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Curators and sojourners in learning networks: Practices for transformation

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ABSTRACT

Networks are a promising mechanism for creating systemic change. Studies abound, but do not examine roles and practices to reveal the processes through which networks create transformative capacity. This participatory single case study provides a framework to examine structures, roles and practices. The framework details common network substructures, across which critical practices occur, and provides a typology of specific network practices of *curators* and *sojourners*. The primary claim is that a variety of structures and interdependent roles and practices work in concert to support transformation across sites and scales. Results have implications for network design, leadership, practice, and evaluation.

1. Introduction

Transformative learning networks are an organizational form that bring together members from across geographically distributed sites and are designed to support transformational change in complex systems across sites and scales. Detailed here are critical practices that occur across roles, sites, and various network substructures. The practices are more than a set of ingredients for transformation. Rather they exist in dynamic tension specific to the complex contexts of network sites. The multiple substructures, practices, and interactions occur as a symphony enabling transformation.

Study results and narrative analysis first describe the four most prominent network substructures across which critical practices occur. This is followed by a thick description of two distinct roles, *curators* and *sojourners*, and the specific practices carried out under these roles and based on observations, interviews, and survey data. These roles require a brief explanation here, but more in-depth characterization occurs later. The curator's role is to build the network, align the network with the larger system undergoing transformation, facilitate co-learning, and define what it means to be competent in the domain. They are actors who possess expertise and facilitate the collective development of expertise across the domain. The sojourner's role is to develop local capacity and cultivate practice and to serve as a two-way bridge between institutions and the network. Sojourners conduct their work independent of the network, but leverage the network to gain legitimacy

and learn across sites. Individuals may primarily serve one role, or be adept at moving between roles responding to the dynamics of each situation. The two roles are interdependent; supporting each other as the network develops transformative capacity. When network members play the curator role, they are central actors and tend toward building boundaries around the network. When network members play the sojourner role they tend engage in boundary navigation practices moving knowledge within and between sites.

Scholars and practitioners can find application for this work in social-educational and social-ecological systems that have failed to shift into desired transformations through other mechanisms. The description of dominant substructures, roles, and typology of critical practices are derived directly from systematic qualitative analysis of the observations, interviews, and surveys collected for this case study. They provide an example through which to understand how flexible and fluid substructures, roles, and their associated practices function to produce various and necessary types of change both within the system and at the system boundaries.

2. Transformative learning networks

Transformative learning networks are complex mechanisms designed to enhance collaborative learning in the complex systems they seek to transform. This alternative organizational form integrates efforts to change systems across sites and scales. This design enables sites

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to experiment, develop, and adapt tools of change to their own unique contexts and challenges. The coordination and collaborations between many sites endow networks with the power of collective action to influence transformation at scale. Learning networks, therefore, come into play when ongoing bottom-up and top-down efforts have not been able to shift systems into transformation. Goldstein and others (Goldstein et al., 2017, p. 537) define transformative learning networks as, “inter-organizational voluntary collaboratives that nurture professional expertise” with the “potential to catalyze systemic change by disrupting old habits, fostering new relationships, and providing freedom to experiment”. They conclude that networks foster transformative capacity when they are “designed and facilitated with a soft touch so that network members in different sites have the freedom to define their place and purpose within their system, as well as their role in bringing about a desired transformation.” The loose and light structure of this type of learning network enables fluidity between roles, and otherwise disconnected efforts, setting the stage for transformative capacity to emerge (Goldstein et al., 2017). However, the details of the network substructures and many specific practices that contribute to transformation remain unexamined in systems where learning networks are central to transformation.

One of many types of networks that have emerged over the last decades, transformative learning networks offer promising approaches to solve society’s intractable problems. Castells (1996) described the rise of the network society and increasing importance of emergent networks in meeting societal challenges. More recently, Raab and Kenis (2009) describe a “society of networks” where the dominant collective social entities are groups of individuals and organizations intentionally organized around making change happen. Weber and Khademain (2008a) capture the fluidity of networks as involving individuals, groups and organizations in a complex web of relationships. By connecting stakeholders across sites, networks enable participants to “co-create solutions to shared problems through collaborative processes that lead to continuous improvement or perhaps even disruptive innovation” (Torfing, Sørensen, & Røiseland, 2016, p.19).

Kapucu, Hu, and Khosa (2014) reviewed 677 network focused articles published in the public administration literature between 1998 and 2012. They noted a dearth of research on the roles of network individuals and the multiple network substructures across which dynamic relationships take place. Others recommend further study on the practices of key actors in networks and encourage a focus on the “softer dimensions” of collaborative networks (Weber & Khademain, 2008a, 2008b) or the intricate and understudied “human dynamics” associated with agency and identity in networks (Keast & Mandell, 2013). These authors highlight social and relational activity of network actors as critical drivers of change and transformation. There is growing realization that many network studies tend to narrowly focus on performance and over-emphasize the role of single leaders while overshadowing interactional and social value created through participant interactions (Knight, 2002; Keast & Mandell, 2013; Knight & Pye, 2005). Processual views of organizational change also emphasize the transformative value of “non-heroic micro-practices” cultivated and co-constructed through networks (Chia, 1999; 2014; Tsoukas & Chia, 2002). For example, actors who recognize the readiness of a decision maker to consider change can optimize success in that particular situation by timing engagement, this is a subtle, almost unrecognizable, act.

