Solving Problems Together:
Findings from the early stages of a Networked Improvement Community

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A dissertation submitted in partial fulfillment of
the requirements for the degree of

Doctor of Philosophy
(Educational Leadership and Policy Analysis)

at the
UNIVERSITY OF WISCONSIN-MADISON
2020

Date of final oral examination: 06/25/2020

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Abstract

This three-article dissertation is a case study of the initial stages of a Networked Improvement Community built around the practices in personalized learning schools. Networked Improvement Communities (NICs) are a type of research-practice partnership that tackle how to sustain and scale change across school communities. Research on how they are initiated is needed as this model is adapted across a range of contexts. Case studies in particular provide the depth of exploration to understand what aspects of the NIC model worked in a particular context, for whom, and under what conditions.

This case study focuses on the Personalization in Practice - Networked Improvement Community (PiPNIC). Each article then takes up one of the three guiding questions of NICs: what problem(s) are we trying to solve?, whose expertise is needed to solve these problems?, and what are the social arrangements that will enable this work? The first article examines how the PiPNIC initiation team identified a problem of practice through radical listening to educators and educational leaders across the state. Drawing on qualitative data, the analysis traces how the activities of the initiation team narrowed the problem space and selected a problem of practice. The second article examines how the NIC activities supported participants in sharing their problem-based expertise. This qualitative study illustrates how the NIC created the conditions for ideas to be generated, selected, and integrated through the coupling of network and team activities and authentic design tasks. Finally, the third article explores how collaborative design fosters help-based interactions, and how these social arrangements provide the conditions for the relational trust necessary to solve hard problems. Each article addresses practical and theoretical considerations for initiating NICs, contributing specifically to the current NIC initiation

framework. By organizing this inquiry as an instrumental case study, the goal is to produce insight in the spirit of continuous improvement, rather than an evaluation of whether NICs "work." As such, this case contributes to the collective effort to leverage the wisdom of research, practice, and design knowledge to improve schools.

Appreciations

Getting to a submitted dissertation would have never happened without the help of many people:

To my advisor, Rich Halverson: Your willingness to do things is an inspiration, like launching this crazy project to bring personalized learning educators together to do some cool design stuff. Learning from you has changed how I understand the world - from design to adjacent possibles to participatory cultures. I am incredibly grateful for the work we have done together and look forward to when our paths will cross again.

To my committee, Carolyn Kelley, Pete Miller, Peter Wardrip; other SoE faculty, Rachelle Winkle-Wagner, John Diamond, Nick Hillman, Julie Mead, Mollie McQuillan, Erica Halverson, Lesley Bartlett; and faculty at other institutions, Justin Bathon, Sara Dexter, David Eddy-Spicer: Thank you for your work to inspire, challenge, and care for me and fellow graduate students as we become scholars.

To Madeline Hafner, I don't even know how to even say thank you for all the care you have shown me. You got me through some of the very toughest moments of this journey, and I am so grateful.

To Sarah Archibald, you have modeled for me how it is possible to both supervise and care for people, and you saw strength in me when I couldn't see it in myself. Thank you for your patience, support, and flexibility throughout this year at the Network.

To my fellow graduate students, Helen, Valerie, Ellie, Paris, Jamila, Ashley, Jacquie, Shelby, Cassidy, and Sarah I; and to the PiP team, Francis, Al, Tanu, and Sarah H: I am thankful our paths crossed here in Madison, whether in classes, offices, or research projects. I am humbled and inspired by the brilliance each of you brings to this world.

Van: You are an inspiration to me as a scholar, mama, and human being. I am so thankful we were in the grad office together. I will miss seeing you at AERA and UCEA!

Emily and Jessie: I do not know what I would have done without you, especially in the last few months of quarantine. I'm looking forward to many more Tuesday evening Zooms and writing together.

Jerry: You have been an awesome and inspiring colleague to work with. Thank you for our many conversations/pep talks in the grad offices.

Nate: I am so grateful we met at Play Make Learn those years ago. I thankful for our friendship.

Tarsha: Thank you for being a text writing partner at 6am, a fellow mom of boys, and a friend to take walks with.

Sarah O'Dell: What luck that you were my ELPA buddy! You inspire and challenge me to think critically about my work and leadership. Please keep sending me articles to read, including yours!

To my fellow student parents, I am thankful that we had each other to make it feel more normal to have babies, kids, and families in graduate school.

To the teachers at the UW Preschool/Child Development Lab, Mary and Katy in the Fox room; Kate, Casey, Dana, and Maria in the Honeybee room; Esther and Linda in the Chipmunk room: Every day I dropped off my kids, knowing they would be loved and cared for. We celebrated milestones together, like first words and steps. Your daily emails, pictures, and portfolios are treasured memories of our time together. Our family is forever better because of you.

To my family, Mom and Jean-Pierre, Dad, Carol and Rob, Deb and Chuck, Jean: At every turn, you have been there to help and support in more ways than I could have imagined.

Dad, you finally got a doctor! Even if it's not that kind of doctor.

Mom, your unyielding support through visits, facetime, and Grandma camps has in so many ways gotten me through this. Thank you for being my greatest cheerleader.

To my husband, Scott: It has been a lot of late nights, drop offs and pickups, poop, dishes, kids crying, dinners, zone defense, cleaning, laundry - all with intellectual banter in between. You heard the first versions of all these ideas, asked me questions, and let me test out arguments. I am so glad that we get to do this life together. Now it's your turn!

Finally, to my boys, Alex, Ethan, and Charlie: Alex, you had just turned two when this all started, and now you are a big brother twice over, independent reader, and skateboard rider. Ethan, you came to class with me at just one week old, and now you are a master Lego builder and bike rider. Charlie, you came along to meetings and conferences (like flying to Houston with me at 5 months), waiting patiently while I dashed between presentations, and now you are climbing on the playground and keeping up with your brothers. You three are the ballast that keeps me moving forward. May you be curious, thoughtful, and persistent in the dreams you dream.

Research Support Acknowledgement

The research reported here was supported by the Joyce Foundation, The University of Wisconsin-Madison, and Institute of Education Sciences, U.S. Department of Education (R372A150031). The opinions expressed are those of the authors and do not represent views of our supporters.

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Chapter 1: Problem Statement

In 2011, Tony Bryk, Louis Gomez, and Alicia Grunow proposed a new model for improving educational systems at scale: the *Networked Improvement Community* (NIC). A NIC is described as a social reorganization of research and development (R&D) activities. They argue that R&D needs a new approach to tackle the complex and systemic nature of the problems that schools face. NICs aim to (1) identify and understand the problem that needs solving, (2) bring together a "diverse colleagueship of expertise" (Bryk & Gomez, 2007, p.19), including researchers and practitioners, and (3) structure the social arrangements through a disciplined inquiry approach called improvement science. In contrast with traditional R&D, NICs are explicitly driven by problems, rather than theory; begin with small, iterative testing, to learn from the variation in outcomes (LeMahieu et al., 2017); and achieve scale by the coordination and combination of these small tests through network partners from different contexts. With growing interest in the implementation of networked improvement[1] nationally and internationally, how to initiate this model with integrity is critical (Russell et al., 2017).

This three-article dissertation presents an instrumental case study of the emerging stages of the *Personalization in Practice - Networked Improvement Community* (PiPNIC), a NIC organized around the practices in personalized learning schools. The case study is framed by the three guiding questions of the NIC model: "First, what problem(s) are we trying to solve? Second, whose expertise is needed to solve these problems? And third, what are the social arrangements that will enable this work?" (Bryk et al., 2011, p.4). The case study draws on qualitative and social network data, gathered throughout the problem identification, recruitment,

[1] See for example, the Bill & Melinda Gates Foundation creating the Networks for School Improvement grants. http://k12education.gatesfoundation.org/what-we-do/networks-for-school-improvement/

and design stages of the network, and presents an opportunity to explore how a common problem of practice was identified, how expertise was leveraged, and how relationships were built.

Publication Status	Under Review: *AERA Open*	N/A	Published: Frontiers in Education
Title	**Article 1:** Radical Listening as a Problem-identification Strategy in the Initiation of a Networked Improvement Community	**Article 2:** Accessing Problem-based Expertise: An analysis of the improvement infrastructure of the early stages of a Networked Improvement Community	**Article 3:** Designing for Trust-building Interactions in the Initiation of a Networked Improvement Community
Overarching Question	How do members of a Networked Improvement Community come together to solve problems of practice?		
Article Research Questions	How did a university-based research team use radical listening strategies to identify a common problem of practice to initiate a Networked Improvement Community?	How can the activities of a NIC be organized to create the conditions to transform problem-based expertise into a resource for improvement?	How do NIC collaborative design activities foster reciprocated, help-based interactions?
Theoretical Framework	Problem-identification Radical Listening	Improvement Infrastructure Problem-based expertise	Social network theory Relational trust Collaborative design
Methodological Approaches	Qualitative with a design focus	Qualitative with a design focus	Mixed methods drawing on qualitative and social network data
Data Sources	Grant Application, Participant Observation, Emailed reflections from participants in the expert convening, Expert Convening Report, Listening session notes from phone calls and visits on a google spreadsheet, Meeting notes, Research Group Meeting Presentation and Meeting Summary, Partnership Memo	Artifacts from the design process including video scripts, facilitator sheets, improvement pitches, draft protocols, user-testing feedback, final protocols; partnership memos, focus groups	Qualitative data included written documents, including the initial grant application, an advisory committee report, a research group presentation, meeting agendas, and a final report Social network data was from a social network survey given to all participants at the last meeting
Analytic Approach	Focus on how the initiation team used a participatory approach to construct a rich problem-solution space, and how this participatory approach supported the initiation team in selecting a different problem of practice	Design-based approach to identifying the features of the activities and inductive coding of the artifacts to trace improvement ideas	Mixed methods analysis began with the social network then qualitative data. The social network analysis was used to identify patterns in interactions, then the qualitative data provided the quality of the interactions.

