were established in the literature. However, even though my study confirms prior research-derived categories of boundary-spanning behaviors, the manner by which local CIRTl leaders engaged in each of the four categories potentially differs from profit-centric organizational contexts (where most boundary-spanning literature resides) due to the focus on educational reform. Thus, generally, local CIRTl leaders engaged in *finding*, *translation*, *diffusion*, and *gaining support* activities, but there were particular nuances specific to educational reform efforts that I highlight in the next two chapters.

In Chapters 8 and 9, I answer the following research question: How, if at all, do formal institutional representatives (i.e., local CIRTl leaders) engage in and make sense of inter- and intra-organizational boundary-spanning roles to help advance the network's reform agenda locally? In Chapter 8, I answer two additional sub-questions specific to the boundary-spanning behaviors of *finding* and *diffusion*: (1) what do formal institutional representatives gain from network participation and interorganizational *finding* behaviors and (2) how do formal institutional representatives *diffuse* network gains across their institution. In Chapter 9, I answer two sub-questions related to the boundary-spanning behaviors of *translation* and *gaining institutional support*: (1) how do formal institutional representatives *translate* network gains for application at their institution and (2) how do formal institutional representatives *gain support* from local stakeholders to advance the STEM reform target of the network? Therefore, the objective of the next two chapters is to provide an overall analysis of boundary-spanning behaviors across the four participating universities.

Finding

I begin this section with a fictional story of a local CIRTl leader named Karl. The story is based upon a composite of my findings and is intended to provide the reader with an example of the boundary-spanning behavior of *finding*. To remind the reader, the behavior of *finding* is defined as identifying and obtaining knowledge, best practices, and resources from participation in the CIRTl Network.

Karl has been an active participant of the CIRTl Network for three years and serves on two Network committees. He has collaborated several times with other CIRTl members on grants and teaching development programming and regularly talks with other CIRTl members about his local CIRTl programs and theirs. Karl feels at home with CIRTl and

thoroughly enjoys interacting with so many individuals who share a passion for teaching improvement and graduate student development. He has greatly expanded his professional network and has learned much to improve his local programs and even help his career. He has been able to leverage his CIRTl participation and CIRTl grant funds to build support for graduate student teaching development on campus. He has also relied upon CIRTl's learning outcomes and core ideas to more fully develop and refine his local offerings with the help of his local CIRTl team. Recently, he was struggling with getting his teaching-as-research program off the ground and reached out to a handful of seasoned CIRTl members to get their advice on how to build the program up, recruit students, and evaluate their progress. CIRTl colleagues gladly shared their program materials, including evaluation instruments. Through CIRTl participation, Karl has gained access to numerous resources to advance professional and institutional goals.

As described in the story above, maintaining interorganizational ties in CIRTl can lead to many benefits, both to the individual providing the link to an interorganizational network (i.e., the boundary spanner) and the individual's home organization. Chapters 4 through 7 showed how leaders and co-leaders maintained several types of interorganizational connections related to (1) network operations, (2) network contributions, (3) collaboration, and (4) knowledge exchange. The purpose of this section is to outline the major individual and institutional benefits that came from these connections and how local CIRTl leaders/co-leaders and other study participants made sense of their *finding* behaviors.

Individual Gains

Study participants mentioned three major types of individual benefits: (1) the ability to engage in a supportive and likeminded community, (2) an extended professional network, and (3) opportunities for career advancement and professional development.

Supportive, Likeminded Community. Participants believed that the CIRTTL Network was a safe and supportive community. One interviewee elaborated:

I think what they actually end up gaining more than they fully expected is the community itself, the moral support, if you will, spiritual support, the pleasure of working with others, the experience and ideas of others. And I think they all realize, or they wouldn't be in, that it is easier to do this within the CIRTTL community than it would be to do it alone.

Others commented on the community being responsive and CIRTTL members being eager and willing to help solve problems. For instance, one participant stated, "I feel like I could go to anybody with a problem and say, yeah, I need help with this, and they would help me figure it out." Another respondent provided an example of such responsiveness:

I think the major positive is that I can send an email right now and say does anybody have some sample language about institutional funding or I need a couple papers on the success of your individual programs or abstracts, and 30 minutes later, I would have five responses. And by 24 hours, I'd probably have ten responses. And half the network would probably respond.

In addition to being supportive and responsive, participants also mentioned that CIRTTL provided them with a community of likeminded peers, "kindred spirits" who are "facing similar

challenges” at their institution in relation to preparing future faculty and who “really do believe...the mission of CIRTTL.” One individual explained:

Most of these leaders are...in a place of challenge at their university where there are STEM faculty, and there’s all this pressure for a STEM faculty to be producing research and producing doctoral students who are producing research and all of that...it’s an uphill battle for them to get teaching valued and to improve STEM education is not necessarily a top goal at a lot of their institutions...I think this network for them is some like-minded individuals who understand the value of the STEM education. They have some of the same values, and they also have some of the same challenges. So I think that’s something that when you’re out there fighting in the minority, you want to find other people who have a similar perspective that you do. And I think CIRTTL serves that.

CIRTTL provided individual leaders and co-leaders with a “scholarly community” that shares similar experiences and concerns and that provides moral support in their collective efforts to improve the preparation of future faculty.

Extended Professional Network. CIRTTL was also a means to extend local CIRTTL leaders’ professional networks outside of their home institutions and provide opportunities to collaborate by “[getting] to know a lot of people that I wouldn’t know otherwise.” For example, one interviewee said that CIRTTL gave local CIRTTL leaders the opportunity to work on grants with their CIRTTL colleagues:

When you get into the more tangible benefits, I think certainly collaboration is one. And it’s amazing how many different grants and collaborative grants in the last year or two that we’ve had...some of them have been funded, some of them haven’t been funded. But even the ones that haven’t been funded, usually it’s a group of people that have met, get

to know each other, they respect each other, they're more likely to think of that person in the context of writing an article or looking for another grant, or interest in going in on something. So I think that kind of network starts to build. And I think that's pretty significant...if somebody walks out of a year or two in CIRTl with three or four or five other significant professional colleagues, that's a lot. That's a lot of additional input and connection that they have to their kind of professional world.

Another participant mentioned that CIRTl provided members, especially faculty, a chance to go outside of their disciplines and broaden their perspectives:

Well one is the opportunity to deal with a national set of colleagues outside their disciplines, which doesn't happen very often for faculty... it's rarer, particularly in the sciences, for faculty to work with disciplinarians outside their area. And you just get this great new perspective from different ways that disciplines look at things, and different experiences that faculty have.

In short, CIRTl provided its members with the means to expand their professional networks outside of their institution in relation to efforts to prepare future faculty, teaching and learning more generally, and even disciplinary associations.

Professional Development. Beyond a supportive community and expanded professional network, interviewees talked about the potential benefits of CIRTl involvement on leaders' and co-leaders' careers. For instance, one respondent said:

I think they do recognize that the national connectivity and the national status of CIRTl is a big deal for them, both locally and nationally and I think a subset of them, not all by any stretch, see this as an opportunity to flex their administrative muscles...For the STEM faculty, or the institutional leaders, especially those who may not be deans yet,

very often this is their first major campus-wide change experience. Maybe not the first but very often it's a bigger...professional step for them.

One participant even talked about receiving a promotion due to their CIRTl participation:

Well, the added responsibility, and attending all these meetings and then having also the responsibility of managing [our university] interfaces with the program...allowed my bosses to ask that my position be upgraded. So directly, as a person, my position became much more significant and important on campus...I've gained a lot of leadership abilities that I didn't, hadn't really had to develop outside the classroom before.

Others believed that CIRTl was a mechanism for professional development and provided an "intellectual community" as evidenced in the following quote:

You develop friendships and colleagues that not only you produce products with but also that you learn, it's part of your own professional development...And so if I'm going to be an institutional leader, I'm going to do it and I'm going to do it right and be engaged and as a result, it has become part of my professional development and that's one of the things I love about CIRTl is I learn things for my personal growth.

Another participant talked about their CIRTl participation helping them "learn a lot about how I impact teaching. I'm like many faculty who never had any formal training...so [it's] really enlivened my own teaching and reinvigorated my enthusiasm." One interviewee said that CIRTl "[gave] me some new opportunities to investigate and expand my academic, my scholarly activities." Another respondent discussed how CIRTl participation expanded their worldview and provided a deeper insight into the literature. This individual said:

I've also gained a perspective that takes me outside of [my institution]. So it's very useful when interacting in the network environment to find out what's similar and what's

different about institutional contexts...and it helps, maybe, get some concreteness to literature that I read.

CIRTL gave leaders and co-leaders opportunities to grow and develop as professionals, which positively affected their careers.

Summary. Overall, I found that local CIRTL leaders individually benefited from CIRTL participation because they gained (1) a supportive, likeminded community, (2) an extended professional network, and (3) opportunities for professional development. Such benefits likely provided local CIRTL leaders with strong intrinsic motivation to participate in the Network and to engage in the various national CIRTL connections as described in Chapters 4 through 7. However, despite the rich personal benefits that come with CIRTL membership, not all leaders and co-leaders equally participated in the four types of interorganizational connections. The first potential explanation for varying types and levels of CIRTL involvement is that leaders and co-leaders had busy schedules and simply lacked the time available to deepen their Network connections. The second explanation is that they did not need or want a supportive community, an extended professional network, or chances to grow professionally. The third potential explanation is that local CIRTL leaders weighed the demands of their local responsibilities against the potential benefits of Network participation. These leaders performed a cost-benefit analysis to determine if the added benefit of engaging in more CIRTL connections would be higher than the cost associated with not paying as close attention to local duties. The fourth possible explanation is that they deemphasized individual benefits and instead focused on potential institutional benefits. From this perspective, they made key decisions as to the extent of Network participation necessary to yield the institutional benefits they required.

Each of the explanations for variance in Network participation may simultaneously play a part in local CIRTTL leaders' decisions to engage in the four types of interorganizational connections. Local CIRTTL leaders must be able to recognize and want the potential benefits, weigh those benefits against local organizational responsibilities and needs, and then decide on the most advantageous interorganizational connections that fit their needs, wants, and busy schedules. Thus, personal benefits alone were insufficient at explaining Network participation and subsequent *finding* behaviors that could affect local CIRTTL programs. Yet, they still represented a major motivating force in driving leaders and co-leaders to develop a rich array of network connections that could create the implicit and explicit knowledge exchange benefits discussed in prior chapters.

Institutional Gains

As the story about Karl demonstrated, CIRTTL participation also provided several unique benefits in building and expanding local programs. CIRTTL was often a “nucleus” for merging existing efforts to prepare future faculty with CIRTTL ideals and concepts. For instance, one interviewee explained:

CIRTTL is able to be a nucleus that they can start to build a whole team around, what I hear from them often, various people often, is how they're making connection with colleagues on their own campus that they haven't before. I had no idea this person in engineering was a kindred spirit in some of these things, and now I'm working with her all the time. And so I do hear that the ability for CIRTTL to be a nucleus around what the local community builds can be, can be a significant networking for them.

Another participant gave an example of how CIRTTL participation was a means of connecting and building their local CIRTTL community:

I think the biggest benefit has been to bring together a group of people in our steering committee that are really truly dedicated to high impact teaching and preparing our graduate students in that. What it does is elevate not just the visibility of any of these collective efforts, but it brings a new awareness in the various dean's offices that are represented, right, to how institutionally we can do a much better job at preparing future faculty...And it's created a nice synergism in that group, some new energy, if you will... Because we had a number of these programs around campus, but now what we're doing a much better job of is when they're collected under the CIRTl umbrella and addressing CIRTl pillars, the programs are made more consistent, but also we have better communication of these programs, advertising of these programs across colleges.

Overall, CIRTl "added a lot of depth and dimension" to build local programs.

More specifically, participants mentioned four institutional benefits that derive from their participation in the CIRTl Network. First, local CIRTl leaders gained additional social capital from their Network participation and used it to advance local efforts. I only provide a brief overview here and discuss it further in Chapter 9. Second, leaders and co-leaders received funding for their local programs. Third, leaders and co-leaders drew upon CIRTl products such as the three core ideas, learning outcomes, and cross-network programming to improve and expand opportunities for their future faculty. Fourth, the Network exposed leaders and co-leaders to many programmatic resources, such as the opportunity to benchmark offerings across the Network, ideas and best practices, and advice.

Social Capital. As mentioned above, I only provide a brief description of the increased social capital that came from Network participation in this section. I report a more detailed description of related findings in the gaining support section in Chapter 9.

The major takeaway was that leaders and co-leaders were able to leverage their association with the CIRTl Network in service to advancing their local programs. One participant explained:

And they are institutions some of which are very prestigious. All of a sudden that brings prestige to the organization. And prestige is key for these boundary spanners. I mean they need to convince their local network that CIRTl's worth being part of...it's innovative, it's on the cutting edge, and there's new people joining, those are all resources that I think they can, they can leverage locally.

Another interviewee expressed a similar sentiment in the following quote:

When you have something that's funded by NSF and it's making a big splash on the national scene, all of a sudden you get a whole other layer of attention. And so it gave a lot of the stuff that we're doing as far as future faculty development, I guess, more legitimacy in their eyes.

In summary, leaders and co-leaders gained social capital by participating in CIRTl, which provided a strong base for legitimizing and leveraging efforts to prepare future faculty on campus.

Funding. Interviewees only occasionally mentioned the fiscal benefits of CIRTl participation. When they did discuss it, their comments were typically general or they described hiring a graduate student or postdoc, providing student stipends for a particular program, or other means of programmatic support. Despite limited interview data, I have observed how crucial grant funding is for the development of local CIRTl programs through my ongoing interaction in the Network for the past five years.

CIRTL has received several million dollars in grant funding in total from donors such as the National Science Foundation (NSF), the Alfred P. Sloan Foundation, and the Great Lakes Higher Education Corporation and Affiliates. While CIRTL used some of these monies to build central infrastructure, national CIRTL leaders directed most of the funding to building local CIRTL programming. Each grant has had different implications for sub-contract awards at CIRTL institutions over time. For instance, Lorimer University has been a member of CIRTL for three separate NSF Grants when the Network consisted of three, six, and 21 institutions respectively. As the Network grew in size, participating institutions received smaller portions of grant funding. Thus, Lorimer and Midwestern, by the length of their tenure in CIRTL, have received more grant funds for their local programs than Green and Serenity Universities.

However, regardless of the total amount of funding received, the fact remains that each university has received grant funding specifically to build their local CIRTL offerings. Without grant funding, leaders and co-leaders would not have been able, or at least would have found it much more difficult, to establish a local team, develop new programs, integrate CIRTL concepts into existing programs, or even gain the support of campus constituents. Therefore, even though participants spent very little time discussing fiscal benefits, funding was still an important facet of leaders' and co-leaders' interorganizational *finding* behaviors as it had vital importance for local programmatic support.

CIRTL Products. Beyond social capital and funding, CIRTL provided leaders and co-leaders with tangible products for their local programs. First, local CIRTL leaders used CIRTL's core ideas of teaching as research, learning communities, and learning through diversity to frame and revise programs. One interviewee gave an example of how they incorporated the core ideas:

It was easy then to take those pillars, the diversity pillars, and teaching as research, and so on, to be able to stick with the core of what we thought was necessary to certify somebody as a potentially good college teacher...and CIRTl helped I think focus it on the STEM areas and then use the CIRTl pillars to help align thinking about what people need to do and how they needed to do it...and CIRTl gave us a great peg to hang some things on, and then to be able to use ideas.

Another participant talked about applying the teaching as research concept locally:

[What we] gained most...would be the concept of graduate students and post docs doing TAR projects. We had graduate students and post docs heavily involved in STEM reform initiatives, but not necessarily taking a lead role in assessing student learning.

Overall, the core ideas served as a means of informing and organizing local programs.

Second, leaders and co-leaders also utilized CIRTl's learning outcomes and related achievement levels, which were based upon the three core ideas. One participant said, "it's been CIRTl that's helped build that framework for us...CIRTl has provided a standard through those learning outcomes, for us to strive for." Another interviewee further elaborated on this point and described the value of the learning outcomes.

Those specific learning outcomes [give] a bit of a touchstone. I think we could all go out and find information about future faculty professional development programs and there are all sorts of resources out there but that can be a bit daunting in itself. And so to be able to say, here's a network. It's a group of informed, educated, experienced people. This is what they've come up with out of this huge forest of literature. All right, well, that's probably good enough for us.

In short, local CIRTl leaders used the learning outcomes to provide structure to their programs and articulate desired student learning outcomes.

Third, leaders and co-leaders were able to tap into online, cross-network programming to complement and expand their local offerings, since such offerings “opened our eyes to programming that’s available for our graduate students.” For example, one participant talked about the benefits of incorporating cross-network programs at their institution.

I know that we’re limited in how much we can offer at the center so I think with...connecting us to CIRTl, it was a really smart move in terms of more flexibility for what students could engage in to meet requirements.

Another interviewee articulated the benefits of CIRTl’s massive open online course (MOOC) in providing students with access to many universities across the nation.

I think using the MOOC as an example, watching all the videos and taking part in all the discussion forums and things like that, there are so many interesting and really specialized initiatives going on at each institution.

However, it was also clear from the data that “it completely varies, how different institutions make use of cross-network [programs]” due to varying local opportunities and needs.

Lastly, a few participants mentioned that there are other resources, mostly found through the “information and data framework through the CIRTl.net website.” This included access to items such as programmatic evaluation instruments, prior publications, and past meeting agendas and recordings. In summary, CIRTl provided leaders and co-leaders with many different products that they could employ in their local CIRTl programs.

Programmatic Resources. Outside of formal CIRTl content and materials, the Network was a rich, knowledge-sharing resource. It exposed leaders and co-leaders to an expansive set of

“different perspectives” to learn from and to potentially adopt or adapt for local implementation.

For example, one interviewee explained:

I think that it’s allowed [local CIRTl leaders] to...see how professional development is being done at other institutions...they at least have an awareness about different approaches...I think any time you can see how somebody else is doing kind of the same thing you’re doing, you can take away some new ideas that can ultimately improve a program.

Another participant expressed gratitude for not having to recreate the wheel in their local offerings:

Well, again, having been involved in the network for a number of years, I appreciate that there’s a wealth of information spread around the network and rather than reinvent the wheel...I think the network allows us to sort of build on what other people have already done in terms of assessment, in terms of programming and that has helped to make my time spent in working with the folks here more efficient.

Overall, participants talked about gleaning ideas, program materials, and other resources in relation to such topics as improving TAR projects, workshops, program assessment, and marketing strategies.

The strong collegial nature of the CIRTl Network was a major factor in facilitating knowledge exchange as evidenced by the following quote:

I can call up [anyone] and say how do you do this professional development and [they just [go] here’s what we did. Here’s our outcomes, here’s our goals. Here’s the syllabus. Go for it. That’s the advantage, I’m building a lot of stuff from scratch. I need this national network to be able to try and bring it back here and try to instill it here.

Fellow CIRTl members were ready and willing to give “actionable advice,” which was particularly important for local CIRTl leaders because they knew “that we haven’t been the first to address or come across this particular problem. Somebody else in that network probably surely has.” Thus, CIRTl members were a wealth of information on all aspects of programmatic issues.

Many participants also used the Network to benchmark their local efforts. For instance, one participant stated:

When we go to those network meetings, it opens our eyes to programming that’s available for our graduate students. We know things that we’re doing here on our campus to make students marketable, but are there other things? What does the land look like?

Where are we standing in terms of providing the support that our graduates need in teaching?

Another respondent went on to describe, “[they] come back from meetings with what other people do, and we talk about, okay, how does that work, and do we think we should make changes to ours.” CIRTl also “gave me more context, knowing what other institutions were doing in this arena in order to be able to evaluate whether...we’re on par with similar institutions.” Leaders and co-leaders gain “a better idea about how to align activities at [their institution] with CIRTl activities.” Thus, leaders and co-leaders used CIRTl as a means of “calibrating” their local programs against the national standard of peer institutions.

Summary. Overall, I found that Network participation had several positive institutional benefits such as social capital, funding, CIRTl products, and programmatic resources. Expanded social capital provided local CIRTl leaders with an additional advantage in advancing local

programs and funding helped support and expand local CIRTl efforts. The Network provided many CIRTl projects and tangible and intangible knowledge sharing resources.

However, despite the rich, knowledge-sharing benefits of the CIRTl Network, participants did not necessarily view knowledge transfer as a simple linear progression where a leader or co-leader learned something at a meeting and then went back to their home institution to immediately implement it. Instead, knowledge exchange was implicit and explicit. For example, one participant explained:

I mean, it's important to recognize that you can look at sort of explicit transferred information, or you can look at very implicit transferred information and I think that implicit part is harder to identify but probably more impactful.

Another interviewee captured the time-delayed nature of knowledge exchange interactions:

I think it's more complicated. I think there probably are examples of this sort of linear transfer where there's a specific program and somebody says I like that idea and I think we could do that here. I think that does happen but I think it's maybe more the other case where sort of subtleties of what I learn from peers. I think they must learn and get ideas, again, just from hearing about what others are doing and I think it probably feeds itself a little bit. It may be six months later that a new program gets started and the seed may have been planted at an in-person meeting at that lunch and you're sitting next to another leader who talked about something they did on their campus.

The following quote further expands the time-delayed and implicit nature of knowledge exchange activities.

And then certainly, getting a sense of the actual specific programming elements that different campuses have...And some of those, they don't necessarily stick in there for a

long period of time but I think that those specific ideas come back to help us build better programming. Whereas when we're in those sorts of discussions, at times those different pieces will come in and will help inform our own discussions.

In summary, knowledge exchange in the CIRTl Network was much more complex than a simple linear relationship. There were instances of direct, explicit knowledge transfer, but knowledge exchange also occurred implicitly, which could influence local CIRTl leaders over time.

Therefore, CIRTl products and programmatic resources were not always well-defined commodities for direct transfer, but represent a range of potential benefits that local CIRTl leaders had to make sense of and translate for personal and institutional use. I discuss this point further in Chapter 9.

The interorganizational connections of local CIRTl leaders constituted the connective potential that they could use to seek out advice or information to address institutional needs. One could argue that the more interorganizational connections, the more potential for knowledge exchange benefits. However, the number of connections was not the only or even most important factor. Local CIRTl leaders likely compared potential institutional benefits to their institutional context, programmatic needs, program mutability, and even available staffing to determine the most beneficial "mix" of interorganizational connections and what they hoped to gain from those interactions. For instance, the leaders at GU looked for very different types of information in building their local program than their longstanding CIRTl colleagues at LU. Yet, Ross at LU had the most comprehensive set of CIRTl connections even though he was not actively seeking resources from the Network to build or improve his local programs. Such a paradox demonstrated that a combination of personal and institutional factors influenced local CIRTl leaders' reasons to engage in national CIRTl connections and gain the resultant benefits.

Individual and institutional factors were dynamic, which implies that local CIRTl leaders were constantly weighing personal and institutional variables as they decided how to allocate their time, what they hoped to gain from CIRTl participation, and how they would implement their Network gains locally. The boundary-spanning behavior of *finding* is a constant negotiation of perceived benefits, individual motivators, institutional context, and interorganizational connections.

Table 1: Individual and Institutional Benefits of CIRTl Participation

Individual Benefits
A Supportive, Likeminded Community
Extended Professional Network
Opportunities for Professional Development
Institutional Benefits
Social Capital
Funding
CIRTl Products
Programmatic Resources

Diffusion

In this section, I again turn to the fictitious story of Karl to provide a composite example of the boundary-spanning behavior of *diffusion*.

Karl attends just about every on-line and in-person CIRTl Network meeting and regularly reports back to his local CIRTl team through written memos and team meetings. He informs them of what's happening at the national level and how it could affect their institution. He also discusses any new opportunities available through cross-network programs for students or other resources or ideas that could help their local CIRTl programs. In addition, Karl regularly meets with his boss, the graduate dean, and often has the opportunity to provide a short update about the status of the national

CIRTL Network and local CIRTL programming in order to secure ongoing support.

Furthermore, Karl organizes efforts to advertise local CIRTL programming to graduate students and postdocs by working with a graduate student to distribute emails on several Listservs, presenting information about CIRTL at campus events, promoting local programs in the courses he teaches, and encouraging the newly created local CIRTL advisory board to bring information back to their home colleges and departments. Karl is a CIRTL advocate and constantly tries to share information about CIRTL across campus.

As the story about Karl demonstrates, local CIRTL leaders diffused what they gained from CIRTL participation in three primary ways: (1) sharing what they acquired from Network participation with their local CIRTL team, (2) updating campus leaders of CIRTL activities, and (3) advertising local and cross-network programs to graduate students, postdoctoral scholars, and faculty.

Local CIRTL Leaders Share CIRTL Information with their Local Team

As demonstrated in Chapters 4 through 7, leaders and co-leaders had local CIRTL teams, consisting of an advisory board and others involved in planning, implementing, and evaluating programs. These individuals were often the first to hear about what leaders and co-leaders gained from CIRTL participation. For example, a member of an advisory board stated:

I do recall being in meetings where [they] talked about having been to a [CIRTL] conference and learning things there and then [they're] going to share that or they're going to try to implement this at [our institution].

Other CIRTL team members had similar responses where they recalled the leader would “try to update us every month in our monthly steering committee meeting” and where they remembered “[the leader or co-leader] coming back from the CIRTL forum and talking about their experience

there” or “after the meeting there is a debriefing meeting with the steering committee. This is what happened, this is what I heard...we need to prepare this...so we are all on the same page.” Also, participants said that others outside of the leader and co-leader would attend CIRTl meetings and likewise reported back to the local CIRTl team what they learned, suggesting that the formal leader and co-leader were not the only intra-organizational boundary spanners connected to local CIRTl efforts.

The leader or co-leader would also consult their local team and report to the national CIRTl leadership team, as evidenced in the following quote:

Sometimes it’s me getting input from the steering committee because of something that [the PI] wants input from institutions on so I go back to the steering committee and say how do we feel about this? What’s our stance? Do we like it? Don’t we like it? Why do we like it? Why don’t we like it? What would we propose differently?

Thus, the local CIRTl leaders served as a bidirectional link between the Network and their home campus.

In summary, local CIRTl leaders were the primary conduits for sharing CIRTl-related information, knowledge, or resources to those primarily responsible for local CIRTl programs. As demonstrated in Chapters 4-7, these leaders often worked with their local teams to translate Network gains for their home campus. While leaders and co-leaders were the main *diffusion* mechanism for programmatic information and resources, sense making and decision making happened more broadly amongst the local CIRTl team, which was congruent with organizational learning principles (Crossan et al., 1999).

Local CIRTl Leaders Update Campus Leaders on Local CIRTl Activities

Leaders and co-leaders actively shared information about CIRTl with administrative and academic leaders on campus. For example, one administrative leader in the Center for Teaching Excellence talked about both local CIRTl leaders keeping them abreast of local and national CIRTl developments. This administrator explained:

So my knowledge about CIRTl other than being on some listserv...comes from the updates that [the leader and co-leader] will give me either directly or through our monthly staff meeting, staff meeting reports and then also...our [center for teaching excellence] advisory board and so [they will] update that group with a little bit more detail on some of the initiatives...in relation to CIRTl.

Another administrative campus leader at the same institution talked about the local CIRTl leader keeping them updated as “part of our systematic set of meetings that we have” that were not usually “just devoted to CIRTl.” The local CIRTl leader described the purpose of these meetings as:

It is me making sure that [the campus leader] knows what’s going on inside of my sphere of the graduate college. So all the professional development, all the recruiting, all the retention activities, they get a pretty extensive summary on a monthly basis from me. So CIRTl’s always a key part of that agenda.

Other leaders and co-leaders with ties to administrative units likewise talked about regular meetings to update and inform campus leaders of the state and progress of their local CIRTl program. The campus leaders to which local CIRTl leaders or co-leaders reported often shared information about CIRTl with those in other senior administrative positions on campus,

suggesting that local CIRTl leaders and co-leaders were not the only conduits for disseminating CIRTl among high level campus administrators.

Interviewees also mentioned that local CIRTl leaders who either had administrative positions and/or extensive connections in academic units also served as a conduit for diffusing CIRTl information to academic campus leaders. In particular, those with administrative positions, especially in the graduate school, could use their administrative authority to “share things at a directors of grad education meeting, share things with associate deans for graduate programs, share things with graduate support staff and programs.” Some members of local CIRTl teams (especially advisory board members) also had leadership positions on campus, either administrative or academic, and used their positions to disseminate CIRTl information.

Overall, local CIRTl leaders used their institutional positions to share CIRTl-related information with administrative and academic leaders. Other administrators and members of the local CIRTl team used their institutional positions and authority to disseminate CIRTl information to campus leaders. The implication is that formal leaders and co-leaders were not the only intra-organizational boundary spanners that advanced local CIRTl ideals. Despite the central importance of the leader and co-leader, they did not likely have direct connections with all key administrative and academic leaders. Thus, the boundary-spanning behavior of *diffusion* in the CIRTl context, just as with the notion of diffusion of innovations in Rogers’ work (Rogers, 2003), was reliant upon multiple individuals to maximize connections across campus.

Local CIRTl Leaders (and their Teams) Advertise Local CIRTl Programs

So far, I constrained the discussion of *diffusion* activities to local CIRTl team members and campus leaders. The last major means of *diffusion* occurred through the marketing and

advertising of local CIRTTL programs to potential participants and faculty. For instance, one interviewee explained:

The biggest thing that isn't purely CIRTTL that I see that has a fair amount of influence is the hard work they've both put in to market and create additional visibility for preparing future faculty programs...And so they've done a lot of work convincing or trying to convince faculty, directors of grad education as well as graduate students and postdocs that these are valuable activities.