Transformative learning networks are similar to communities of practice in that they cultivate shared practice and learning (Lave & Wenger, 1991; Wenger, 1998, 2000; Wenger, McDermott, & Snyder, 2002). However, because learning networks operate at the systems level, they are more aligned with developing theory about *Learning in Landscapes of Practice* (Wenger-Trayner & Wenger-Trayner, 2015). Landscapes theory accounts for the complexity of one’s landscape of multiple communities of practice and the boundaries between them as rich learning assets. This framing helps to clarify the practices that enable fluidity in complex systems, between many communities in a

landscape. Individuals in complex landscapes are sometimes building boundaries, and other times working across them. They customize their roles and practices to suit a given situation and community.

Complexity is critical in understanding networked approaches to transformational change and boundaries are a key aspect of complexity in these multi-sited, multiscale systems. Boundaries can be concrete such as the boundary between two distinct organizations. More abstract boundaries – for example, the boundary between disciplines such as sociology and social work that may not be distinguishable to outsiders – also play important roles in complex systems. Actors who engage in navigating across boundaries, do so through relational interactions. To be successful they work to understand the mini-cultures of different communities of practice in a landscape. These boundary crossers are constantly modulating how they identify with groups based on shifting context as they navigate a complex landscape of communities and practices (Wenger-Trayner & Wenger-Trayner, 2015). Weber and Khademian (2008b) describe boundaries as multilateral and spanning across organizations, sectors, disciplines, and professional positions. These authors identify key actors in collaborative systems as “collaborative capacity builders” (2008a) and hone in on “crossing boundaries frequently and with ease” as one of six key practices in addressing wicked problems by maintaining fluid boundaries to support adaptability (2008b).

In addition to the emphasis on navigating across boundaries in networks (Weber and Khademian 2008a, 2008b), boundary building is also important work that demarcates groups from each other by distinguishing who is “in” and who is “out” (Tajfel, 1982). Boundary navigation and boundary building, both critical to transformative process, occur in productive tension (Risien & Goldstein, 2018). Boundaries in networks have two distinct functions and accordingly two sets of practices enabling these functions. Risien and Goldstein (2018) demonstrate that boundary navigation practices expand a network’s collective knowledge resources by facilitating regular and productive opportunities for interaction. They show that boundary building increases a network’s authority and influence in the system by distinguishing those who are members of a network as the collective holders of expertise and competence in a domain. They conclude that when network actors treat boundaries dynamically, shifting emphasis between strength (enabling influence and authority) and fluidity (enabling growth and expansion of knowledge resources) accordingly, the network gains transformative capacity to stimulate and support change across sites and scales.

The case evidence below is interpreted with a boundaries lens examining 1) network substructures in terms of how they support boundary navigation; 2) network roles in terms of the tensions of building boundaries around the network and maintaining open boundaries to grow the network; and 3) practices associated with building and navigating across many boundaries in the complex landscape.

3. The National Alliance for Broader Impacts

The National Alliance for Broader Impacts (NABI), a network born in 2013, responds to the challenges experienced by research organizations, primarily universities, in addressing increasing requirements of the National Science Foundation (NSF) to broaden the societal impacts of research. This is a challenge because many scientists lack training to address broader impacts, professional reward structures are un-supportive, and there are cultural and structural difficulties in establishing necessary partnerships across disciplines and organizations (Author & Storksdieck, 2018; NABI, 2018). NABI serves as a professional home for the emerging domain of broader impacts support by hosting a community of learners working together to build capacity to improve the connection between science and society. This distributed community of professionals and scientists engaged in broader impacts collectively innovates, tests, and propagates best practices in the domain. The network also serves as a resource to NSF and national organizations working to support broader impacts. A loose web of

connections and relationships, with a variety of activity hubs, NABI's nearly 700 members participate with various levels of engagement. They are part of an observably growing population operating in the "third space" of universities performing critical boundary and brokerage roles (Bouwma-Gearhart, Perry, & Presley, 2012; Whitchurch, 2008; 2013). They are often central actors without positional authority, but who can influence policy, practice, and culture of university systems (Kezar, 2014). Many members do not identify with traditional instructional, research, or administrative roles in academia. Instead, they tend to serve as connectors between and across distinct parts of their institutions, often serving in central offices such as Extension, research administration, or science outreach offices. An annual Summit is the network's central event for connection and learning. A listserv, individual communications between members, and cross-site visits sustain interactions between Summits. A principal, and small logistical staff, support network activities and engage a steering committee in leadership and an advisory board to help set the strategic direction of the network. Subcommittees of active members and leadership tackle specific needs such as financial planning, training, and event planning.

4. Methods

This study was conducted using participatory action research methods (Baum, MacDougall, & Smith, 2006; Chevalier & Buckles, 2013; McIntyre, 2008) with the author embedded as an ethnographer would be (Emerson, Fretz, & Shaw, 1995; Lofland, Snow, Anderson, & Lofland, 1984; Weiss, 1995). The qualitative approach, with NABI as a single in-depth case, enabled capture of participant experiences in real time rather than relying on participants to recall past events (George & Bennett, 2005; Goldstein & Butler, 2009). The author participated as an active network member while concurrently conducting observations of monthly network leadership calls, six biennial multi-day in-person steering committee meetings, two multi-day broader impacts focused meetings at NSF, three advisory board meetings and four annual full network gatherings from 2014 through 2018.