Argument	Radical listening in the problem-identification process provides a practical and critical strategy for NIC initiation and supports the vision of NICs as a problem-centered model for systems change.	Two network-level features of the improvement infrastructure include provided access to educators' problem-based expertise.	Collaborative design activities can foster the kinds of trust-building networks necessary for NIC success.
Significance	Radical listening provides a practical strategy and participatory stance for the design of NICs and operationalizes the vision of Networked Improvement Communities as a model of participatory, problem-centered reform.	This paper extends the understanding of how NIC leaders can design an improvement infrastructure to reorganize educational improvement around common problems in order to both generate new ideas and get them into action.	This paper demonstrates how social network and qualitative data might be used to generate network-level data for improvement and contributes theoretical insight into the way collaborative design creates the conditions for the long-term development of relational trust.

Table 1-1: Dissertation Article Summary Chart

Three Articles

The first article, *Radical Listening as a Problem-identification Strategy in the Initiation of a Networked Improvement Community,* takes up the inquiry into how a NIC initiation team identifies a problem of practice. Despite the fact that "problem of practice" is central to most literature on partnerships, little is discussed about how the problem is identified. I draw on data collected across the PiP research alliance and PiPNIC subproject to identify how the research team narrowed the problem space, and the inflection point from conferring as a phenomenon of interest to object of design.

The second article, *Accessing Educators' Problem-based Expertise: An analysis of the improvement infrastructure of the early stages of a Networked Improvement Community*, examines how expertise is shared across the network in the collaborative design activities of the NIC. NICs rely on the practice-based expertise of participants to inform the design activities of the network, however the presence of practitioners is not sufficient for their engagement in a design process (Muller, 2003). Drawing on a range of qualitative data, this article examines how

the features of the design activities of PiPNIC's 90-day design cycle created the conditions for participants in the NIC to generate, select, and integrate their problem-based expertise into a resource for networked improvement that informed the design process and the final products.

The third article, *Designing for Trust-building Interactions in the Initiation of a Networked Improvement Community*, looks at social arrangements that foster reciprocated, help-based interactions during initiation. These help-based interactions are a theoretical precursor to relational trust, an essential resource for working with others to ask and answer hard questions. The analysis focuses on how the collaborative design activities at the heart of a NIC and contributes a perspective of seeing relational trust as a capacity to be built through network design.

Implications

For Networked Improvement Communities to become a practical reality, learning at the network level is essential. Network-level learning means inquiry into what works, for whom, and under what conditions of each NIC implementation. Case studies, like this dissertation, provide a qualitative inquiry that can support the development and refinement of frameworks. This inquiry provides practical insight into the internal dynamics of how NICs are initiated, including how problems are defined, how expertise is leveraged, and how people work together, contributing to the gap in practical knowledge of how NICs work (Coburn & Penuel, 2016). Case studies informed the current initiation framework (Russell et al., 2017), and each article addresses how this case contributes to this framework. Additionally, there is significant interest in how to assess the effectiveness of partnerships (Henrick et al., 2017), and this case contributes to growing interest in using social network analysis as a methodology to do so. The overall goal of the case is to contribute to a network level learning of NICs as a model for educational R&D.

Organization of the Dissertation

The three articles of this dissertation are oriented by the initiating guiding questions and connect different layers of the NIC initiation framework (See Figure 1-1). These three articles, tied together in through this dissertation, contribute an inquiry into the emerging stages of one NIC. The three-article format examines the same case from different perspectives and scales. For example, the first article will draw on the literature of problem-identification and focus more broadly on the actions of the research team over the course of three years. In contrast, the second and third articles focus on the core mechanism of NICs, collaborative design, during the 90-day design cycle to understand how these activities create the conditions to unlock expertise and build relational trust. The three articles come together around the same phenomenon (initiating NICs), yet each makes distinct methodological and theoretical contributions.

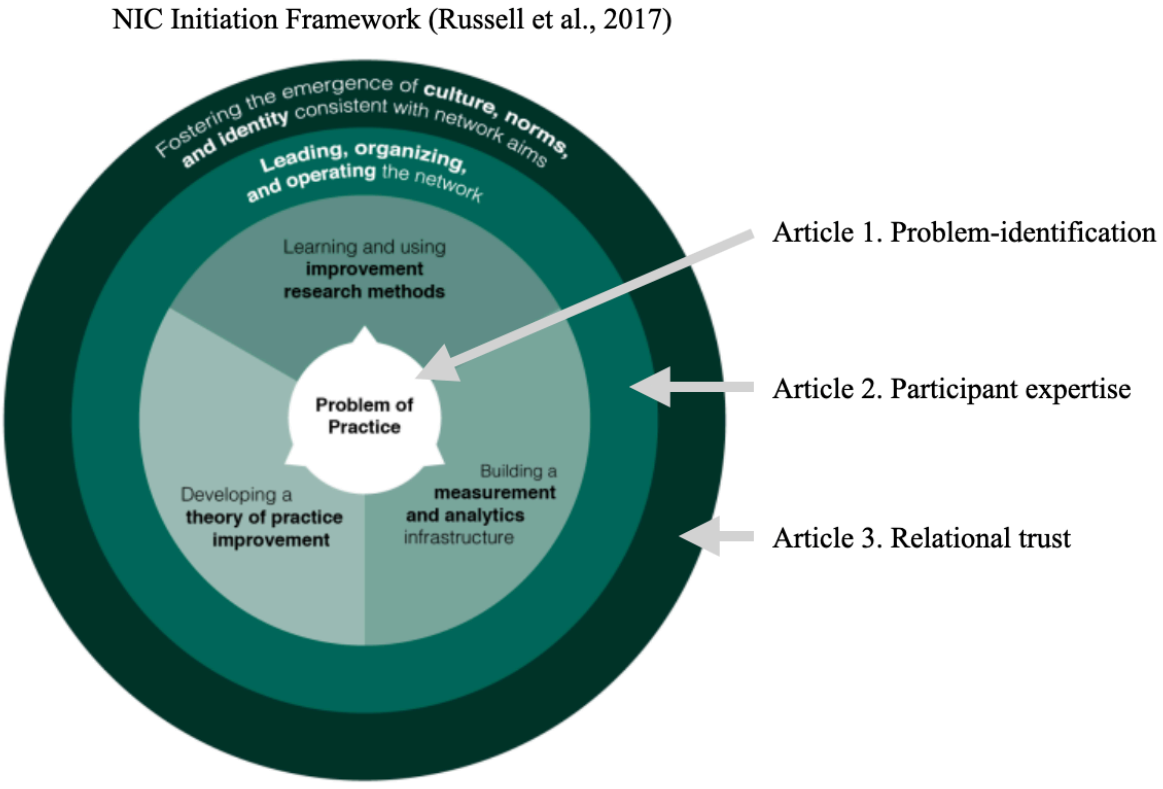

Figure 1-1. Diagram of Article Contribution to the NIC initiation Framework (Russell et al., 2017).

The subsequent pages of this chapter provide an overview of the history of research and development in education in order to situate NICs and how what they propose is a *re-*organization. This includes current critiques of NICs themselves and the necessity for research on the varied ways these ideas are taken up in order to inform the improvement of the NIC model. Next, I include a brief rationale for each article, including why the guiding question is important, key pieces we already know, and how PiPNIC is a good case through which to examine the question. Finally, I provide an overview of the research design methods used including the rationale for an instrumental case study, a description of the three stages of PiPNIC, and data collection and analysis methods.

Educational Research & Development

Schools are central institutions in educating students for future civic and economic participation, but the current system is struggling to meet the increasing demands of the 21st century (e.g. Resnick, 2010). Bryk (2017) calls this gap between our aspirations for school systems and the reality of what they accomplish the social justice imperative of our time, and this imperative demands that we change how we improve educational systems at scale.

Traditionally, industries have looked to research and development (R&D) organizations to come up with new ideas, strategies, and products to improve output (Stokes, 1997). The current linear R&D model begins with basic research, often at universities. This work produces knowledge, guided by the development of theory. Applied research activities then study these theories in use. Developers, often in the commercial sector, take these results to make tools or products, which are meant to disseminate these ideas to the final user. In this model, scale comes from applying the rigorously produced knowledge in more places with fidelity.

Education has attempted to replicate this R&D model, but there is a long, complex history of looking to educational research to improve the practice of schooling (Lagemann, 2000; Cuban, 2016). This linear conception can be seen in the 2002 Education Sciences Reform Act, which created the Institute for Educational Sciences (IES) and the "What Works Clearinghouse." The theory of action of the "What Works Clearinghouse" is that knowledge, created through rigorous reasoning and scientific methodologies, would inform the work of changing practices in schools (Shavelson & Towne, 2002). This strategy, however, has routinely come up short toward impacting practice (Kane, 2016). A key critique of the What Works approach is the disproportionate emphasis on understanding causal relationships, while ignoring the knowledge about how it will be applied in practice (Bryk & Gomez, 2007).