Another participant discussed the success they had in improving their marketing activities, as described in the following quote.

We have better communication of these programs, advertising of these programs across colleges...I mean we quadrupled the number of applicants we had to this TAR fellows program by more aggressively marketing it and talking directly [with] students...So just learning how to kind of do our own internal publicity and marketing of these programs, and building on the more basic ones to advance them towards the more advanced ones. So it's better coordination, better advertising.

Overall, participants talked about local CIRTTL leaders using six major advertising media: (1) email, (2) presentations, (3) existing courses and programs, (4) individual referrals, (5) members of the advisory board, and (6) prior teaching development programming students.

Marketing through Email. Probably the most common medium, local CIRTTL leaders (and other members of the local CIRTTL team) sent emails to a wide variety of campus stakeholders informing them of upcoming local events and cross-network programs. For instance, one advisory board member stated, "I get an email that goes to all the graduate students and the faculty in our department so that's how I know there are some opportunities coming up."

Such comprehensive coverage was possible because local CIRTl leaders often kept “email lists...of any student who’s had any CIRTl contact at all.”

The task of distributing email program advertisements was different at each case institution. The leader and co-leader were typically the key decision makers in what messages would be sent out to potential students, but the task of sending the emails was split between leaders, co-leaders, advisory board members, and other CIRTl team members. The goal of the local CIRTl team was to reduce communication redundancies and utilize the existing campus connections of various CIRTl affiliates. For example, at one institution, there was strong representation of the major colleges through the advisory board members, which provided an easy mechanism to diffuse advertisements into academic units.

Marketing through Campus Presentations. Participants (local CIRTl leaders and other local team members) talked about purposefully seeking out opportunities to present information about CIRTl, often in connection to similar activities on campus. For instance, one interviewee stated:

The way of spreading the word is by going to different departments and doing a small presentation, making them aware of what is TAR, what we are doing in TAR and usually, in my presentations, I talk about the challenges and how we help you with those challenges.

Another individual expressed similar experiences:

One of the main places we talk about CIRTl is our new student orientation, which is very large. We have one each semester. We give presentations there, or at least man a table zone that’s definitely going to do a presentation.

In short, local CIRTl leaders and members of their local team actively found live venues to inform students and faculty about the benefits of CIRTl and related programming.

Marketing through Courses and Programs. Interviewees also mentioned that they used their existing courses and programs to talk about CIRTl. For example, one local CIRTl leader used their current course as a platform to advertise CIRTl. One participant explained:

I know that they teach an engineering course in education, engineering education research, and he refers his students to CIRTl resources and he talks about CIRTl and the existence of that and what is it and how important it is to think about this.

Another interviewee observed local CIRTl leaders using their strong PFF program as a marketing vehicle.

I think the main program that they work with is preparing future faculty and they try to emphasize about CIRTl in that, when the class starts or whenever these sessions happen, so they emphasize that. And a course is taken by about 70 graduate students and postdocs...so if you are spreading word, like each semester, they will be a new group of students. So this is how I think they are doing a great job in spreading the word about CIRTl through the PFF because all our future faculty are there, and they're interested.

Thus, given that most leaders and co-leaders in my study engaged in other preparing future faculty activities, there were multiple opportunities to market CIRTl in existing programs.

Marketing through Individual Referral. Beyond mass marketing strategies, leaders and co-leaders also focused on individual student needs. For example, one leader had “done a nice job of looking specifically into the network to see what might be available to them and doing more of an individualized referral.” In other words, a leader or co-leader (or even a CIRTl team member) would align a particular CIRTl resource with the needs of a specific student or

group of students because it might be “particularly useful,” which assumes a preexistent relationship or even prior CIRTl participation. Therefore, local leaders employed both widespread and more individualized marketing strategies.

Marketing through the Advisory Board and Prior Students. As already mentioned above, members of the advisory board were “an inlet into the colleges” and often disseminated CIRTl information into their respective colleges and departments with varying degrees of success. Such information could consist of pre-packaged email communications from local or national CIRTl leaders or more customized dissemination that took into account the unique context of a particular academic unit. Advisory board members, because of their on-campus connections, served as another layer in boundary-spanning activities on campus and could act as “ambassadors for the CIRTl core ideas.”

Current and prior CIRTl participants were also excellent promoters of local CIRTl programming “because they talk to their colleagues.” For instance, one interviewee stated:

I think the most powerful thing is the voice of the students who have been through and have enjoyed it. And it’s reminding those students that they do have something good that they want to say to people about it.

Another participant likewise expressed the great potential of former students marketing their local CIRTl program:

So those graduate students who are participating were coming from all over. So they would diffuse. So they were great emissaries in terms of diffusing back what they were learning...I think [that] helps recruit new students into [our program] and new faculty actually into [our program], because all of those programs required a faculty mentor.

Overall, respondents mentioned that students were an excellent vehicle for reaching potential program participants and faculty mentors.

Chapter Summary

In partial response to how formal institutional representatives engaged in inter- and intra-organizational boundary-spanning roles, my analysis demonstrated that local CIRTTL leaders, acting as formal institutional representatives, engaged in the boundary-spanning behaviors of *finding* and *diffusion* as described in the literature. Leaders and co-leaders were the major conduit (although not the only conduit) for acquiring the benefits of CIRTTL participation. In answer to research question 2.1, leaders and co-leaders were able to secure individual and institutional benefits through the several different types of interorganizational connections described in Chapters 4-7. Such benefits had a direct impact on their and their institution's efforts to prepare future faculty as effective teachers. Individual benefits consisted of gaining a supportive, likeminded community, an extended professional network, and career advancement and professional development. Institutional benefits, centered on building local CIRTTL programming, involved increased social capital through CIRTTL participation, funding, CIRTTL products, and programmatic resources.

Local CIRTTL leaders were also the primary mechanism (although not the only mechanism) for diffusing the benefits derived from Network participation into their home campuses. In relation to research question 2.2, local CIRTTL leaders diffused what they found in the Network with their local CIRTTL team, campus leaders, and used various marketing channels to advertise local and national CIRTTL programs. Based upon the extent and nature of intra-organizational connections shown in Chapters 4-7, it was clear that *diffusion* capability is dependent upon both the formal work roles of the leader and co-leader and their pre-existent

social and professional connections on campus. However, there were limitations to the leader's and co-leader's reach on campus, suggesting the need for multiple individuals to participate in *diffusion* activities to market and gain support for local CIRTTL programs.

Implications

My findings also demonstrated other important aspects of how *finding* and *diffusion* behaviors were believed to influence local efforts to prepare future faculty. Specifically, my findings revealed three important implications: (1) multi-faceted motivations, (2) non-linear knowledge flow, and (3) shared boundary-spanning behaviors.

Multi-Faceted Motivation. First, the individual and institutional benefits that come from CIRTTL participation provide unique insight into the driving motivators for boundary spanners. By joining CIRTTL, local leaders and co-leaders became members of a community of practice where they had the freedom to celebrate, commiserate, strategize, and collaborate with likeminded peers, which could have many positive individual career effects. They were also formal representatives for their institution and genuinely cared about the success and status of their local CIRTTL programs. In essence, individual and institutional motivators simultaneously drove boundary-spanning behaviors.

Since individual and institutional circumstances are dynamic, motivators are also likely in constant flux. For instance, a local leader who is a full professor and is months away from retirement at an institution with a strong local CIRTTL program may have little interest in participating in a new collaborative project or seeking advice from CIRTTL colleagues. In contrast, a leader from a CIRTTL institution struggling to build its local programs and who is eager to expand its local and national professional network may interact very differently in both inter- and intra-organizational interactions. The major point is that knowing how individuals

engage in *finding* and *diffusion* behaviors is not enough. We must also examine what influences their decisions to engage in these activities. The individual and institutional benefits described in this chapter reveal multiple incentives for leaders and co-leaders to be active boundary spanners, incentives that they must weigh against individual and institutional circumstances. In Chapter 10 and 11, I explore additional individual and institutional factors that influence boundary-spanning behaviors as a way to further explore the mixed motivators of leaders and co-leaders.

Non-Linear Knowledge Flow. Second, despite the appeal of a basic linear relationship where local CIRTTL leaders acquired knowledge in the CIRTTL Network and then automatically passed it on to institutional stakeholders, reality was more complicated. For example, a leader or co-leader may pick up an idea from a colleague in CIRTTL at a meeting but not act upon that knowledge for months or even years, depending on local need and circumstance. Current institutional context will heavily influence what a leader or co-leader may look for in the Network, what they pass on to local campus constituents, and even what they share with fellow CIRTTL colleagues. With that said, knowledge exchange is not a one-road truck delivery system where the leader or co-leader parks their truck at CIRTTL, fills it up with boxes, and then drops the boxes off at a loading dock at their institution. Certainly, this has happened at the four institutions in my study, but this model does not fully capture the process. Instead, knowledge exchange is multi-directional, non-linear, and contingent upon the individual and institutional motivators described above. Also, as I show in Chapter 9, *finding* behaviors are very interconnected with the boundary-spanning behavior of *translation*, where the leader, co-leader, and other campus stakeholders decide how to integrate CIRTTL with their institutions, which likewise influences what they look for in CIRTTL, what is diffused on their campuses, and efforts to gain administrative and academic support. Thus, the interorganizational boundary-spanning

behavior of *finding* is directly related to the intra-organizational boundary-spanning behaviors of *translation*, *diffusion*, and *gaining support*, since they inform what boundary spanners seek from interorganizational connections and even why they seek it.

Shared Boundary-Spanning Behaviors. Lastly, my data analysis showed that local CIRTl leaders were not the only individuals involved in diffusing CIRTl across campus and to some extent, interorganizational *finding* activities. The expanded cast of boundary spanners suggests that leaders and co-leaders were just one piece of the boundary-spanning puzzle on a campus. Despite the importance of local CIRTl leaders or even their often extensive local connections, it may be necessary to have multiple inroads into campus units to be able to effectively diffuse CIRTl programs and concepts. Therefore, while local CIRTl leaders provided the key connective tissue between the national Network and their home campuses, successful *diffusion* was contingent upon multiple individuals who provided the mechanisms for fostering broad academic and administrative support.

Chapter 9: Translation and Gaining Support

The previous chapter focused on what leaders and co-leaders gained from CIRTl participation (*finding*) and how they shared CIRTl-derived gains with campus constituents (*diffusion*). In this chapter, I examine two boundary-spanning behaviors that are intimately tied to the rich cognitive processes of leaders, co-leaders, and other CIRTl team members: *translating* CIRTl for local campus implementation and *gaining support* from key campus leaders and units. My goal is to explore answers to my second research question: how, if at all, do formal institutional representatives (i.e., local CIRTl leaders) engage in and make sense of intra-organizational boundary-spanning roles. I also examine two sub-questions: (1) how do they *translate* what they gain from Network participation for application at their institution; and (2) how do they *gain support* from local stakeholders to advance the STEM reform target of the network?

Below, I report findings concerning the boundary-spanning behaviors of *translation* and *gaining support* and provide a summary of observations and implications at the end of each section. To conclude the chapter, I provide a short overview of the four boundary-spanning behaviors discussed in Chapters 8 and 9.

Translation

Like Chapter 8, I begin this section with a short, fictional story of a local CIRTl leader named Karl. His story is a composite of my findings and provides the reader with an example of the boundary-spanning behavior of *translation*.

Karl regularly attends CIRTl meetings and pays close attention to presentations and conversations with CIRTl colleagues for best practices or other resources that will help him develop and improve his local CIRTl offerings. He sits next to the institutional co-

leader (Angie) at in-person meetings and they often spend the flight home talking about what they learned from the meeting and how it affects their local CIRTl offerings. The same is true for online meetings. Karl and Angie will meet after monthly online meetings to debrief and consider what they can pull from the national network to inform their local CIRTl community. In addition, Karl regularly interacts with a small local CIRTl team (including a nascent advisory board) and together, they figure out how CIRTl fits within their institutional context and how to improve and expand local offerings. Karl is also able to leverage his position and experience in the graduate school to embed CIRTl concepts into existing offerings, but he is heavily reliant upon his local CIRTl team to make sense of CIRTl and to create local CIRTl programs that are congruent with institutional needs and priorities.

As the story demonstrates, the boundary-spanning behavior of *translation* is intimately tied to identifying potential benefits of CIRTl participation and integrating CIRTl into a pre-existing institutional structure and culture. Below, I focus on how local CIRTl leaders translate Network gains by answering three major questions: (1) who participates in translating CIRTl for local implementation, (2) what is translated, and (3) what influences the *translation* process.

Who Translates?

Overall, my findings showed that the boundary-spanning behavior of *translation* was distributed between local CIRTl leaders and members of the local CIRTl team, including the advisory board.

Leader and Co-Leader. The local CIRTl leaders, often acting as a team, were the primary individuals involved in translating CIRTl for their campuses. The following quote

shows the thought process of one of the local CIRTl leaders in processing new ideas gained from the CIRTl Network:

My first thought is do we already have this? Yes or no? Is what we're offering covering the same ground? And if so, is it working kind of in the same way, is it giving them what [students] need in the same way that the other thing is? And then the next thing is, okay, does this new idea fit how our institution works? Can it fit into something we already have? Can it piggyback with something we already have so that people will understand what it is?

It was quite common for the leader and co-leader to "look for the places where as an institution, we already had a lot of synergy" and then integrate CIRTl with existing local programs. One participant explained, "What are we doing already related to graduate student professional development...I think we have some pieces of CIRTl here already...let's go ahead and make it fully CIRTl."

The leader or co-leader were typically the primary decision-makers with respect to local CIRTl programs, mainly due to their formal institutional role. For instance, one local CIRTl leader had to prevent the development of certain activities because they failed to fit within the larger set of future faculty programs on campus. They said:

There may be other times, there's probably more times, when I say we're not going there. We're just not doing that. Because it may conflict with stuff we're already doing in the Graduate School.

Another local CIRTl leader talked about how they pushed for a particular programmatic focus on campus. They elaborated:

We really wanted to focus on the first year. So we certainly adapted that. I think that was solely driven by me, I was very interested in this whole idea of how graduate students make the transition.

The last two quotes focused on individual-based decision-making, but in reality the pair or, in one case trio, of local CIRTLL leaders worked together to translate CIRTLL for their campus. For example, one leader talked about working with the co-leader to make programmatic decisions:

And then the other thing is bouncing it off [my co-leader] and saying well what do you think?...Am I right in thinking that this could be cool. And they'll come back with, yeah, I think that's great and it matches this other thing, let's bring it in and figure out how we can make it work. Or they'll be like that's a really great idea, but I'm just not seeing how it's going to work here.

Overall, leaders and co-leaders worked together and most had the authority to make programmatic decisions because their positions "allowed for very frequent interaction as we were building out and CIRTLLizing these programs."

Translation activities were not limited to developing or "CIRTLLizing" (i.e., integrating existing programs with CIRTLL concepts and outcomes) programs. Participants mentioned that leaders and co-leaders thought through the implications of their boundary-spanning behaviors related to their diffusion and gaining institutional support activities. For instance, one interviewee talked about the importance of selecting key boundaries to span on campus:

Where is the low hanging fruit? Where are the connections that could be made with almost no, you don't have to die in this ditch to win this battle to be able to do this. It's something that's going to be win/win for everyone. And so because of that, you have to

choose your battles wisely. You have to choose what boundaries you want to span carefully. You just can't span any boundary. You have to span certain boundaries. In short, leaders and co-leaders had to actively assess their local institutional context and determine the most fruitful pathways to advertise programs and *gain support* within administrative and academic circles.

CIRTL leaders also kept an eye out for CIRTL materials or resources that would benefit their students and postdocs, thus demonstrating the strong link that *translation* has to both *finding* and *diffusion* boundary-spanning behaviors. One local CIRTL leader talked about their student focus:

I find myself kind of keeping an eye on stuff from the student view to think about how can I use and reach out for these resources for students for our [CIRTL program], for my graduate students.

Other interviewees likewise talked about leaders and co-leaders looking “at other institutions” with the explicit purpose of how they could translate or adopt their programs for local use. This implies that leaders and co-leaders constantly evaluated the resources available through their CIRTL connections and chose what would be the most relevant for their local context.

In summary, local CIRTL leaders played a key translation role in *finding* CIRTL knowledge that was relevant to their institution, making decisions on how CIRTL content and concepts were incorporated into new or existing programs, deciding what CIRTL-related information was shared with campus constituents, and strategizing on the best ways to gain the support of administrative and academic units. Thus, the boundary-spanning behavior of *translation* was intimately embedded within the other boundary-spanning activities.

Local CIRTl Team. Despite the central importance of the local CIRTl leaders, other members of the local CIRTl team were involved in translating CIRTl for their campuses. For example, one local team member talked about working with the leader and co-leader to improve their local TAR program:

There was this paper about writing good proposals [that they got from the CIRTl Network] and I think they were talking on email to each other and then they forwarded it to me and they started the conversation that we should have a student write a good proposal, TAR proposal...So this is how it's an iterative and continuously improving process. Like we are, every semester, we do something new. We try to do something new, to make it a better experience for the students

Participants also mentioned that programmatic planning occurred between not only the leader and co-leader, but involved the teaching and learning center and graduate school staff. One individual explained:

But most of the planning and stuff happens between me [and the leader] and then also some other people in the [teaching and learning center], but then also a couple of other people over there in the grad college, because they're helping us make the new courses that are going to catalog CIRTl stuff.

Another interviewee attempted to demonstrate the role that other CIRTl team members, especially members of the advisory board, played in the *translation* process:

There'll be some, some more detailed back and forth discussions about CIRTl activities here on campus or planning for new activities or modifying existing programs in one way or another. So there is a lot of that back and forth interaction amongst the steering group

members to modify, to adjust and adapt perhaps things that come from the network and bring it into our local programming.

One co-leader further explained the collaborative process that they used within their local CIRTl team to translate CIRTl for their campus.

And so we would have these brainstorming sessions where we come together and say, all right, this is where we see a disconnect between what CIRTl is envisioning and what we currently have. How do we do this? How do we do this in a way that preserves what [our institution] has, or can we preserve what [our institution] has and still align with CIRTl?

So I think we've spent probably three to six months in particular going back and forth.

Thus, leaders and co-leaders actively utilized the perspectives and experiences of local CIRTl team members in making decisions about local CIRTl programming.

The advisory board was the most consistent platform for team-based *translation* activities. For example, "when we needed to re-fit some of our programs to fit CIRTl, it started as an initial brainstorm amongst the [advisory board]." It could also work the other way, where the advisory board would provide input to the national CIRTl Network, as evidenced in the following quote.

Sometimes it's me getting input from the [board] because of something that [the PI of CIRTl] wants input from institutions on so I go back to the [board] and say how do we feel about this. What's our stance? Do we like it? Don't we like it? Why do we like it? Why don't we like it? What would we propose differently? So this is a way for me to collect information, then to take feedback up the food chain.

In short, the leader and co-leader used their advisory boards and other CIRTl team members as an additional translational lens in integrating CIRTl with preparing future faculty programs on

campus. This suggests that the *translation* process is not an individual endeavor but instead represents a group effort to engage in organizational learning. The leader and co-leader indeed shaped and molded *translation* activities in most cases, but ultimately, *translation* was a group learning effort to integrate CIRTl on campus and make other strategic decisions to *diffuse* information about CIRTl and even *gain support* from academic and administrative units.

What is Translated?

While there was some evidence that the four case institutions created new programs due to their CIRTl participation, local CIRTl leaders primarily built their local CIRTl programs upon existing campus offerings. To borrow the expression of CIRTl members, local CIRTl leaders “CIRTlized” programs on their campus, which typically consisted of adapting local programs to align with CIRTl principles and learning outcomes. One participant at SU explained:

My perception is that we tweak existing programs slightly so they fit kind of CIRTl initiatives and I’m thinking primarily...about both, the learning communities and TAR projects...we adapted and modified slightly existing activities in order to support CIRTl efforts as opposed to bringing something completely new in from CIRTl and adapting [at our institution].

Another interviewee from a different campus mentioned a very similar sentiment of “tweaking” what they already had to fit the CIRTl mold.

So what we did is to use the new verb, we CIRTlized the existing programs and tweaked some of their activities, tweaked some of their outcomes, and so forth, to fit within the scholar, practitioner and associate models.

In another example, a respondent talked about creating alignment between an existing program and CIRTTL.

We worked to basically align one of our programs with a lot of CIRTTL outcomes. We'd already agreed this program needed to be revisited anyway and so we took a single-tiered certification program for TAs and then turned it into basically a three-tiered system, which matched up with the practitioner, associate and scholar levels with CIRTTL. And it was something that was needed on our campus anyway so we just aligned it with the CIRTTL goals.

Each campus had its own nuances and circumstances, which made it challenging to simply extract a program or idea from CIRTTL and adopt it without making it align with local context.

One interviewee elaborated:

People have to think about adapting, not adopting. It's very rare that you can just pick up a program and drop it in on your campus and it's good. You have to be able to figure out how to adapt what it is somebody else is doing from whatever circumstances you have.

Lastly, another participant talked about the delicate balance of incorporating CIRTTL while also staying true to core institutional values.

I don't think they customized CIRTTL. I think they customized the programs at [our institution] to align with CIRTTL. Which would be the [three core ideas], ensuring that each of the [core ideas] are incorporated into the programming, which may or may not have happened before. It would have been more based on the core values of our institution, as opposed to the core values of CIRTTL. Now they're very similar, but they, the core values of our institution would be highlighted and...purposefully incorporated in a different way. And...we have to add to or repackage the CIRTTL [core ideas] to make

sure that we're also including them...it's a fine line, you've got to be able to combine the two.

In summary, local CIRTl leaders and their respective campus teams adapted their local programs to align with CIRTl versus creating programs from scratch. It was true that CIRTl gave leaders and co-leaders "a great peg to hang some things on," but ultimately, local context shaped how CIRTl was manifest locally.

Adapting local programs to include CIRTl content and concepts was not without its challenges. For instance, one participant talked about problems they faced in trying to adapt a program on campus and the pushback they received from campus constituents.

It's hard for us to step in and say no, no, CIRTl needs to drive this bus now, and you guys just sit back and relax. It would change the whole character of that program, and what it means to the students involved. And so we don't do that.

Others mentioned the increased time commitment of trying to integrate CIRTl into local programs, which added an additional layer of complication.

I think some of the initiatives that come from CIRTl are interesting but the reality of implementing them on top of already existing programs at an institution makes it difficult. It's added work.

Overall, leaders, co-leaders, and other local CIRTl team members had to be able to simultaneously understand local context, local programs, and CIRTl-related content to be able to successfully adapt local programs to include CIRTl components. This required ongoing discussion and debate within distinctive institutional settings to find proper alignment with the ideals of CIRTl. The result was that no local CIRTl program was exactly like another institution and certain aspects of CIRTl were more prevalent based upon local needs,

infrastructure, and goals. In short, *translation* was a complicated negotiation of CIRTl and local priorities that produced unique amalgamations specific to each member university.

What Influences Translation?

My analysis revealed many factors that influence the boundary-spanning behavior of *translation*. A more complete discussion of the factors that broadly help or hinder boundary-spanning activities are found in Chapter 10. In this section, I do not include a comprehensive list of everything that could influence *translation*. Instead, I provide a brief synopsis of three major factors that influenced *translation* activities.

Institutional Role. As I pointed out in Chapters 4-7, the institutional role of local CIRTl leaders played a major part in shaping their boundary-spanning behaviors. For instance, one participant explained:

I think the more someone's role is specifically designed around either supporting CIRTl or a concept that's intimately linked with CIRTl, the more influence they would have on translating CIRTl to their local campus.

Having an institutional role linked to graduate student professional development, in either the graduate school or teaching and learning center, was particularly useful, as evidenced in the following quote.

[The leader is]...an associate dean for the graduate school and so part of [their] portfolio is developing graduate student professional development...[The co-leader is] very engaged and leads their teaching and learning center and has been involved in graduate professional development.

Such roles provided leaders and co-leaders with a familiarity of "how graduate programs function," the "challenges being faced," and direct access to and, in many cases, authority over

pre-existing preparing future faculty programs. For example, speaking of positional authority, one interviewee talked about how their position provided sufficient leverage across campus to improve local programs.

When I was in the graduate school, I could use that leverage locally to convince the provost or the vice president for research or other deans in the colleges that...these are the kinds of things that we need to be doing for our graduate students and most of the time...they agreed as well.

Across the four cases, it was clear that institutional role was a major factor in influencing *translation* activities. Positions in the graduate school and teaching learning center were vital in maintaining proximity to the local programs and provided the authority and clout needed to make programmatic changes, either individually or with a local team.

Prior Background. Participants talked about prior experiences influencing their *translation* activities, since their background provided the lens by which to assess local dynamics and CIRTLL benefits. For instance, one participant talked about his extensive faculty and administrative experience directly related to graduate education.

I have a graduate program on my own, it's been an externally funded one and I've been a graduate program director and I've worked at all levels of graduate education at our institution, from the department level, to the college level, to the university level and now at the administrative level. And so when we talk about mentoring, I know the mentoring issues.

Another interviewee used her prior experiences to inform her decision related to CIRTLL.

I don't mean for this to sound facetious but I think that's just the definition of wisdom. I hope that as an institutional leader that I draw from all of my variant experiences and use that to help inform the best decision possible.

In summary, prior experiences and background provided the foundation for leaders and co-leaders to analyze national CIRTl content and local institutional dynamics to adapt local programs to include CIRTl components.

Pre-Existing Programs. Local CIRTl leaders typically incorporated CIRTl components into existing programs. The presence and extent of pre-existing programs was a major factor in influencing *translation* behaviors. Rather than trying to reinvent the wheel, participants talked about relying on what their institution already had in incorporating CIRTl locally. One interviewee talked about the benefits of utilizing existing programs and resources:

I don't know if it's management 101, if we have some existing structure already in place then it really behooves us to use that, right...as I said our faculty CIRTl institute was a year-long program. So we just basically tagged on with that...I've been burned too many times by either myself or somebody else trying to start something new and there was already something very similar in place, and it just becomes, it's a waste of resources and it's contentious, and it's silly. So my first instinct is to see what we have in place that is very similar in mission or scope and see how we can partner.

Another participant expressed a similar sentiment:

Well, I think my approach...is to defer to [our institution's] structure rather than throw it out. I think we had a reasonable set of programs in place prior to joining CIRTl and rather than saying, all right, let's pitch these...we really said how can we take this as a core element, take the infrastructure, the campus awareness of these programs and not

change them... Hold onto the positive elements of the awareness that we've built on campus and some of the successes that we built and seek to improve what we had rather than throw it out.

In order for local CIRTTL leaders to rely on prior programs, they had to know what already existed and see how CIRTTL fit into a much larger institutional picture. An interviewee explained:

Then it's often kind of figuring out how to fit it into what's already being done so people's toes aren't getting stepped on, so people understand the language, figuring out where the need is, not trying to duplicate things, not trying to come in with ideas you say are new ideas that they've been doing for years, so there's a dance there of wanting to find out what's happening, wanting to value that, and wanting to work with it.

This "dance" required "finesse" as articulated in the following quote.

Because you're in an institution where there already may be similar things happening that overlap with this, it takes a while and a little bit of finesse to sort of get things working seamlessly together because you don't want to replace their activities that they've already set up but at the same time, you can bring, you can add value to what they have already, to what they're doing by, by tapping into some of these CIRTTL resources. So it's a complicated dance of matching interests and CIRTTL programming to existing things going on here on campus.

Preexisting programs were the primary canvas for translating CIRTTL at participating campuses. Leaders and co-leaders (and their teams) had to select the local programs that were most aligned with the purposes of CIRTTL. Thus, leaders and co-leaders had to be knowledgeable enough about the local landscape to see potential overlaps, challenges, and the specific niche that CIRTTL can fill locally.

Summary of Translation Behaviors and Implications

Above, I reported findings related to how leaders and co-leaders engaged in translation activities. I structured the section according to who translates, what is translated, and what influences translation. I found that both local CIRTl leaders and their local teams were actively involved in translating CIRTl for their campus and translation efforts were targeted towards preexisting programs. Lastly, I discussed three major factors that influenced translation activities, namely, local CIRTl leaders' institutional role, their prior backgrounds, and the extent of preexisting programs. I conclude this section with two important implications.

First, as shown in other chapters, boundary spanning was not limited to formal institutional representatives. Like *diffusion* activities, other members of the local CIRTl team provided input and guidance in translating CIRTl content and concepts for local programming. The leader and co-leader typically had authority to make decisions regarding local CIRTl programming, but they required other campus stakeholders to provide assistance in aligning CIRTl with institutional structure, priorities, and needs. The boundary-spanning behavior of *translation* involved individual and team-based levels of organizational learning, both in identifying new sources of information from Network participation that could improve organizational functioning and in integrating CIRTl content and resources. While it was true that local CIRTl leaders (and sometimes members of their local CIRTl team) performed the function of *finding* and introducing new knowledge and resources to their organizations, the work of integration was not limited to two or three local CIRTl leaders, regardless of their institutional positions and clout. Limiting translation activities isolates the reach and depth of local CIRTl programs and minimizes local stakeholder involvement and ownership. This does not mean that everyone on campus has to take part in integrating CIRTl locally, but it does

suggest the involvement of a local CIRTl team to provide multiple access points into larger organizational learning dynamics. In short, *translation* was about the integration of CIRTl and local context in service to the preparation of future faculty, which required team-based sense-making and organizational learning.