Data collection procedures included recording of in-situ ethnographic field notes (Bernard, 2006; Emerson et al., 1995) using an observational protocol (modified from that used for Kezar & Gehrke, 2014) attuned to discourse about boundaries, boundary work, collective action, member identification with the network, and shared identity within the network. Field notes captured direct quotes, summary of observed discussions, and analytical notes to account for context of tone, setting, and relative participation of various network members. To gather more information about member experiences at their sites and perceptions about their role in the network, the author conducted semi-structured individual interviews (Bernard, 2006; Lofland et al., 1984; Weiss, 1995) of NABI members ($n = 12$), NSF staff and former staff working to advance broader impacts practices ($n = 4$). The interviews lasted between 45 and 75 min, following a protocol which framed questions around concepts of activity, practice, boundaries, identity, and change. A survey of network members ($n = 95$), conducted in April 2017, provided additional data including narrative answers to open ended questions about how members perceived their professional role and practice.

Open coding schemes were applied to field notes, interview transcripts, and open-ended survey questions. This approach positions the researcher as the primary instrument with the role of tuning and applying the interpretive lens based on direct experience of the network and relevant theory to guide analysis and organization of data collected while embedded in the network. Analytic memos and ethnographic field notes were used to organize an initial open coding scheme, which was then applied using methods established for the development of grounded theory (Auberbach & Silverstein, 2003; Bernard, 2006; Corbin & Strauss, 2014; Glaser & Strauss, 1967; Miles, Huberman, & Saldana, 2014). The result was 460 substantive excerpts broadly having to do with boundaries and boundary work. Next the coded excerpts

were reviewed for recurrence of key practices and experiences of actors along with assessment of whether they were acting in the curator and sojourner role. This process resulted in a closed coding scheme and the data was then reanalyzed (Miles et al., 2014), to verify and refine the typology presented herein. The dominant network substructures emerged from repeated descriptions in interviews and observations. Results from empirical and interpretive analysis are integrated in the sections below. Network substructures (Fig. 1) appear first as the structural context in which many of the practices of curators and sojourners occur and provide an overall picture of the layered learning network organizational form. Table 2 contains network practices organized in a typology and the narrative includes examples and more detailed descriptions of the observed practices in each of the four categories for both curators and sojourners.

5. Network substructures

Network substructures are often identified using quantitative social network analysis tools (Kapucu et al., 2014) and whole network structure, form, and governance types have been presented by several scholars (Keast, Brown, Mandell, & Woolcock, 2004; Provan & Kenis, 2008; Provan, Fish, & Sydow, 2007; Raab & Kenis, 2009). Empirical examination of network substructures in the context of the practices they enable are not apparent in the literature.

There are several substructures, within the transformative learning network, across which boundary work and other practices occurred. To bring alignment between many disparate institutions and communities, the learning network leveraged difference in institutional cultures, practices, and experiences. Actors innovated shared practices to contribute to a transformed system. Network boundaries, around the network itself, are difficult to characterize because they are generally permeable matching the loose and light structure of the network. For the network practitioner, however, static bi-lateral conceptions of boundaries (see Gieryn, 1983 and Tajfel, 1982) – for example the social and professional boundary between science and the public or between scientists and outreach professionals – failed to capture the nuance of boundaries in the complex broader impacts system they inhabit. A deeper look at the substructures in, and across, which actors performed critical practices is required.

Table 1 includes characteristics of observed substructure configurations. The four substructures here were the most frequently referenced by members as part of their practice, also in terms of the value they added to transformative processes. They are far from an exhaustive set of examples, but illustrate the variety and complexity of substructures in the overall system. The characteristics in Table 1, along with member descriptions and field observations, are the foundation for the four substructures in Fig. 1.

The hub and spoke example (Fig. 1a) was prevalent in site-based activities. The network members serving as the hub connected across disciplines and programs within an institution and sometimes with local or regional organizations to develop broader impacts partnerships. The hub member acted on behalf of their institution, as a local broader impacts expert, at the same time served shared network goals in a sojourner role. Members described such work as supporting site-based connection across the many boundaries between organizations, practices, and scholarly disciplines. These hub and spoke structures often emerged independently from the network. Service as a local "hub" was a key shared practice among network members around which they cultivated relationship and aligned with the overall network goals. One member described such site-based boundary work as "kind of like Uber, we don't have a lot of people but we have managed to have a lot of capacity based off of our network" referring to the regional community of people across multiple boundaries (interview, June 2017). The people in these hub positions are often non-academic professionals who sit in central university offices such as a research office, a STEM center, or an office of science outreach. It is their practice, more than their