More broadly, the disconnect between the knowledge generated by research and change in school is known as the research-practice gap (Biesta, 2007). Some have called for dedicated research coordinators in schools or translational research efforts to act as linking agents between research and practice (Woolf, 2008). This approach, however, is predicated on the assumption that practitioners merely need to try harder or be taught how to use the research, not that the research itself does not have the information practitioners need. Recent research suggests that leaders actively eschew research to maintain legitimacy in their practice-based context (Roegman & Woulfin, 2019).

In 1999, the National Academy of Education (Brown et al., 1999) called for efforts to rethink the relationship between research and practice and support "new forms of research organization that are focused on practice and on engaging researchers and practitioners together in problem solving and theoretical analysis" (Brown et al., 1999, p.11). The current movement toward research-practice partnerships (RPPs) is one increasingly popular effort to transform the

relationship between research and practice (Coburn & Stein, 2010). RPPs are defined as "long-term collaborations between practitioners and researchers that are organized to investigate problems of practice and solutions for improving schools and school districts" (Coburn & Penuel, 2016, p.1). There are generally three accepted types (Coburn, Penuel, Geil, 2013):

1. research alliances, that use inquiry methods to investigate issues or problems the district faces;
2. design-based partnerships, that use co-design methods to focus on building interventions to work within the local context; and
3. Networked Improvement Communities, that use improvement methods to develop interventions that work across a range of contexts.

In practice, however, the line between these types often blurs. For example, this dissertation examines a Networked Improvement Community that emerged from an existing research alliance and draws from both improvement and co-design methods.

It is worth noting here that the goal of NICs, and research-practice partnerships more generally, as a reorganization of R&D, is not meant to eliminate basic research. Basic research is critical to create knowledge that can be used to improve institutions. The shift here is to look toward knowledge about implementation as a correlative endeavor that has been largely overlooked and as an opportunity use the existing institutions, like universities, to solve problems in a way that might transform systems and their outcomes. Thus as this social R&D reorganization strategy is taken up, research into these efforts is needed to understand how these ideas are implemented (Coburn & Penuel, 2016).

NICs as a Social Reorganization of R&D

Networked Improvement Communities, a type of RPP, are defined as "a social structure to organize collaborative improvement" (Russell et al., 2017, p.2). This social strategy is threefold: leverage the innovative power of networks, discipline the inquiry and align efforts

through improvement science, and foster the emergence of communities of learners who engage with hard problems and continue to pursue improvement.

The term "Networked Improvement Community" originates with Douglas Engelbart's (1992) work to conceptualize a macro-structure for the accumulation of practice-based knowledge. This macro-structure includes three levels: A-level is the primary activity (in this case, the teaching and learning that happens with teachers and students), B-level is the work across the organization (in this case, school), and C-level is the knowledge that is generated across organizations (in this case, the network). The focus of this dissertation is primarily the design of C-level network activities.

Bryk and colleagues (2011) describe C-level activity this way:

> C-level activity is inter-institutional, representing the capacity for learning to occur across organizations…. C-level activity affords mechanisms for testing the validity of local knowledge, adjusting local understanding of the true nature of a problem, and advancing local support structures for improvement. (p.7)

That the C-level is arranged as a network is significant in three ways. One, the implementation of improvement ideas in multiple contexts provide information to highlight the role of context in development. In this way, NICs become a strategy to leverage context to improve the development of interventions rather than variables to be controlled for or flattened, as with traditional research methods. Second, networks provide the weak-tie connections that are critical for sparking and spreading new ideas (Johnson, 2011). For example, digital networks are providing rich problem-solving capacities in ways that education could leverage (Nielsen, 2012). Third, the problems that educational systems need to solve are generally complex and exist at multiple levels. The consequence of this is that the knowledge needed to solve the problems rarely exists in one person (Mintrop, 2016). Collective effort is needed to see the complexity of the problem and make changes in the system that produces the undesired outcomes.

The activities at the C-level directly influence how B- and A-level improvement takes place. The B-level focuses on organizational learning through improvement science. LeMahieu and colleagues (2017) describe improvement this way:

> Improvement research closely inspects what is already in place in social organizations – how people, roles, materials, norms and processes interact. It looks for places where performance is less than desired and brings tools of empirical inquiry to bear and to produce new knowledge about how to remediate the undesirable performance" (p.3).

The roots of improvement approaches are in the industrial efficiency innovations of Walter Shewhart and William Edwards Deming (1994). These ideas informed the Total Quality Movement in business in the 80s and then influenced the Institute for Healthcare Improvement (IHI) (Berwick, 2008). IHI was then a direct partner in the development of NICs at the Carnegie Foundation for the Advancement of Teaching under the direction of Tony Bryk, Louis Gomez, and Alicia Grunow (2011).

At this organizational level, improvement science provides an inquiry framework within which to apply changes. The tenets of improvement include disciplined inquiry into a problem of practice; proposing change ideas based on an understanding of the system that produces the problem; a feedback mechanism for the changes, such as practical measurements; testing and adapting changes at a small scale first before system-wide implementation; and making the changes sustainable by integrating them into the current system (Bryk, et al., 2015). Practitioners play a key role in problem-identification and problem-solving processes (Perla, Provost, & Parry, 2013).

The participants in networked improvement must engage with each other, and NICs draw on ideas of collaborative to shape out problems are identified and solved through production and reflection cycles (Bryk & Gomez, 2007). Collaborative design, also sometimes called participatory or co-design, is a diverse field and draws on many traditions. Historically, many of

these roots are from the Scandinavian work reforms of the 70s and 80s that gave workers more agency over their work conditions, and describe both a methodology and a philosophy of political engagement; co-design is pragmatic, democratic, and collective (Bødker, Ehn, Sjögren, & Sundblad, 2000). In the United States, co-design was adopted by the Human-Computer Interaction field (Schuler & Namioka, 1993; Muller, 2003), and has more recently begun to influence the learning sciences and design-based research methods (DiSalvo et al., 2017).

Collaborative design, as it has been brought into education, has been defined as "a highly-facilitated, team-based process in which teachers, researchers, and developers work together in defined roles to design an educational innovation, realize the design in one or more prototypes, and evaluate each prototype's significance for addressing a concrete educational need" (Penuel, Roschelle, Shechtman, 2007, p.51). Similar to improvement, a key component of co-design is bringing the voice of users into all aspects of the design process and a focus on assessing concrete impact of the intervention.

In addition to NICs as a structure for solving problems, NICs become their own organization and bring about the emergence of their own culture, norms, and identity (Russell et al., 2017). The formation of this "community" across organizational affiliation, physical location, or level of expertise may provide a resource for motivation and continued engagement in the hard work of improvement. Bryk & Gomez (2007) describe this as a "diverse colleagueship of expertise" (p.17). Whereas in traditional R&D, where are clear distinctions between researchers (knowledge-producer) and practitioners (knowledge-user), NICs blur these distinctions, likened to a kaleidoscope as opposed to a mosaic (Bryk, 2017). Indeed the success of a NIC may hinge on whether a community coheres around the collective work (Bryk et al., 2011).

Situating the Vision of NICs

Peurach (2016) characterizes NICs as a new type of "self-improving educational systems that can better serve more students in ways that we are just beginning to imagine, let alone understand." Erik Olin Wright, in his book, *Envisioning Real Utopias* (2010), lays out a framework for how social scientists might think about alternatives to current realities, providing a road map for realizing a vision at the scale of a paradigmatic change. While Wright's subject is imagining an alternative to capitalism, Bryk's (2015) AERA address is laying out a vision for transforming the work of educational systems and everyone involved in them. Wright suggests three criteria: desirability, viability, and achievability. Desirability is a largely theoretical stage with mainly contributions of abstract principles or ideals. Viability looks at a specific institutional design and whether this could be created. This leverages a "proof of concept" idea, in creating test cases or first tries that demonstrate that a design is possible. This has been the role of the Community College Pathways NIC and the Beginning Teachers Network. These first cases demonstrate that the model is indeed both desirable and viable. Achievability depends on the strategies of implementation and mobilization and must cope with the interaction with larger systems, unintended consequences, and a range of other conditions. Achievability descends into a swamp of contingencies that are difficult to parse and ultimately unhelpful in understanding what NICs are attempting to do.

For this reason, this dissertation is a study of NIC viability. While others have demonstrated that ideas of NICs are possible, what is needed now is an understanding of whether and how these ideas can be picked up by others and used to inform other efforts. Wright argues for studying alternatives from the standpoint of viability by stating "Developing credible ideas about viable alternatives is one way of enhancing the possibility of their achievability" (Wright,

ASA Presidential Address, 2012). This is the "instrumental" part of this inquiry, to contribute knowledge to the viability of an improvement paradigm for improving educational systems.

Wright's desirability, viability, and achievability framework for imagining alternatives also provides a way to situate critiques of NICs. For example, Petrilli (2019) asks up three questions for how NICs will be different than other reforms:

1. "How to better marry the 'bottom up' zeal of 'improvement science' with the top-down expertise of the larger research enterprise,"
2. "the 'culture of improvement' approach … assumes that there are lots of schools or systems out there with the drive to get better," and
3. overcoming "the political barriers to change within the system itself."