The second implication of my findings relates to individual characteristics that aid the *translation* process. For instance, local CIRTl leaders (and members of their team) had to pay attention to both the ideals and mission of CIRTl as well as the specific needs and goals of their institutions. They had to make key decisions as to where CIRTl fit on campus, to what extent, and how such programming interacted with other similar offerings across campus. These intra-organizational boundary spanners served as interpreters who decoded CIRTl content and resources and deciphered the best ways to align CIRTl with preexisting preparing future faculty activities. Furthermore, local CIRTl leaders' institutional positions and prior experience played a major role in their decision-making authority, proximity to preparing future faculty efforts, and understanding of graduate education on their campus. They had to be able to work in a team environment and utilize their team members' advice and input to fully understand how and what CIRTl elements to translate for their campus. In summary, the boundary-spanning behavior of *translation* required a keen sense of both local and national dynamics and the ability to engage in group-based organizational learning to continuously improve preparing future faculty programs.

Gaining Support

I begin this section with another short story excerpt about the local CIRTl leader named Karl to illustrate the boundary-spanning behavior of *gaining support*.

Karl is a tenured faculty member, an associate dean in the graduate school, and has the respect of administrators and faculty alike. He is well known for his passion for

improving STEM education and has won several teaching awards at the same time as maintaining a robust research agenda. He has gained more recognition in the past three years because of his CIRTl involvement, since many value the size and prestige of the Network, especially because he is able to rub shoulders with a few key peer institutions. He has used his existing reputation, his formal administrative and faculty roles, and the added visibility from CIRTl engagement as mechanisms for meeting with key administrative and academic leaders. For instance, his graduate school position affords him the opportunity to meet with the graduate dean often. He uses these meetings as a means to highlight local CIRTl success and lobby for additional resources to help graduate students at his institution. In addition, his graduate school role puts him in close contact with department chairs, assistant and associate deans, and even faculty across multiple college units. Combined with his strong, positive reputation, he has had success through many productive conversations with leaders and faculty about the importance of preparing future faculty and the benefits of encouraging their students to participate in local professional development opportunities. However, not all academic units are receptive to Karl, regardless of his reputation or involvement with CIRTl. Some units are adamant that graduate students are to only learn how to be competent researchers and any deviation is a waste of time. Regardless of these setbacks and challenges, Karl continues to meet with key campus leaders and advocate for the local CIRTl program.

As the story demonstrates, the boundary-spanning behavior of *gaining support* from administrative and academic units was heavily influenced by involvement in the CIRTl Network, existing social capital on campus, and, as shown in other chapters, formal institutional

roles. Below, I expand the discussion of how local CIRTTL leaders engaged in *gaining support* activities by (1) investigating the positive social capital benefits of CIRTTL participation, (2) examining other social capital sources for local CIRTTL leaders, (3) exploring efforts to *gain support* within academic units, and (4) inspecting efforts to *gain support* from administrative units.

Social Capital: Derived from Network Membership

CIRTTL was a means for local CIRTTL leaders to increase their social capital and gain “more credibility” amongst administrators and faculty to advance programs to prepare future faculty on campus. One of the major sources of social capital stemmed from the large grants awarded to the Network, which “helped a lot with faculty and administrators.” One interviewee explained:

The fact that we had \$10 million from NSF was huge for credibility. I mean, even if you didn’t believe what CIRTTL was doing and even if you thought it was all bunk, nonetheless, you had a \$10 million NSF grant and that gave you a whole lot of credibility for walking in the door.

Securing grant funds helps legitimized the reform work of the Network. Such grants demonstrated that big funding agencies (the same ones that fund faculty in more traditional scientific research) believed preparing future faculty was important. This had the added benefit of encouraging faculty to be “willing to open the door and listen and hear you out...you’re not going to...have the door slammed in your face before you even get a word out.”

The opportunity to rub shoulders with prestigious peer institutions was another major advantage in increasing the credibility of local CIRTTL efforts. One interviewee stated, “One is

we're in good company, if you look at who the other network members are...that gives it credibility." A participant elaborated:

Universities and faculty, they look at the prestige, they look at who their players are, they don't want to play in pools of people who aren't very good, and who aren't, sort of pulling their weight in the research and learning communities. And so, that's gone a long way into making CIRTl.

In short, participants talked about the social capital benefits of interacting with a nationally funded network and prestigious peer institutions.

Expanded social capital helped local CIRTl leaders gain traction on their campus with respect to local CIRTl programming. For instance, social capital derived from CIRTl participation was used to make a compelling argument for the importance of preparing future faculty.

So CIRTl is one instance of that to try to convince people to pull them out of the parochial view of what we do to say why this is really important and [our institution] needs to be doing these things...But it's as much as being able to point to that and say here's all these other institutions that are doing this.

Such social capital was also used to make the argument for paying the annual dues to be in the CIRTl Network.

I think that if CIRTl hadn't initially been NSF funded and we hadn't been able to say hey we're looking at NSF funding sources and stuff, it might have been a harder sell to get that \$10,000.

CIRTl membership was also helpful in expanding professional development opportunities for graduate students.

I think because of his involvement in CIRTl, he's probably been able to push things forward in the graduate school, push forward a vision that is related to CIRTl because of his involvement. So he's used it as leverage there to expand the graduate student professional development program

In summary, local CIRTl leaders drew upon social capital derived from Network membership to advance their local CIRTl efforts. Their membership allowed them to make a national versus local argument for the need to prepare future faculty.

However, there was variability with how visible CIRTl was on campus, which affected the degree by which this social capital was used to enact local change. For example, at one institution, a participant said that they believed most people on campus knew very little about CIRTl.

I think this is a very good question because not many people actually know about CIRTl. If you talk about CIRTl, you have to explain what CIRTl is. Right? So that is the difficulty and the challenge we encountered.

Another interviewee at the same institution believed that CIRTl did not have a strong national reputation, which translated to low visibility on their campus.

Maybe CIRTl will become more and more famous. When you mention that I used to work for CIRTl program, good. That is a bonus for your CV. That will be wonderful. But at this point, I don't see this happening yet...So what we need from CIRTl is reputation, which CIRTl doesn't have yet. It's not happening yet. Which means [they] need more time along with the development of CIRTl. His impact on local community would be increased along with the increase of CIRTl's reputation.

In addition, participants discussed how CIRTl could be a small or large part of local CIRTl leaders' professional image on campus. For example, one interviewee said that CIRTl was a major component of one leader's professional identity on campus:

I think his identity would probably be first associate dean of the graduate school...But then I think CIRTl is the next sort of big piece...because I know he spends a lot of time on it, I think it is a very important part of his professional identity.

Others talked about how CIRTl played only a very small part in local CIRTl leaders' professional activities and that many campus constituents would not even be aware they did anything with CIRTl. Yet, the degree that CIRTl was embedded in their professional identity depended "on the circles in which you're in," suggesting that awareness of a local CIRTl leader's involvement in CIRTl depended on the particular audience (e.g., faculty, administrators, etc.). Overall, just like institutional CIRTl visibility, participants discussed a significant range of how they perceived CIRTl to be part of the professional identities of local CIRTl leaders.

Local CIRTl leaders were able to use the social capital derived from Network participation to advance their local programs. However, despite the prestige attached with being a member of CIRTl, not all institutional members knew about or even cared about their local CIRTl leaders' Network connection. Nor did institutional members value CIRTl in the same way, since faculty, administrators, and even graduate students all had different interests and concerns. Thus, social capital was not a universal factor that could be used with all campus groups in the same way. Local CIRTl leaders had to decide which campus audiences would best respond to arguments based in the prestige of the CIRTl Network and customize their approach to match their values and interests.

Social Capital: Derived from Preexisting Campus Connections

Local CIRTl leaders also used their existing social capital (i.e., social capital that did not result from Network participation) to advance local CIRTl programs. For instance, one participant talked about the importance of having a faculty position so they could speak credibly with other faculty members:

I believe that it comes from...having enough research activity so that when they ask someone to let their graduate students participate or when they ask someone to participate themselves, I'm thinking of faculty members, they've got enough skin in the game themselves, so that it doesn't look like they're basically just sort of piling on, another add-on to all the things faculty have to do. And so when they walk into a meeting and say, look, this is really important for our graduate students to succeed...you can give explicit examples of your own graduate students. You've actually, you're walking the walk as well as just the talk.

Social capital that resulted from disciplinary experience and respect was another important mechanism as evidenced in the following quote.

I have the sense that he has a very strong professional identity in his own discipline, that he's pretty well thought of and well known in his disciplinary area...I have a sense that he uses some of that positioning to really push the STEM education reform and CIRTl.

The same was true for those with administrative experience, since it provided extensive connections across campus.

The people who are deans or used to be deans, are faculty that have been around a while, served on lots of administrative kind of roles...those people are much more likely to be respected, to be listened to and also know how to, who to talk to. They have the

connections to talk to the right people or to go through the channels that are really going to be effective for change. I think some of the institutions where we've had people who are very enthusiastic but somewhat new to the institutional administration, they might have taught for a long time but haven't worked in the administration level, I think can have a harder time figuring out how to leverage CIRTTL.

The social capital benefits increased further when you combined faculty and administrative circles.

They do not see him as someone who's been an administrator that just went off into the sunset and disconnected. They see him as a scientist. He is also perceived as an academic leader on campus...he is very much involved in academic leadership in his college and his department.

Lastly, social capital also resulted from local CIRTTL leaders' dispositional qualities. For instance, one participant described one of the local CIRTTL leaders at their institution.

My sense is she's very thoughtful, very well respected, and people listen. When she talks, people listen. And so she will think very carefully, and then when she speaks, it carries a lot of weight because she's kind of a very thoughtful person.

In summary, local CIRTTL leaders were able to draw upon their faculty roles, administrative roles, disciplinary connections, and dispositional characteristics to advance local CIRTTL efforts. As I previously demonstrated in the four case chapters, leaders and co-leaders were able to tap into their formal and informal connections on campus to recruit local CIRTTL team members, diffuse CIRTTL information, and gain an audience with administrative and academic circles to advertise CIRTTL programs and convince them of CIRTTL's value. In the next section, I further

show how leaders and co-leaders, rooted in network and social capital, gained support from academic and administrative units.

Academic Unit Support

Local CIRTTL leaders and co-leaders had mixed success in gaining the support of academic units. Some were able to secure involvement from various colleges and departments. Others were not as successful. For example, a participant described the challenges of the local CIRTTL leader, saying, “there are still colleges on campus that he’s very frustrated by because he hasn’t been given the time of day.” The purpose of this section is not to provide a detailed accounting of successes and failures, but to summarize the main strategies that leaders and co-leaders used to penetrate academic units and seek their support.

Table 2: Strategies to Gain Support from Academic Units

Strategies to Gain Support from Academic Units
Using local CIRTTL leaders' administrative positions to gain audience with academic leaders
Relying on advisory board members to reach colleges and departments
Using local CIRTTL leaders' on-campus personal and professional connections
Engaging faculty in teaching development programs
Using multiple program advertisement mediums

The first approach was to utilize the administrative position of leader or co-leader to make direct connections with academic leaders. For instance, one participant stated that, “in the sense that my position on campus, I sort of operate, I deal with all the deans of the colleges, the provost’s office.” Similarly, another interviewee said that the local CIRTTL leader, due to his appointment in the graduate school, regularly met with academic leaders.

He has for multiple years now tried to on a continuing basis meet with [directors of graduate education]...of every department or even department chairs...[and] the directors of admissions...he’s tried to contact them and set up meetings with them and telling them

about...CIRTL and what...they can actually offer to our graduate students here and just trying to make a good case for it and recruit essentially the department's interest to buy into the ideas that are available through CIRTL.

In short, leaders and co-leaders use their administrative positions to meet with academic leaders and pitch the importance of CIRTL.

Second, local CIRTL leaders used their advisory boards to reach academic units. A respondent explained:

Our first line of communication is with members of our steering committee, because we have no associate deans for grad programs from eight colleges involved. And so that's one primary means of disseminating, and asking them to publicize it with their departments and graduate students in their departments, graduate students and faculty in their departments. So that's one key means of communication.

Advisory board members were boundary spanners and helped diffuse CIRTL information into colleges and departments. They also directly and indirectly interacted with academic leaders and advocate for local CIRTL programming.

Third, local CIRTL leaders used their personal and professional connections to advertise CIRTL and gain entrance into academic units as evidenced below.

[Our co-leader] tries to contact other departments, her colleagues she knew of and they try to bring their students to a TAR project. So they are trying [to use] their network at the university to spread the word about CIRTL.

Others talked about leaders and co-leaders using their personal connections to build advisory boards. For instance, one local CIRTL leader elaborated:

So I knew a lot of people that I, to be real blunt about it, to get the first [advisory board] together, there were people that I knew, I was calling in favors. They were people that...had diverse expertise and I was calling in favors and frankly, to be real selfish about it, that I liked working with.

In summary, local CIRTTL leaders used their colleague networks and social capital on campus to build their local CIRTTL programs.

Fourth, local CIRTTL leaders engaged faculty and raised awareness about CIRTTL and the importance of preparing future faculty. Faculty participation could take the form of advisory board membership, serving as a mentor on a TAR project, and even teaching a workshop or course. For example, one participant talked about the range of participation:

How they recruit faculty is by doing small asks. Asking them to sit on a panel, or asking them, sometimes, honestly, she recruits faculty by asking them to teach whole courses. Local CIRTTL leaders also used subtle ways to pitch CIRTTL programs by inviting them to non-committal events. For instance, one local CIRTTL leader would say, “hey, come to the symposium, even though you’re not a mentor, just come check it out.” There were also more formal outreach events as described in the following quote.

And so we sponsored a lunch event for interested faculty to come learn about what is CIRTTL, what are these programs here on campus. So as part of that activity, of course, we had to explain at least the core ideas of CIRTTL, right, and that, and of course the major purpose being to prepare future faculty.

In addition, local CIRTTL leaders attempted to show faculty and academic leaders that local CIRTTL programs offered services to their students, which did not require fiscal investment on their part. A respondent explained:

I think the very basic reality is CIRTl is something that is bringing resources to campus to enable our graduate students to be the best graduate students they can be. He is coming to say we have money to offer [your students]. We have an infrastructure where they are going to have the opportunity to really dig into their teaching. So he's actually not asking for funding.

Lastly, local CIRTl leaders advertised CIRTl programs to graduate students and postdocs through multiple channels. Since Chapter 8 already went into depth about program advertisement, I will not reiterate those findings. Overall, I found that advertisements were a major strategy of *gaining support* from academic units by providing information to potential student participants, faculty, and administrators. As members of colleges and departments participated (and presumably had a good experience), they could advocate for local CIRTl programs and potentially increase the success of other ongoing marketing strategies.

Despite the multi-pronged strategies of *gaining support* from academic units, local CIRTl leaders had mixed success. As noted in Chapters 4-7, local CIRTl leaders and their teams spend considerable effort in trying to penetrate academic units and convince academic stakeholders (e.g., faculty, department chairs, deans) of the importance of CIRTl and preparing future faculty. Yet, given the near universal decentralization of major research universities, local CIRTl leaders had to individualize their efforts with each academic unit, since each unit differed from the others, for example, in varying degrees of existing faculty buy in for teaching and learning-related initiatives. To compensate, local CIRTl leaders had to utilize the formal connections that resulted from administrative positions and expand the pool of individuals situated in academic units to diversify *gaining support* strategies. Therefore, *gaining support*

activities within academic units were not limited to a single strategy, but incorporated as many channels and people as possible to maximize exposure across diverse and decentralized units.

Administrative Support

With minimal exception, all four case institutions had strong administrative support. This was in no small part due to the fact that at each institution, there was at least one local CIRTl leader in an administrative position who reported to at least one key campus leader. For instance, one participant from the national CIRTl leadership team mentioned that since all four case universities had a local CIRTl leader embedded in the graduate school, they could focus on other bridge-building activities instead of trying to secure initial startup funds.

In every case their institutional leaders were already connected to the graduate school...So in their cases, which is not to imply they didn't need to still build bridges to other colleges and to the provost typically, it was more in the sense of building conceptual bridges, political capital, wanting to be able to work with the other colleges around enacting the programs than it was for some other institutions where it's literally about the money. And trying to get the commitment so they can operate.

Overall, having a leader or co-leader in an administrative position in the graduate school had many advantages. For example, as one participant described the local CIRTl leader, "because the graduate school's a respected entity and he is an associate dean, he automatically has a lot of doors open. People are at least willing to listen."

Despite direct links to administrative channels, local CIRTl leaders still needed to maintain administrative support. As discussed in Chapters 4-8, the most common way they accomplished this was by regularly updating key campus leaders on the progress of local CIRTl

programs. They also gained administrative support by appealing to the things that administrators valued most, as evidenced below.

[CIRTL] is the type of thing, in my opinion, that administrators like to support because there are tangible, programmatic things...they are the proposals which are relatively small amount of money [but] give the program high visibility and create tangible outcomes. And in my experience upper administration typically likes those kinds of things.

In addition, one local CIRTL leader talked about how they took the time to understand the dynamics of the graduate school and prominent actors within the unit.

When I first started working at the Graduate School, I drank a lot of coffee with a lot of different people to understand that culture because I thought, I can't be an effective person in the Graduate School unless I know who the players are and kind of what the rules are.

In summary, local CIRTL leaders commonly held administrative positions and were in regular contact with key campus leaders. My findings showed that gaining institutional support was a product of securing access to administrative units, appealing to the goals and needs of the leaders of these units, demonstrating the value-added nature of CIRTL engagement, and then demonstrating potential synergies between CIRTL and existing local programs that would minimize cost. Social capital gained from Network participation, as described above, could also be used to incentivize campus leaders by demonstrating the work of peer institutions and showing the possibility of being attached to large, prestigious grant funding. Thus, even though my four cases lacked contrast in the range of administrative support, it was still possible to

extrapolate a few elements that are important for boundary spanners to gain administrative support to advance their educational reform goals.

Summary of Gaining Support Behaviors and Implications

In this section, I demonstrated the importance of social capital derived from Network participation and existing professional roles and connections in advancing local CIRTTL programs. I showed that social capital derived from Network membership was highly variable and its utility in leveraging CIRTTL on campus depended upon with whom the local CIRTTL leader interacted. Various campus groups valued the prestige of the CIRTTL Network differently and placed varying degrees of importance on the leader and co-leader's involvement in CIRTTL. Thus, while gaining additional social capital from CIRTTL participation was possible, such benefits were only useful to those on campus who valued CIRTTL. This suggests that boundary spanners must determine when it is in their best interest to draw upon their interorganizational CIRTTL connections with campus colleagues and leaders to advance local efforts to prepare future faculty and when to rely on their existing social capital (or both). In addition, my analysis showed that social capital was a by-product of institutional role (faculty, administrative, combined), disciplinary affiliation and respect, existing professional and person connections, and dispositional qualities. Local CIRTTL leaders drew upon different facets of their social capital sources when interacting with different campus groups, which suggests that they had to be aware of what leverage they had on campus and how they could use various facets of their professional life to gain traction.

I also showed that local CIRTTL leaders used five strategies to gain audience with academic units. First, they used their administrative positions to gain audience with academic leaders. Second, they used members of their advisory board to reach colleges, departments, and

academic leaders. Third, they drew upon other personal and professional connections to recruit local CIRTl team members. Fourth, they attempted to engage faculty and raise awareness of CIRTl. Fifth, they actively advertised local CIRTl programs to academic units. Overall, I found that local CIRTl leaders had to utilize a mixed set of *gaining support* strategies that involved many other campus colleagues to broaden the reach into diverse and decentralized academic units. Gaining access to and support from academic units took considerable time, since each college and department had different values, goals, and needs. Regardless of institutional role and existing social capital, two to three local CIRTl leaders lack sufficient connections, influence, and time to reach every campus unit. The major implication is that gaining support from academic units and stakeholders requires a distributed approach, one that employs many boundary spanners who possess nuanced understandings of specific college and departmental cultures. Local CIRTl leaders can certainly increase their connections and influence over time, but long-term and widespread success is dependent on multiple points of contact with academic units.

Finally, my analysis showed that each of the four case institutions had strong administrative support. Local CIRTl leaders used their administrative positions to gain audience with key campus leaders, update leaders about local CIRTl program progress, and secure ongoing support. Even though my case universities were homogenous in terms of upper administrative support, my findings still revealed two important traits that boundary spanners needed to advance education reform. First, access was a necessary prerequisite to gaining administrative support. A boundary spanner needs a way to gain audience with key campus leaders, which could be a result of their formal institutional role, involvement in certain projects or committees, or prior professional or personal connections. Second, a boundary spanner must

also know and understand administrative leaders' priorities and needs and show how CIRTl will add value to the institution without dramatically increasing cost. Just as the boundary-spanning behavior of *translation* was concerned with integrating national and local contexts, a boundary spanner engaging in *gaining support* activities must be able to communicate potential CIRTl-university synergies to administrative leaders and show how CIRTl aligns with current institutional policies and practices. Thus, *gaining support* was an applied translation activity that sought to convince academic leaders of the value of ongoing CIRTl participation.

Boundary Spanning Summary

In Chapters 8 and 9, I presented findings related to the four boundary-spanning behaviors of *finding*, *diffusion*, *translation*, and *gaining institutional support*. My goal was to answer research question two and the four interrelated sub-questions. In this chapter summary, I provide a short synopsis of the major takeaways for each boundary-spanning behavior before discussing individual and institutional attributes that influence boundary-spanning behaviors in Chapters 10 and 11.

Finding

Local CIRTl leaders maintained four types of interorganizational connections with colleagues in the national Network relating to network operations, network contributions, collaboration, and knowledge exchange. As I demonstrated in prior chapters, the diversity of connections and the complementarity of local leaders' connections provide an institution with a rich array of potential benefits. Individual benefits included a supportive and likeminded community, an extended professional network, and professional development opportunities. Institutional benefits consisted of expanded social capital, funding, CIRTl products, and programmatic resources. Motivations to engage in *finding* activities were dependent upon what

leaders and co-leaders perceived as potential benefits, both personally and for their institution. In addition, the benefits acquired through CIRTTL participation did not necessarily flow consistently or in a straight line. Instead, interorganizational connections in CIRTTL resulted in implicit and explicit exchanges that influenced local programming over time. Thus, *finding* behaviors were firmly rooted in how leaders and co-leaders identified potential benefits, made sense of personal and institutional needs, and engaged in long-term connections that provided many opportunities for implicit and explicit influences on local programming activities.

Table 3: Summary of Boundary-Spanning Behaviors

Summary of Boundary-Spanning Behaviors	
<i>Finding</i>	<ul style="list-style-type: none"> • <u>Interorganizational connection types</u>: network operations, network contributions, collaboration, and knowledge exchange • <u>Individual benefits</u>: a supportive and likeminded community, an extended professional network, and professional development opportunities • <u>Institutional benefits</u>: social capital, funding, CIRTTL products, and programmatic resources
<i>Diffusion</i>	<ul style="list-style-type: none"> • <u>Mechanisms</u>: sharing CIRTTL knowledge and resources with local CIRTTL team, updating campus leaders, & advertising CIRTTL program opportunities • Distributed boundary-spanning activity
<i>Translation</i>	<ul style="list-style-type: none"> • Local CIRTTL leaders and members of their local CIRTTL team translated CIRTTL into local teaching development programming • Translation informed finding, diffusion, and gaining support behaviors
<i>Gaining Institutional Support</i>	<ul style="list-style-type: none"> • <u>Mechanisms for gaining support from academic units</u>: local CIRTTL leaders' administrative positions and on-campus connections, advisory board members, faculty engagement, and marketing mediums • <u>Mechanisms for gaining support from administrative units</u>: Update campus leaders and demonstrate value of CIRTTL participation • Distributed boundary-spanning activity

Diffusion

Local CIRTTL leaders *diffused* CIRTTL-related information in several ways, namely sharing what they acquired with their local CIRTTL team, updating campus leaders of CIRTTL activities, and advertising local and cross-network programs to graduate students, postdoctoral scholars, and faculty. Each of these communicative channels was extremely important as each influenced the local CIRTTL team's ability to translate CIRTTL locally, provide key information to campus leaders about the progress of and the need for local CIRTTL programs, and disseminate advertisements to potential program participants. The leader and co-leader were not the only ones to engage in *diffusion* activities. Instead, other campus constituents played an active part in sharing information about CIRTTL across campus, which greatly broadened the reach of the leader and co-leader.

Translation

Translation activities were the glue that held the other three boundary-spanning behaviors together. Leaders and co-leaders had to make sense of what was available through CIRTTL participation, with whom to share certain kinds of CIRTTL-related information, and how to integrate CIRTTL content with existing local programming. They also had to determine the best strategies to inform and convince campus leaders and other stakeholders of the importance and value of being in the CIRTTL Network and efforts to prepare future faculty as effective teachers. *Translation* activities were not limited to the leader and co-leader. Instead, other members of the local CIRTTL team were involved in the *translation* process, which suggested that the boundary-spanning behavior of *translation* was a group organizational learning activity. Certainly, leaders and co-leaders played a major or even dominant role in translating CIRTTL for their campus, but

they also utilized other campus constituent perspectives to broaden their understanding of campus dynamics and to better align with institutional priorities.

Gaining Support

Lastly, local CIRTTL leaders actively engaged in efforts to *gain support* from academic and administrative units. They used their administrative positions, members of the advisory board, their personal and professional connections with campus colleagues, opportunities to invite faculty to learn about and engage in local programs, and extensive marketing strategies to gain entrance into academic units. They also used their positions to update key campus leaders on local CIRTTL progress and made ongoing efforts to demonstrate the value of CIRTTL participation. Overall, local CIRTTL leaders spanned many organizational boundaries to advertise and convince campus stakeholders that they should support and participate in local CIRTTL programming. They had to be able to “read” their campus and decide on the best strategies to reach academic and administrative units. They had to use a diverse portfolio of approaches (and people) to *gain support* in accommodation to the decentralized nature of their universities. Thus, leaders and co-leaders had to work within their institutional structure, politics, and policies and use the full extent of their positions, connections, and local CIRTTL team to move their local CIRTTL initiative forward.

Chapter 10: Individual Attributes that Influence Boundary-Spanning Behaviors

In Chapters 4-7, I presented findings related to each case institution by exploring the inter- and intra-organizational connections of local CIRTTL leaders and their boundary-spanning behaviors. In Chapters 8 and 9, I broadly examined boundary-spanning behaviors across all four case institutions. Each of my previous finding chapters gave detailed answers to my first two research questions by answering (1) what inter- and intra-organizational connections do local CIRTTL leaders have and for what purposes and (2) how do local CIRTTL leaders engage in and make sense of their boundary-spanning roles. Prior chapters also revealed several individual and institutional attributes that influenced local CIRTTL leaders' boundary-spanning abilities, such as institutional role and campus decentralization.

The purpose of this chapter and the next is to expand my initial discussion of individual and institutional attributes that affect boundary-spanning behaviors. Specifically, I present findings to answer the following research question: What individual and organizational attributes help or hinder their (i.e., local CIRTTL leaders) boundary-spanning activities? I conducted a cross-case analysis to both holistically identify key individual and institutional attributes and, where appropriate, dissect the nuances of these attributes at case institutions. For my analysis, I used qualitative social network data and interviewee data to identify and compare themes across my dataset.

Below, I present the four most prominent individual attributes influencing boundary-spanning behaviors that emerged from my analysis: local CIRTTL leaders' commitment to CIRTTL goals and ideals, institutional role, the convergence of local and CIRTTL responsibilities, and local CIRTTL leadership. I conclude with a chapter summary to discuss two major implications of my findings.

Commitment

Interviewees regularly reported that local CIRTTL leaders from all four case institutions were committed to and enthusiastic about the goals and ideals of CIRTTL. One member of the central CIRTTL administrative team described them as individuals that “really do believe in the idea of the mission of CIRTTL, the idea of graduate student preparation to be faculty and improving STEM undergraduate education.” Another said, “they are all people that are just very charismatic, they’re very excited, they’re really passionate.” In short, “the one thing we [local CIRTTL leaders] all have in common is...we’ve all drunk the Kool Aid, we all absolutely believe that [CIRTTL] is an important thing to do.”

Enthusiasm and commitment were common boundary-spanning attributes at each of the four case institutions. At GU, the local CIRTTL leaders (Betty and Tom) were enthusiastic and committed to CIRTTL and preparing future faculty. One participant described Betty’s strong dedication to graduate student development.

I think she’s been one of the consistent voices on campus for the importance of faculty development, graduate student development and excellence in teaching. Her role here at the center was indicative of her personal commitment to the value of that.

Tom, due to the nature of his formal appointment, also strongly supported graduate student professional development and built extensive ties across campus in support of local CIRTTL efforts.

The local leaders at SU (Arielle, Gertrud, Rufus) were deeply committed to CIRTTL as described in the following quote.

I think all three of them are really enthusiastic about CIRTTL...I don’t see any hindrance...to spread the word about CIRTTL because they take it very seriously. It’s not

like they have to do this TAR program and they're not serious about it...So I think individually...I don't see any hindrance because they are already enthusiastic about this work or about this Network and spreading the core pillars throughout campus.

Local CIRTTL leaders' dedication at SU was partly due to their prior experience advancing teaching and learning initiatives. In addition, their commitment was a direct result of their determination and persistence. One respondent described this trait in Arielle at SU:

I want to say Arielle's biggest strength is just her level of determination and persistence. She believes in it and she is going to move forward with it...So I want to say her absolute...persistence is probably, in my view, is her strongest characteristic in terms of promoting CIRTTL.