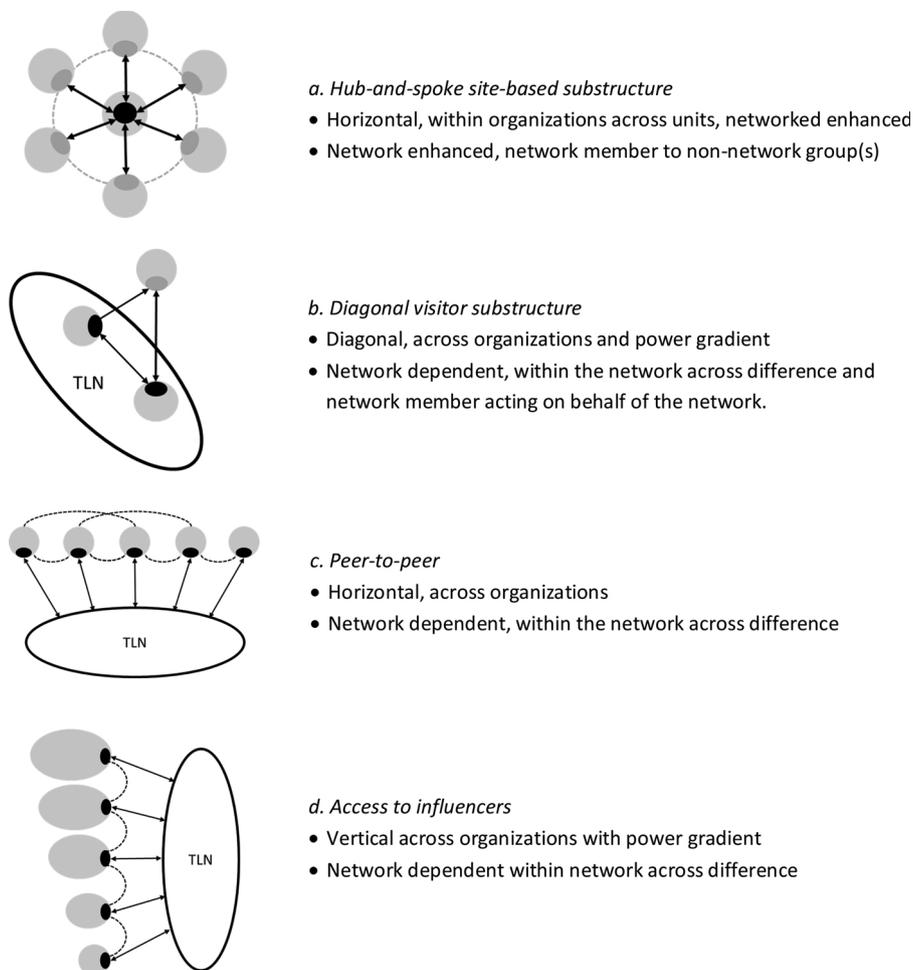


Fig. 1. Transformative Learning Network (TLN) substructures. Black nodes are network members, black lines are flow of information through social interactions. Dark grey nodes are non-members receiving network information, light grey areas represent spheres of influence through which network knowledge moves creating a magnifying effect.

Table 1
Structural components of boundary work in a transformative learning network.

Horizontal	across organizations within organizations across units
Vertical	across organizations with power gradient within organizations across units with power gradient
Network Enhanced	network member to non-network group network member to non-network individual
Network Dependent	within network across difference on behalf of network with external groups or individuals

position, which drives their role as a connector in their community.

Members described their hub and spoke work as enhanced by the network in two important ways. First, their engagement in the network invoked a sense of support, and feelings of being less alone, in what often are ill-defined local roles. Second, members frequently engaged in collaborative learning with network peers and shared best practices for working across local boundaries through the network events. Table 2, discussed in more detail later, describes many of the specific activities conducted in this substructure as part of the sojourner suite of practice. One member described the hub role, saying, “I run a community of practice for people who do education and outreach on my campus and off campus – groups like museums, people from other universities – through this central network, I keep tabs on many things going on at my campus and in my community” (interview, June 2017).

The diagonal example (Fig. 1b) often occurred during site visits when local members invited and hosted central curating members,

usually involved in the network leadership, for a campus visit. A critical part of the curator visit is joining the local member in meetings with local decision-makers to secure or grow administrative and fiscal support for local progress towards shared network goals. The local member usually had already conducted vertical boundary work engaging local decision makers, but many reported that an outside expert voice enhanced access to high-level administrators. For example, a university professional in an office of science outreach may have not have reliable access to their Vice Chancellor for Research to discuss investment institutional infrastructure to support broader impacts. However, when that professional is host to the leadership of a national organization, the Vice Chancellor is more likely to grant an audience to discuss the same topic. The visitors, have voice, and their presence lends voice to the local member supporting their request for resources by verifying NSF’s stance on broader impacts and providing examples on infrastructure investment at peer institutions.

Curator visitors also provided training for faculty, gave campus seminars, and talked to administrators about developments in broader impacts practice at federal agencies. Visitors crossed the horizontal boundary across institutions, and simultaneously the vertical boundaries across a power gradient, resulting in diagonal work. The visiting curator served as a spokesperson for the network’s collective expertise with position and power as a leader in a national organization. The network guides and bolsters both the local member and the curator visitor in these interactions. One such curator described the diagonal work, “when I work with administrators, I want them to *really*

Table 2
Critical practices of curators and sojourners in a transformative learning network.

Curators/Central Participation/Scaled Focus	Sojourners/Peripheral Participation/Local Focus
<p>C1: Build Community <i>C1.1 - foster member belonging and development</i> <i>C1.2 - empower members as ambassadors</i> <i>C1.3 - cultivate shared language/understanding in domain</i> <i>C1.4 - cultivate member identification</i></p> <p>C2: Focus Scope <i>C2.1 - problematize in the system</i> <i>C2.2 - prioritize activity within domain</i> <i>C2.3 - articulate/cultivate network boundaries</i> <i>C2.4 - align with national scale needs/policy</i></p> <p>C3: Steward Competence <i>C3.1 - claim and grow expertise in the domain</i> <i>C3.2 - conduct/guide scholarship in the domain</i> <i>C3.3 - develop, identify and articulate best practices</i> <i>C3.4 - provide resources/advice to peripheral actors/outside</i></p> <p>C4: Advocate</p>	<p>S1: Foster Expressibility / Imagination <i>S1.1 - engage outsiders in domain</i> <i>S1.2 - expose actors to similarities between domains</i> <i>S1.3 - act as a personalized guide</i></p> <p>S2: Cultivate Collaboration <i>S2.1 - broker new relationships build trust</i> <i>S2.2 - identify and leverage points of alignment</i> <i>S2.3 - coordinate multiple entities</i> <i>S2.4 - maintain robust professional network</i></p> <p>S3: Broker Information/Service <i>S3.1 - share and distribute curator provided information</i> <i>S3.2 - synthesize or interpret available information</i> <i>S3.3 - share undocumented stories and experiences</i> <i>S3.4 - provide direct service, support, and training</i></p> <p>S4: Advocate</p>

understand what it is like in the trenches” referring to the importance of the work performed by local professionals in advancing broader impacts. (interview, October 2016).