These three questions are rooted in Petrilli's assumptions of the existing conditions of educational systems and R&D, such as the location of expertise in the "research enterprise." These are legitimate questions for achievability, as NICs will need to address how to handle the varying conditions of implementation. The work here, however, is situated within determining whether NICs are a viable alternative.

LeMahieu (2011) offers the strategy of focusing research on NICs themselves through a model of implementation integrity, rather than fidelity. Fidelity of implementation is to use a practice or program as intended by the researchers or developers (Wallace et al., 2008). The use of the idea of fidelity is aligned with the traditional conception of R&D, where knowledge was produced in one place and then is transferred to another. Fidelity is a strategy where the producer tries, usually unsuccessfully, to retain control. From an implementation integrity standpoint, context must interact with the practice or program: "This idea of *integrity in implementation* allows for programmatic expression in a manner that remains true to essential empirically-warranted ideas while being responsive to varied conditions and contexts" (LeMahieu, 2011, n.p.). Designing for integrity, instead of fidelity, of implementation, is the goal

of the interventions that NICs develop, but may also support improvement of the NIC model itself.

This is the approach that I take in this dissertation by grounding my inquiry in the guiding questions of NICs. Understanding early adaptations of NICs as part of a collective effort to learn fast and glean from them insights into what NICs might look like, we may contribute to the collective effort of "get[ting] better at getting better" (Bryk et al., 2015) to accelerate learning at the network level.

Guiding Questions of NICs

This dissertation thus frames this inquiry by the guiding questions of NICs, with the goal of supporting their design for integrity of implementation, rather than fidelity, and learning fast to implement well. The three questions that guide this inquiry are, What problem are we trying to solve, whose expertise is needed, and what social arrangements are needed to make will enable it to work?

What problem are we trying to solve?

While it might seem that problems abound in education, how NIC initiation teams identify a problem to anchor NIC activity is actually quite a challenge in itself. Identifying a "compelling and measurable aim that will motivate collective action" is one of the key challenges of NIC initiation (Russell et al., 2017, p.4). Penuel and Gallagher (2017) note that "the very first formulation of the 'problem' will [rarely] be a most productive one around which to design the joint work" because "the initial problem representation typically represents only a partial view of the situation" (p.45).

Whereas in traditional R&D problem identification would be led by theory, the problem at the heart of the NIC is led by what is happening in practice. And this problem is part of a

larger problem system: “it is within the problem system where students actually progress or fail” (Bryk et al., 2011, p.5) and “for a NIC to make headway towards constructive improvements on a complex problem, the community needs to detail the contours of its problem-solution space” (p.15). The problem space identifies the people, policies, and programs involved and how they interact with the problem, as well as a detailed understanding of the current state of the problem and an idea of desired solution states. This problem space may include goals of the system that contradict the goals of individual actors, and the problem space may change over the course of improvement.

How NIC problems are identified is largely unexplored, though some work has been done in the context of design-based research-practice partnerships (Penuel, Coburn, & Gallagher, 2013). Mintrop (2016), for instance, discussion some factors that might make a problem appropriate, including that it is achievable within the time frame constraints of the network, it is perceived as a problem at multiple levels, and it has a solution that is high leverage toward improving desired outcomes. This article thus contributes novel insight on this part of the NIC initiation process.

The case of PiPNIC provides a good case for this analysis because problem identification grew out of a research alliance that had spent two years documenting the practices of personalized learning. There is thus a rich base of qualitative data tracking the research team’s understanding of the practices of personalized learning and sensemaking of how the reform was taking hold across the region. As the partnership shifted to initiating a NIC, we continued to document how our understanding of the problem and envisioned solutions alongside the activities of the NIC.

Whose expertise is needed to solve these problems?

Problem-identification and problem-solving both require expertise (Newell and Simon, 1972; Feltovich, Ford, & Hoffman, 1995). Expertise is a combination of knowledge, skills, and experience. It is often conceptualized as a "thing" that people possess or not, but it is not nearly so concrete. Expertise lies "not simply within a single individual, but is situated in the relationships between practitioner, task, environment, and the organizational characteristics that direct and constrain practice in the domain" (Roesler & Woods, 2007, p.222). Thus solving problems is not simply a matter of getting the "right" people, but instead about getting people together in the "right" way.

One of the key features of NICs is including practitioners throughout the problem-identification and problem-solving processes. Practitioner knowledge, rooted in the particulars of practice, can be difficult to make public, share across contexts, and verify and improve (Hiebert, Gallimore, & Stigler, 2002). Thus accessing the practitioner expertise is about structuring participation to draw out the practice-based knowledge they have to contribute.

This second article focuses on how the configuration of the design activities provided the conditions for educators to transform their expertise into a resource for improvement. For example, the collaborative design activities asked educators to first construct public representations of their conferring practices through a modified video club activity, then pitch improvement ideas through a pitch, and finally user-test the protocols to verify and improve them. The analysis draws on a range of qualitative data, including artifacts, observational data, and focus group reflections.

What are the social arrangements that will enable this work?

NICs bring people together to solve common problems, but this joint work requires participants to be vulnerable, flexible, and reliable, among others, to be successful. The kinds of relationships that provide the capacity for the work needed in NICs has been characterized as relational trust (Bryk & Schneider, 2002). Trust has also been identified as a key condition for initiating partnerships and an important outcome of participation (Henrick et al., 2017). Relational trust can be built through reciprocated help-based interactions, where two people ask for and receive help from each other over time. This is an example of what collaborative designers call *infrastructuring* (Ehn, 2008; Penuel, 2019).

Thus the third article focuses on the social arrangements that support the development of relational trust. Again, PiPNIC provides a case study to look at these social arrangements, focusing specifically on the sequence of collaborative design activities, patterns of interactions across the network, and the quality of those interactions. This article draws on social network and qualitative data.

Chapter Summary

As Bryk and colleagues (2011) note, these three questions are seemingly straightforward, but have complex answers in how NICs are implemented in the real world. NICs themselves are social systems built on an existing social system. As such, the goal of this dissertation is to illuminate how NICs are an achievable, social reorganization of R&D and research at the network level can produce know-how for getting ideas into action. The next section details the research design of the case of PiPNIC.

Research Design

This three-article dissertation uses an instrumental case study approach (Stake, 1995). Bryk and colleagues (2011) call for analyses of cases to inform the emergence of NICs as an organization: "Much knowledge know-how can be gleaned from comparative analyses across multiple cases emerging in the field" (p.38). The first article takes a qualitative approach while the second and third article uses a mixed methods approach that draws on social network and qualitative data to answer a qualitative research question (Plano Clark & Ivankova, 2016).

Research Questions

How do members of a Networked Improvement Community come together to solve problems of practice?

- *Article 1*. How did a university-based research team use radical listening strategies to identify a common problem of practice to initiate a Networked Improvement Community?
- *Article 2*. How can the activities of a NIC be organized to create the conditions to transform problem-based expertise into a resource for improvement?
- *Article 3*. How do NIC collaborative design activities foster reciprocated, help-based interactions?

An Instrumental Case Study

This three-article dissertation presents an instrumental case study of the integrity of implementation of NICs. This case is instrumental because the goal is to understand PiPNIC as an instance of NIC initiation, rather than an intrinsic interest in PiPNIC itself. Identifying this as an instrumental case study is helpful for determining how PiPNIC is a good case to learn fast about the viability of NICs.

A case study format provides the depth, attention to context, and detail of the activities to provide insight into how the ideas of NICs are taken up and operationalized (Baxter & Jack, 2008). Eventually, an understanding of the variation in NICs might inform evaluations or improvement of the model itself. Case studies of NICs have been used to explore this new organizational model by highlighting important theoretical and methodological perspectives (Dolle et al., 2013; Hannan et al., 2015; Russell et al., 2013). Similar to these, this case is bounded through the actions of research team, beginning and continuing with the PiP research alliance and activities specific to the PiPNIC subproject.

PiPNIC is a good case to study for a couple reasons. PiPNIC was grounded in the research the PiP team had been doing and grew out of the need to combine efforts across organizations. Second, whereas many network analyses are done in retrospect, our research team collected data during each phase, documenting both practices in personalized learning and the research team's process. This means that there is a rich collection of data to examine in different ways, from the raw data to formal writing about personalized learning, as well as the process records of meeting minutes. Additionally, the close relationship between my role as research and as participant in PiPNIC provides for a depth of connection for a case study, though this is also a validity threat, which is discussed later.

That said, there are limitations to using PiPNIC as a case study of NICs. First, the NIC subproject is no longer running. The effort and funding for the research team to maintain the improvement work initiated in the 90-day design cycle was not sustainable while also doing research on the process itself. So while PiPNIC provides insight into the emerging stages of a NIC, it lacks connection to how this partnership would be sustained for longer. Still, an instrumental case study does not need to be typical or representative to be instructive (Stake,

1995). The goal is to use PiPNIC to understand how the guiding questions of the NIC model provide a viable structure for integrity of implementation.