Similarly, at LU, one participant described Ross (the local CIRTTL leader) as, "I just see him energized by what he does. He is so excited about what CIRTTL is and does, right." Another talked about "Ross' tenacity" as one of his defining features in advancing local CIRTTL. Even beyond CIRTTL, "Ross is, I think ultimately, passionately committed to high quality graduate education. And lives and breathes that" and more generally, "Christine (the other local CIRTTL leader) and Ross are very committed to teaching and learning at the post-secondary level." Thus, just like the local CIRTTL leaders at SU, Ross and Christine were committed, enthusiastic, and dedicated to improving teaching at the college level.

Lastly, the local CIRTTL leaders at MU (Deanna, Isaac, Tracy) were also in "full support of CIRTTL" because "they know that teaching is very important, and they know the role that graduate students play both on this campus and after they graduate." For instance, one participant talked about the commitment of Tracy at MU: "he's actively making connections with people and bringing them into the CIRTTL steering committee...he's committed to this program and its

end product.” Likewise, Isaac at MU talked about his “sincere interest in preparing graduate students to be the most competitive they can be for their future.” Overall, the local leaders at MU were strong advocates of preparing future faculty and the ultimate aims of the CIRTl Network.

However, commitment to CIRTl must be situated within local CIRTl leaders’ dedication to their home institutions. An accurate representation would be that local CIRTl leaders are committed to ideals and purposes of CIRTl as a means to advance local efforts to prepare future faculty. Their primary concern is their institution and their STEM graduate students and postdoctoral scholars. The CIRTl Network provides an opportunity for local leaders to align their commitment under a shared purpose, but such commitment is firmly rooted in institutional goals. Thus, commitment to a STEM reform network is a composite of local reform needs and national Network ideals. For a reform network such as CIRTl to be a compelling cause for boundary spanners, local and national goals must be congruent. Otherwise, institutional representatives will likely not participate or will provide minimal assistance in helping to advance the national mission of the network.

In summary, the consistent theme across all four case institutions was that local CIRTl leaders possessed a strong commitment to and enthusiasm for the reform target of CIRTl. The implication is that boundary spanners who link their institution to a higher education reform network must strongly believe in the reform goal of the network. Otherwise, they may not seek out network membership or take the time, amidst already very busy schedules, to engage in the boundary-spanning behaviors of *diffusion*, *translation*, and *gaining institutional support*. However, as I demonstrate below, commitment alone is insufficient for success in boundary-spanning behaviors. We must also consider institutional role, the degree of convergence between local responsibilities and CIRTl, and local leadership skills.

Institutional Role

In Chapters 4-7, I found that institutional role was a major factor in influencing local CIRTl leaders' boundary-spanning behaviors. I demonstrated that institutional roles (1) put local CIRTl leaders in proximity to existing programs to prepare future faculty, (2) gave local CIRTl leaders authority to make programmatic decisions, (3) provided access to campus leaders, and (4) often resulted in on-campus connections and social capital. Below, I provide a brief synopsis of the institutional roles of the ten local CIRTl leaders at the four case institutions and then conclude with a discussion of themes relating to the importance of institutional role.

Green University

Betty, the local CIRTl leader, was the associate dean in the college of engineering and a professor of computer science. Previously, she was the interim director for the teaching and learning center and has been a faculty member at GU for just under 20 years. She was known on campus for her dedication to teaching and learning and had the respect of administrators and faculty colleagues. When Betty was the interim director of the teaching and learning center, she had direct oversight of local CIRTl programs and used her position to create a partnership between the center and the graduate school. However, since she left her interim director position, she no longer had decision-making authority for local CIRTl programs. Instead, she provided advice and guidance to the teaching and learning center staff in charge of local programs and attempted to influence the new leadership in the teaching and learning center to continue GU's affiliation with the CIRTl Network. Thus, in Betty's new role, she was no longer in close proximity to local CIRTl programs, she lost the ability to make programmatic decisions, she could no longer leverage the connections of the teaching and learning center (at least formally), and had to convince the upper administrators in the teaching and learning center of CIRTl's

value. In sum, Betty was disconnected from local CIRTl programming, which limited her boundary-spanning abilities.

Tom, the local CIRTl co-leader, was a recent hire and an assistant dean in the graduate school who was broadly responsible for graduate student professional development, amongst other duties. Despite his non-faculty background, he made valiant efforts to connect with administrators and faculty across GU in service to local CIRTl programming. His position in the graduate school, coupled with a pleasant personality, helped him gain audience with all sorts of campus constituents, which led to the recent formation of the local CIRTl advisory board. In addition, he had the ear of the graduate dean and influenced the teaching and learning center through funding for graduate student professional development programs. In short, Tom influenced local CIRTl programming through funding decisions, had access to the graduate dean, and leveraged his graduate school position to *gain support* for local CIRTl programs from administrators and faculty members.

Serenity University

Arielle, the local CIRTl leader, was a full professor in a STEM department and an assistant dean in the graduate school. She was responsible for the graduate student experience, including professional development. She regularly met with the graduate dean and used her graduate school position to meet with academic leaders across campus. In addition, she was very involved in local CIRTl programs and was the key programmatic decision-maker. She had an extensive personal and professional network on campus, due to her long tenure at SU, her assistant dean role, and her proclivity to collaborate with many campus colleagues related to both disciplinary research and efforts to improve teaching and learning. Thus, Arielle was in close proximity to local CIRTl programs, was empowered to make programmatic decisions, reported

to the graduate dean, and maintained extensive on-campus connections to *diffuse* CIRTl across SU and *gain support* for local CIRTl programs.

Gertrud, a supplemental local leader, was the associate director of the teaching and learning center and led all center initiatives related to graduate student teaching professional development. She was previously the local CIRTl leader at SU and was a tenured STEM faculty member with a long history of collaborative projects with campus colleagues. She also had an extensive personal and professional network at SU, stemming from her current role and long history at SU, and actively sought out new connections and utilized her organizational ties to advance efforts to prepare future faculty. Overall, as associate director, she was heavily involved in local programming, made programmatic decisions, was strongly connected to the director of the teaching and learning center and the associate provost, and could leverage her social capital to reach campus constituents.

Lastly, Rufus, the local CIRTl co-leader, was a program coordinator in the teaching and learning center and was directly responsible for running local CIRTl programming logistics. He maintained important connections with graduate students, teaching and learning center staff, graduate school staff, and advisory board members. In summary, he was in close proximity to local CIRTl programs, had some degree of programmatic decision-making, and was connected to program participants and those responsible for planning, implementing, and evaluating local CIRTl offerings.

Lorimer University

Ross, the local CIRTl leader, was an associate dean in the graduate school and a tenured professor in the college of life sciences. He had been at LU for over 20 years and led the local CIRTl effort since LU joined the Network. Due to his appointment in the graduate school, he

had direct access to local programming for graduate student professional development and had the autonomy to make programmatic decisions in conjunction with other administrators in the graduate school. He also had direct access to the graduate dean, informed the dean of local and national CIRTl activities, and lobbied for continued support of local CIRTl initiatives. In addition, Ross was connected to many campus colleagues across multiple academic and administrative units, which was a result of his administrative and faculty roles. In sum, Ross was in close proximity to local CIRTl programs, was the key programmatic decision-maker, maintained strong and direct ties to the graduate dean, and had an extensive professional network at LU that he tapped into to advance local CIRTl efforts.

Christine, the local CIRTl co-leader, was a non-tenure track faculty member in the college of natural sciences and was the lead for a large teaching and learning initiative in her college. She was heavily involved in the local CIRTl TAR program for nearly ten years and, like Ross, was a key decision-maker for that program (whereas Ross oversaw multiple programs in the graduate school). Unlike Ross, she did not have administrative authority and lacked direct ties to upper administrators. However, she did have a strong professional network on campus, but her network was mainly limited to others who had interest in improving STEM education. Thus, Christine was close to a single local CIRTl program, was a decision-maker in that program with Ross, lacked ties to upper administrators and administrative authority, and had a strong social network of likeminded peers.

Midwestern University

Deanna, the local CIRTl leader, was the associate provost in the office of graduate studies and had been at MU for over 20 years. She was the primary decision-maker for graduate student professional development, including local CIRTl efforts. She gave guidance to Isaac and

Tracy, provided funding for local programs, and directed access to upper administrators and academic leaders on campus. She likely had an extensive professional network due to her long tenure at MU, her administrative role, and her background as a STEM faculty member. Overall, she was responsible for local CIRTl programs, was a key decision-maker, had access to upper administration, and had many useful connections with campus colleagues that she drew upon to advance local CIRTl programs.

Isaac, the local CIRTl co-leader, was an assistant provost in the office of graduate studies and a tenured professor in the college of education. Whereas Deanna had a much broader set of responsibilities related to graduate education, Isaac only worked on graduate student professional development and with Deanna's blessing, made programmatic decisions (CIRTl and non-CIRTl related). His position provided access to campus administrators and academic leaders, though not to the same extent as Deanna. However, his campus connections that resulted from his faculty position were disconnected from local CIRTl efforts, suggesting that he had two non-overlapping, parallel professional networks. Thus, he was in close proximity to local CIRTl programs, made decisions about local CIRTl programs, and had connections to administrative and academic leaders, but he had not utilized his faculty network to influence local CIRTl development.

Tracy, a supplemental local CIRTl leader, was a full professor of molecular biology and used to occupy a similar role as Deanna's in the office of graduate studies and as the local CIRTl leader. Even though he was not a formal local CIRTl leader, he was an active participant of the advisory board and ran the local TAR program. He did not have formal authority to make final decisions regarding CIRTl programs but he was a rich resource for Deanna and Isaac and regularly provided insight and guidance on how to proceed with local CIRTl efforts. When he

was in the office of graduate studies, he had direct access to upper administrators and academic leaders, but now his social network was limited to his department and a few remaining connections as a result of his former title. In short, he was tied to local CIRTl programs, he had some degree of programmatic decision-making, and had some cross-institutional connections that benefited local CIRTl efforts.

Overarching Themes

Proximity and Decision-Making. All of the local CIRTl leaders were somehow tied to local CIRTl programming. However, the nature of their appointments influenced how they interacted with teaching professional development programs. Some local CIRTl leaders were closely related to local CIRTl programs while others were not. For instance, some of the local CIRTl leaders were not involved in the delivery of local CIRTl programs. Deanna and Tom occupied upper administrator positions in the graduate school (or equivalent) and were not concerned with day-to-day programmatic operations. Betty was also not directly involved in day-to-day operations since she no longer directed local CIRTl efforts in the teaching and learning center. There were multiple reasons for programmatic distance. For example, Deanna was the equivalent of a graduate dean and had many other pressing responsibilities that prevented “in the weeds” involvement. Tom, likewise, had a demanding position in the graduate school, lacked the background and expertise in developing and delivering professional development, and had no formal role in the teaching and learning center that implemented local CIRTl programs. Betty was also not formally attached to the teaching and learning center although she maintained cross-institutional connections with center staff. Thus, the lack of proximity to local CIRTl programs could be a result of not being in the organizational unit that delivers programs, not possessing

professional development skills and knowledge, and occupying a position that prohibits in-depth involvement.

Other local leaders were more involved with programmatic delivery. For instance, Isaac and Arielle played a major role in leading local CIRTTL activities, although their leadership was more general oversight than detailed logistical implementation. Both had parallel positions in the graduate school (or equivalent) and worked with a larger team to execute CIRTTL programming. Several other local CIRTTL leaders were even more involved in local programs. Gertrud, Rufus, Ross, Christine, and Tracy all directly led or helped run local CIRTTL programs, even though their institutional roles varied greatly. Ross was in the graduate school, Gertrud and Rufus were in the teaching and learning center, and Christine and Tracy were faculty members. These findings suggest that a high variety of institutional roles can be associated with high proximity to local CIRTTL programs. The same constraints certainly apply with respect to organizational placement, skills and knowledge of professional development, and role flexibility, but boundary spanners do not need a specific positional archetype to be involved with local CIRTTL programs.

Beyond programmatic proximity, institutional roles also influenced local CIRTTL leaders' ability to make programmatic decisions, which was a direct result of positional authority. For example, local leaders such as Betty, Tracy, Rufus, and Christine relied on their ability to influence local programs and lacked the authority to make major programmatic decisions. Other leaders such as Deanna, Ross, Isaac, Arielle, and Gertrud provided some decisional autonomy for their colleagues, but ultimately they retained the final say on programmatic matters. There was no coincidence that Betty, Tracy, Rufus, and Christine were either not affiliated with the unit responsible for local CIRTTL programming (i.e., Betty) or did not have an administrative position. In contrast, Deanna, Ross, Isaac, and Arielle all had formal positions that imbued them with the

authority to make programmatic decisions. Even Tom, who did not have much involvement with specific programs, had positional authority to direct funding and therefore influenced programmatic decisions. In short, decision-making authority was highly contingent upon formal institutional role and title. Boundary spanners with all sorts of institutional roles can participate in local CIRTTL programming, but decision-making is limited to those with formal authority. One could even argue that positional authority is more useful and compelling than programmatic proximity for local CIRTTL leaders. Proximity allows local leaders to influence campus CIRTTL programming but formal positional authority can result in concrete and institutionalizable actions.

Access to Campus Leaders and On-Campus Connections. Of the ten local CIRTTL leaders in my study, many had direct access to administrative and academic leaders. For example, Tom, Arielle, Gertrud, Ross, Deanna, and Isaac all reported to an upper administrator and used that connection as a means of securing and maintaining support for local CIRTTL activities. In addition, the nature of their formal administrative roles provided access to academic units and leaders. In contrast, Betty, Rufus, Christine, and Tracy lacked direct, formal access to upper administrators or academic units and instead had to rely on their local CIRTTL colleague(s) or prior connections (e.g., when Tracy led the office of graduate studies). This suggests that formal administrative positions are an effective way for local CIRTTL leaders to gain access to campus leaders. Non-administrators can still presumably interact with campus leaders, but these connections are likely less frequent and lack the pull of an administrative office. Thus, similar to programmatic decision-making, formal administrative roles and subsequent authority were crucial in gaining widespread support for local CIRTTL efforts.

Local CIRTl leaders also had varying degrees of on-campus connections that they could use to advance local CIRTl activities. Arielle, Gertrud, Ross, and Deanna had extensive on-campus connections related to CIRTl or other efforts to prepare future faculty. These connections resulted from being at their institution for a long duration, their formal administrative positions, their faculty careers, and prior collaborations with campus colleagues. In contrast, Betty, Tom, Christine, Isaac, Tracy, and Rufus had low to moderate campus connections related to CIRTl, even though they (with the exception of Tom) had been at their institutions for a long time. The lack of extensive campus connections could be a result of not holding or no longer holding a central administrative position (e.g., Betty, Christine, Tracy, Rufus), short tenure at their institution (Tom), the lack of overlapping professional circles (Isaac), or not being on a tenure stream or a faculty member (Christine, Tom, Rufus). Overall, my findings demonstrated that institutional roles highly influence on-campus connections. Such connections are a function of time at the institution, current and former administrative roles, faculty positions, and past collaboration.

However, not all campus connections directly translated to advancing local CIRTl efforts. Many campus connections did not directly relate to CIRTl, which limited what connections local CIRTl leaders could use to *diffuse* CIRTl programming or *gain support* for preparing future faculty. The strength of administrative positions tied to graduate student professional development was that they provided local CIRTl leaders with direct on-campus connections that were related to efforts to prepare future faculty as effective teachers. In contrast, boundary spanners with institutional positions that were removed from CIRTl-related activities found it more difficult to identify campus connections to advance the local CIRTl effort. Thus, the majority of local CIRTl leaders in this study likely had numerous on-campus contacts, but

those with administrative positions connected to graduate education could more easily draw upon their position and institutional experience to advance local CIRTl programs.

Summary of Implications. I found that institutional role was a major influencing factor in boundary-spanning activities because institutional roles affected proximity to local CIRTl programming, programmatic decision-making, access to campus leaders, and on-campus connections. Organizational placement, skills and knowledge of professional development, and role flexibility influenced program proximity. I also found that there was no positional archetype that a boundary spanner must have to be involved with local CIRTl programs. Second, I showed that formal, positional authority was crucial to programmatic decision-making. Third, I found that formal administrative positions provided better access to campus leaders than their non-administrative counterparts. Lastly, I demonstrated that on-campus connections were a result of many factors, but to be of any use, they must be synergetic or at least related to the aims of CIRTl, which often resulted from administrative positions linked to graduate student professional development. In summary, local CIRTl leaders who drew upon their administrative roles in combination with other institutional experiences and responsibilities stood a better chance at succeeding in intra-organizational boundary-spanning activities. This does not mean that there is a singular recipe for an ideal institutional role to aid in boundary-spanning activities. As I stated in previous chapters, boundary spanning is a team endeavor, which means that not every local CIRTl leader has to be an upper administrator or a tenured faculty member. However, my findings do suggest that team members, in some combination, must be in close proximity to local programs, have the ability to make decisions, have access to upper administrators, and possess on-campus connections in service to local CIRTl goals. Local CIRTl leaders with administrative positions possess many of these attributes.

Convergence

Occupying a key campus role was not enough to be an effective boundary spanner. Local CIRTTL leaders' institutional roles and CIRTTL responsibilities had to also converge and align in meaningful ways. For example, one of the members of CIRTTL's central leadership team talked about the importance of role congruency.

I think the more someone's role is specifically designed around either supporting CIRTTL or a concept that's intimately linked with CIRTTL, the more influence they would have on translating CIRTTL to their local campus.

For many of the local CIRTTL leaders, this was an apt description since often, "their careers are about professional development," which forms a nice synergy with CIRTTL efforts.

At SU, the local leaders were involved with teaching professional development and their institutional roles were aligned with CIRTTL responsibilities. For instance, Arielle, because of her role in the graduate school, was directly responsible for "the graduate student experience." Her supervisor explained:

In her role in the Graduate College, broadly, she's responsible for...what I would generally describe as the quality of the graduate experience beyond the direct research academic program...I guess my impression is her responsibilities with the graduate students and graduate programs leverage nicely with her activities with CIRTTL and give her good opportunities to sort of bring CIRTTL activities to the attention of both faculty members and graduate students and postdocs.

For Gertrud, given her role in the teaching and learning center, "CIRTTL is just kind of another finger on the hand of what she does. I think it is largely in line with a lot of the other things that she does." Rufus, also being in the teaching and learning center, "is our administrative collator

for CIRTl [and the] program coordinator for [the] Preparing Future Faculty Program,” where “the missions of those two organizations are intertwined and in some ways going the same direction.” Overall, the local CIRTl leaders at SU had institutional roles that were strongly aligned with CIRTl activities.

At other case institutions, local CIRTl leaders’ roles were also “meshed and integrated” with local CIRTl programming. For example, Ross “managed to connect CIRTl with...his role in the graduate school [and]...also connects it to what’s going on in his department.” An interviewee explained that Christine’s and Ross’ other work roles directly aligned with their CIRTl responsibilities:

The example that first comes to mind is Christine has always focused on the importance of graduate professional development. And so has Ross. I mean really they both have. That’s essentially Ross’ job as associate dean in the graduate school is graduate student professional development... [his] role in the graduate school as associate dean has certainly interrelated. And the two responsibilities are mutually beneficial, certainly. Tracy provided another example of how his work on the local TAR program fit with his other institutional responsibilities.

So as I mentioned, the TAR fellows model is something that I’ve been involved in from earlier on in the CIRTl program and it fits in with the activities that we’re involved in here, improving TA training for our TAs and also in developing sort of TAR type of research for this improving introductory STEM courses. And so that fits in nicely. Furthermore, Betty talked about her former role in the teaching and learning center and that “CIRTl was within the teaching and learning center activities and so participating in CIRTl work was, was just part of the job.” In short, most local leaders expressed alignment between

their CIRTl and local responsibilities.

However, participants also discussed instances of misalignment. For example, even though Gertrud was responsible for preparing future faculty programs at the teaching and learning center, she had many other responsibilities outside of CIRTl related to “a lot of undergraduate, just plain old pedagogy, teaching stuff.” More generally at SU, “some things focus specifically on CIRTl and some of them, I would say, are well aligned with CIRTl but not entirely focused on CIRTl.” Arielle further explained multiple motivations for local role duties:

We have responsibility for preparing people for a broad range of careers...and future faculty is just one small slice of that. I have a motivation to put effort into the CIRTl activities, but it's, it's not my only motivation.

At LU, Christine expressed a similar sentiment of how CIRTl is one part of her work responsibilities.

Well like I said, my job is not one hundred percent CIRTl, but my job is to represent STEM education... So in that sense then, CIRTl is one, in preparing future faculty is one facet of that...for me CIRTl is just another sort of quiver in the arrow of that set of things, as opposed to...that's not the leading piece.

Tom held a similar sentiment by acknowledging:

So my focus, I mean as much as I wanted to do more stuff on CIRTl this fall, my focus...has to be on the graduate school overall, and CIRTl is just one aspect of it.

One of the participants from MU even went so far as to suggest that Tracy's and Isaac's CIRTl duties did not overlap with their other faculty responsibilities.

I would say for Tracy there's no overlap. I would say that for Isaac, too. There's no

overlap between what they do as faculty and what they do as CIRTl. Two separate camps that they're running.

Local CIRTl leaders had many other responsibilities that ran in parallel to or are completely distinct from CIRTl activities, which potentially limited what time they could devote to CIRTl.

Participants also discussed some degrees of misalignment with institutional promotion criteria. For instance, a member of the central CIRTl administrative team talked about the tradeoffs associated with engaging in CIRTl activities at the cost of career advancement metrics.

I think there's always a tension there and it's a tension that shows up in time in the sense of how much time does one put into CIRTl locally and how much, how much time can you afford essentially, in your career trajectory to put into an initiative like CIRTl...

There also are many for whom they're STEM faculty like myself in the sense that we always have a tension in the orthogonality of CIRTl and what CIRTl is doing to our STEM measures of publication, grad students, all the merit criteria both nationally and locally that are typical for STEM faculty but for which by and large, CIRTl does not play.

Ross, at LU, also talked about how CIRTl activities did not always factor into career advancement.

I've got plenty to do over in my home department. Frankly, my chair doesn't give a rip what I do for CIRTl. But yet, he's the primary person that influences what my raise is. In short, CIRTl activities did not always align with what "counts" for promotion and career advancement on campus.

Furthermore, time constraints were a major limitation in balancing local responsibilities and CIRTl activities. One participant explained:

Knowing that everyone else has different pressures from their own universities, different deadlines, they work on different schedules, they work under different grants in their own time in addition to what they do for CIRTl, there's so many competing demands on people's time that no matter how much they care about...supporting students through this specific pathways that we use, they still face very real limitations in terms of how they can cooperate and support what we do.

For instance, Betty at GU talked about the challenge of trying to fit CIRTl in with two other demanding administrative roles.

I have two administrative roles on campus that are already effectively over 100% of my time and CIRTl is no longer really part of any of those. At least in my former position, CIRTl was within the teaching and learning center activities and so participating in CIRTl work was, was just part of the job. Now, it's definitely beyond that but I feel that it's important to keep this going.

Gertrud's supervisor likewise discussed the challenge of balancing a full local workload with CIRTl involvement.

It's been a huge time commitment...As I look at it from a supervisory standpoint, she's committed a lot of her time and energy to the network and I don't know... it's hard for me to know exactly what the payoff is on a local level...There's a bit of disconnect between the expectations and what the institutions need to be doing or should be doing or how they can leverage it more when that just becomes an add on to a person's already existing responsibilities.

Gertrud added some additional reflection about trying to stay afloat despite the demanding task of balancing her work in the teaching and learning center with her CIRTl responsibilities.

Sometimes I wonder how I can do both. It's just, it's a lot... so sometimes I just, I feel like on my better days I feel like I'm on the surfboard and I'm staying on the wave, but sometimes I fall off. And it's not pretty. I do the best I can to stay on top of that thing. Now I try to have good lists and scheduling and somehow it all works, but sometimes it's really difficult to juggle it all. You bet.

Rufus expressed similar frustrations with managing such a heavy workload:

The biggest impediments are a really busy schedule, fitting it in with everything I have going on, and then thinking big picture. How is going to CIRTl going to help my students, help my program, help me, help my institution. Because I think it does all of those things. To keep being really present in mind about that, and not just focused on here's the thing I need to survive today, and here's the 52 emails I got while having this talk. But there are students freaking out and need to be answered. Taking that time for a big picture. That's a challenge.

Ross mentioned that choosing to engage in CIRTl potentially limited his local productivity and presented an opportunity cost.

Each institution is supposed to provide one person 25% time. I think as the network has grown and as the way we do business has changed, I think that's an underestimate... There's a lot of people who put a lot of time into CIRTl and... it's things that they're not doing... but it comes at a cost for their individual potential productivity... And so I think you have to be careful what you say yes to. Because if I'm doing, if I'm going to make a commitment, big time commitment to CIRTl [then] I'm not going to do something else.

Tracy at MU also viewed time as a limited commodity and cited the challenge of doing both CIRTl and performing his other local duties.

I think it's probably most other folks involved in CIRTl around the network, unless they happen to have a job that is you're the CIRTl person on campus, are trying to juggle three or four jobs at the same time and CIRTl is one of them and try to keep it connected as much as possible to the other balls that they're juggling so that it's not a tremendous drain on people's time because it would result...in making it difficult for the program, the CIRTl program to grow locally because...you always have to...find ways of committing yourself 150% just to keep the programs that you have on campus rolling.

Overall, participants talked about local CIRTl leaders' busy and demanding schedules and how they are often "spread very thin" in balancing "all those different roles and responsibilities."

Thus, time constraints are a major limiting factor for local CIRTl leaders. Potential solutions consist of aligning work responsibilities with CIRTl activities (i.e., a "kill two birds with one stone" approach) and managing time effectively to do more with less, which was a common trait of local CIRTl leaders in my study.

In this section, I demonstrated the importance of convergence. For the most part, local CIRTl leaders had institutional positions that strongly overlapped with CIRTl activities, which provided a platform to engage in local CIRTl programming. However, CIRTl was typically one part of a much broader spectrum of institutional work and competed with busy and overtaxed schedules. The implication is that boundary spanners must maximize areas of convergence between CIRTl and local responsibilities and create alignment where CIRTl work and institutional work can be one and the same. In addition, boundary spanning requires strong time management skills to balance multiple and often competing demands, especially in areas that do

not have considerable overlap with CIRTTL. Therefore, time is a limited resource and can be a major impediment to reaching education reform goals. Boundary spanners must work within these constraints and prioritize activities that will yield the highest output aligned with their and their institutions' goals.

Managerial Skills

Beyond the attributes of commitment, institutional role, and convergence, local CIRTTL leaders had to manage local CIRTTL efforts by delegating responsibilities and reading institutional dynamics. With respect to delegation, local CIRTTL leaders and other participants talked about the need to build local CIRTTL teams to accomplish more than what two or three local CIRTTL leaders could do on their own. For example, one participant talked about Arielle's strategy of building strong teams:

My experience with Arielle leads me to believe that her strategy is that she identifies really good people who might be interested in a project...so her strategy is often to put a good team together. And at a high level, supervise those teams.

Similarly, an interviewee at LU discussed how Ross regularly "delves things out" to his team to spread the workload.

He tries to give responsibility to others...and help them...I need you to do this because we need to get this done; these are the objectives here. His attribute of being able to kind of delve things out and give it to others to help, because he can't do it all himself. I think that's a positive one.

Likewise, Isaac at MU mentioned the importance of delegating tasks to other local CIRTTL team members.

Well, I'm learning to delegate a little more. I mean, I really rely heavily on Marcela...and now that we have Jenny, I can offload. So learning to delegate the smaller tasks is important, especially on reporting...So delegating as much as possible.

Overall, to counteract busy schedules, local CIRTTL leaders have to delegate CIRTTL responsibilities. This process is strongly related to team-based boundary spanning discussed in previous chapters and requires that local CIRTTL leaders recruit local team members and determine the best division of labor to meet local goals. Local CIRTTL leaders were not the only ones with decision-making authority, but my analysis demonstrated that these boundary spanners benefited greatly from managerial skills that helped divide and conquer the work in the most efficient way possible. Such managerial skills were also crucial in managing local CIRTTL programming logistics and keeping the local program on track.

Beyond delegation, study participants also discussed the importance of local CIRTTL leaders being able to read institutional landscapes to identify opportunities, understand local politics, and figure out the best way forward. For example, a member of the central CIRTTL administrative team outlined this important skill.

It's often kind of figuring out how to fit it into what's already being done so people's toes aren't getting stepped on, so people understand the language, figuring out where the need is, not trying to duplicate things, not trying to come in with ideas you say are new ideas that they've been doing for years. So there's a dance there of wanting to find out what's happening, wanting to value that, and wanting to work with it.

An interviewee at SU expressed a similar sentiment:

I think they've got just a really great ability to be able to tune in and find out what people are interested in, maybe what their needs are and then figure out how they might be able

to help those things come to fruition.

The ability to read the institutional landscape was often a result of local leaders' campus connections. For example, one respondent linked campus familiarity with frequent campus contacts:

Once you meet with people and get to know them a little bit, I think you're better able to interact with the climate of that particular group. So you have to know people to be able to interact with them.

In short, the local CIRTTL leaders, with the exception of Rufus, were adept at reading the institutional landscape to “understand the politics of the campus,” recognize the “complicated dance” of campus constituents, and know “enough about the context of and the players across campus” to fit CIRTTL into existing programs. Thus, beyond delegating work responsibilities, boundary spanners need to be able to read the climate and politics of their campus to know when and how to engage in *finding*, *translation*, *diffusion*, and *gaining support* activities in support of local reform goals. This may be one of the most important skills since, without it, boundary spanners may ignore crucial campus dynamics that are in favor of or in opposition to their local efforts. We can assume that upper administrative positions or at least positions in organizationally central units provide local CIRTTL leaders with a wider understanding of campus context than single academic departments. The amount of time at the institution can also influence their ability to read campus dynamics, since a longer tenure at the institution may provide a more detailed, holistic picture of campus operations.