The peer-to-peer substructure (Fig. 1c) illustrates the dominant substructure in which the network, through gatherings and listserv communication, provided members an interactional learning space for sharing and innovating practice. The primary boundary worked was horizontal, across institutions with unique cultures and conditions. This substructure example illustrates how members’ participated in both emergent and planned co-learning enabled by the core activities and coordination of the network. For example, new members who were already supporting broader impacts at their institutions usually reported feeling alone, like they have few peers in their organizations. When they attended their first annual Summit they are elated to learn that they did have many of peers at other institutions with who they began to share their broader impacts experiences, tools, challenges, and solutions. Members also reached out to each other outside of network hosted events, but cited the network activities as the primary host for sharing ideas and innovations. One member described the advantages of collaborating through the network this way, “universities are autocratic, but I never get that sense with NABI, it’s like ‘we all have to work together on this, it’s a joint problem and let’s pool our resources together’; that kind of discussion is frankly rare” (interview, June 2017).

Fig. 1d illustrates how the network serves to enable access to policy influencers and decision makers from federal agencies and associations active in the system transformation. Like the peer-to-peer example, this depends on network facilitated gatherings and communication through the listserv. The primary boundaries worked in this example are vertical across organizations along a power gradient. The network integrated the peer members with influencers who could advocate for the network shared goals at scale. The Summits provided opportunities for sojourners and curators alike to collectively access and inform decision makers and influencers across scales. For example, policy directors from major higher education and research associations regularly attended gatherings to learn about members’ experiences and shared challenges. They used that information to optimize how they advocate for policies and practices that support broader impacts. Reciprocally, such influential individuals provided up to date information on national scale initiatives that may impact members’ local work and the network as a collective. Member access to influencers (and vice versa) guided and aligned practice across scales. One member described how the network facilitated such access, “I see so many organizations represented at NABI, [at my institution] we are not anywhere near D.C., we are not next to the people who are getting things done at the highest levels, but there are people in NABI who are much more tied to what is happening nationally... that’s something we cannot do on our own” (interview, June 2017).

6. Practices of curators and sojourners

The previous section described dynamic and multilateral boundaries and substructures observed in this case study. Here focus shifts to the distinct, but interdependent, roles and practices of curators and sojourners.

While specific practices are associated with specific roles actors operate in the system with substantial fluidity, moving between roles and scales responding to the dynamics of each situation. For example, several members serve on the network leadership and epitomize the curator role in the whole network setting. Those same members also reported typical sojourner practices as the driver for participation of the network, “I am just as excited as everyone else to attend the sessions and find out how people are solving their problems” (observation, April 2016). The opposite is also true; a member who is not part of the network leadership may nevertheless effectively engage in curator practices such as working to clarify the language used in broader impacts discourse. Curator and sojourner are then categories for practices individuals engaged in while playing different roles in the system. In the curator role, individuals tended to be centrally situated in the network conducting practices that build boundaries around, and identity within, the network. In the sojourner role members were relatively peripheral in the network focusing their practice as experts at their own campus. Sojourners prioritize local needs and seek alignment with the network on local terms.

6.1. Curator practice

Members who assume the curator role build the network community, shared identity and network boundaries, align the network with the larger system, and facilitate co-learning among members. Curators engaged in practices that demarcate who is “in” from who is “out” of the network (see Gieryn, 1983 and Tajfel, 1982). They balanced such boundary building with navigating across boundaries to expand the membership and thereby collective knowledge and reach of the network (Risien & Goldstein, 2018). They facilitated the collective cultivation of expertise in the domain also developing and maintaining what it means to be competent in the community (Wenger, 1998) with high accountability to the domain (Wenger-Trayner & Wenger-Trayner, 2015). They used the network to test, ground, and innovate broader impacts practice. They cultivated a membership to ensure a variety of perspectives contribute to the developing field. Many curators self-identified as innovators, monitoring and focusing their energy on the collective impact and overall vision of the network.

The analysis of boundary related data uncovered a suite of curator practices (Table 2) in four primary categories: building community; focusing the scope of the network; stewarding competence in the

domain; and advocating at the collective scale. Descriptions of critical curator practices appear below organized by category.

C1: Building community across the many organizations involved in the emerging broader impacts domain was a primary aim of several curators. While the dispersed individuals and programs have a history of addressing broader impacts, the network provided the first opportunity for facilitated interaction and community building in the domain. Curators established a set of network norms privileging permeable boundaries and offering members broad connectivity with a collective. They encouraged members in their sojourner roles to serve as ambassadors for the shared network goals and to express their connection to the larger initiative around broader impacts in their local work. One member described the unbounded nature of the network, “NABI has got to be the most welcoming, friendly, genial group of professionals I have ever come across, there is no criticizing or grandstanding, you don’t see that much, it is a respect thing” (interview, June 2017).

Heterogeneity enabled a variety of good ideas and practices from a diverse set of members to coalesce in the network. One curator recognized this characteristic, “the diversity of the individuals who participate in NABI is a strength” (interview, May 2017); nearly all survey respondents agreed with this sentiment. Curators take on the job of casting a wide enough net to maximize learning opportunity and generate important connections to other domains or organizations in the system.

Curators encouraged the membership to engage in vertical integration on their campuses, but also at the national level. They used their own ambassador practices as an example to follow. One member described how the network is a collective that can be leveraged, “there is a huge push from our university to increase our standing, to engage nationally, NABI is a huge part of that” (interview, May 2015).