Another strength and weakness of PiPNIC as a case study comes from the reform context. PiPNIC focused on the practices at the cutting edge of personalized learning, which provided a rich area of innovation. This contrasts with other examples of recent NICs which take more traditional aims at achievement gaps in math and literacy (Proger et al., 2017). The opportunity here was that the common problem of practice was less defined, which drew out the problem identification process, but it also means that the significance of the design work around conferring is less evident outside of personalized learning.

Along with the focus personalized learning, we intentionally recruited experts in personalized learning, individuals and teams who had sustained fundamental changes in their school organizations. These are organizations that have demonstrated capacity and resources for change. This contrasts with most school improvement networks that involve organizations with low capacity for change (Peurach & Glazer, 2016). This may constrain what can be generalized about PiPNIC, but the variation also provides an alternative application of who gets recruited.

In the next section, I provide an overview description of PiPNIC.

Personalization in Practice - Networked Improvement Community

The Personalization in Practice (PiP) research group was formed in 2014 to study school-wide efforts to design and implement personalized learning strategies in K-12 schools (Halverson et al., 2015). PiP is a research alliance between the University of Wisconsin-Madison School of Education, the Institute for Personalized Learning (IPL), and the Wisconsin Department of Public Instruction. The partnership is supported by the Joyce Foundation and by the US Department of Education Institute of Education Sciences. The goal of PiP is to document

how public schools engage in personalized learning, then to transform these insights into opportunities for professional learning for interested educators.

There is a strong and growing network of personalized learning schools in Wisconsin, and IPL has been a regional and national leader in designing, supporting, and scaling this grass-roots movement since 2009 (CESA1, 2011). IPL defines personalized learning as,

an approach to learning and instruction that is designed around individual learner readiness, strengths, needs and interests. Learners are active participants in setting goals, planning learning paths, tracking progress and determining how learning will be demonstrated.

The PiP research team conducted phenomenological studies of 12 IPL schools engaged in personalized learning. They identified three key personalized learning practices:

- educators designed cultures of agency to engage students as active participants in their learning;
- educators acted as facilitators of learning by regular conferring with students to construct learning pathways and set learning goals; and
- schools developed socio-technical ecologies of digital tools, such as productivity tools, learning management systems, computer adaptive testing and curriculum tools, and digital media and design tools to coordinate instructional, assessment and learning tasks. (Halverson et al., 2015)

In the fall of 2016, the Personalization in Practice - Networked Improvement Community (PiPNIC) was launched to bring together expert personalized learning educators to identify, document, and improve core practices. As an emerging area of interest, educators had significant questions about personalized learning. PiPNIC sought to engage expert practitioners and researchers in collaborative design around common, meaningful problems of practice that would

produce practical and theoretical knowledge about cutting-edge personalized learning practices. The network theory of action was that engaging practitioners and researchers in collaborative design would spark help-based interactions, which would in turn generate solutions to the problem of practice and develop the capacity to support further improvement.

The formation of a Networked Improvement Community was conceptualized as three stages: problem identification, participant recruitment, and a 90-day collaborative design cycle.

Stage 1: Problem identification

This stage involved contacting and interviewing schools across the state to identify shared problems of practice in personalized learning. Identifying a problem of practice from the field established the interdependence and authenticity of the partnership from the start as researchers would have to rely on the practice-based knowledge of educators, while educators would have to rely on the researchers to structure the common inquiry. To do this, our network initiation team drew on Gawande's (2007) idea of listening to those closest and most knowledge about the work in order to identify meaningful insights and challenges. Through phone calls, visits, and discussions at conferences, over 60 educators were consulted from traditional public, charter and private school communities. Schools were nominated through the researchers' existing connections for their expertise in personalized learning. In this way, the research team leveraged its existing social capital to better understand the challenges faced at the frontiers of practice.

We identified three key problems on the frontier of personalized learning practices: developing learner profiles, measuring non-cognitive learning outcomes, and establishing shared practices of conferring. "Conferring" emerged as a practice that educators in personalized learning environments rated as having the highest utility for their work (Rutledge, 2017).

Conferring came to be defined as the regular one-on-one conversations between a teacher and student. The practice serves a common purpose of developing relationships, supporting individualized learning, and capturing information about learning. While the instructional origins of conferring are in the Reading & Writing Workshop model (Calkins & Harwayne, 1991), it has strong parallels in goal setting and individualized educational program (IEP) meetings. Despite near universal agreement that conferring was central, there was little documentation, consensus, or evidence of impact of the practice. This made it an excellent opportunity collaborative design in the context of a NIC.

Stage 2: Participant Recruitment

The listening effort resulted in a long list of potential participants. We narrowed this list by recruiting practitioners that had well established conferring practices, had district leadership support, and resources for improvement. We invited 21 educators from five K-12 public schools. Participants were chosen based on their expressed expertise in conferring and their willingness to spend four weekends in Spring 2017 working on a collaborative design project. Each participant received a stipend and the option of continuing education credit. Ten UW researchers agreed to help coordinate the collaborative design process.

Stage 3: 90-Day Design Cycle

In the spring of 2017, 10 UW researchers and 21 educators from five schools came together to participate in collaborative design activities. These activities were organized by the 90-day design cycle (Park & Takahashi, 2013) as a way to synchronize the work of participants from different organizations, a key challenge of RPP (Coburn & Penuel, 2016). The common design task was to develop and validate conferring protocols that could be used across the schools. Each school team that participated ultimately produced a protocol to guide their local

conferring practice, and all protocols were published in a final 90-day report (Kallio & Halverson, 2017). Meetings were held on four Saturdays, hosted by participant schools.

The primary activity of PiPNIC was collaborative design work that was organized by the 90-day design cycle. The 90-day design cycle is a way to prototype an innovation through leveraging knowledge of those within and outside of the field associated with the topic; coordinating the development and "testing" of a product by at least one of several means; begin and conclude within a span of 90 days … [and] deliver needed knowledge in a timely fashion (Park & Takahashi, 2013, p. 6-7). The research team developed a series of five activities to engage participants in collaborative design. Each school:

1. created videos to share current conferring practices;
2. pitched a proposal for a re-designed protocol within the school team and to the whole group;
3. developed protocols that described the context, conversation, and documentation strategies for their desired conferring practices;
4. engaged in a user-testing cycle where each teacher tried out their school's protocol and experimented with protocols from other schools; and
5. contributed to a final report and community discussion where experts in personalized learning and student-focused instruction commented on the presentation of new practices.

To facilitate these activities, each research team member was assigned as a liaison, or "site captain" as primary points of contact for each school. Site captains visited participant schools prior to and throughout to support design activities.

The product of the 90-day cycle was a set of five protocols (Kallio & Halverson, 2017). The protocols have since been shared through the state Department of Public Instruction, as well

as presented by participants and researchers at state-wide educator conferences. There has also been follow up between researchers and schools as part of a continuation of the Personalization in Practice study, specifically focused on the implementation of the conferring protocols and the instructional systems that support it.

Data Collection

A significant analytic challenge for design-based research, and applicable here, is the volume of data collected in trying to characterize different layers of context, as well as being alert to other contextual variables or interpretations that might have influence but were not originally the focus of the study (Collins et al., 2004). This data frequently necessitates collection and coordination of a complex array of sources (Cobb et al., 2003). The following sections detail how the qualitative and social network data was collected.

Qualitative Data Collection

All three articles draw on data collected specifically as part of the PiPNIC subproject. A number of written documents served as data sources, including the initial grant application, an advisory committee report, a research group presentation, meeting agendas, and a final report. During the listening sessions, the research team had a Google form that team members filled out with the answers from their calls. We collected planning documents and agendas, with notations for how meetings were modified in the moment, as well as email communications, internal and external presentations. Observation data was recorded by research team members as they participated in and/or facilitated activities related to the project, including notes and participant reflections from all collaborative design meetings.

	Phase		
Source	Problem Identification	90-Day Design Sprint	After
Researchers	grant application advisory committee report internal and external presentations	running meeting notes planning documents and agendas with modifications 90 day report slideshows for Saturday meetings and the final presentation meeting conferring analysis and definition documents observations	detailed design narratives for each site (5) and the hub (1)
Participants	listening sessions conferences notes emails to and from schools	Saturday presentations references and resources shared with us informal surveys after meetings team debrief of the user testing process social network and feedback survey	informal follow up visits in the fall/spring 2017-18

Table 1-2: PiPNIC data sources.

During the 90-day Design Cycle, we had a few forms of direct feedback from participants. After the first meeting, we asked participants for feedback about the activities, their thinking about conferring and personalized learning, and what each individual was interested to improve. After the second meeting, participants emailed one thing that they found to be the most meaningful during the morning's activities. On the last Saturday, we had teams do a focus group debrief of the user testing process and reflect on their progress up until then. The audio from these focus groups was transcribed.

At the conclusion of PiPNIC, members of the research team used the qualitative data to write detailed design narratives for each site (5) and the network (1). The network narrative included observations across school teams and leadership decisions about how to structure activities and changes made during the meetings themselves.

Social Network Data Collection

Both articles 2 and 3 draw on data from the social network survey. The social network survey was developed by the PiPNIC team to collect data about participant interaction during the

90-day cycle. The survey was given once, at the conclusion of the 90-day cycle, to all participants (n=31, 21 educators and 10 researchers), built and delivered through Qualtrics (See Article 3, Appendix 4-B). Participants indicated who they had interacted with about conferring prior to participation and who they interacted with during. They then rated how important that person was to their learning about conferring.