This section showed that local CIRTTL leaders require the ability to delegate and manage local CIRTTL activities and read the institutional landscape to align CIRTTL efforts with local goals and resources. Both leadership skills are necessary for local CIRTTL programming success

and subsequent boundary-spanning behaviors. Local CIRTl leaders do not have sufficient time to engage in all activities related to CIRTl and must therefore lead and manage a team to accomplish core tasks. At the same time, they must be able to understand the institutional context and *translate* it to influence local CIRTl implementation. Therefore, local CIRTl leaders must be managers in addition to their boundary-spanning activities.

Chapter Summary

In this chapter, I found four major individual attributes that influenced boundary-spanning behaviors. First, I demonstrated the importance of local CIRTl leaders' commitment to the reform goals of the CIRTl Network and how local institutional goals and priorities contextualized such commitment. Second, I examined formal institutional roles and concluded that no singular position type was associated with proximity to local CIRTl programming; however, administrative positions were crucial for programmatic decision-making, access to campus leaders, and direct campus connections related to CIRTl. Third, I discussed how local CIRTl leaders' institutional roles must also align with local CIRTl efforts and that extensive institutional responsibilities can limit the extent of congruence. Lastly, I showed how local CIRTl leaders must also possess certain managerial skills related to delegating and managing local CIRTl responsibilities and reading the institutional landscape to encourage alignment with institutional context.

Implications

Time Constraints. My findings present two main implications for boundary-spanning behaviors. First, my study showed that local CIRTl leaders were extremely busy and have significant time constraints. Confirming prior research, the boundary spanners in my study had to make decisions on what they could realistically dedicate to the local CIRTl effort, knowing that

their commitment to CIRTl ideals did not always translate to high rates of participation. To compensate, local CIRTl leaders had to delegate responsibilities and or find ways to align their current work responsibilities to match CIRTl. Local leaders whose institutional roles were already in close proximity to CIRTl activities found it much easier to accomplish this task. In contrast, leaders who were far away from local CIRTl programming had to cross intra-organizational boundaries, which presumably took more time, thus potentially limiting CIRTl engagement. Convergence of CIRTl and institutional responsibilities and programmatic proximity were highly intertwined. As both increase, local CIRTl leaders are able to combine institutional duties with CIRTl, which reduces workload. In addition, programmatic decision-making authority puts a local CIRTl leader in a position to delegate responsibilities to other CIRTl team members, which further reduces time constraints. The main point is that boundary spanners must find ways to manage and reduce time constraints in order to do more with less. Formal institutional roles are a key factor, since they influence workload convergence, programmatic positioning, programmatic decision-making, delegation, and time management.

Motivation. The second implication is that individual attributes were closely tied to motivation. The local CIRTl leaders in this study were all highly committed to the reform goals of the CIRTl Network, but each of them translated that commitment within the context of their own institutional reform goals and priorities. I argue that commitment, both to CIRTl and local CIRTl leaders' home institutions, runs through the other individual attributes that influence boundary-spanning behaviors. For instance, the degree of commitment shapes what local CIRTl leaders prioritize as important and influences their decisions about local programming, efforts to *gain support* from campus leaders, and even how they interpret the institutional landscape. Their commitment also affects how much time they dedicate to local CIRTl efforts. Many other

factors influence CIRTl-related behaviors, but their commitment and passion for improving the preparation of future faculty drives their actions and leads to local leaders spending many hours of their free time to advance CIRTl-related initiatives on campus. For these leaders, CIRTl-related duties are more than just a set of job responsibilities that they execute and go home. Instead, they are driven by a sincere passion for CIRTl and preparing future faculty. They may be able to delegate responsibility and read the institutional climate to make CIRTl activities more compatible with local priorities. They may also have administrative roles that provide a platform to direct local CIRTl efforts. However, even if a boundary spanner possessed all of the attributes described above, without commitment and dedication, they would have limited success. Thus, commitment is the constant thread that weaves through the other individual boundary-spanning characteristics.

Chapter 11: Institutional Attributes that Influence Boundary-Spanning Behaviors

The purpose of Chapter 10 and 11 is to expand my initial discussion of individual and institutional attributes that affect boundary-spanning behaviors. Findings from these two chapters answer my third research question: What individual and organizational attributes help or hinder local CIRTTL leaders' boundary-spanning activities? I conducted a cross-case analysis to holistically identify key attributes and dissect the nuances of how these attributes played out at the four case institutions. For my analysis, I used qualitative social network data and interviewee data to identify and compare themes across the dataset.

Below, I discuss the three main institutional attributes that emerged from my analysis that influence boundary-spanning behaviors: (1) institutional alignment with the goals and purposes of CIRTTL, (2) local programmatic infrastructure, and (3) decentralization. I conclude with a chapter summary to discuss the implications of my findings.

Institutional Alignment

In Chapter 10, I showed the importance of congruency between local CIRTTL leaders' institutional work roles and their CIRTTL responsibilities. The degree of alignment between institutional priorities and CIRTTL also helped or hindered how local CIRTTL leaders performed their boundary-spanning activities. Institutional alignment, taking the form of a campus mission and culture that valued teaching and learning and graduate student teaching development, shaped the context in which local CIRTTL leaders operated and made it easier or more difficult to build local CIRTTL programs. The purpose of the rest of this section is to explore similarities and differences in how institutional alignment occurred in each of the case universities.

Green University

Because of GU's focus on STEM majors, the campus was already strongly aligned with the mission of the CIRTl Network. The STEM-centric nature of GU and the recent institutional push to advance teaching and learning on campus directly affected Betty's and Tom's (the local CIRTl leaders) efforts to establish a local CIRTl program and engage in boundary-spanning behaviors.

For example, one participant said that incorporating CIRTl's concept of teaching as research was easier because the STEM-centric campus culture:

I think something that makes it easier is that we're, STEM fields are highly valued on campus... So I think that it's smart to be affiliated with a center that's looking to integrate research on teaching and learning because I feel like talking about research really connects to this population.

In addition, GU had "a provost that was very pro student, pro professional development" and "we have seen a shift in the culture in terms of just more attention and focus on teaching and professional development." Nascent efforts to improve teaching and learning on campus have even begun to trickle into tenure and promotion policies. One interviewee explained, "There's also a push on our university... there's a new initiative that all faculty members in all departments are going to have a teaching portfolio reviewed for tenure, which is new." The local CIRTl leaders were able to tap into these types of institutional characteristics that aligned with CIRTl to help build their local CIRTl programs

However, Tom and other local study participants stressed that GU's focus on teaching and learning was relatively new, and that improved teaching practices were not yet widely adopted on campus. Tom explained:

My sense is that evidence based teaching is not something this campus has adopted. I mean, whereas some other campuses, other places, it seems to be embedded in the DNA of the institution...I wasn't sensing that here.

The lack of wide-spread adoption was a direct result of the "historic value of research over teaching" and was heavily influenced by the decentralized campus units with individual autonomy. Overall, GU was coming into greater alignment with the mission of CIRTLL, but there were still strong structural and cultural barriers that created misalignment with CIRTLL and difficulties for Betty and Tom.

Serenity University

In contrast to GU, SU was a prime example of an institution that "was just sort of a natural alignment" with the mission of CIRTLL before joining the Network. SU was already a strong proponent of learning communities, had an active scholarship of teaching and learning community entrenched in teaching and learning improvements, and was overall "a pretty collaborative place." One interviewee described this sentiment:

I would say for SU that they were really ready for something like CIRTLL, and it just very quickly, very easily translated. I think they had some skilled people behind it...they had a wide-open niche that was ready be colonized. I'm speaking like an ecologist, but it really went fast, and it was really well received...it fit well with kind of some of the needs of the institution.

Furthermore, as discussed in Chapter 5, SU enjoyed strong support from upper administrators, which was partly due to a "value system" that supported interaction with prestigious national peers and SU's land grant heritage. Arielle, a local CIRTLL leader, discussed the land grant culture of her institution:

I also have to say our university is a land grant university, I think that deeply held value system means that we're on the spectrum of thinking about graduate education in sort of two extremes. Graduate education is trying to develop young scholars is one place that characterizes a graduate school. And there's another part that occasionally comes up... graduates are there to get research done for the faculty, and in that, now I'm not trying to create a false tension, but sometimes there is a tension between the two. SU largely is on the side of we're interested in developing young scholars and so that's part of the culture of the university. And so CIRTl fits into that culture pretty nicely.

SU was also a STEM-centric campus and sought, as an organization, to improve STEM education. The following quote illustrates that dynamic:

I think there is a pretty widespread belief that...preparing STEM educators to be more effective in enhancing both student learning and student success in those disciplines is something our campus is pretty committed to because we're a very STEM heavy campus.

Additionally, an emphasis on teaching and learning found its way into tenure and promotion practices and allowed "faculty members to be promoted based on scholarship of teaching and learning." Overall, SU represented a campus firmly dedicated to improved teaching and learning, which enabled the local CIRTl leaders (Arielle, Gertrud, and Rufus) to have much success in *translating, diffusing, and gaining support* for CIRTl on campus.

Lorimer University

Like SU, Lorimer University had a high degree of alignment with the mission and purposes of CIRTl since "it fit rather naturally into what LU was doing anyway." The graduate school, long before joining CIRTl, was actively creating professional development opportunities for graduate students with faculty and non-faculty career aspirations. Also, being a land grant

institution, LU had a mission-specific drive to improve teaching and learning as evidenced in the following quote.

Just the general mention of LU as a land grant institution and being very solidly focused on high quality, accessible education... I mean, high quality undergraduate teaching is at the core of CIRTTL. So I think the fact that this is a part of our mission here is really key and it makes it a wonderful launching space [for CIRTTL]...I think the fact that LU has been a place that's explicitly committed to professional development of graduate students for a very long time also made a difference.

Participants also noted that LU had become increasingly supportive of educational initiatives over the past ten years, which influenced the local CIRTTL leaders' ability to "permeate [CIRTTL programs] to places where it wasn't before." Furthermore, interviewees mentioned that their institutional culture supported cross-unit interaction, which aided local CIRTTL leaders' ability to *diffuse* CIRTTL-related content and *gain support* for local CIRTTL initiatives.

However, many autonomous academic units on campus valued research far more than improving teaching and learning. The former graduate dean explained:

I think there are some...who still don't understand that part of their responsibility is professional development of their students. They almost treat their graduate students like technicians.

Ross, a local CIRTTL leader, even said that faculty in his own department still have negative or mixed feelings towards teaching professional development. He related a recent incidence:

I had a graduate student sit right there on Wednesday, student in my department who is not one of my students...and she literally almost asked me, my professor wants to know if doing something like this is worth my time. Or is it going to be a waste of time?

Both local CIRTTL leaders talked about the tenure and promotion system being a major culprit in preventing more enlightened opinions of preparing future faculty. Christine, another local CIRTTL leader, elaborated:

The barrier is the tenure system...The structure, this twelfth century, medieval, hierarchical, the inmates are running the asylum structure is the problem...that's a big problem. That's not just here at LU and so then we layer on top of that this whole pile of administrative crap to try to corporatize this environment because now it's a big corporate structure.

Thus, like SU, LU was a case that represented the co-existence of institutional factors that aligned and misaligned with the mission of CIRTTL, which made local boundary spanning easier or more difficult. Local leaders such as Ross and Christine had to navigate the good and bad in order to engage in intra-organizational boundary-spanning behaviors.

Midwestern University

Lastly, MU, similar to SU and LU, also had a positive culture towards teaching and learning on campus. For instance, Isaac, one of the local CIRTTL leaders, talked about the high value placed on undergraduate learning on campus: "I know our board of regents puts a high premium on quality teaching of undergraduates. So any program that plugs into that priority will probably get good support." Another study participant believed that MU has "some strong core values and I think they probably align well with the pillars [of CIRTTL]." In addition, there was strong support from upper administrators for CIRTTL and CIRTTL-related initiatives. Overall, the general sentiment was that "we're all pulling towards the same thing. And CIRTTL, as focused on kind of professional development of teaching, was a natural partnership."

However, one interviewee mentioned that the strong focus on undergraduate education was “one small obstacle institutionally,” since it limited the emphasis on graduate education and made it more difficult to gain traction with professional development programming. Additionally, MU faced challenges related to decentralization and a research-centric climate that perpetuated a “reward system [that] was very much based on research.” Each of these barriers contextualized the boundary-spanning behaviors of the local CIRTl leaders (Deanna, Isaac, and Tracy) and made it difficult to *translate* CIRTl locally, *diffuse* CIRTl content, and *gain support* for local programs. Thus, once again, my findings demonstrated that local CIRTl leaders simultaneously drew upon supportive institutional cultures and priorities that aligned with CIRTl, while at the same time, they had to overcome local challenges that created misalignment with the aims and purposes of CIRTl.

Summary

In this section, I showed that the four case institutions were simultaneously aligned and misaligned with CIRTl. All four campuses valued teaching and learning, undergraduate education, and to varying degrees, graduate education. Such high-level support validated local CIRTl leaders’ efforts and allowed them to draw upon institutional priorities to make a cogent case for establishing or maintaining local CIRTl programs. In each case, alignment between local missions and CIRTl ideals made it easier to develop local CIRTl programs and to engage in intra-organizational boundary-spanning roles. Local CIRTl leaders positioned CIRTl as a mechanism for accomplishing local goals with upper administrators. They also sought funding, resources, and staffing because their efforts potentially aligned with local needs and desires. In short, as alignment increased the work of local CIRTl leaders became easier because they did not have to fight against the grain of the institution.

However, an institutional climate that supported improved teaching practices and the preparation of future STEM faculty was not enough. Local leaders also faced alignment challenges due to a decentralized campus that created pockets of campus units that valued research-centric tenure and promotion policies over teaching improvement efforts. A broad university mission statement may be congruent with CIRTl, but how that mission is interpreted and valued changes across campus units. This means that local CIRTl leaders, acting as boundary spanners, must be able to tap into university-wide support for CIRTl-related initiatives and at the same time, must be able to deal with the ambiguity that results from numerous autonomous campus units. Regardless of the level at which alignment occurs, the mechanism was the same. Local CIRTl leaders had to find ways to align CIRTl with local priorities to justify ongoing involvement, resource distribution, and student program participation. This could be fairly straightforward at the university level (if the institutional culture or mission supports it as evidenced with the four case institutions in my study), but it became more complicated when trying to seek alignment with other campus units, especially colleges and departments. Thus, as Chapter 10 already discussed, boundary spanners must “read” institutional dynamics and identify the most likely campus units that align with CIRTl versus trying to singlehandedly reshape or change existing campus unit cultures.

Programmatic Infrastructure

While alignment was a crucial institutional attribute, it was often a step removed from the actual work of creating, implementing, and evaluating local CIRTl programs. In this section, I discuss the impact of programmatic infrastructure on boundary-spanning roles, where programmatic infrastructure is defined as pre-existing programs, local CIRTl teams, and

organizational unit involvement. I talk about each case institution and conclude with a summary and a few observations.

Green University

Like the other cases in my study, GU already had existing preparing future faculty programs before joining CIRTl and used these programs as the base for local CIRTl activities. One of the local CIRTl leader's rationale was that it was simpler to work with the structure of GU rather than come up with new and disconnected programming. She explained:

My approach...is to defer to GU's structure rather than throw it out. I think we had a reasonable set of programs in place prior to joining CIRTl and rather than saying, all right, let's pitch these and follow [other CIRTl institutions' programs], we really said how can we take this as a core element, take the infrastructure, the campus awareness of these programs and not change them... Hold onto the positive elements of the awareness that we've built on campus and some of the successes that we built and seek to improve what we had rather than throw it out.

By linking CIRTl to existing programs, the local CIRTl leader and a few individuals in the teaching and learning center did not need to create new programs, only incorporate CIRTl concepts. However, integration efforts were not always seamless, as evidenced by a quote from a teaching and learning center staff member:

[We] already did a lot of work which is similar to CIRTl's work before CIRTl came into GU, right?... And CIRTl came in so we struggled a lot of the time...why are we doing that? We're already doing this.

Furthermore, GU was described as a "mom and pop shop for future faculty programming," which was reflected in much smaller CIRTl student participation numbers as compared to the

other three case institutions. In summary, prior programming at GU was an important stepping stone for GU to build local CIRTl programs, but the lack of overall programmatic development was a major limitation.

With respect to a local CIRTl team, GU had the most unique setup of any of the case institutions. Tom, one of the local CIRTl leaders, was concerned with high-level logistics in the graduate school and Betty, the other local leader, worked with programmatic implementation. However, due to Betty's role outside of the teaching and learning center, she no longer had direct oversight of teaching and learning center staff. There were three individuals in the center who implemented local CIRTl offerings, but they reported to leaders of the center, not to Betty. GU had also recently created a local advisory committee, constituting academic leaders from across the university, but it was unclear how they would participate and at what frequency. Thus, there was a local CIRTl team at GU but the team was somewhat disconnected and lacked clear and central leadership.

Because of a rather eclectic local CIRTl team, CIRTl duties were spread across multiple campus units, namely the graduate school, the teaching and learning center, and Betty's college. The graduate school and the teaching and learning center were in a state of flux and transition, further complicating the local CIRTl dynamic. Because of institutional transition and the distributed nature of organizational unit involvement, the local CIRTl leaders at GU had to cross many organizational boundaries to build their local CIRTl programs at the cost of huge time commitments. Therefore, even though GU had existing programs that could serve as the base for local CIRTl efforts, an organizationally distributed team resulted in numerous infrastructure barriers. Yet, GU recently created an advisory board, which may contribute to a firmer infrastructure by which to expand and refine local CIRTl programs. The ultimate goal of GU

study participants was to move from a “mom and pop shop” to a more institutionalized model as found at institutions such as SU and LU.

Serenity University

Like GU, SU also had graduate student professional development programs prior to joining the CIRTTL Network. However, in contrast to GU, local programs were much more refined and had a much longer institutional history. For example, one participant talked about SU’s successful preparing future faculty (PFF) program, which provided a framework for integrating CIRTTL components at SU.

I think that SU is a little bit different maybe than some of the other institutions that are part of the network in that we have already in place a well-established and very successful preparing future faculty program. So although it may not be...as robust as what would be available by leveraging all these multiple institutions, we still have a very strong framework already in place.

In addition, SU was already very active in creating learning communities and had an active scholarship of teaching and learning program through the teaching and learning center, both of which provided a secure platform for integrating CIRTTL concepts and resources. Arielle, one of the local CIRTTL leaders, expressed a similar rationale as Betty from GU for wanting to build upon what is already in place versus creating programming from scratch.

I don’t know if it’s management 101, but if we have some existing structure already in place, then it really behooves us to use that...I’ve been burned too many times by either myself or somebody else trying to start something new and there was already something very similar in place...it’s a waste of resources and it’s contentious, and it’s silly. So, my

first instinct is to see what we have in place that is very similar in mission or scope and see how we can partner.

In short, pre-existing programs played a crucial role in building local CIRTTL programs and provided the context by which local CIRTTL leaders (and their team) *translated* CIRTTL for SU. In addition, one can assume that the on-campus connections relating to pre-existing programs facilitated local CIRTTL leaders' *diffusion* and *gaining support* activities, since prior programs likely contextualized and framed the connections necessary to plan, implement, and evaluate local CIRTTL initiatives.

The local CIRTTL team at SU was also very strong. Arielle, Gertrud, and Rufus (the local CIRTTL leaders) worked well together and involved multiple individuals across campus in the local CIRTTL team to distribute the local CIRTTL workload. The local leaders also represented two of the major centralized campus units and were able to tap into the cache and notoriety of the graduate school and the teaching and learning center to lead local programming efforts (in contrast to Betty at GU). Each team member played a complementary role and they all worked fairly harmoniously. Yet, despite team productivity, there were still concerns. For example, interviewees said that they wanted the advisory board to “have skin in the game” and be more active in advancing CIRTTL and other efforts to prepare future faculty. However, for the most part, the advisory board was limited to reviewing and approving small grants for TAR projects and learning communities, which limited their potential to help local CIRTTL programs. Yet, despite this weakness, SU represented one of the strongest local CIRTTL teams of the four case institutions and had a strong local infrastructure to build and deliver local programs.

Lorimer University

Similar to GU and SU, LU also had pre-existing programs prior to joining CIRTTL. For

the local CIRTTL leaders, it was easier to integrate CIRTTL into existing work than establish brand new programming. The former graduate dean talked about the nice synergy between existing programs and CIRTTL.

We already had a certification in college teaching program. We didn't quite have [our TAR program] until CIRTTL got on board. And then it was easy then to take those pillars, you know, the diversity pillars, and teaching as research, and so on, to be able to stick with the core of what we thought was necessary to certify somebody as a potentially good college teacher and have something on a transcript, and then to be able to focus that in the STEM areas because the certification in college teaching is everybody. And CIRTTL helped, I think, focus it on the STEM areas and then use the CIRTTL pillars to help align thinking about what people need to do and how they needed to do it. So lots of these things were organically sort of growing at the same time. And CIRTTL gave us a great peg to hang some things on, and then to be able to use ideas.

Ross, LU's primary local CIRTTL leader, mentioned that several of the pre-existing programs "didn't have the language of CIRTTL but they were doing the same things," which created a nice synergism to refine and expand local offerings such as the TAR program. Thus, just like the GU and SU cases, pre-existing programs provided a useful platform to build and develop local CIRTTL offerings.

The local CIRTTL team at LU, however, was a bit different than the teams at GU and SU. Ross was at the heart of two distinct locales for CIRTTL work. First, he worked with staff from the graduate school to plan and implement many programs for graduate students and postdocs, with CIRTTL being one of many activities. In his graduate school role, he interacted with key administrators and had access to many resources. Second, he was also the chair of the TAR

program advisory board and worked with Christine (the other local leader) to lead the program with the assistance of a small handful of board members. LU's advisory board was more active than SU's advisory board, but they only focused on a singular program. Overall, even though Ross engaged two separate groups in local CIRTl efforts, the local CIRTl team was quite Ross-centric. This placed a large amount of pressure on Ross, which potentially could have negative implications for programmatic productivity. Yet, for now, the local CIRTl team at LU functioned well and regularly created and delivered high quality programming.

Midwestern University

Lastly, consistent with the other three cases, MU had pre-existing programs that shaped local CIRTl programming development. The familiar rationale was to build upon what already existed and not reinvent the wheel. Tracy explained:

So we have had a long history of preparing, well, longer than CIRTl history, of preparing future faculty with [TA training] here on campus and the [teaching and learning center] and so one of the early things that we did was to sort of marry CIRTl to those activities because it made no sense to replace them.

However, in contrast to other case institutions, MU struggled to incorporate CIRTl content into existing programs. For example, local CIRTl leaders had a hard time building their local TAR program and merging CIRTl concepts into the student-run teaching preparation organization. Thus, the presence alone of pre-existing programs was not a guarantee of CIRTl integration. Instead, local CIRTl leaders, as discussed in Chapter 9, had to understand the extent and limitations of existing local programs and determine the best course of action for *translating* CIRTl for MU.

In terms of a local CIRTl team, MU was unique in that both local CIRTl leaders were

housed in the equivalent of the graduate school. They used the authority of the office to lead local CIRTl efforts, *translate* CIRTl for their campus, *diffuse* CIRTl content, and *gain institutional support*. They also had a strong “inner core” of advisory board members in the graduate school and teaching and learning center who had the appropriate expertise and who helped plan and execute all programmatic activities. Additionally, there was an “outer core” of academic leaders from each of the primary colleges, providing access to potential student and faculty participants. However, even though the local CIRTl team was quite large, one of the local CIRTl leaders discussed the challenge of having enough staff to take care of programming logistics.

The key challenge is, I’m sure you’ve heard umpteen times, is finding faculty and staff time to dedicate towards this because it falls kind of outside the usual day-to-day requirements of people’s positions, unless of course they are actually funded by specific funds dedicated to this.

Overall, the MU case demonstrated a strong team, spread across the two campus units most aligned with the CIRTl cause, who had the expertise and resources to lead and continue to expand local CIRTl programming.

Summary

In this section, I repeatedly showed the importance of pre-existing programs since they provided the base infrastructure by which to integrate CIRTl concepts and resources. When institutions join the CIRTl Network, they are not blank slates that adopt CIRTl programming in a cookie-cutter fashion. Instead, most institutions already have preparing future faculty programs that are embedded within the specific context and resources of the university. Creating new programs separate from existing offerings is illogical, since it requires local CIRTl leaders to

find additional funding, staffing, and time, all of which are usually scarce resources at higher education institutions. Instead, local CIRTTL leaders typically built their CIRTTL programs on pre-existing offerings to minimize the costs of production and utilize established institutional resources and connections. Thus, the four cases demonstrate the importance of existing programmatic infrastructure.

However, the mere presence of prior programs was not enough to guarantee the successful translation of CIRTTL locally. Pre-existing programs also had to align with the ideals and purposes of CIRTTL and the staff connected to these programs had to recognize the value-added nature of CIRTTL participation. To use a metaphor, existing future faculty programs were the soil where local CIRTTL programs could be planted, but the soil had to be conducive to and supportive of CIRTTL seeds. Therefore, just because a campus possessed well-developed future faculty programming, it did not necessarily equate to alignment with CIRTTL concepts or resources. Thus, each institutional context was slightly different and had different soil compositions.

Furthermore, this section demonstrated the need for a strong and productive local CIRTTL team who were affiliated with key campus units most aligned with CIRTTL activities. A productive CIRTTL team and key organizational unit involvement were closely linked to pre-existing programs, since local CIRTTL team members, including local CIRTTL leaders, were typically the ones who planned, implemented, and evaluated prior programming. Of course new individuals could be brought into the programmatic mix, but those who were tied to existing future faculty preparation were the ones who usually made up the local CIRTTL team.

The implication is that when discussing campus infrastructure, it is not just the extent and strength of pre-existing programs but it also includes the individuals who participate in program

planning, delivery, and evaluation. A CIRTl institution with both a strong local team and vibrant pre-existing programs may be able to immediately focus on *translating* CIRTl into local programs, *diffusing* CIRTl-related content, and *gaining institutional support*. In contrast, local CIRTl leaders at a CIRTl institution with a limited team and rather nascent future faculty programming must carry out the same tasks as their more developed counterpart and find the time to build the local team and create new programming. There are potential benefits of creating new programs to build the local CIRTl initiative, but it comes at a substantial time cost.

In addition, well developed CIRTl institutions, even though they can quickly start to *translate* CIRTl locally, may find it difficult to determine the value-added nature of CIRTl participation since their programs are already robust. Thus, campus infrastructure is not just a simple formula of strong pre-existing programs and a productive local team with connections to key organizational units. Each seedbed is slightly different with respect to size, soil content, and nutrients. The key takeaway is that CIRTl needs somewhere to grow, which is facilitated or hindered by pre-existing programs, the local CIRTl team, and/or organizational unit affiliation.

Decentralization

Green University

Interviewees from GU viewed their university as a “pretty distributed campus,” which influenced cross-unit interaction and contextualized local CIRTl leaders’ boundary-spanning activities. For instance, even though Betty and Tom (the local CIRTl leaders) were currently or were at some point attached to strong, centralized units, they still found it difficult to promote centralized CIRTl programs because other campus units retained extensive autonomy and several had their own teaching professional development offerings. One participant summarized

this frustration by saying, “It’s very difficult. We don’t do things in a very centralized way. And so doing something that’s a campus wide activity is always a little bit challenging.”

In addition, Betty talked about how decentralization created isolation and “fiefdoms,” which further complicated advancing centralized local CIRTl offerings.

I think part of the limitation is that our campus is highly Balkanized. At least we use that phrase. [Colleges are] very siloed and separate from the rest of the campus... They have a lot of power on campus. They have their own future faculty development programs. They’re doing just fine, thank you very much, and they don’t really need the central campus to provide these resources for them... I think the limitations are... the fact that different units on this campus are isolated. They like to be isolated. They’ve got their little fiefdoms and I think mostly for historical budgeting reasons, they want to retain those fiefdoms as much as possible.

Such isolation resulted in “a tremendous amount of conflicting interests and goals that made it hard for anybody to connect and engage with everything all at once.” Betty and Tom possessed considerable social capital, due to their tenure at the institution and professional roles, and for the most part had direct access to campus units. However, the decentralized structure of their campus prevented them from using their institutional roles and centralized authority (i.e., Tom being an associate dean and Betty when she led the teaching and learning center) to forcibly push CIRTl across campus. Instead, as evidenced by Tom’s active role in meeting with numerous academic leaders across campus for the past few years, they had to cross numerous intra-organizational boundaries to slowly garner sufficient support to create an advisory board with broad institutional representation. This advisory board will likely become a key component in the local CIRTl leaders’ ability to work within the decentralized organizational structure. Yet, even if

broad support takes shape across multiple academic units, these local CIRTl leaders will still have to negotiate individual campus unit autonomy and the persistent “fiefdom” culture as they engage in *finding*, *diffusion*, and *gaining institutional support* activities.