The open boundaries and low barriers to membership described above are in tension with how curators also manage to build identity and define the criteria for membership. They did not achieve this through intentional exclusion, but allowed self-selection to regulate membership. There was an ongoing debate about who is in and who is out. In the course of debate, some curators exposed their predisposition toward clarity of boundaries and desire to maintain a manageable network size, while others prioritized permeability, citing opportunities for growth and learning.

Discussions around developing a shared language and understanding of broader impacts indicated identity building work. Curators engaged in discourse about the need for thoughtful use of language to establish meaning in this new domain. In one such discussion a curator brought up the network’s “linguistic footprint” noting that, “NABI may be giving NSF the language to talk about broader impacts in a more meaningful way” (observation, April 2015). Other discussions among curators focused on what it means to be a broader impacts professional. Attention to the use of language also influences curator practices of focusing scope and stewarding competence.

Overall, curators align the network with other key entities in the system and provide a “safe space” for members who are “looking for support [from leadership] at their institution and coming to NABI for ideas, community, and support” (observation, October 2015). Rather than just building a network where they feel belonging, curators were intentional about providing belonging for a variety of members. Anyone who shared the larger mission and moral imperative, improving connections between science and society, could productively engage.

C2: Focusing scope requires curators to understand how the network is situated in the system, identify problems in the system, and prioritize network actions around those problems while simultaneously aligning with national and local scale needs. NABI is “trying to find its place among organizations involved in research” (survey, May 2017). Curators engaged with external organizations and people to understand problems in the system and prioritize which problems the network

should collectively address. For example, curators regularly connected with NSF staff to discuss how NABI may inform and support the agency’s progress on broader impacts. A group of curators also met with members of the National Science Board and a congressional staffer to learn about planned policy activity in relation to broader impacts. Curators used what they learn from such interactions to align the network with national-level policy trends.

Curators gathered information from stakeholders throughout the system to help them problematize around broader impacts. For example, the academic promotion and tenure process is widely considered in the network to constrain transformation as it privileges grant income and discipline specific peer-reviewed publication over achievement of broader impacts. Network curators grappled with gaining a full understanding of scientists’ lived experience of the reward structure to identify the degree to which the network should prioritize action to improve this situation.

Practices to cultivate boundaries around the network are critical in focusing scope as the network is a reflection of the collective knowledge and perspective of the membership. One member described the potential advantages network demarcation by expressing concerns about increased heterogeneity, “there’s a lot of solidarity among those of us doing similar kinds of work...if we lost that, if we became diluted, that would be disappointing” (interview, June 2017). These practices occurred in tension with efforts to keep boundaries permeable and navigable to building community.

C3: Stewarding competence aligns with the network goal of building a distributed community of professionals, where the curators are holders of what it means to be competent in the domain. Such practices contributed to building boundaries around the network community and occurred with acknowledgement of how expertise relies, in part, on one’s ability to tap into network collective knowledge. Early dialog included statements of vulnerability articulating that nobody is an expert here, we are all figuring this out together (observations, April 2015; October 2015; April 2016). After two years of development statements began to counteract the vulnerability sentiment, “I am an expert, if anyone is, I am, we are” (observation, October 2016). External decision makers also acknowledged the “great collective knowledge” of the membership (observation, April 2016).

Part of stewarding competence was promoting and guiding scholarship around broader impacts. Curators contributed to peer-reviewed journals, shared their broader impacts research at Summits, and recently made significant progress toward establishing a dedicated broader impacts journal. A group of curators collaboratively developed a *Guiding Principles* document to steer broader impacts practices across the system (NABI, 2016). Most active members reported that they use the document when supporting scientists. Sojourners asked NABI for more similar resources that synthesize knowledge and guide practice in specific areas such as evaluation and broadening diversity in the sciences. In September of 2018 a group of curators was awarded substantial financial support to create and broadly disseminate additional resources and training that reflect the network collective knowledge and elevate broader impacts practice across the scientific community.

C4: Curators advocate for national-scale systems and processes that better enable success across sites. They kept a moral imperative, “I do this for my kids, for the generations that come after me” (interview, October 2015), and “bigger picture” central as they advocated. High-level influencers engaged in the network invited network leadership to discuss issues in the domain and the role of the network with NSF leadership, legislative staff, and organizations that develop policy on behalf of the scientific community. This high-level work, emerged from top-level interactions (Fig. 1d) and maintains the network as a force of transformation in the system where curators are the stewards and their practices build authority of the network in the system (Risien & Goldstein, 2018).

6.2. Sojourner practice

Sojourners, not responsible to build a network and develop the domain at scale, focus on improving local broader impacts activities engaging a variety of local actors to support progress. Here, the term sojourner describes the role a member employs as they modulate between co-learning in the network and more central practices at their home institution. Sojourners identified boundary work, specifically brokering, as key practices and dispositions of their practice. The critical mass of like-minded sojourners was a driving force initiating the network and members sharing their site-based experiences remains an essential focus of co-learning. Curators looked to their sojourner selves and colleagues to ground the network in everyday experiences of practice. Relative to curators, the sojourners have less accountability to the network, but high accountability to their own institution. Sojourner practice occurred across all of the four substructures described earlier with an emphasis on expanding local knowledgeability by navigating site-level boundaries (Fig. 1a). The sojourner finds alignment within their own institution and bolsters their success by aligning with the network. They work with an array of collaborators from across disciplines, organizations, positions, and practices. They foster expressibility and imagination as they cultivate partnerships, serving as brokers of information, and advocating for improved broader impact practices.