We mitigated the challenges of collecting social network data in a few ways. To ensure 100% response rate, participants were given time during the final meeting to complete the survey, and the network coordinator verified that each person had submitted it before the meeting concluded. We considered creating a network from meeting and observation data, but we wanted the perceptions of importance from participants directly. To reduce the time it took, we used a roster with the names of all the participants, but we broke it up into two pages, one with the list of all the educators and one with the list of all the researchers. This visually reduced the number of people respondents had to scroll through. Also, we asked only about interaction around conferring and one measure of the strength of the tie ("How important was this person to your learning about conferring"), rather than asking for other dimensions of the tie, such as frequency. While this limited the depth of what we are able to infer about the relationship, we felt it was more important to limit the burden of response time.

Qualitative Data Analysis

Article 1 uses qualitative data from PiPNIC to show how conferring was identified as an opportunity for design. There are two parallel things to trace: what the team was doing and how the problem space was narrowing. First, I create a timeline of research team activities as evidenced by the collection of data, research minutes, and writing, then I document the questions being asked by the initiation team at key points. I then continue to trace the evolution of the

definition of conferring and activities of the research team to provide evidence that the inflection point is a meaningful way to think about problem identification.

By focusing on the initiation team's problem-identification process, I make the assumption that the activities of the initiation team contributed to the narrowing of the problem space, which risks becoming a "just so" story that is more linear in hindsight than in was in practice. As part of the analysis, I will also show the other problems of practice that were considered, and how attention was placed on other ideas or how other proposed problems, such as developing measures for noncognitive skills, were identified. This will be explored more fully in the analysis in the article.

Article 2 is an analysis of the artifacts produced by the design activities of PiPNIC. The analysis for this article begins with the design activities of PiPNIC and how they were executed. These are then tied to the artifacts that were produced at each step. The expertise that participants brought to the design activities were codified in the protocols. Thus the analysis will look at when and where ideas were proposed and taken up, how they changed over the course of the design activities, and how this transfer was situated in the social network of participants and researchers.

Article 3 draws on qualitative data to elucidate the quality of interactions amongst participants during the design-based activities of the 90-day cycle. The qualitative descriptions of the interactions provide a way to interpret the nature of the interaction and whether it was help-based. The instances provided draw across multiple design activities and highlight research-educator interactions, within school team interactions, and cross-school team interactions. Drawing on observable patterns of behavior and connecting them with social network data is

how I propose low-inference measures for relational trust. I propose these are low-inference measures because the help-based interactions are directly observable.

Social Network Data Analysis

Articles 2 and 3 draw on the social network data. In the analysis of this data, I use whole network and dyadic characteristics (Borgatti, Brass, & Halgin, 2014). Responses from the social network survey were imported into Excel, anonymized, and uploaded into UCINET (Borgatti, Everett, & Freeman, 2002). In creating social network graphs, operationalizing what the tie represents is critical for interpretation. In article 2, the presence of interactions is used to understand possible mechanisms for the transfer of ideas documented in the qualitative data. In article 3, the social network data provides insight into the distribution and quality of ties across the network and situates qualitative observations of how participants relied on one another for help in the design activities.

Researcher bias

In qualitative research, the researcher is intimately connected with collecting and analyzing the data. It is not my goal to eliminate my role, but rather to examine my own position in conducting this research through an awareness of my own goals and my personal connections to the work (Maxwell, 2013). My hope in doing research is to understand how systems change at scale and the role that practitioner expertise can play in that. I find NICs to be a compelling strategy to shift how changes happen in schools. One that engages the expertise of practitioners and honors and values the people doing the work. Despite my own hope for this as a method for change at scale, to do research is to be critical, and that critical thinking means holding ideas up with skepticism and disciplined inquiry so as to make my methods and conclusions transparent.

Researcher Positionality

The first and foremost threat to validity is my positionality as project coordinator, which means that I had a vested interest in making PiPNIC work, and that investment may blind me to the perspective of other participants. Thus a key component of my research methods is to have other participants, including members of the research team and educators, contribute their own understanding and perspectives on the work. This is an area where the fact that much of the data was collected by a broad research team, that the analysis draws on artifacts that teachers created, and that teachers filled out the social network survey. For example, during data collection, I was the primary person who documented network activities through the meeting notes document, however this was a shared Google document that others regularly contributed to and were displayed at meetings. At the conclusion of the 90-day cycle, site captains wrote summaries of their school's participation, integrating much of the data we had collected, and then presented these to the research team. Again, they were shared Google documents, so each member of the research team commented on the documents to provide additional insight or revise what was said. This checking amongst the research team was a strategy of increasing the validity of the documentation of the process. Additionally, as I draft each of my articles, I will send these to the participants, again both researchers and educators, for their feedback on whether what I have written reflects how they remember it. In this way, I am able to ground my analysis in the data and triangulate from multiple sources.

A second internal threat, particularly for the first article on problem identification, is representing the problem identification process as a "just so" story, one with a narrative smoothed by hindsight. Again, grounding my analysis in the data collected along the way will support identification of key decision points, reviving a sense of what was being considered at the time.

In-group Bias

As a white woman and former teacher, from a middle class background and whose parents were teachers, I am from the dominant demographic of people who work in schools. This means that I identify with the majority of people who are engaged in the work that is the subject of this study, and it also means that I do not identify with those marginalized by this system nor can I see the system as they do. This includes teachers who are marginalized in change processes, either because they are not part of the dominant demographic, socially disconnected from innovations like personalized learning, new to a school, or other possible reasons. From a different perspective, being part of the dominant demographic also affords me insider status because of who I am and who I am affiliated with. As a representative of a flagship university and partner with the Institute for Personalized Learning for the past three years, I have credibility. This allows me to gain access and develop trust with the educators I interact with.

My relationship with the educators is professional. First, when I am doing fieldwork, I always show up on time, so that there is no outsized inconvenience to their schedule. I try to show up nicely but not over dressed, adjusting my attire to what they wear but slightly less. Second, I aim to find ways to support their work as well. With the teachers involved in the PiP phenomenological study and teachers involved in the PiPNIC design work, I have offered to support their own professional development, presenting with them at regional conferences.

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Chapter 2, Article 1: Radical Listening as a Problem-identification Strategy in the Initiation of a Networked Improvement Community

Abstract

In this article, I propose radical listening as a problem-identification strategy in the initiation of a Networked Improvement Community (NIC). NICs are a model for research-practice partnerships that reorganize research and development activities to tackle complex challenges. Drawing on observations, artifacts, and memos from the 8 months *prior* to the initiation of PiPNIC, the Personalization in Practice - Networked Improvement Community, I examine the features of our problem-identification process through the lens of radical listening. In the analysis, I show how the initiation team used a participatory approach to construct a rich problem-solution space, and how this participatory approach supported the initiation team in selecting a different problem of practice. I argue that radical listening in the problem-identification process provides a practical and critical strategy for NIC initiation and supports the vision of NICs as a problem-centered model for systems change.

Problem Statement

Networked Improvement Communities (NICs) are a type of research-practice partnership in education (Coburn et al., 2013). NICs bring researchers, practitioners, and other experts together to examine how a problem occurs in local contexts, identify root causes, and build robust data pathways to inform the iterative design of solutions (Bryk et al., 2015). Early examples of NICs, such as the Community College Pathways, demonstrated success where others had failed (Baron, 2017), prompting broad interest in using NICs to address other seemingly intractable problems of practice (LeMahieu et al., 2017). How a NIC initiation team identifies a problem of practice and who participates in the problem-identification process become important questions in adapting the NIC model to other problems in other contexts.

Bryk, Gomez, and Grunow (2011) frame NICs as a problem-centered approach to research and development (R&D) activities. A problem-centered approach contrasts with the traditional linear conceptualization of R&D activities as a progression from basic research through application testing and dissemination (Stokes, 2011). The linear conceptualization positions researchers as knowledge creators and practitioners as implementers, and the division of tasks and lack of dialogue is often called the "research-practice gap" (Biesta, 2007). In a complex system such as education, this division has negative consequences. For example, if researchers' interests do not match practitioners' needs, the uptake of solutions is unlikely (Cain, 2015). Moreover, the exclusion of practitioners until implementation is one way practitioners are marginalized in change processes more broadly (Apple, 1985). This exclusion can rhetorically and materially de-skill teaching as a profession, build resentment and resistance to externally created solutions, and even cause leaders to reject research as a way to demonstrate their agency and status (Roegman & Woulfin, 2019). The problem-centered focus of the NIC model is an attempt at a social reorganization that recruits researchers, practitioners, and other experts as

necessary partners. As such, the NIC model is an ambitious and potentially transformative project that shifts both how and by whom change happens.

As NIC activities are built around a common problem during initiation (Russell et al., 2017), initiation teams must ask critical questions, such (1) how and by whom this problem is identified, (2) for whom it as a problem, and (3) for what it is solved (Phillip, Bang, & Jackson, 2018). One way to interrogate these critical questions is to examine the design of NIC initiation processes, such as how to define problems that are of interest to practitioners and how the status and authority of the people involved in the process (Penuel, Coburn, & Gallagher, 2013). Penuel and colleagues (2015) include in their vision of partnership in which there is a joint negotiation to find a problem of practice is that is of equal interest and importance to both researchers and practitioners. To date, there is no research that specifically examines how a research team negotiates the problem-identification process prior to NIC initiation.