Serenity University

Participants from SU also viewed their campus as highly decentralized and SU stakeholders were “very proud of being a decentralized organization.” A decentralized campus structure influenced how local CIRTl leaders engaged in boundary-spanning activities, especially with academic units. For example, SU had two strong, well-respected campus units (the graduate school and the teaching and learning center) and two local CIRTl leaders (Arielle and Gertrud) that could wield the authority and social capital of their respective units to advance CIRTl locally. However, the authority of each centralized unit had limited reach across campus. This caused local CIRTl leaders to not rely solely upon centralized teaching professional development opportunities and instead, met academic units in their own sphere of influence (e.g., graduate learning communities). One interviewee described the interplay of centralized and decentralized campus units and that purely centralized CIRTl activities would not work within SU’s campus structure.

There are very few institution wide activities and that’s a result of the culture at SU and kind of this pride in unit autonomy and individual autonomy... The analogy I would use is we don’t have a university career services. Each college has their own careers services office. We don’t have an undergraduate studies advising area. Each college has their [own]... It wouldn’t surprise me if somebody thought it would be a good idea for each college to have its own teacher preparation, kind of preparing future faculty initiative except because of [the teaching and learning center] being such a strong centralized unit

[that]...is well known, it is well respected...It's really interesting to me that CIRTTL tends towards, CIRTTL activities are done at the institution level and that's probably not the most effective place to do these kinds of activities at SU.

The main idea is that local CIRTTL leaders' boundary-spanning activities were contextualized by the decentralized culture at SU. Arielle, as an associate dean in the graduate school, could gain audience with academic leaders across campus, but even with the authority of the graduate school, she could not force CIRTTL programming into colleges and departments. Instead, she had to understand enough of the context and needs of a particular academic unit and then customize her approach to *diffuse* CIRTTL content or *gain support* for local CIRTTL programs.

A decentralized campus was not without its problems. For instance, one participant from SU talked about how the decentralized structure added "some challenge because getting people on board really needs to happen at a department by department level." Support for CIRTTL was not painted in large brush strokes across campus units, but in individual departments. This greatly expanded what organizational boundaries local CIRTTL leaders had to span and increased overall time commitment, which as discussed in Chapter 10, problematized what local CIRTTL leaders could actually accomplish.

Lorimer University

LU also had a decentralized campus structure and, like SU, possessed a strong centralized unit (the Graduate School) that bisected academic units. Instead of working against a decentralized culture, the Graduate School positioned its professional development offerings within the context of academic unit autonomy. One interviewee explained, "the fact that the colleges and departments do their own thing makes it even more important for the philosophy, operating philosophy of the graduate school to be department-focused." Ross (the local CIRTTL

leader), as an associate dean in the Graduate School, was embedded within this operating ethos and shaped CIRTl offerings to follow suit.

However, like the GU and SU cases, there were challenges that resulted from a decentralized structure because “there were still silos everywhere, and that made it challenging.”

One interviewee explained:

I think some of the things that make it more difficult is that we are huge and distributed.

And every college and every department runs things just a little differently, and you

know trying to get all the ducks in a row so to speak has got to be nearly impossible.

The differences between academic units required local CIRTl leaders to invest considerable more effort in developing *diffusion* and *gaining support* connections. It also forced them to customize their approach due to the specific nuances of each college and department. In short, decentralization complicated their boundary-spanning activities.

Nonetheless, even though decentralization expanded their boundary-spanning tasks, it prevented instances of blanket disapproval from colleges and instead produced pockets of supports within departments or with smaller groups of faculty. For example, an interviewee believed that decentralization was a good thing “because you can really highlight where there’s pockets of departments that are really committed to high quality teaching and can be involved in CIRTl.” Thus, decentralization can be a delimiter of boundary-spanning activities but also be a safeguard by providing a decoupled organizational structure.

Midwestern University

Lastly, MU also had a decentralized campus, which influenced how the local CIRTl leaders (Deanna, Isaac, and Tracy) carried out their intra-organizational boundary-spanning duties. For example, unlike the other three universities, Deanna led the office of graduate studies,

which was very similar to a graduate school but lacked equally strong centralized authority. Isaac expressed concerns regarding the limit of the office of graduate studies' reach on campus due to this dynamic, although he remained optimistic.

Deanna is not a graduate school dean who typically has a little more bully pulpit power.

It's a more decentralized system. So she has to work with a whole committee of associate deans for graduate programs in the various colleges to come up with policy decisions...The fact that we are not a graduate school, that we are more decentralized, is perhaps a small obstacle...I could be wrong, I could be over-estimating the influence that deans of graduate schools might have across their own universities. But with this decentralized system, it really emphasizes the freedom of individual colleges and departments to create their own programs, their own priorities, so I think that decentralization of graduate administration is a small obstacle. I don't think it's anything insurmountable.

Despite its organizational weaknesses, the office of graduate studies did provide Deanna and Isaac with consistent access to administrative and academic units. Both individuals maintained a strong connection to the centralized teaching and learning center to create and implement teaching professional development programs, including CIRTTL programs. In addition, because of their positions, they were able to pull in key academic leaders to the CIRTTL advisory board. Furthermore, the local CIRTTL leaders and team were able to successfully fill their teaching development programs and had wide support from graduate students and postdocs across multiple colleges and disciplines. Thus, despite the decentralized structure of the university, the local CIRTTL leaders and their CIRTTL teams were able to develop lines of communication with key campus units.

Yet, similar to the other case institutions, the local CIRTl leaders (and members of their advisory board) had to customize interactions with various campus units to match their needs and interests, which came with a significant time cost. The local CIRTl leaders tried to diffuse this problem by distributing boundary-spanning behaviors amongst members of the local CIRTl team, but they still struggled to gain widespread support from faculty in departments and colleges. The office of graduate studies provided local CIRTl leaders with access to academic leaders but this did not necessarily translate to individual faculty members knowing or caring about CIRTl programs or the need to prepare future faculty as effective college teachers. The implication is that decentralization affects multiple levels of the campus hierarchy and the ability of local CIRTl leaders to reach different types of campus stakeholders. Not only do local CIRTl leaders need to gain access to campus leaders who influence resources and policy but also to individual faculty members, graduate students, and postdoctoral scholars. This multi-level, multi-stakeholder process is repeated for each campus unit. Therefore, decentralization magnifies the differences found within campus units and sub-units and complicates what organizational boundaries local CIRTl leaders must span in order to *diffuse* CIRTl content and *gain support* for local CIRTl programs.

Summary

A decentralized campus structure, as noted in prior chapters, limited the reach of local CIRTl leaders because it was unlikely that they could develop fruitful relationships with every academic unit on campus. This was especially problematic when we consider that, at each of the four case institutions, local CIRTl programming was delivered through a centralized unit. The authority and prestige of these centralized units provided local CIRTl leaders inroads into colleges and departments, but they had to promote a centralized opportunity with no direct

guarantee that academic leaders, faculty, or even graduate students would listen and value CIRTl programming. They had to repeat the process countless times because each academic unit was slightly different. The workload of gaining support from academic units can be distributed to a larger local CIRTl team, but even then, it takes considerable effort to gain audience with each academic unit. There are, of course, benefits to a decentralized structure, since it allows local CIRTl leaders to identify “pockets” of individuals with similar beliefs without fear of reprisal from other academic units. However, to expand local CIRTl programs to those who do not already believe in preparing future faculty as effective teachers, local CIRTl leaders and their teams had to find ways to *diffuse* CIRTl content and *gain support* from academic stakeholders. Such a grand task was definitely possible over time, but local CIRTl leaders had to develop unit-specific boundary-spanning strategies that drew upon institutional alignment and programmatic infrastructure. Thus, decentralization created numerous organizational boundaries for local CIRTl leaders to span outside of their centralized unit responsibilities.

Chapter Summary

In this chapter, I presented findings related to three institutional attributes that can help or hinder local CIRTl leaders’ boundary-spanning roles. First, I found that it was important for institutional goals and priorities to align with the mission of the CIRTl Network. Local CIRTl leaders had to find ways to align CIRTl with local priorities to justify ongoing involvement, resource distribution, and student program participation. Second, programmatic infrastructure, in the form of pre-existing programs and a local team with members from key campus units, was the foundation for building and sustaining local CIRTl programs. The boundary-spanning behaviors of *translation*, *diffusion*, and *gaining support* were in many ways dependent upon pre-existing programs and staff, since they provided crucial institutional context, resources, and on-

campus connections. Lastly, I found that decentralization, due to campus unit autonomy, greatly expanded the organizational boundaries that local CIRTl leaders had to span in order to advance local CIRTl efforts.

Implications

In addition to the three findings described above, my analysis revealed two important implications, namely the importance of institutional context and the interconnectivity of individual and institutional characteristics.

Institutional Context. I found that institutional context played a major role in shaping how and why local CIRTl leaders engaged in boundary-spanning behaviors. For example, if an institution's priorities are aligned with the mission of CIRTl, local CIRTl leaders may find it easier to convince upper administrators to allocate resources to local CIRTl programming. However, if an institution is strongly aligned with CIRTl ideals but has extensive pre-existing professional development programs, the institution may be reluctant to partner with CIRTl, since it could be viewed as a redundant activity. Institutional context also applies to the boundary-spanning behavior of *translation*, where institutional alignment and programmatic infrastructure shape how CIRTl is integrated into local offerings and who is involved in the process. The same is true for *diffusion* activities, since institutional alignment could influence the receptivity of campus stakeholders and programmatic infrastructure could affect the number and scope of local CIRTl leaders' campus connections to whom to advertise local CIRTl programs. The major point is that local CIRTl leaders perform their boundary spanner roles within a unique organizational context that will be different for each CIRTl institution. The implication is that boundary spanners must be particularly adept at reading their institutional environment

and the ramifications associated with differing levels of institutional alignment, programmatic infrastructure, and decentralization.

Interconnectivity of Individual and Institutional Characteristics. The second implication is that individual boundary spanner characteristics and actions do not exist apart from institutional attributes described in this chapter. A local CIRTl leader's commitment to CIRTl ideals, institutional role, convergence of CIRTl and non-CIRTl duties, and managerial skills are all potentially influenced by institutional alignment, programmatic infrastructure, and decentralization. For example, if an institution is already dedicated to preparing future faculty and has strong pre-existing programs, there is a good chance that at least one of the local CIRTl leaders will have work responsibilities that overlap with CIRTl activities. In contrast, a local CIRTl leader who comes from poorly aligned institution that has limited, if any, programming may have to rely on their individual commitment to the cause and carry out CIRTl responsibilities above and beyond their regular work roles. The implication is that institutional context both shapes the parameters of boundary-spanning behaviors and influences individual characteristics that in turn help and hinder boundary-spanning activities. Thus, individual and institutional attributes are highly interconnected and collectively help to determine the boundary-spanning potential of local CIRTl leaders.

Chapter 12: Conclusion

In this final chapter, I first provide a summary of my study, which includes a brief synopsis of the study's research questions, methods, and findings. Second, I discuss the major implications of my study focused on (1) what boundary spanners gain from multi-institutional network participation, (2) what boundary spanners need to be successful, (3) the importance of team-based boundary-spanning activities, and (4) a revised conceptual framework of boundary-spanning activities. Third, I provide a set of recommendations to key education reform stakeholders and discuss future research that could build upon my work. Finally, I discuss the limitations of my study and provide a few concluding remarks.

Study Summary

Background and Research Questions

As noted in the introduction, the lack of wide-spread adoption of evidence-based teaching practices in STEM (Austin, 2011; Henderson et al., 2011) has resulted in more systemic approaches to STEM reform that emphasize the interconnectivity between colleges and universities (AAU, 2014; Austin, 2011; Coalition for Reform of Undergraduate STEM Education, 2014; Kezar, 2014). Due to this shift, multi-institutional higher education STEM reform networks have been increasingly used as a change strategy. Despite an intuitive sense that networks are effective educational reform pathways, there is limited research that supports or contradicts this assumption (Kezar, 2014).

Many have argued that institutional representatives, serving as boundary spanners, are key to securing the knowledge-sharing benefits of interorganizational membership (Agranoff, 2008; Ahuja, Soda, & Zaheer, 2012; Brass, Galaskiewicz, Greve, & Tsai, 2004). Boundary spanners are individuals who connect their organizations to the external environment and gain

valuable external knowledge to support local organizational performance (Aldrich & Herker, 1977; Brion, Chauvet, Chollet, & Moth, 2012; Katz & Tushman, 1981). Specific boundary-spanning activities include *finding* knowledge through interorganizational connections (Aldrich & Herker, 1977; Ancona & Caldwell, 1992), *translating* network gains for local application, *diffusing* knowledge and resources into their organization (Rogers, 2003), and *gaining institutional support* (Ancona & Caldwell, 1992; Faraj & Yan, 2009; Joshi et al., 2009).

Institutional representatives in multi-institutional STEM reform networks provide an important link between their network and their home college or university, yet their role as boundary spanners and in translating network participation for local implementation is not well-understood.

The purpose of my study was to explore the inter- and intra-organizational boundary-spanning roles of institutional representatives at one multi-institutional higher education STEM reform network. The Center for the Integration of Research, Teaching, and Learning (CIRTL) is a network of 43 universities that seeks to prepare graduate students to be effective teachers so they can go on to positively affect undergraduate STEM education. Specifically, my study addressed the following research questions:

1. What inter- and intra-organizational connections do formal, institutional representatives of a multi-institutional STEM reform network have (in relation to the network) and for what purposes?
2. How, if at all, do these formal institutional representatives engage in and make sense of inter- and intra-organizational boundary-spanning roles to help advance the network's reform agenda locally?

- a. What do they gain from network participation and interorganizational *finding* behaviors?
 - b. How do they *translate* network gains for application at their institution?
 - c. How do they *diffuse* network gains across their institution?
 - d. How do they *gain support* from local stakeholders to advance the STEM reform target of the network?
3. What individual and organizational attributes help or hinder their boundary-spanning activities?

Methods

I conducted four case studies of CIRTTL institutions. I based my selection criteria on the amount of time the institution had been a member of CIRTTL and the institution's depth of local CIRTTL programming. The four institutions included: (a) one long-standing institution with extensive local programming, (b) one long-standing institution with moderate-low local programming, (c) one newer institution with extensive local programming, and (d) one newer institution with moderate-low local programming. For each case institution, I identified two to three local CIRTTL leaders who acted as formal boundary spanners between their institution and the reform network ($n = 9$). I also selected individuals from CIRTTL's central administrative team and individuals at each university with whom local CIRTTL leaders had an intra-organizational connection related to CIRTTL.

Data collection consisted of a social network mapping exercise and semi-structured interviews. First, I asked local CIRTTL leaders to map their inter- and intra-organizational connections they had over the past year related to CIRTTL and to describe the type of each connection and its purpose in their STEM reform efforts. Second, I conducted 30 to 45 minute

interviews with the local CIRTl leaders to clarify their network maps. Third, I conducted a separate 45 to 90 minute semi-structured interview to discuss their boundary-spanning behaviors. Lastly, I conducted 30-45 minute interviews with participants' defined campus connections ($n = 31$) and members of the central CIRTl administrative team ($n = 4$) to triangulate network connections and boundary-spanning activities.

I used thematic analysis to examine participant social network maps and semi-structured interviews. I used Braun and Clarke's (2006) six steps of thematic analysis to guide my work. For hand-written social network maps, I reviewed each map, recorded their verbatim responses into a spreadsheet, identified the types of connections, and generated themes that summarized the major connection types. For interview transcripts, I familiarized myself with the data, generated initial codes, coded the dataset with NVivo, searched for themes within each code, coded for sub-themes, reviewed themes across the dataset (including the network maps), and finalized my findings.

Findings

In this section, I only provide a general summary of some of the major findings of my study. Please consult Chapters 4 through 11 for a more detailed account.

Research Question 1: Connections. I found that local CIRTl leaders reported four major types of interorganizational connections with CIRTl members. First, *network operation* connections were defined as local CIRTl leaders interacting with other CIRTl members to help run various facets of the Network. Second, *network contributions* consisted of online, cross-network programming that member campuses provided to the Network. Third, *collaboration* referred to engagement with CIRTl members outside of regular Network operations. Lastly,

knowledge exchange related to specific interactions where local CIRTl leaders shared information or resources with their CIRTl colleagues.

I found that local CIRTl leaders engaged in three main types of intra-organizational connections. First, *programmatic connections* involved local CIRTl leaders working with various campus stakeholders to plan, implement, and evaluate local CIRTl programming. Second, *administrative connections* consisted of local CIRTl leaders keeping upper administrators informed of local CIRTl activities and either maintaining or gaining their support. Third, *academic connections* involved efforts to gain support for local CIRTl programs from stakeholders in academic units (e.g., deans, department chairs, faculty, graduate students), which included advertising local opportunities and convincing academic leaders and faculty to recognize the value of CIRTl.

Research Question 2: Boundary-Spanning Behaviors. Local CIRTl leaders, acting as formal institutional representatives, engaged in the boundary-spanning behaviors of *finding*, *diffusion*, *translation*, and *gaining institutional support* as described in the literature. Although I remained open to additional boundary-spanning behaviors during data collection and analysis, the boundary-spanning activities of local CIRTl leaders were congruent with my literature synthesis. This finding demonstrates that there are similarities in boundary-spanning behaviors across different organizational settings. The purposes for engaging in boundary-spanning activities may be different (e.g., reform versus profit oriented), but the basic mechanisms are comparable.

With respect to *finding*, leaders and co-leaders were the major conduit (although not the only conduit) for acquiring the benefits of CIRTl participation. Individual benefits consisted of gaining a supportive, likeminded community, an extended professional network, and career

advancement and professional development. Institutional benefits, centered on building local CIRTl programming, involved increased social capital through CIRTl participation, funding, CIRTl products, and programmatic resources. Motivations to engage in *finding* activities were dependent upon what leaders and co-leaders perceived as potential benefits, both personally and for their institution.

Local CIRTl leaders were also the primary mechanism for *diffusing* the benefits of Network participation into their campuses. They diffused CIRTl into their institutions by sharing network gains with their local CIRTl team, keeping campus leaders informed of CIRTl activities, and advertising CIRTl programs. Each communicative channel affected the local CIRTl team's ability to translate CIRTl locally and gain support from administrative and academic campus units. Other individuals on campus also participated in diffusion activities, such as advisory board members and student advocates, who helped spread the word about CIRTl and marketed local and national CIRTl offerings.

Translation was the epicenter for all boundary-spanning behaviors. Leaders and co-leaders (and their local teams) had to make sense of what was available through CIRTl participation, with whom to share certain kinds of CIRTl-related information, and how to integrate CIRTl content into existing local programming. They and their teams also had to determine the best strategies to inform and convince campus leaders and other stakeholders of the importance and value of being in the CIRTl Network and efforts to prepare future faculty as effective teachers.

Lastly, local CIRTl leaders (and their local teams) routinely worked to *gain support* from academic and administrative units. They used their formal institutional roles, social capital, the advisory board, personal and professional connections, and extensive marketing strategies to

seek support for and participation in local CIRTl programs. They also used their formal campus positions to show upper administrators the value of CIRTl membership and to update campus leaders on the progress of local CIRTl efforts. Overall, I found that local CIRTl leaders had to utilize a mixed set of *gaining support* strategies that involved many other campus colleagues to broaden their reach into diverse and decentralized campus units.

Research Question 3: Factors that Help or Hinder Boundary Spanning. At the individual level, there were four major individual attributes that influenced boundary-spanning behaviors. First, I found that commitment to the reform ideals of CIRTl shaped how and why local CIRTl leaders engaged in the four boundary-spanning behaviors. Second, I found that institutional roles contextualized boundary-spanning behaviors by providing varying amounts of decision-making and access to key campus constituents. Third, the degree to which CIRTl aligned with other work roles and responsibilities significantly shaped boundary-spanning activities. Lastly, managerial skills in the form of delegating local CIRTl responsibilities and reading the institutional landscape were vital skills in developing and running local CIRTl programs.

My study also revealed three key institutional factors that influenced boundary-spanning behaviors. First, I found that it was important for institutional goals and priorities to align with the mission of the CIRTl Network. Second, programmatic infrastructure, in the form of pre-existing programs and a local team with members from key campus units, was the foundation for building and sustaining local CIRTl programs. Lastly, I found that decentralization, due to campus unit autonomy, greatly expanded the organizational boundaries that local CIRTl leaders had to span in order to advance local CIRTl efforts.

Discussion and Implications

In this section, my goal is to present the four most salient implications of my study, both for research and practice. The four implications include: what individuals gain from boundary-spanning activities, what skills and dispositions are needed to be a boundary spanning, the importance of team-based boundary-spanning activities, and a revised conceptual framework that modifies the interplay between the four boundary-spanning activities, Crossan et al.'s (1999) 4I framework, and four STEM reform categories (Henderson et al., 2011).

Why would you want to be a boundary spanner?

As noted above, local CIRTTL leaders gained many individual and institutional benefits by participating in the CIRTTL Network. My intent here is not to reiterate the list of various benefits, but to instead discuss why an individual would want to become an institutional representative in a higher education network. My study demonstrated that local CIRTTL leaders were extremely busy individuals who had many pressing commitments and responsibilities. Why would someone like this take the time to engage in a network such as CIRTTL? To frame this discussion, I talk about the mixed motivations of institutional representatives, a sense of community, and interorganizational knowledge exchange.

Mixed Motivation. Local CIRTTL leaders were complex individuals who had individual and organizational goals and motivations. March (1991) and Lavie et al. (2010) described organizations as either displaying explorative and exploitative behaviors. While the authors originally applied these dispositions to the organizational level, they are equally applicable to institutional representatives (i.e., local CIRTTL leaders). First, if an institutional representative displayed explorative qualities, they would have a disposition for outward seeking behaviors that extend beyond the confines of their organization. Second, if an institutional representative

displayed exploitative qualities, they would be content with what they already had within their organization. Local CIRTTL leaders simultaneously engaged in explorative and exploitative behaviors. For instance, consider a local CIRTTL leader who views CIRTTL as a source for professional growth and development but rarely extracts knowledge from the Network to build their local community because they consider their programs to already be strong. In contrast, consider a local CIRTTL leader who only has institutional motivations and wants to gain network knowledge and resources for their institution. Both polar examples demonstrate that a local CIRTTL leader can engage in explorative and exploitative behaviors at the same time, depending on the mix of individual and institutional goals.

My study also showed that local CIRTTL leaders were simultaneously motivated by individual and institutional goals. For example, a local CIRTTL leader could care deeply about preparing future faculty as effective teachers, their formal institutional role responsibilities could involve creating and implementing teaching professional development, and their institutions could fully support the advancement of teaching. Another local CIRTTL leader could share the same degree of devotion to preparing future faculty, but lack a work role directly related to teaching professional development and be at an institution with minimal desire to improve graduate student education. Each of these factors combine to form and influence a blend of motivation specific to the local CIRTTL leader and their unique organizational context. In addition, the mix of motivation is dynamic and can change due to factors such as a change in role or position and shifting individual or institutional values and mission.

The implication is that institutional representatives enter interorganizational connections as complex individuals who are not merely representatives for their organization. They also have individual desires and interests that shape their network participation. Multi-institutional

networks need to realize this and purposively design the community to engage, meet, and build upon individual and institutional interests, realizing that there is not a single mold for an institutional representative. In the next section, I highlight two important incentivizing agents that can appeal to both individual and institutional motivators.

Sense of Community and Knowledge Sharing Benefits. As I mentioned in Chapter 2, multi-institutional networks can be conceptualized as communities of practice, since members share a common purpose, work and interact regularly, and work together to advance their specific practice (Wenger et al., 2002), which in the case of CIRTTL is teaching professional development for future faculty. My study showed that CIRTTL was indeed a vibrant community of practice that espoused collegial interactions and, congruent with the literature (e.g., Ahuja, Soda, & Zaheer, 2012; Brass et al., 2004; Hemmasi & Csanda, 2009; Kirkman et al., 2011; McDermott & Archibald, 2010), had an active knowledge sharing culture.

The benefits of network participation for individual local CIRTTL leaders and their institutions came from integrating into the community through the four types of interorganizational connections described in previous chapters. Yet, local CIRTTL leaders in my study had varying degrees of network participation and often concentrated their efforts on certain types of interorganizational connections. For example, a few leaders narrowly focused on connections that they believed would have direct benefits for their institution and disregarded most network-level activities (e.g., serving on committees). This approach assumes that network benefits are packaged commodities, where a local CIRTTL leader could “shop around” until they found a specific kernel of knowledge or resource that fit individual or institutional needs. While this demonstrates one aspect of finding behaviors, it ignores the greater benefits that could result from deeper participation in the community of practice.

Expanded participation across the four types of interorganizational connections allowed local CIRTTL leaders to develop strong professional relationships and a network of potential knowledge- and/or resource-sharing connections. Viewed from this perspective, community of practice participation offers its members actual and potential, direct and indirect, knowledge-sharing benefits. Institutional representatives who only scan the surface of the community for information to immediately affect their home campus potentially miss out on deeper levels of knowledge exchange and the collective advancement of practice. While there is an increased time commitment associated with expanded network participation, it is possible to align network activities with individual and institutional motivators. This requires that institutional representatives see and understand the potential value of increased participation and that benefits may not be immediate. It also requires that network participation be viewed as an opportunity to engage in an active, dynamic community pushing for collective action.

Another implication of viewing the network as a community of practice is that knowledge- and/or resource-sharing benefits are non-linear and instead represent the connective potential of their interorganizational ties. Put another way, the extent of network connections influences their social capital or “the goodwill available to individuals or groups [that comes from]...the structure and content of the actor’s social relations [that]...flow from the information, influence, and solidarity it makes available to the actor” (Adler & Kwon, 2002, p. 23). Local CIRTTL leaders who develop many different interorganizational connections in the Network can draw upon those connections as individual and institutional circumstances dictate over time. In short, as local CIRTTL leaders move from the periphery to core of the community of practice, they potentially increase the potential benefits of network participation if viewed from a longitudinal perspective.

In closing, an individual thinking about taking on the role of an institutional representative in a multi-institutional STEM reform network should examine their individual motivations and what they expect to gain for their institutions. They should ask questions such as “Am I committed to the reform goal of the network,” “Will network participation benefit my career and professional aspirations,” “Will the network inform or improve my on-campus responsibilities,” and “Will involvement provide knowledge and resources of worth and value to my institution.” In addition, potential institutional representatives should weigh their individual and institutional motivators against short-term and long-term gains of network participation. They should also understand that reform networks operate as communities of practice and that their membership is not just a means of knowledge and resource access but an opportunity to join a collective change effort. Personal, professional, and institutional benefits are all contingent upon the quality and extent of an institutional representative’s interorganizational connections. It is possible to secure short-term, immediate benefits, but “information, influence, and solidarity” build over time through community of practice involvement.

What does it take to be a boundary spanner?

Beyond articulating the factors that help or hinder boundary-spanning behaviors, my study also revealed several important characteristics of boundary spanners. My goal is not to articulate the “ideal” boundary spanner but to discuss several key characteristics that increase the likelihood of success, knowing that such characteristics may be spread among multiple institutional representatives or local team members.

Committed and Passionate. The first quality is that boundary spanners must genuinely care about the reform mission of a multi-institutional STEM reform network. This was the most consistent trait of local CIRTl leaders. It served as a major individual motivator and shaped the

functioning of CIRTTL as a community of practice. Local CIRTTL leaders were extremely busy people who had many work role responsibilities outside of their CIRTTL duties. Despite time limitations, they still chose to attend network meetings and develop and run their local CIRTTL programs, at times without any compensation. They all felt strongly about the importance of preparing future faculty as effective college instructors and used that passion to fuel their network participation.

Other institutional representatives in interorganizational networks (i.e., not education reform-centric) undoubtedly share the quality of commitment and passion, but their zeal would likely concentrate on their home institution. Institutional representatives in an education reform network have a broader purpose, demonstrating commitment to their college or university, the campus units with which they affiliate, and the cause or reform mission of the network. Harking back to mixed motivations, institutional representatives in multi-institutional reform networks have multiple loyalties. Yet, I argue that their commitment to the reform ideal of the network is the most prominent influencing factor for their boundary-spanning activities. If we were to strip away reform commitment, institutional representatives would only participate in a reform network or engage in intra-organizational boundary-spanning behaviors if their respective work roles or organization incentivized or required their participation. Thus, the heart of boundary spanning for reform purposes is the commitment and passion for the reform itself.

Change Leader. Boundary spanners must also be change leaders on their respective campuses. They can be change leaders who utilize a top-down, planned approach (Bess & Dee, 2008b; Eckel, Hill, Green, & Mallon, 1999) and/or advance change through more grassroots-oriented methods (Kezar, 2011b). To help advance change from a top-down level, boundary spanners must possess at least some degree of decision-making authority, be well-connected, be

able to communicate the need for change to campus constituents, and understand their campus context and how it may influence change efforts. Similarly, from a grassroots level, boundary spanners must also be well-connected since they are not necessarily able to draw upon campus authority to diffuse information or garner support for change. However, my study demonstrated that local CIRTTL leaders often worked at both ends of the change spectrum due to their extensive informal ties on campus and their formal institutional positions. In addition, change efforts embedded in boundary-spanning activities were performed by many of the members of the local CIRTTL team, suggesting that change leadership was very much a distributed activity. Regardless of who performed change leadership duties, the common theme was that boundary spanners were change leaders on campus and that their boundary-spanning activities were a direct extension of change efforts.

Learning Leader. Related to organizational change, I found that local CIRTTL leaders were also closely connected to organizational learning because of their boundary spanner activities. As I pointed out in my conceptual framework, each of the four major boundary-spanning activities line up with the components of Crossan et al.'s (1999) 4I framework. Boundary spanners need to be able to intuit potential learning gains from network participation, weighing individual and institutional motivators to guide their finding behaviors. They must also be able to interpret knowledge gained from the network, both individually and with a local team, and determine the best way to apply that knowledge locally. In addition, boundary spanners can use their varied campus connections to integrate learning gains across campus by diffusing that knowledge and engaging in effective dialogue. Lastly, they can help to institutionalize learning gains through their formal institutional roles or through ongoing campus interactions. In short,

boundary spanners can participate in all four levels of organizational learning, though they may have less direct ownership of the integration and institutionalization levels.