Sojourners drive an iterative learning cycle, connecting site-based innovations with the depth of knowledge and experience in the network. They consistently report that the network provides them credibility as knowledgeable individuals in the system, enabling them as competent providers of information about broader impacts.

S1: Fostering expressibility and imagination are two critical aspects, subtly enabled by sojourners, of personal identification that individuals learn in a complex landscapes of practice. Imagination is being able to imagine oneself as part of a community new or different from the communities with which one normally engages. Expressibility is the degree to which one can express who they are in a given community. Enhanced imagination and expressibility may influence individual choices of what communities and with whom to commit their energies (Wenger-Trayner & Wenger-Trayner, 2015). One member described their practice helping university scientists overcome “their uncomfortable feeling that there has to be difference in the way we communicate with minority people” (interview, June 2017). This sojourner, like many others, served as a personal guide for scientists, exposing common ground with a community that shares the natural curiosity that drives science. The sojourner helped scientists shift their thinking, from a compliance frame, e.g. “I just have to do this stuff, because NSF requires it”, to imagining that they can find common interests with an underserved community. Exposing similarities, not only differences, across social boundaries helped scientists see that these learners are “just regular people, they are smart, curious and interested”. By personally guiding people across such boundaries, the sojourner enabled each group to see what they have in common, increasing fluidity between groups.

S2: Cultivating collaboration includes sojourners’ practices that broker new relationships, cultivate partnerships, and build trust across different communities. They identify and leverage points of alignment across different communities of practice codifying potential for productive collaborations. For example, a scientist may have an interest in public engagement, but not a venue or science communication skills to follow through. Sojourners often connected such scientists with the training they need and established mutually beneficial partnerships with facilities such as science centers with built-in audiences. Sojourners maintain robust social-professional networks to facilitate such collaborations and demonstrate skill in coordinating multiple disparate entities for whom collaborative potential may not be otherwise obvious. One member described their practice as, “connecting [scientists] to the media, to museums, to schools, to evaluators; a lot of

it is just making the connections to the outside organizations, people and professionals, it can be really difficult” (interview, June 2017). Another member described this work, “it’s knowing a lot of people, partners and programs...if I didn’t have my ear to the ground, being familiar with what’s happening on campus [I could not help scientists] meet people in the community and make connections” (interview, June 2017). Sojourners spent significant energy weaving the web that connects people, listening, and learning to contribute to local broader impacts progress.

S3: Sojourners broker information and provide services to their local networks. There are four dominant and recurrent examples of sojourners conducting information brokerage services in alignment with the NABI network goals. First, using the previously referenced *Guiding Principles*, sojourners provided information about broader impacts development and practice to scientists who may not already have the skills to competently develop broader impacts plans.

Second, sojourners gathered information at Summits or through direct requests for from their network peers. They contextualized information for maximum interest and utility on their campus and for individuals whom they are supporting. This included changes in NSF review practices, anticipated legislative action, or specific broader impacts framing that may gain positive reviews of broader impacts plans. For example, emphasis on broadening participation in science is of increasing priority for NSF. Many sojourners learned about this at network gatherings and came to understand changes at NSF by listening to NSF staff and discussing early experiences of these changes with their peers.

Third, sojourners gathered stories of success and failure from their peers expanding their repertoire of justifications and pathways to help scientists plan and design broader impacts. Fourth, sojourners provided direct support to scientists in the form of training, proposal development, and evaluation services. NABI provided sojourners specific content from which they could draw to develop targeted local trainings. The inverse is also true, sojourners developed resources and trainings on their campuses and shared those with the network.

S4: Sojourners advocate at the local level. Many reported engaging with upper-level administrators at their institution to advocate for local broader impacts support. Often aided by the diagonal substructure (Fig. 1b), sojourners highlighted their role in the network and presented themselves as extensions of the collective knowledge and national standing of NABI. Sojourners shared strategies with each other on connecting broader impacts to local administrative priorities such as boosting public relations or competing with other universities. One member appealed to leadership, “I tell them, ‘hey look, there is money on the table [for broader impacts], we can direct it to our strategic planning goals if we do it carefully’” (interview, May 2017). Others reported using the moral imperative, improving the connections between science and society, as a basis for advocacy noting, however, that administrators are compelled more by “return on investment” via more competitive grant proposals.

The results and analysis in this section detail NABI as a case study and application to other networks will require thoughtful cross-walking. The next section includes insights for how understanding of network substructures, roles, and practices may assist network leaders, designers, members, and evaluators in accessing the full potential of a network.

7. Lessons learned

A comprehensive report completed by an external evaluator of NABI highlighted that network impact radiates out from active members who have a magnifying effect in the system. Such impact is difficult to measure or causally link to network activity. This study uncovers and examines some mechanisms for this magnifying effect in terms of the variety of substructures and practices that can enable feedback loops to ensure that the network itself learns and evolves via input and

knowledge that flows between member sites, partner organizations, and the network as a collective. For example, a network member employing the hub and spoke substructure (Fig. 1a) may gather information about the pitfalls associated with the short-term nature of broader impacts funding. The issue may then be discussed and synthesized among peers (Fig. 1c); after which a clear message of the specific nature and effect of short-term funding is conveyed to influencers in the system (Fig. 1d). The process works in reverse too. Influencers share a significant anticipated shift in practice at NSF with network members (Fig. 1d). Member peers then work together to assess the implications of the shift and collaboratively develop strategies to cope with the change (Fig. 1c). Members then share the anticipated change coupled with ideas on how local stakeholders should prepare for and address the anticipated shift (Fig. 1a and b).