In this paper, I examine the problem-identification process of a university-based initiation team in the 8 months *prior* to initiation through the case of PiPNIC, the Personalization in Practice - Networked Improvement Community. PiPNIC provides an ideal case through which to examine the participatory design of the problem-identification process. First, PiPNIC emerged from a pre-existing research alliance, and I, as the project director, intentionally documented the process as it unfolded. Second, our process successfully identified a problem and supported the later recruitment of 21 educators from 5 different schools to participate in NIC activities, providing at minimum a positive test case of problem identification in the initiation of a NIC. Third, and perhaps most importantly, our team took seriously the idea of practitioner participation in framing and solving the problem and structured a “listening” process to identify a problem.

The listening focus of the problem-identification process is the unit of analysis of this paper. I retrospectively label our approach *radical listening* to more accurately capture the way the process deliberately attempted to position educators as experts in their own practice and elicit their expertise. I construct radical listening as a theoretical framework from feminist, critical pedagogy, and participatory design genealogies to interrogate our process. *I use the word radical to communicate the degree of change that this approach represents as a contrast to traditional, theory-led change*. In the findings, I show that a radical listening approach supported the emergence of multiple problems of practice; built a rich, contextual knowledge of how each problem of practice was situated in context; and activated relationships that supported the selection of a problem.

From these findings, I argue that the reorganization of R&D activities proposed in the NIC model, and RPPs more broadly, must include critical attention to the problem-identification process. Radical listening provides a practical strategy and participatory stance for the design of NICs and operationalizes the vision of Networked Improvement Communities as a model of participatory, problem-centered reform.

The paper is organized as a qualitative study of a design-based process. I begin with a review of the literature on problem-identification and then construct radical listening as a theoretical framework. I then present the partnership context and research design. In the findings, I describe the construction of the problem-solution space and problem selection. Finally, I discuss the findings, exploring what radical listening offers in terms of NIC initiation and the reorganization of R&D more broadly.

Background

A *problem* exists when there is a gap between a current reality and a desired state. *Problem identification* is recognizing and articulating a gap, whereas *problem solving* is the set of actions to move to the desired state. Problem identification includes the activities described in a range of fields, including problem framing (Mintrop & Zumpe, 2016), formulation (Baer et al., 2016), and finding (Nickerson, Yen, & Mahoney, 2012). I distinguish problem identification from problem analysis, the latter of which happens once the initial problem is articulated and is done using improvement tools, such as root cause analyses (Crow et al., 2019).

The problem-identification process has two parts: the construction of the problem-solution space and the selection of a problem. The construction of the problem-solution space is a set of actions to define the relevant parameters of the context in which a problem or problems exist, as well as the ideas for solutions (Newell & Simon, 1972). If the parameters of the problem and tasks to solve the problem appear straightforward, these are often called tame, well-structured, or well-defined problems; in contrast, wicked, complex, or ill-structured problems are difficult to define, involve complex systems, and do not stay solved (Gomez et al., 2016).

Problems in education are almost always this latter type. City et al. (2009) use the term *problem of practice* to situate the undesired state in the routines and actions of the people in the organization. From this perspective, a problem of practice is actually more like a property of the complex social system that produces it. A complex social system is comprised of dynamic and interconnected subsystems whose interactions contribute to the behavior that is visible at the surface. In complex social systems, "events and actions have multiple causes and consequences, and ... order and structure coexist at many different scales of time, space, and organization" (Jacobson & Wilensky, 2006, p.12). The constructed and complex nature of problems of practice

is thus rooted in the people and their position in the system, therefore the process of defining complex problems can never be done exclusively from only one person's position.

Identifying a problem of practice for a NIC thus requires co-constructed knowledge of and multiple perspectives on the behavior of the complex system. NICs are part of a range of co-constructed approaches, including community-based approaches in health (Webb, Jennings, Minovi, 2018) and participatory design experiments in the learning sciences (Bang & Vossoughi, 2016), among others. As a co-constructed approach, NICs leaders need an understanding of how to identify problems with practitioners through dialogue, where dialogue allows practitioners an authentic voice in what and whose problems are the NIC is trying to solve. For this, I draw on critical pedagogy and feminist approaches around the term "radical listening," then connect these with the NIC roots of participatory design.

Radical Listening: Broadening Participation in the Problem-Identification Process

Drawing on critical pedagogy, feminist, and participatory design genealogies, I define radical listening as an approach to conversation across research and practice that positions the practitioner to share their expertise openly and honestly and that builds positive relationships with interests to continue to work together (Table 2-1). Both critical and feminist scholars use the term "radical listening," where radical listening is an approach to research-practitioner dialogue that positions the practitioner as an expert. The term "radical listening" itself is often attributed to Joe Kincheloe's work in critical pedagogy (Tobin, 2009), and draws on the foundations of critical pedagogy laid out in Paulo Freire (1970, 2005)'s *Pedagogy of the Oppressed*. Freire describes humanizing ways of teaching and learning that are rooted in love, humility, and faith, and that happen through the act of dialogue. Radical listening is "learning to view difference as a resource, understanding and valuing the possibilities, personal values and potential of others, and

encouraging those with difference to participate and share their voice'' (Alexakos & Pierwola, 2013, p.41-42). From a critical pedagogy standpoint, radical listening is an approach to dialogue where parties suspend judgement of the other, opening possibility for social transformation through building relationships, all with the goal of transformation of oppressive systems (Tobin, 2009; Kress & Krueger-Henney, 2016).

Theoretical Background for Radical Listening	Literature	Importance for Designing a Participatory Process
Critical Pedagogy	(Freire, 2005) (Tobin, 2009)	Humanizing ways rooted in love, humility, and faith Treat difference as a resource Suspension of judgement and opening of possibility through relationships
Feminist Theory	(Gilligan & Eddy, 2017) (Gilligan, 2015)	People as experts in their own experience Approaching others with curiosity Attending to the context and arrangement of the speaker and listener
Social entrepreneurship	(Chang, 2018) (Webb et al., 2018)	Strategy for discovering the root causes Done with love and respect Done with the intention of following through
Participatory Design	(Penuel, Roschelle, & Shechtman, 2007) (Muller & Druin, 2007) (Schuler and Namioka, 1993)	The user is involved in defining which problem to solve and solving the problem Open-ended questions to position the user as the expert in their own experience

Table 2-1. Summary of the literature underpinning the theoretical framework of radical listening.

Feminist theorist Carol Gilligan likewise focuses on listening as the way to approach others not as subjects for assessment but as "experts on their own experience" (Gilligan & Eddy, 2017, p.77). In this tradition, listening stresses replacing judgement with curiosity. Gilligan (2015) asks listeners to consider four questions: "Who is speaking and to whom? In what body or physical space? Telling what stories about which relationships? In what societal and cultural frameworks?" (p.69).

In addition to these critical pedagogy and feminist genealogies, radical listening has begun to be used amongst social entrepreneurs (e.g. Chang, 2018). Webb et al. (2018) describe

using radical listening as a strategy for discovering the root causes of the problem of deforestation in Borneo, which was actually rooted in a lack of affordable, local healthcare. Here, listening is radical when it is done with love and respect and with the intention of following through, which represents a departure from traditional research methods. Radical listening, like the ethos of research-practice partnerships, is a commitment to open and honest interactions that are valuable in and of themselves.

Radical listening aligns well with participatory design approaches[2] that are a core influence on the conceptualization of how NICs would reorganize R&D (Bryk & Gomez, 2007). At its root, participatory design is about involving users in a way that solves pragmatic tasks, as well as engages them in a dialogue to build community and bring imagined futures into an actionable articulation. Participatory design offers insight into how to involve users (or educators, in the case of education) in problem identification. Whereas *design* is an iterative process of creating and revising a solution to a user's problem, *participatory design* is when the user, the person who experiences the problem, is involved in both defining which problem to solve and solving the problem (Penuel, Roschelle, & Shechtman, 2007; Schuler & Namioka, 1993).

In participatory design, therefore, the role of the user goes beyond attendance, buy-in, or engagement; participatory design is a process "to uncover self-motivations, identities, and interests and to construct meaningful engagements by working together with participants" (DiSalvo & DiSalvo, 2014, p.1). Centering the user in the participatory design process is not as

[2] Participatory design is also called collaborative (or co-)design. A full review of the differences in approach and lineages of these terms is beyond the scope of this paper. While collaborative design is the term most frequently used in education research in the United States, I use the term participatory design to align with the roots of the participatory design movement, which are in the shift toward worker control over the means of production in the 1960s and 1970s in Scandinavia (Ehn, 1988).

simple as their physical presence. True participation "takes work, and new ways of thinking, and new kinds and methods of openness, to bring substantively new voices into a conversation" (Muller & Druin, 2007, p.3). Partnership requires opportunities for multiple people to direct the conversation (Schuler and Namioka, 1993).

Then the question I investigate in this paper is, *How did a university-based research team use radical listening strategies to identify a common problem of practice to initiate a Networked Improvement Community?*

Research Design

In this paper, I present a study of the problem-identification process prior to the initiation of PiPNIC, the Personalization in Practice - Networked Improvement Community (Table 2-2). The design focus of this paper makes the problem-identification process the unit of analysis to examine the features and affordances. In this section, I describe the context of the partnership and the activities that took place prior to NIC initiation. I then describe the data that was collected during this process and my analytic approach. Finally, I reflect on my positionality as the designer and researcher.