Connected. Being an organizational change and/or learning leader is highly dependent upon intra-organizational connections (Brands, 2013; Dyer and Nobeoka, 2000; Gherardi et al., 1998; Hansen, 1999; Mohrman et al., 2003; Phelps et al., 2012; Tenkasi & Chesmore, 2003; Tsai, 2001). In addition, there are benefits of both strong and weak ties (Ahuja, 2000; Burt, 1992; Granovetter, 1983; Krackhardt, 1992; Tiwana, 2008). The implication for boundary spanners is that their reach and effectiveness is contingent upon their on-campus connections, which are a direct result of their formal institutional roles, faculty affiliations, and informal relationships. A boundary spanner with minimal campus connections will find it especially challenging to diffuse network gains and garner support from administrative and academic units. However, campus connections are not a factor of just a small amount of multi-institutional representatives. Instead, the local team attached to the particular reform agenda of the network represents a comprehensive connective potential. Thus, boundary spanners must not only take stock of their individual strong and weak ties on campus but also map the connections of those similarly engaged in the same local reform effort. A single boundary spanner will reach a connective saturation point and must rely on others to maximize reach for organizational learning and change efforts.

Time Management. Lastly, as evidenced in prior literature (Boardman & Bozeman, 2007; Friedman & Podolny, 1992; Johlke & Duhan, 2001; Organ, 1971; Stamper & Johlke, 2003), boundary spanners simultaneously interact in multiple organizational contexts and lack sufficient time to solely focus on their network involvement or responsibilities. They have to balance parallel and possibly competing work demands, not to mention familial duties. The

implication is that boundary spanners need to find ways to align their other work responsibilities or at least have their activities serve dualistic purposes. They can also coordinate with other boundary spanners to distribute boundary-spanning activities that match time availability. In summary, boundary spanners must be able to seriously examine their current responsibilities, what they can realistically do, and then carve out time for inter- and intra-organizational connections.

Can boundary spanners do it alone?

In line with the last section, my findings repeatedly showed that two or three institutional representatives could not be responsible for or even carry out all boundary-spanning behaviors. Instead, the boundary-spanning behaviors of *finding*, *diffusion*, *translation*, and *gaining institutional support* were distributed amongst local CIRTTL leaders and their local CIRTTL team. Local CIRTTL leaders were definitely the primary boundary spanners given their direct interorganizational connect to CIRTTL, but at the local level in particular, they were one of many attempting to embed CIRTTL into local reform efforts or advance local change initiatives.

Diversified and Expanded Reach. There are many benefits to a distributed boundary-spanning model. For instance, local reform efforts can draw upon the diverse experiences and connections of the local team to gain audience with administrative and academic units. No singular boundary spanner, regardless of their role and institutional authority, can develop effective connections with everyone on campus. A distributed approach provides multiple inlets into campus units and utilizes the existing social capital of team members. In addition, because of differences between top-down and grassroots change, certain local team members would conceivably gain more traction than others because of their formal institutional appointment or

existing professional relationships. In short, a team-based boundary-spanning approach allows a campus to build a tapestry of connections versus relying on a few thick cords.

In order for a team-based boundary-spanning approach to work, individual boundary spanners have to coordinate their efforts. The CIRTTL institutions in my study often used an advisory committee to accomplish this goal, since they could meet together regularly and make decisions regarding local programs, advertising, and gaining support from key players or units. However, it was obvious that these advisory boards were not always thinking about boundary-spanning activities. Instead, they were focused on accomplishing certain tasks that had implicit boundary-spanning implications. These groups may improve their ability to coordinate connections and activities by mapping their intra-organizational connections in light of their organizational change and learning goals (McGrath & Krackhardt, 2003; Quardokus & Henderson, 2015). This process could identify connective gaps in key units or even key players who would be good additions to the local team. The main point is that boundary spanners must find a way to coordinate their boundary-spanning behaviors to maximize their reach across campus and energize their short- and long-term reform goals.

There are also implications for interorganizational connections. For the most part, there were two or three connections to the CIRTTL Network from the four participating institutions (i.e., the local CIRTTL leaders). A few study participants discussed the problematic nature of this structure, since it could create a bottleneck of information. Instead, they suggested that institutions participating in multi-institutional STEM reform networks should have multiple local representatives engaged in the network. Going back to the tapestry or quilt metaphor, by building more than two or three inter-organization connection points, institutions would be able to garner the expanded reach and perspectives of multiple campus representatives. Each institutional

representative has a mix of individual and institutional motivators that shape their finding behaviors. By diversifying network participation, there would be a greater chance for novel or useful information to enter the institution. It was not clear what the magic number would be (e.g., 5, 10, etc.), but my findings suggested that expanding network involvement could generate more chances for individuals to engage in the multi-faceted interorganizational connection types, thereby increasing connective potential.

A Revised Conceptual Framework

My conceptual framework in Chapter 2 was an effective way to frame my study and create data collection instruments. My framework consisted of four primary boundary spanners extracted from the literature (*finding*, *diffusion*, *translation*, and *gaining institutional support*), Crossan et al.'s (1999) 4I organizational learning framework (intuit, interpret, integrate, and institutionalize), and Henderson et al.'s (2011) four categories of institutional STEM reform (disseminate best practices, develop reflective practitioners, create shared vision, and enact policies). The four boundary-spanning behaviors aligned with elements of the 4I framework (e.g., finding/intuiting) and led to various types of STEM education reform. However, in the process of data analysis, it was apparent that a few modifications to the framework were needed to accurately account for the CIRTL case and inter- and intra-organizational boundary spanning.

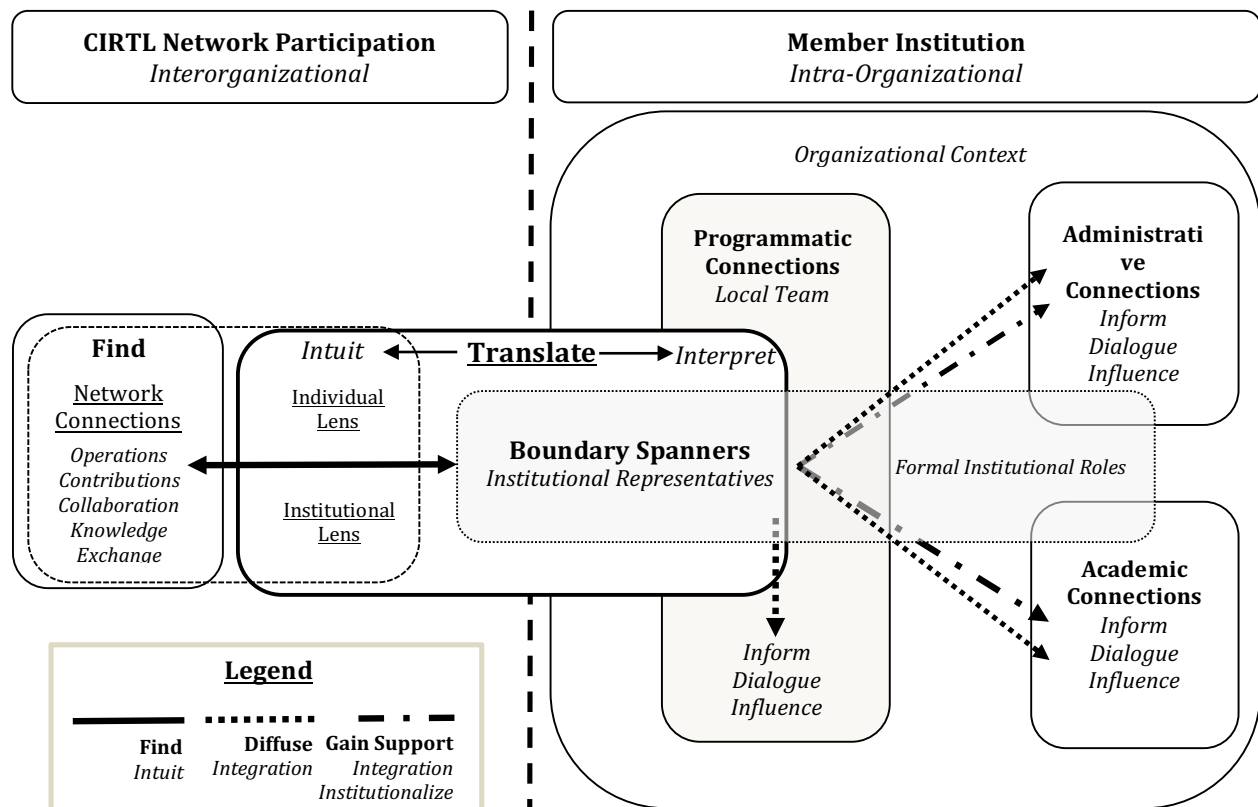
Translation. My study showed that *translation* was central to the boundary-spanning activities of local CIRTL leaders. It influenced what they found from Network participation, how they diffused CIRTL information across campus, and even how they attempted to gain support from campus stakeholders and units. Initially, I linked the behavior of *translation* to the *interpretation* component in the 4I framework (Crossan et al., 1999). However, my findings suggested that *translation* was really a product of both *intuiting* and *interpreting*.

Boundary spanners (institutional representatives) occupy a unique space between the network and their home institution. In order to participate in finding behaviors, they must intuit potential knowledge from network participation through their specific individual and institutional lenses. For instance, personal (e.g., career advancement) and institutional goals (e.g., improve their local CIRTl program) could influence what a local CIRTl leader sees in the network and what they seek from their network connections. Even before they actually find something of worth or interest in the network, they must carry out a preliminary translative activity. Another way to describe this process is that local CIRTl leaders likely establish a sort of cognitive filter, based upon needs, interests, and goals. This filter shapes their decisions to engage in various types of network connections and what they seek from the network and network members. In short, as local CIRTl leaders enter interorganizational space, they initially translate and intuit potential learning gains that they can find and bring back to their home campuses.

Once local CIRTl leaders identify or intuit something to be of worth to them individually or institutionally, they bring that new knowledge to the other side of translation, namely, *interpretation*. Before they cross the interorganizational/intra-organizational divide, local CIRTl leaders take their newly acquired network gains through the same individual and institutional lens to make key decisions on how such knowledge could be applied at the local level. They also share their network learning with key campus staff and work with a local team to further translate Network gains for their local programs. In the diagram, a local CIRTl leader's programmatic connections (those with whom he or she shares network knowledge gains and engages in translation activities) intersect with the translation box to demonstrate that translation and interpretation activities occur simultaneously at individual and group levels.

In addition, formal institutional roles extend from the translation box across the rest of the framework. I found that institutional roles were a major shaping agent for intra-organizational boundary-spanning behaviors, both for local CIRTTL leaders and their local teams. I also found that organizational context (depicted in the large encompassing square) highly influenced local boundary-spanning activities. Overall, translation activities were not only a product of individual and group interpretation intersections, but were embedded within individual and institutional context.

Figure 6: A Revised Boundary-Spanning Framework



Finding. As mentioned above, the behavior of *translation* was aligned with both the intuition and interpretation components of the 4I framework. *Finding* was also found to be an intuiting activity. I found that local CIRTTL leaders engaged in four major types of interorganizational connections: network operations, network contributions, collaboration, and

knowledge exchange. Each connection type represented a potential node where local CIRTl leaders could apply their cognitive filters to extract useful knowledge or resources. As local CIRTl leaders engaged in these relationships, they brought their translative lenses to discern what is of value and what warrants further consideration or action. Thus, intuiting involved the boundary-spanning behaviors of *finding* and *translation*.

Programmatic Connections. My initial framework lacked specificity of where local CIRTl programs fit into the local boundary-spanning mix. In my study, I found that local CIRTl leaders maintained three types of connections: programmatic, administrative, and academic. For greater continuity to my findings, I incorporated each into the revised framework.

As noted above, local CIRTl team members participated in translation/interpretation activities. The local CIRTl leaders *informed* the local team of national CIRTl progress, novel information, and resources, which closely aligns with the boundary-spanning behavior of diffusion and Henderson et al.'s (2011) reform category of the dissemination of best practices. The local CIRTl leaders (in some cases other institutional representatives) served as the primary link to the CIRTl Network and diffused CIRTl content into local CIRTl programs.

In addition, local CIRTl leaders engaged their local programmatic teams in *dialogue* about CIRTl, the preparation of future faculty, and ways to augment and improve their local offerings. This closely aligns with Henderson et al.'s reform category of developing reflective practitioners, where local CIRTl leaders used CIRTl as a means to advance the conversation of graduate student professional development amongst those that plan, implement, and evaluate these programs.

Lastly, local CIRTl leaders' connection to their programmatic teams not only represented a chance for fruitful dialogue but provided a chance to *influence* local programs. For

instance, local CIRTl leaders and their respective teams translated CIRTl's learning outcomes and achievement levels or made other changes to their programs as result of their network participation. Thus, local CIRTl leaders' network participation and individual and group-based translation activities resulted in opportunities to *inform*, *dialogue*, and *influence* local efforts to prepare future faculty.

Administrative and Academic Connections. In the diagram, I represented diffusion and gaining institutional support activities by two different types of arrows. Unlike the initial model, I purposively placed the origin of these arrows at the intersection point between programmatic connections, the boundary spanner, and translation boxes. Decisions to engage in diffusion and gaining support were often a direct extension of translation activities, where local CIRTl leaders and their teams made key decisions as to when, where, and how to engage in these activities. In addition, local CIRTl leaders were not the only ones to interact with administrative and academic units. Furthermore, the *diffusion* and *gaining institutional support* lines travel through the formal institutional roles box, demonstrating that the ability to engage in these behaviors is often a result of institutional roles and existing social capital.

For the diffusion arrows, I retained their connection to the integration component of the 4I framework. Diffusion was a major means for local CIRTl leaders and their team members to share information or knowledge about CIRTl with other campus units in hopes that organizational learning realized at the programmatic level would disseminate out into other campus units. For gaining institutional support, I changed it to align with the 4I framework components of integration and institutionalization, since gaining support could consist of embedding knowledge within campus units and working to routinize learning gains into everyday practice.

I also included the same set of outcomes as the programmatic connections box. First, local CIRTl leaders (or members of their local team) *informed* administrative or academic stakeholders/units of CIRTl information or opportunities, which aligned with the dissemination of best practices of Henderson et al.'s (2011) model. However, intra-organizational boundary spanners were not always relating a specific best practice. Instead, they would inform campus leaders of local progress, explain what CIRTl was and how it could help, and tell faculty and graduate students about programmatic opportunities.

Beyond simply sharing CIRTl-related content, local CIRTl leaders (and team members) had the opportunity to engage campus stakeholders in dialogue about the importance of preparing future faculty, the need and utility for professional development programs, and how individuals could get involved. This process roughly translates to developing reflective practitioners (Henderson et al., 2011). Local CIRTl leaders (and their teams) were able to use or could potentially use CIRTl as a means to advance conversations surrounding STEM education reform with administrators, academic leaders (department chairs, deans), faculty, and graduate students.

Lastly, I truncated the creating a shared vision and enacting policies components (Henderson et al., 2011) in the initial framework because diffusion and gaining support behaviors in this study were more aptly described as mechanisms of influence than absolute directive actions. Yet, by engaging in diffusion and gaining support activities, local CIRTl leaders could influence a shared vision of the importance of preparing future faculty as effective teachers by engaging colleagues and connections in fruitful dialogue. They could also slowly influence policies and practices surrounding professional development opportunities for graduate students. Most local CIRTl leaders were not in a position to singlehandedly change policy on

campus (e.g., they could not just flip a switch to change tenure and promotion criteria), but they could influence key campus leaders. Thus, local CIRTl leaders could *inform*, *dialogue*, and *influence* administrative and academic units through their boundary-spanning roles.

Broader Theory. While my revised framework is specific to CIRTl institutions, it has theoretical value for other higher education reform networks, especially those that focus on professional development programming. Institutional representatives of other networks likely must engage in translation activities to both intuit what they may find through multiple types of interorganizational connections and to translate any knowledge/resource gains for their campus. In addition, it is unlikely that they would be the only ones involved locally with the particular reform focus of the network. They might have a local team to aid in translation activities that would inform local efforts, create beneficial dialogue amongst practitioners, and influence and improve local programs. To create widespread impact, they and their teams would have to develop connections with administrative and academic units, as direct extensions of their institutional roles, to diffuse network gains and to convince campus groups of the importance of the reform agenda. Through these connections they would be able to inform, dialogue, and influence. In short, my revised framework could easily transfer to other multi-institutional higher education reform networks because it describes the interplay between boundary-spanning behaviors, organizational learning, and reform targets.

Recommendations

The findings and implications of my study can inform several groups of constituents involved in STEM education reform and higher education networks. First, I recommend that institutional representatives in higher education networks use the results of my study to examine their own boundary-spanning behaviors and to reflect upon their network engagement, their local

institutional roles, their on-campus connections, their interaction with a local education reform team, and how they perform *finding*, *translation*, *diffusion*, and *gaining institutional support* functions.

Second, I likewise encourage leaders of multi-institutional networks (such as CIRTl) to examine how their members engage in boundary-spanning activities and to purposively select a team of institutional representatives that possess positive boundary-spanning attributes. Related to that, I recommend that multi-institutional networks provide professional development opportunities for their members that are designed to help them explore their inter- and intra-organizational connections related to the network, assess their local team dynamic and institutional context, and identify what connections they need to create and how they could develop them.

Third, I recommend that campus leaders use my findings as a means to justify multi-institutional network involvement and to reassess their resource allocation to properly support boundary spanners. By better understanding the dynamics of local boundary-spanning behaviors, campus leaders could help overcome obstacles and become additional connective nodes in advancing local reform efforts.

Fourth, I encourage funding agencies and donors to explore the complexity of educational reform using a networked approach and identify funded projects that increase the finding benefits of network participation, improve or support the translation of network gains for local implementation, aid the diffusion of network learning or products into participating campuses, and provide tools and resources for boundary spanners to gain the support from administrative and academic units on campus. My hope is that funders will be able to reference my study to target interventions that will increase the impact of higher education networks. In

summary, I recommend that multiple constituency groups use my study as a means to more fully understand one major avenue of network impact and to identify ways to improve the effectiveness of boundary spanners.

Limitations

The first limitation of this study was that it was limited to the CIRTl Network and the universities involved in the study. While my methods provided ample depth to explore inter- and intra-organizational boundary spanning, the study's findings were context specific and may not apply to other networks or higher education institutions. This does not mean transferability is not possible, just that the specific findings of a case study are bound to the case it describes or analyzes (Yin, 2014). Thus, my study was not meant to be a comprehensive account of everything that has to do with boundary spanning and its connection to local STEM reform. Instead, it was an initial exploration, which could inform future research on the role of boundary spanning and its influence on local STEM undergraduate education reform.

Second, time was a major limitation. Boundary spanning is dynamic, since, in a given year, a local CIRTl leader may be more or less engaged in certain boundary-spanning behaviors. I collected data at one point in time, which did not take into account the historical and longitudinal nature of boundary spanning in relation to STEM reform efforts. I addressed some of this by selecting institutions that have been involved with CIRTl for varying amounts of time, selecting institutions that have varying levels of CIRTl programming, and by having respondents reflect upon their entire time within the CIRTl Network. However, this did not remove all time-bound concerns. For example, interview protocol questions did not probe enough about why the four campuses decided to join the CIRTl Network and how those decisions shaped initial and ongoing connections with the national network or the development

of local CIRTTL programming. In addition, I did not collect institutional documents (e.g., meeting agendas) that could have captured some of the temporal elements of local CIRTTL dynamics over time. Thus, the findings of this study are further constrained to a specific point in time versus a holistic view of boundary-spanning behaviors over time. Despite this limitation, future studies will be able to build upon my descriptive work and frame additional studies to factor in this missing element.

The third limitation is related to reliability issues. For example, since every named campus connection of local CIRTTL leaders at my four case institutions did not participate in my study, there may be important information missing that could confirm or contradict the responses from other participants. Participants may have attempted to “save face” by focusing more on the positive aspects of their CIRTTL involvement or local CIRTTL dynamics. Interviewees may not have had much chance, prior to the interview, to think about their boundary-spanning roles. Each of these concerns could shape the reliability of my data and subsequent analysis.

Future Research

My study deeply explored the role of institutional representatives as boundary spanners in a specific higher education network. Given my study’s focus on a single network and the exploratory nature of the study, there are many additional lines of research that could be explored in the future. For instance, future work could take my conceptual framework and findings and conduct similar studies with other higher education networks (STEM and non-STEM specific) to further examine boundary-spanning behaviors and to see if the same mechanisms applied in each network case. Future work could also use my qualitative, exploratory findings to generate survey instruments to measure network and institutional characteristics that help or hinder the boundary-spanning process and the impact of boundary-

spanning activities on local education reform. These types of studies would greatly expand the transferability of my study and help identify general and network-specific aspects of boundary-spanning activities.

Future work could more fully examine the impact that STEM network participation has on participating campuses, both through key boundary-spanning individuals and other network impact mechanisms. My study primarily focused on an important change mechanism, but I was unable to investigate actual, measured impact of network participation on member campuses. Future studies could concentrate on changes that occur because of network membership and boundary-spanning activities of institutional representatives and their local organizational teams.

Related to measured impact and change, future studies could also more fully explore local institutional dynamics including elements such as (1) the social construction of a local reform community and subsequent knowledge, products, and programs; (2) local organizational context; and (3) the balance between national network involvement and local autonomy. The exploration of local institutional dynamics (as related to network involvement) would address the temporal limitations of my study by including multiple rounds of data collection (including perceptions of the past by participants), expanding data collection strategies (e.g., interviews, social network data, documents, observations and site visits), expanding the number of participants, and better triangulating data to demonstrate similarities and differences among institutional representatives that engage in the national network, their local reform teams, and other campus stakeholders. Another direction could be to more fully examine group-based intra-organizational boundary spanning and see how campus leaders and constituents draw upon their varied positions and connections to advance education reform. My study demonstrated the

importance of the team in local boundary spanning, but future work could focus greater attention on team-based processes.

In addition, another line of research could track, using quantitative and qualitative social network methods, boundary-spanning activities over time to see how boundary-spanning behaviors change as a result of shifting priorities, positions, institutional culture, varying levels of network participation, and so forth. Future research questions could also focus on individuals that maintain membership in multiple higher education networks and other interorganizational connections related to STEM reform. My study focused on the CIRTl Network but many local CIRTl leaders had connections to similar initiatives that could have shaped their boundary-spanning activities and local reform activities.

Lastly, another study could explore the similarities and differences between the social capital derived from multi-institutional network participation and the social capital that comes from institutional work roles and existing professional connections. My study demonstrated the importance of both types of social capital for boundary-spanning activities, but it primarily focused on the social capital of the individual boundary spanners. It may also be possible for social capital to be defined and applied at the institutional level. Future studies could explore this dynamic in relation to multi-institutional network membership.

In summary, there are numerous research tracks that could be explored to investigate the mechanisms by which multi-institutional networks and associated institutional representatives influence local education reform.

Conclusion

Institutional representatives in multi-institutional higher education STEM reform networks perform a key boundary-spanning role by linking their campus to an

interorganizational community of practice. I studied four member institutions of the Center for the Integration of Research, Teaching, and Learning to examine what inter- and intra-organizational connections they had with respect to CIRTTL, how they made sense of their boundary-spanning roles, and what helped or hindered their boundary-spanning activities. Local CIRTTL leaders maintained several types of interorganizational connections related to network operations, network contributions, collaboration, and knowledge exchange. Due to these connections, they *found* numerous individual and institutional benefits and worked with their local teams to *translate* network gains for local implementation. They *diffused* network-related information to and *gained institutional support* from administrative and academic units and stakeholders. There were multiple individual and institutional attributes that influenced boundary-spanning behaviors. At the individual level, factors such as commitment, institutional role, role alignment, and managerial skills shaped how local CIRTTL leaders engaged in boundary-spanning roles. Institutional factors such as alignment with the purposes of CIRTTL, programmatic infrastructure, and decentralized likewise played a major influencing role on boundary-spanning activities. In summary, my study demonstrated the complexity and integration of the four primary boundary-spanning activities of local CIRTTL leaders in service to local STEM reform. They were able to inform campus groups and units, advance a dialogue of the importance of preparing future faculty, and influence local policies and practices.

APPENDICES

Appendix I: Directions for Qualitative Social Network Mapping Exercise

Map of CIRTTL-Related Connections

My study explores how CIRTTL institutional leaders and co-leaders engage in and make sense of their boundary-spanning roles (related to STEM reform) both within the network and within their home college/university. Boundary spanners are individuals who connect their institution to the external environment and gain valuable external knowledge to support local organizational performance. Specific behaviors of a boundary spanner can include: (1) locating knowledge and best practices; (2) making sense of what they learn for their unique institutional context; (3) sharing what they learn across their institution; and (4) gaining institutional support. The **purpose of this activity** is for you to map your connections related to the CIRTTL Network in order to better understand boundary-spanning roles and behaviors related to STEM reform.

Directions

1. **Review** the questions on the following page regarding your connections outside of and within your institution related to CIRTTL and your local CIRTTL learning community.
2. **Record** your connections *related to CIRTTL* on the large sheet of paper enclosed. Your name will be printed in the center of the paper. On the left, include interactions that you have had outside of your institution. On the right, include interactions that you have had inside your institution (including the CIRTTL institutional leader or co-leader). For each connection:
 - a. **Record** their name. Please include first and last names.
 - b. **Draw** a line from your circle to the individual and use arrows to represent the direction(s) of the connection (e.g., I received knowledge... would warrant an arrow from the individual to you. See the example connection map enclosed).
 - c. **Record** their institution/organization for interactions outside your institution **or** record their campus unit and position for interactions inside of your institution.
 - d. **Record** the type(s) of interaction(s) you have had with this person (e.g., I received materials, I shared ideas, I asked for funding, we collaborated on a project, etc.).
 - e. **Record** the purpose or role the connection has had in advancing your local CIRTTL programming (e.g., it helped me improve the assessment of student learning, I increased buy-in with faculty on my campus).
3. **Reflect** on all of your connections and add or revise where appropriate.
4. **Return** the study materials via the self-addressed envelope by **Nov 19th**.

Comments

- You will likely not be able (or want) to record every connection you have had in relation to CIRTTL. **Please focus on key connections that you believe affect or could affect your local CIRTTL programming.**
- I have included connection worksheets to use as brainstorming tools or to record additional information as needed.
- Where possible, group related connections (e.g., individuals from the same campus unit)
- Please write as legibly as possible.

Connection Questions

Connections Outside of Your Institution

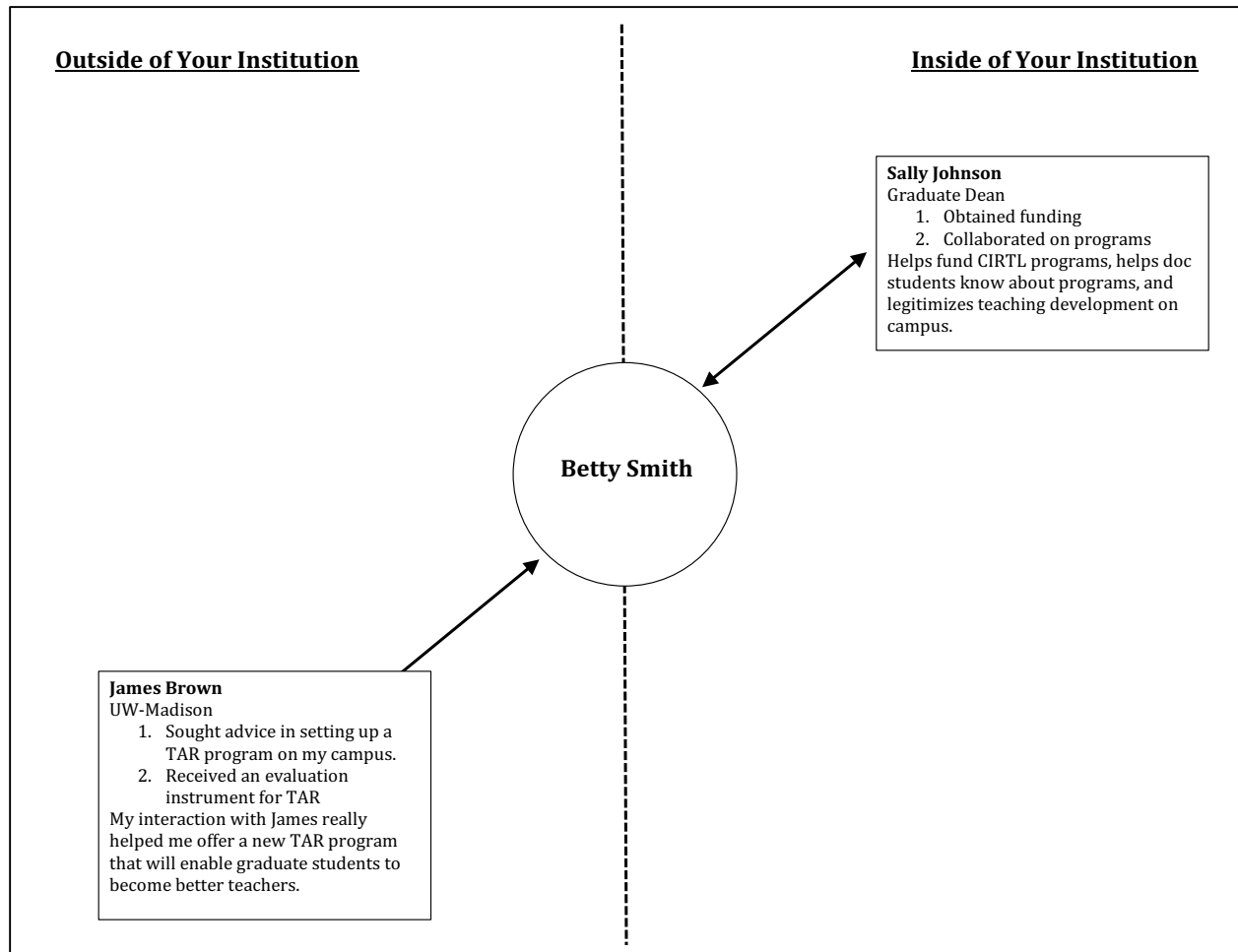
- Over the past year, with whom have you interacted **outside of your institution** specifically related to the mission of CIRTl and your local CIRTl learning community?
- For each individual, please describe the type(s) of interaction(s) or connection(s) you had? (e.g., they gave me advice, ideas, curriculum, funding, etc.)
- What purpose or role did each connection serve in advancing your local CIRTl programming related to the preparation of future faculty as effective teachers?