Multi-sited learning networks are a mechanism for scaling up the communities of practice model (Lave & Wenger, 1991; Wenger, 1998, 2000) to work at the systems level and attend to the complex landscape of communities, practices and boundaries in the system (Wenger-Trayner & Wenger-Trayner, 2015). Learning networks are designed to transform the system more comprehensively across sites and scales and beyond practice to address boundaries, institutions, and power structures. Learning networks magnify the flow of information about practice by providing the superstructure for curators to work from the center of the community, and sojourners to fluidly enrich the network with an array of site-based knowledge and experience.

The activity scaffolded by substructures is critical to the transformative potential of NABI enabling flow of information in all directions across locations and scales. These substructures (Fig. 1b–d) emerged because curators in leadership roles were being responsive to the needs of sojourners who are responsive to the needs of their own institutions (Fig. 1a). Such mechanisms can be built-in to learning networks enabling monitoring of how substructures are used and the outcomes they produce. For example, recognition of the diagonal structure (Fig. 1b) and its role enhancing site-based support and resources could allow development of an intentional site visit program inclusive of an evaluation protocol to track event outcomes. Practitioners, sojourners and curators alike, can also use these substructures as an anchor for adaptive processes as they seek to balance site-based and scaled transformation goals.

Network leaders, designers, and members can couple the practices presented here with their own experiences to expand perspectives on the contributions of a broad suite of practices. Observations in NABI included several debates about how to bound membership, use internet collaborative platforms, involve for-profit entities, and accept sponsorship. During these debates individuals elevated the practices relevant to their own previous experiences and argued on that basis. There was a tendency to try to reach a consensus on the best practices. Network leadership ultimately remained open to members self-selecting how to engage with the network and how to conduct their own practice. They embraced the complexity by remaining open and adaptive acknowledging that transformative learning networks are complex endeavors. Many practices that seem to counteract one another can in fact productively co-occur progressing the network in terms of expanding authority and knowledge resources (Risien & Goldstein, 2018). Practitioners do not need to choose one or the other, rather weave together multiple practices allowing individuals to gravitate toward those practices and roles that suit their skills, dispositions, and sites.

Prescribed practices and defined roles are not necessary to develop transformative capacity. Transformation across sites and scales is not the result of single leaders nor bottom-up processes. It emerges from a concert of interdependent roles and practices, central or peripheral, curator or sojourner. By understanding and valuing both curator and sojourner roles and practices, network designers may enhance transformative capacity.

This framework is ripe for iteration and expansion. Network evaluators and planners may use it in its current form as network-

contextualized framing for discussions about system complexity, emergence, and adaptability. It may be of further use in helping networks identify and understand their own sets of practices and roles by examining them in comparison to the ones derived from this case. When applying this work to other networks it will be important to avoid using the practices and substructures as a prescription. There are, undoubtedly practices, roles and substructures missing here that may be critical to the success of networks with different goals and different designs. However, this framework is a starting point for a network to examine the substructures in which they are operating and to identify their own sets of practices and how they may work in concert, even if they at first seem to be in contradiction.

The framework may also diffuse debate about best practices by introducing the transformative potential of a broad variety of practices. A learning network should not simply supplant a hierarchical approach to change with a less formal organizational form. A network is transformative because it supports many small acts of change across sites and scales. This framework emphasizes the critical role of the sojourner in contributing to the overall transformation, they are the bottom-up force of change and deserve recognition for the impact of their practice and contribution to collective knowledge. Equally important are the curators as they work to achieve a cohesive, but sufficiently flexible, community in alignment with relevant national initiatives.

8. Conclusion

Risien and Goldstein (2018), offer a meso-theoretical contribution to the network literature to describe the process of network development and growth in terms of collaborative learning and building collective authority. They conclude that two kinds of boundary work – building and navigating – are critical in developing transformative capacity and occur in productive tension growing network authority and knowledge respectively. They assert that networked approaches to transformational change must attend to both types of boundary work. This article details the specific roles, practices, and substructures that, when woven together, can develop transformative capacity. This deep dive into a single case answers the call to examine network substructures and individual roles (Kapucu et al., 2014), explain the “human dynamics” in a network (Keast & Mandell, 2013); and describes the key practices of actors that enable the “softer side” of network practice (Weber & Khademian, 2008a, 2008b). Learning networks do not develop as hierarchical organizational forms, but instead emerge as a complex suite of fluid and interwoven structures, roles, and practices. In this case-study success is not the result of heroic leadership or rigid attempts to define organizational structures. Success rather appears to depend on both leveraging variety and supporting collaborative learning across sites and scales.

There is inherent conflict in distilling the many moving parts across multilateral boundaries in complex systems. Clarity requires categorizing, but this can detract from the true complexity of the system. Likewise, disaggregated practices presented in the typology are not a simple list of ingredients for network practice; their power lies in how they are interconnected. This analysis provides practitioners a road map of the suite of activities that have helped NABI create a positive environment on the path to transformation. In application, practitioners will weave these and other practices together in response to their own context.

The substructures and sets of practices are useful to examine learning networks or similar social innovations working to disrupt the status quo towards transformation of complex systems. Multiple substructures and a variety of curator and sojourner actions are all important and contribute to the transformative potential of learning networks. From this case study it appears that network leaders should avoid prioritizing specific structures, roles, or practices and instead embrace complexity mindful that all structures and actors have a role to play. Transformative learning networks may rely on the interplay

between sojourner and curator roles to make progress toward systemic change that extends across sites and scales. Future research could compare across such phenomena in several networks to further test if this open structure and multiplicity of practices substantially influences network success towards transformation in other learning networks.

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