Connections Inside Your Institution

- Over the past year, with whom have you interacted **at your institution** specifically related to the mission of CIRTl and your local CIRTl learning community?
- For each individual, please describe the type(s) of interaction(s) or connection(s) you had? (e.g., I shared information about CIRTl with department chairs, I lobbied for increased funding...)
- What purpose did each connection serve in advancing your local CIRTl programming related to the preparation of future faculty as effective teachers?

Appendix II: Example Qualitative Mapping Exercise Participants

Figure 7: Example of Qualitative Mapping Exercise



Appendix III: Connections Worksheet – Interorganizational

Table 4: Interorganizational Connections Worksheet

Individual	Institution or Organization	Describe the type(s) of connection(s) you had? (e.g., they gave me advice, ideas, curriculum, funding, etc.)	Describe the purpose/role of the connection(s) in advancing your local CIRTl efforts.

Appendix IV: Connections Worksheet – Intra-organizational

Table 5: Intra-organizational Connections Worksheet

Individual	Position & Campus Unit	Describe the type(s) of connection(s) you had? (e.g., sharing information with faculty, locating funding)	Describe the purpose/role of the connection(s) in advancing your local CIRTl efforts.

Appendix V: Institutional Representative Interview Protocol

1. What have you gained, if anything, from participating in the CIRTl Network to help your institution's local CIRTl learning community and general efforts to prepare future faculty (doctoral students and postdoctoral scholars) as effective teachers?
 - a. What information, knowledge, best practices, and other resources have you found, looked for, or are currently looking for in the CIRTl Network?
 - b. What influences your decision to seek out or not seek out information, knowledge, best practices, and other resources in the CIRTl network?
 - c. How do you decide if information, knowledge, best practices, or other resources in CIRTl are beneficial to your institution?
2. How do you make sense of or translate what you gain from the Network for use at your institution and local CIRTl learning community?
 - a. In what ways, if any, do you alter or customize the information, knowledge, best practices, and other resources to be more applicable to your institution?
 - b. In what ways, if any, does your prior knowledge, involvement in other projects within or outside of your institution, or other non-CIRTl activities influence how you translate what you gain from CIRTl?
 - c. How do you decide what and with whom to share information, knowledge, best practices, and other resources gained from CIRTl with your campus colleagues to advance local programming for graduate students and postdocs? To garner support for your local CIRTl learning community?
3. In what ways do you share what you gain from CIRTl with members of your institution?
 - a. In what ways, if any, do you diffuse best practices related to preparing future faculty as effective teachers into your institution?
 - b. In what ways, if any, do you engage members of your institution in regular discussion and feedback related to CIRTl and your participation?
 - c. In what ways, if any, do you feel you have been able to help advance a shared vision across your institution regarding the importance of preparing future faculty as effective teachers?
4. How and in what capacity do you interact with individuals on campus to gain support for your local CIRTl learning community and the preparation of future faculty as effective teachers?
 - a. In what ways, if any, have you used your CIRTl affiliation to influence change in campus policies and procedures?
 - b. In what ways, if any, have you used your CIRTl affiliation to influence a shared vision regarding the importance of preparing future faculty as effective teachers especially among those that determine campus policies and procedures?
5. What has helped or hindered your ability to act as a boundary spanner?
 - a. What individual attributes have helped or hindered your boundary-spanning activities?
 - b. What attributes of CIRTl have helped or hindered your boundary-spanning activities?
 - c. What attributes of your institution have helped or hindered your boundary-spanning activities?

- d. What additional challenges have you encountered from being a boundary spanner?
 - e. In what ways, if any, have you responded to and found solutions to challenges?
- 6. How do you manage your boundary-spanning activities both outside of and within your institution?
 - a. How do you prioritize your boundary-spanning activities related to CIRTl?
 - b. How do you manage your boundary-spanning activities in light of your primary work responsibilities?

Appendix VI: Campus Connection Interview Protocol

1. What has _____ gained, if anything, from participating in the CIRTl Network to help your institution's local CIRTl programming and general efforts to prepare future faculty as effective teachers?
 - A. What information, knowledge, best practices, and other resources has _____ looked for or is currently looking for in the CIRTl Network?
 - B. What may influence or has influenced _____'s decision to seek out information, knowledge, best practices, and other resources in the CIRTl network?
 - C. How is information, knowledge, best practices, or other resources gained from CIRTl participation determined to be beneficial to your institution?
2. What may influence how _____ makes sense of or translates what they gain from CIRTl for use at your institution and local CIRTl programming?
 - A. In what ways, if any, has _____ altered or customized the information, knowledge, best practices, and other resources gained from CIRTl to be more applicable to your institution?
 - B. In what ways, if any, has prior knowledge, involvement in other projects within or outside of your institution, or other non-CIRTl activities potentially influenced how _____ translates what they gain from CIRTl?
 - C. What may influence how _____ decides what and with whom to share information, knowledge, best practices, and other resources gained from CIRTl with your campus colleagues to advance or garner support for local CIRTl programming?
3. In what ways has _____ shared what they gain from CIRTl with you or members of your institution?
 - A. In what ways, if any, has _____ diffused best practices related to preparing future faculty as effective teachers into your institution?
 - B. In what ways, if any, has _____ engaged you or other members of your institution in regular discussion and feedback related to CIRTl and the preparation of future faculty as effective teachers?
 - C. In what ways, if any, do you feel _____ has been able to help advance a shared vision across your institution regarding the importance of preparing future faculty as effective teachers?
4. How and in what capacity does _____ interact with individuals on campus to gain support for local CIRTl programming and the preparation of future faculty as effective teachers?
 - A. In what ways, if any, has _____ used their CIRTl affiliation to affect change in campus policies and procedures?
 - B. In what ways, if any, has _____ used their CIRTl affiliation to advance a shared vision regarding the importance of preparing future faculty as effective teachers among those that determine campus policies and procedures?
5. What has helped or hindered _____'s ability to act as a boundary spanner?
 - A. What individual attributes have helped or hindered their boundary-spanning activities?
 - B. What attributes of CIRTl have helped or hindered their boundary-spanning activities?
 - C. What attributes of your institution have helped or hindered their boundary-spanning activities?

- D. What additional challenges have _____ encountered by being a boundary spanner?
- E. In what ways, if any, have they responded to or found solutions to challenges?
- F. How has _____ managed their boundary spanning (outside of and within your institution) and primary work responsibilities?

Appendix VII: CIRTl Central Staff Interview Protocol

1. What has _____ gained, if anything, from participating in the CIRTl Network to help their institution's local CIRTl programming and general efforts to prepare future faculty as effective teachers?
 - A. What information, knowledge, best practices, and other resources has _____ looked for or is currently looking for in the CIRTl Network?
 - B. What may influence or has influenced _____'s decision to seek out information, knowledge, best practices, and other resources in the CIRTl network?
 - C. How is information, knowledge, best practices, or other resources gained from CIRTl participation determined to be beneficial to their institution?
2. What may influence how _____ makes sense of or translates what they gain from CIRTl for use at their institution and local CIRTl programming?
 - A. In what ways, if any, has _____ altered or customized the information, knowledge, best practices, and other resources gained from CIRTl to be more applicable to their institution?
 - B. In what ways, if any, has prior knowledge, involvement in other projects within or outside of your institution, or other non-CIRTl activities potentially influenced how _____ translates what they gain from CIRTl?
 - C. What may influence how _____ decides what and with whom to share information, knowledge, best practices, and other resources gained from CIRTl with their campus colleagues to advance or garner support for local CIRTl programming?
3. In what ways has _____ shared what they gain from CIRTl with members of their institution?
 - A. In what ways, if any, has _____ diffused best practices related to preparing future faculty as effective teachers into their institution?
 - B. In what ways, if any, has _____ engaged members of their institution in regular discussion and feedback related to CIRTl and the preparation of future faculty as effective teachers?
 - C. In what ways, if any, do you feel _____ has been able to help advance a shared vision across their institution regarding the importance of preparing future faculty as effective teachers?
4. How and in what capacity does _____ interact with individuals on their campus to gain support for local CIRTl programming and the preparation of future faculty as effective teachers?
 - A. In what ways, if any, has _____ used their CIRTl affiliation to affect change in campus policies and procedures?
 - B. In what ways, if any, has _____ used their CIRTl affiliation to advance a shared vision regarding the importance of preparing future faculty as effective teachers among those that determine campus policies and procedures?
5. What has helped or hindered _____'s ability to act as a boundary spanner?
 - A. What individual attributes have helped or hindered their boundary-spanning activities?
 - B. What attributes of CIRTl have helped or hindered their boundary-spanning activities?

- C. What attributes of your institution have helped or hindered their boundary-spanning activities?
 - D. What additional challenges have _____ encountered by being a boundary spanner?
 - E. In what ways, if any, have they responded to or found solutions to challenges?
6. How has _____ managed their boundary spanning (outside of and within their institution) and primary work responsibilities?

Appendix VIII: Consent Form – Institutional Representatives

Advancing Undergraduate STEM Reform Through Multi-Institutional Networks: The Role of Formal Boundary Spanners

Study Consent Form

(Primary Research Participants - Institutional Representatives in the CIRTL Network)

Study Description: Undergraduate STEM education reform is a national priority. Yet, the adoption of effective teaching practices over the past few decades has been limited. In response, networks such as CIRTL have been formed to improve STEM education. However, limited research has been conducted that either supports or denies the claim that these networks are an effective means of bringing about change. The individuals that represent their institutions in these networks (i.e. institutional representatives) are potentially a major path through which a network influences member institutions because they act as *boundary spanners*, individuals who connect the network and associated benefits to their institution. Yet, not much is known about their unique role. The *purpose of my study* is to explore how members of a multi-institutional STEM reform network, namely, CIRTL, engage in and make sense of boundary-spanning roles both within the network and within their home college/university related to STEM reform.

Procedures: You are being asked to participate in three research activities.

First, you will receive a large sheet of paper in the mail. You will be asked to record and map your connections over the past year with individuals inside the CIRTL Network and within your institution specifically related to the CIRTL Network.

Second, you will be interviewed for approximately 30-45 minutes over the telephone or Skype to clarify and discuss what you record in the first stage of the study.

Third, you will be interviewed again over the telephone or Skype for approximately 45-90 minutes to discuss your role as a boundary spanner.

Your participation is entirely voluntary and you can end your participation at any stage of the study. With your permission, I will audio-record the interviews.

Risks and Benefits: The risks you may incur by participating in this study are minimal. There is the potential for information you provide to be linked to your institution and/or position. The results will be useful in contributing to our understanding of higher education STEM reform networks and the specific role of boundary spanners in facilitating the impact of these networks on member colleges and universities.

Payment: You will receive no monetary compensation for participating in this study.

Subject's Rights: Your participation in this study is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to answer particular questions. Your responses will be reported in a way that ensures, to the best of our ability, that your identity is not revealed, and your confidentiality will be protected to the maximum extent allowable by law. However, due to your position, it may not be possible to fully protect your identity as an interviewee.

The research data will be stored at Michigan State University for at least three years following the conclusion of the project and will be accessible by Prof. Ann Austin and the local IRB office.

If you have any concerns or questions about this research study, such as scientific issues or how to participate in any part of the study, or if you believe you have been harmed because of the research, please contact Dr. Ann E. Austin, Higher, Adult, and Lifelong Education, 419A Erickson Hall, Michigan State University, East Lansing, MI 48824, 517-355-6757, or email aaustin@msu.edu, or fax 517-353-6393. If you have any questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the MSU's Human Research Protection Program at 517-355-2180, fax 517-432-4503, or email irb@msu.edu, or regular mail at 202 Olds Hall, MSU, East Lansing, MI 48824.

By signing below, you indicate your voluntary agreement to participate in this study.

☐ I voluntarily agree to participate in this study.

☐ I voluntarily agree to have the interviews in which I participate audio-recorded.

Printed Name of Participant

Signature of Participant

Date

Appendix IX: Consent Form – Campus Connections

Advancing Undergraduate STEM Reform Through Multi-Institutional Networks: The Role of Formal Boundary Spanners

Interview Consent Form

(Secondary Research Participants: Institutional Representatives' Campus Connections)

Study Description: Undergraduate science, technology, engineering, and mathematics (STEM) teaching reform is a national priority. Yet, the adoption of effective teaching practices over the past few decades has been limited. In response, multi-institutional higher education STEM reform networks have formed to improve STEM teaching. However, there is not much evidence to support or deny the claim that these networks are an effective means of bringing about change. The individuals that represent their institutions in these networks (i.e. institutional representatives) are potentially a major way for a network to influence member institutions because they act as *boundary spanners*, individuals that connect the network and associated benefits to their institution. Yet, not much is known about their unique role. The purpose of the study is to explore how members of a multi-institutional STEM reform network, namely, the Center for the Integration of Research, Teaching, and Learning, engage in and make sense of boundary-spanning roles both within the network and within their home college/university related to STEM reform.

Procedures: You are being asked to participate in a 30-60 minute interview over the telephone or Skype to discuss your association with one or more individuals who formally represent your institution in the Center for the Integration of Research, Teaching, and Learning (CIRTL). CIRTL is a national network of 22 research universities that seeks to improve undergraduate STEM education through the preparation of future faculty (i.e. doctoral students) as effective teachers.

Your participation is entirely voluntary and you can end the interview at any time. With your permission, I will audio-record the interview.

Risks and Benefits: The risks you may incur by participating in this study are minimal. There is the potential for information you provide to be linked to your institution and/or position. The results will be useful in contributing to our understanding of higher education STEM reform networks and the specific role of boundary spanners in facilitating the impact of these networks on member colleges and universities.

Payment: You will receive no monetary compensation for participating in this study.

Subject's Rights: Your participation in this study is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to answer particular questions. Your responses will be reported in a way that ensures, to the best of our ability, that your identity is not revealed, and your confidentiality will be protected to the maximum extent allowable by law. However, due to your position, it may not be possible to fully protect your identity as an interviewee.

The research data will be stored at Michigan State University for at least three years following the conclusion of the project and will be accessible by Prof. Ann Austin and the local IRB office.

If you have any concerns or questions about this research study, such as scientific issues or how to participate in any part of the study, or if you believe you have been harmed because of the research, please contact Dr. Ann E. Austin, Higher, Adult, and Lifelong Education, 419A Erickson Hall, Michigan State University, East Lansing, MI 48824, 517-355-6757, or email aaustin@msu.edu, or fax 517-353-6393. If you have any questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the MSU's Human Research Protection Program at 517-355-2180, fax 517-432-4503, or email irb@msu.edu, or regular mail at 202 Olds Hall, MSU, East Lansing, MI 48824.

By beginning this phone interview, you indicate your voluntary agreement to participate in this phone interview.

___ Do you voluntarily agree to participate in this study? Yes or No

___ Do you agree to audio-recording of the interview? Yes or No

Name of Participant

Name of Interviewer

Date

Appendix X: Consent Form – CIRTl Central Staff

Advancing Undergraduate STEM Reform Through Multi-Institutional Networks: The Role of Formal Boundary Spanners

Interview Consent Form

(Secondary Research Participants: Members of CIRTl Central)

Study Description: Undergraduate science, technology, engineering, and mathematics (STEM) teaching reform is a national priority. Yet, the adoption of effective teaching practices over the past few decades has been limited. In response, multi-institutional higher education STEM reform networks have formed to improve STEM teaching. However, there is not much evidence to support or deny the claim that these networks are an effective means of bringing about change. The individuals that represent their institutions in these networks (i.e. institutional representatives) are potentially a major way for a network to influence member institutions because they act as *boundary spanners*, individuals that connect the network and associated benefits to their institution. Yet, not much is known about their unique role. The purpose of the study is to explore how members of a multi-institutional STEM reform network, namely, the Center for the Integration of Research, Teaching, and Learning, engage in and make sense of boundary-spanning roles both within the network and within their home college/university related to STEM reform.

Procedures: You are being asked to participate in a 30-45 minute interview over the telephone or Skype to discuss your association with institutional leaders and administrative co-leaders from four of the current CIRTl institutions.

Your participation is entirely voluntary and you can end the interview at any time. With your permission, I will audio-record the interview.

Risks and Benefits: The risks you may incur by participating in this study are minimal. There is the potential for information you provide to be linked to your role and/or position. The results will be useful in contributing to our understanding of higher education STEM reform networks and the specific role of boundary spanners in facilitating the impact of these networks on member colleges and universities.

Payment: You will receive no monetary compensation for participating in this study.

Subject's Rights: Your participation in this study is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to answer particular questions. Your responses will be reported in a way that ensures, to the best of our ability, that your identity is not revealed, and your confidentiality will be protected to the maximum extent allowable by law. However, due to your position, it may not be possible to fully protect your identity as an interviewee.

The research data will be stored at Michigan State University for at least three years following the conclusion of the project and will be accessible by Prof. Ann Austin and the local IRB office.

If you have any concerns or questions about this research study, such as scientific issues or how to participate in any part of the study, or if you believe you have been harmed because of the research, please contact Dr. Ann E. Austin, Higher, Adult, and Lifelong Education, 419A Erickson Hall, Michigan State University, East Lansing, MI 48824, 517-355-6757, or email aaustin@msu.edu, or fax 517-353-6393. If you have any questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the MSU's Human Research Protection Program at 517-355-2180, fax 517-432-4503, or email irb@msu.edu, or regular mail at 202 Olds Hall, MSU, East Lansing, MI 48824.

By beginning this phone interview, you indicate your voluntary agreement to participate in this phone interview.

___ Do you voluntarily agree to participate in this study? Yes or No

___ Do you agree to audio-recording of the interview? Yes or No

Name of Participant

Name of Interviewer

Date

Appendix XI: Invitation Letter to Institutional Representatives

Subject Line: Request for Dissertation Research Participation

Dear _____,

I am writing to request the participation of _____ University's CIRTl leadership team (institutional leader, administrative co-leader, and any related affiliates) in a research study for my dissertation involving the CIRTl Network. The title of my study is, ***Advancing Undergraduate STEM Reform Through Multi-Institutional Networks: The Role of Formal Boundary Spanners***. It examines the unique role of individuals that link multi-institutional STEM reform networks to participating colleges and universities in service to institutional efforts to reform STEM education. The CIRTl Leadership Team has approved this study and the results should be of use to CIRTl's continuing progress.

My study, while related to the work that I have done with Ann Austin as part of the research and evaluation team, represents my original work and will not be conducted as part of my formal duties in CIRTl. Of course, your participation is entirely voluntary and you can end your participation at any point. I know how busy you are, but I hope you will consider participating in this study. Your contribution will be an important part of the project.

Purpose of the study:

As you well know, undergraduate STEM education reform is a national priority. Yet, the adoption of effective teaching practices over the past few decades has been limited. In response, networks such as CIRTl have been formed to improve STEM education. However, limited research has been conducted that either supports or denies the claim that these networks are an effective means of bringing about change. The individuals that represent their institutions in these networks (i.e. institutional representatives) are potentially a major path through which a network influences member institutions because they act as ***boundary spanners***, individuals who connect the network and associated benefits to their institution. Yet, not much is known about their unique role.

The ***purpose of my study*** is to explore how members of a multi-institutional STEM reform network, namely, CIRTl, engage in and make sense of boundary-spanning roles both within the network and within their home college/university related to STEM reform.

Procedures: You are being asked to participate in three research activities.

First, you will receive a large sheet of paper in the mail. You will be asked to record and map your connections over the past year with individuals inside the CIRTl Network and within your institution (specifically related to the CIRTl Network).

Second, you will be interviewed for approximately 30-45 minutes over the telephone or Skype to clarify and discuss what you recorded in the first stage of the study.

Third, you will be interviewed again over the telephone or Skype for approximately 45-90 minutes to discuss your role as a boundary spanner.

Benefits

Similar to the study that Ann Austin and I conducted in the summer of 2014 with institutional leaders and co-leaders, my study will help further advance our understanding of multi-institutional STEM reform networks, broadly, and CIRTL, specifically. It will illuminate the role of boundary spanners in collecting and disseminating the benefits of network participation. Boundary spanners are by no means the only way the network could impact a member institution, but institutional representatives potentially play a major role in obtaining knowledge from the network, implementing that knowledge to advance local STEM reform efforts, and seeking support from campus units and stakeholders. Specific to CIRTL, my study could help the network in its attempts to assess its impact on member institutions, identify desirable traits that could be used to select institutional representatives, and identify behaviors and actions that could be used to increase impact. Findings would be made available to the CIRTL Network through manuscripts/publications and potentially through in-person or online network meeting presentations.

I have attached a consent form for your review. If you choose to participate, please sign and date the document and then return it electronically to lucashillprofessional@gmail.com or mail it to:

Lucas Hill
1427 Kelsey Ave
Lansing, MI 48910

Given the design of my study, ***it is crucial to have both the institutional leader and administrative co-leader participate*** (and any other campus leader that participates in CIRTL meetings) so as to explore the extent and scope of boundary spanning related to CIRTL engagement. I truly appreciate your time and consideration and look forward to hearing from you soon.

Please let me know if you have any questions.

Sincerely,

Lucas Hill
Doctoral Candidate
Michigan State University

Appendix XII: Invitation Letter to Campus Connections

Subject Line: Request for Research Participation Regarding the CIRTLL Network

Dear _____,

I am writing to request your participation in a short phone or Skype interview of approximately 30-45 minutes. As a doctoral candidate at Michigan State University, I am studying the roles of individuals who link multi-institutional STEM reform networks to participating colleges and universities. Specifically, I am studying interactions in regard to the Center for the Integration of Research, Teaching, and Learning (CIRTLL), in which _____ University participates. I would like to talk with you about your perceptions of the role of _____ in connecting the CIRTLL network to your university.

Details about the study and the conversation I would like to have with you are provided below. I know how busy you are, but I hope you will consider participating in this study. Your contribution will be an important part of the project.

Purpose of the study:

Undergraduate STEM education reform is a national priority. Yet, the adoption of effective teaching practices over the past few decades has been limited. In response, networks such as CIRTLL have been formed to improve STEM education. However, limited research has been conducted that either supports or denies the claim that these networks are an effective means of bringing about change. The individuals that represent their institutions in these networks (i.e. institutional representatives) are potentially a major path through which a network influences member institutions because they act as *boundary spanners*, individuals who connect the network and associated benefits to their institution. Yet, not much is known about their unique role.

The *purpose of my study* is to explore how members of a multi-institutional STEM reform network, namely, CIRTLL, engage in and make sense of boundary-spanning roles both within the network and within their home college/university related to STEM reform. CIRTLL is a national network of 22 research universities that seeks to improve undergraduate science, technology, engineering, and mathematics education through the preparation of future faculty (i.e. doctoral students and postdocs) as effective college teachers. The title of my study is, *Advancing Undergraduate STEM Reform Through Multi-Institutional Networks: The Role of Formal Boundary Spanners*.

Procedures:

You are being asked to participate in a 30-45 minute interview over the telephone or Skype to discuss your perceptions of one or more individuals who formally represent your institution in the Center for the Integration of Research, Teaching, and Learning (CIRTLL).

Benefits:

The results of my study will be useful in contributing to our understanding of higher education STEM reform networks and the specific role of boundary spanners in facilitating the impact of these networks on member colleges and universities.

I have attached a consent form for your review. If you choose to participate, you can agree to participant verbally at the beginning of the interview. Your participation is entirely voluntary and you can end your participation at any point.

I truly appreciate your time and consideration and look forward to hearing from you soon.

Please let me know if you have any questions.

Sincerely,

Lucas Hill
Doctoral Candidate
Michigan State University

Appendix XIII: Invitation Letter to CIRTl Central Staff

Subject Line: Request for Research Participation Regarding the CIRTl Network

Dear _____,

I am writing to request your participation in a short phone or Skype interview of approximately 30-45 minutes. As a doctoral candidate at Michigan State University, I am studying the roles of individuals who link multi-institutional STEM reform networks to participating colleges and universities. Specifically, I am studying interactions in regard to the Center for the Integration of Research, Teaching, and Learning (CIRTl). Given your leadership role in the CIRTl Network, I would like to talk with you about your perceptions of the role of institutional leaders and administrative co-leaders from four CIRTl institutions in how they connect CIRTl to their home campuses.

Details about the study and the conversation I would like to have with you are provided below. Of course, your participation is entirely voluntary and you can end your participation at any point. I know how busy you are, but I hope you will consider participating in this study. Your contribution will be an important part of the project.

Purpose of the study:

Undergraduate STEM education reform is a national priority. Yet, the adoption of effective teaching practices over the past few decades has been limited. In response, networks such as CIRTl have been formed to improve STEM education. However, limited research has been conducted that either supports or denies the claim that these networks are an effective means of bringing about change. The individuals that represent their institutions in these networks (i.e. institutional representatives) are potentially a major path through which a network influences member institutions because they act as *boundary spanners*, individuals who connect the network and associated benefits to their institution. Yet, not much is known about their unique role.

The *purpose of my study* is to explore how members of a multi-institutional STEM reform network, namely, CIRTl, engage in and make sense of boundary-spanning roles both within the network and within their home college/university related to STEM reform. The title of my study is, *Advancing Undergraduate STEM Reform Through Multi-Institutional Networks: The Role of Formal Boundary Spanners*.

Procedures:

You are being asked to participate in a 30-45 minute interview over the telephone or Skype to discuss your perceptions of and association with institutional leaders and administrative co-leaders from four CIRTl institutions.

Benefits:

The results of my study will be useful in contributing to our understanding of higher education STEM reform networks and the specific role of boundary spanners in facilitating the impact of these networks on member colleges and universities.

I have attached a consent form for your review. If you choose to participate, you can agree to participant verbally at the beginning of the interview. Your participation is entirely voluntary and you can end your participation at any point.

I truly appreciate your time and consideration and look forward to hearing from you soon.

Please let me know if you have any questions.

Sincerely,

Lucas Hill
Doctoral Candidate
Michigan State University

Appendix XIV: Determination of Exempt IRB Status

MICHIGAN STATE UNIVERSITY

September 9, 2015

To: Ann Austin
417 Erickson Hall
MSU

Re: **IRB# x15-946e** Category: Exempt 1
Approval Date: September 9, 2015

Title: Advancing Undergraduate STEM Reform Through Multi-Institutional Networks: The Role of Formal Boundary Spanners

Initial IRB Application Determination ***Exempt***

The Institutional Review Board has completed their review of your project. I am pleased to advise you that **your project has been deemed as exempt** in accordance with federal regulations.

The IRB has found that your research project meets the criteria for exempt status and the criteria for the protection of human subjects in exempt research. **Under our exempt policy the Principal Investigator assumes the responsibilities for the protection of human subjects** in this project as outlined in the assurance letter and exempt educational material. The IRB office has received your signed assurance for exempt research. A copy of this signed agreement is appended for your information and records.

Renewals: Exempt protocols do not need to be renewed. If the project is completed, please submit an *Application for Permanent Closure*.

Revisions: Exempt protocols do not require revisions. However, if changes are made to a protocol that may no longer meet the exempt criteria, a new initial application will be required.

Problems: If issues should arise during the conduct of the research, such as unanticipated problems, adverse events, or any problem that may increase the risk to the human subjects and change the category of review, notify the IRB office promptly. Any complaints from participants regarding the risk and benefits of the project must be reported to the IRB.

Follow-up: If your exempt project is not completed and closed after three years, the IRB office will contact you regarding the status of the project and to verify that no changes have occurred that may affect exempt status.



Office of Regulatory Affairs Human Research Protection Programs

Biomedical & Health
Institutional Review Board
(BIRB)

Community Research
Institutional Review Board
(CRIRB)

Social Science
Behavioral/Education
Institutional Review Board
(SIRB)

Olds Hall
408 West Circle Drive, #207
East Lansing, MI 48824
(517) 355-2180
Fax: (517) 432-4503
Email: irb@msu.edu
www.hrpp.msu.edu

Please use the IRB number listed above on any forms submitted which relate to this project, or on any correspondence with the IRB office.

Good luck in your research. If we can be of further assistance, please contact us at 517-355-2180 or via email at IRB@msu.edu. Thank you for your cooperation.

Sincerely,

A handwritten signature in dark ink, appearing to read "H. McGee".

Harry McGee, MPH
SIRB Chair

c: Lucas Hill

REFERENCES

REFERENCES

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