Research Question	Theoretical Framework	Data Collected	Analysis
How did a university-based research team use radical listening strategies to identify a common problem of practice to initiate a Networked Improvement Community?	Radical listening as an approach to conversation across research and practice that positions the practitioner to share their expertise openly and honestly and that builds positive relationships with interests to continue to work together	Partnership documents, participant observations, team meeting notes and memos.	Analyze the two parts of the problem-identification process (problem-solution space construction and problem selection) for how and with whom radical listening happened and what the impact was on the process.

Table 2-2. Summary of the research design.

Partnership Context and Problem-identification Activities

PiPNIC grew out of an existing research alliance, the Personalization in Practice (PiP) Research Alliance (Figure 2-1). PiP was formed in 2014 to study how public schools design and implement personalized learning (PL) strategies in K-12 schools, where personalized learning represents a range of approaches to redesign learning around student interests, strengths, and needs (Rickabaugh, 2016). As a partnership between education researchers at the University of Wisconsin-Madison and practitioners at the Institute for Personalized Learning (IPL) at Cooperative Educational Service Agency (CESA) #1 and the Wisconsin Department of Public Instruction (DPI), PiP meets the definition of a research alliance as a long-term, co-organized partnership between a research university and practice-focused organizations (Coburn & Penuel, 2016).

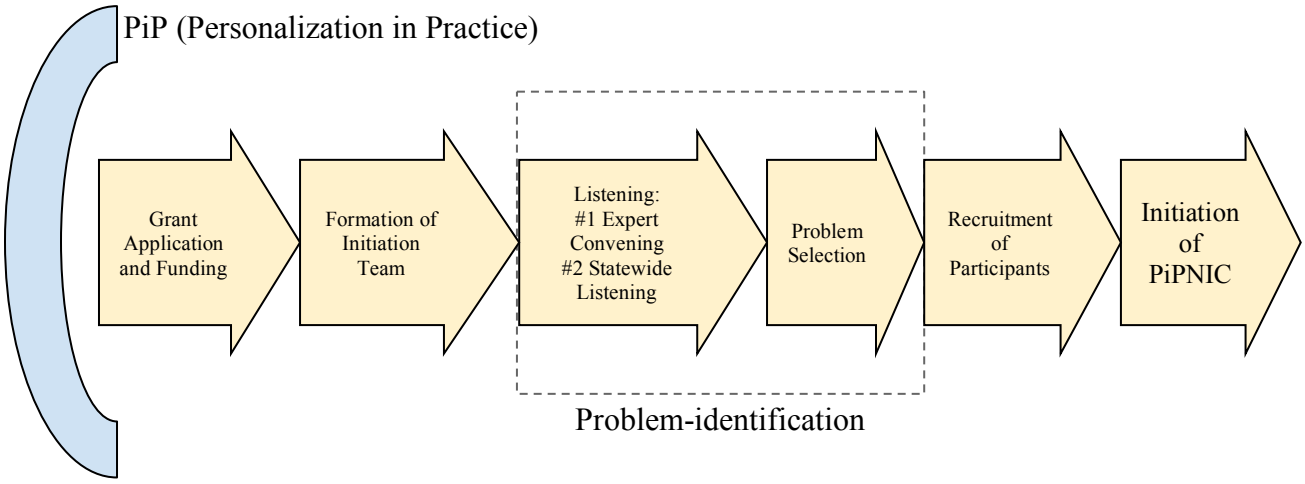

Figure 2-1. Diagram of the transition from the PiP Research Alliance to the initiation of PiPNIC.

The PiP team's initial work was to describe the implementations of personalized learning. The PiP team's initial research report described three domains of shifting practices: student agency over aspects of the time, pace, space, place, content, and goals of learning; co-

construction of learning pathways through regular, data-driven conferring; and the use of a range of technologies to support these learning pathways (Halverson et al., 2015).

In shifting their practices, educators regularly encountered problems of practice with no clear solutions and little existing research that they felt was relevant to their context. For example, educators and students in the PiP study regularly described the struggle with accurate measures of learning because their student-centered approaches did not align with state or district learning measures. Without accurate measures to know whether students are achieving their valued learning goals, PL educators struggled to document the impact of their program.

Observing that practitioners needed a collaborative problem-solving approach to share and improve these emerging practices at scale, the PiP team decided to adopt the Networked Improvement Community model. In the spring of 2016, the lead researcher of the PiP alliance wrote a grant to fund a NIC focused on the problem of accurate measures of learning in PL environments.

Three people from the PiP team, three researchers, and one new graduate student formed the "initiation team" and took up the task of problem identification. The team included the faculty principal investigator (PI) who had experience in participatory design with educators, one graduate student project assistant (me, author of this paper) in charge of organizing the process, three university-based researchers who had familiarity with educational policies in the state, and one graduate student with longstanding ties with innovative schools across the state and research interests in assessment practices.

As a team, we designed a listening process that included an expert convening and subsequent statewide conversations with educators and leaders. We then used information gathered during the listening process to propose three potential problems of practice for the NIC

and select one. After selecting one, we recruited 21 educators from 5 schools across the region to initiate the NIC in the spring of 2017.

Data Collection

The initiation team collected data throughout the eight months of problem identification activities leading up to NIC initiation. Whereas many partnership analyses are done retrospectively (Coburn & Penuel, 2016), our research team intentionally collected data throughout the process and across multiple partnership activities. This study, like much design-based research, draws on a complex array of sources (Cobb et al., 2003). Table 2-3 describes the different types of data, how they were used in the design of the problem-identification process and how they were used in this analysis.

One limitation in this data set is that the listening calls and visits were not audio recorded, thus we are unable to do the kinds of conversational analysis that would reflect the Feminist and Critical Pedagogy approach to listening. The initiation team made the decision not to record because we thought it would create a barrier to open and honest conversations, and our goal was to get out into the field quickly.

Data Type	Description	Use in the Design	Use in the Analysis
Grant Application	Written purpose and description of planned activities written by the PI and submitted to partners	Described using NIC model, who would be on the initiation team, and the idea to focus on measures of learning.	First record of what and how the initiation team planned to initiate the NIC, with whom, and around what problem.
Participant Observation	Members of the initiation team regularly took notes on what they observed during the expert convening.	Record of what happened in the small breakout groups that were facilitated by members of the initiation team.	These observations were used as triangulated records of who participated and how during the expert convening.
Emailed reflections from	After the expert convening, the PI and I emailed each attendee to thank them for attending, ask for their feedback, and	The initiation team used the nominated connections to add to our	These emails are a primary data source of how educators articulated

participants in the expert convening	ask them to nominate a few schools or educators that we should follow up with.	list for the statewide listening activities. The feedback of the day was integrated into the expert convening report.	their experience of the convening.
Expert Convening Report	Summary of the organization of the meeting, attendees, major themes that emerged, including raw notes as an appendix.	The initiation team referred to this document throughout the following months as part of our records of what we were hearing from educators.	This report provided a description of the event and summary of insights that were gained.
Listening session notes from phone calls and visits on a google spreadsheet	After each conversation with educators around the state, the researcher would fill out a google form with who they talked to, the answers the person gave to the questions, any other notes, and rated whether this contact would be a good follow up for the NIC. (See Appendix 2-A for the question protocol.)	The initiation team regularly referred to this document to share what they were hearing in the statewide conversations.	The spreadsheet of responses provided a record of who from the initiation team was doing the phone calls and visits, who was contracted, and a record of the content of their conversation.
Meeting notes	Google document where notes were taken at each meeting, including when the meeting was, who was there, the agenda, and notes on conversation. The document was shared with everyone on the team and projected at each meeting, so although I was the primary record keeper, there was often input or correction from the team either verbally or directly on document.	Recorded planning, decisions, follow up actions, and debrief conversations. Team members were tagged when they had follow up actions. Other documents were linked.	The meeting notes provided a chronology of actions and sequence of problem articulation.
Research Group Meeting Presentation and Meeting Summary	The team (primarily me) created a set of slides to describe the listening process and present the three possible problems that could be selected. After the meeting, I wrote up a description of the conversation.	The slides at the December 12th meeting to generate conversation about which problem would be selected. The meeting summary was written to document the decision as we moved forward with recruitment, as well as to share the decision with team members who were not present.	The presentation slides plus the meeting summary provided the primary source of data for how we made the decision to select conferring protocols.

Partnership Memo	The initiation team wrote memos to document the process and outcomes of the NIC activities. I wrote a meta-design memo focused on the implementation of the NIC. The memo was semi-structured and drew on the data sources described in this table. At a team meeting, the memo was cross-checked for accuracy.	None - this was done at the conclusion of the NIC.	Triangulated source of the chronology of activities, as well as some reasons for design moves.

Table 2-3. Summary of the different types of data, how they were used in the design of the problem-identification process and how they were used in this analysis.

Data Analysis

In the analysis, I focus on how the features of the process (the how, who, and what) and how this connects to the construction of the problem-solution space and selection of the problem. First, I look at how educators were positioned to be experts through the use of open-ended questions (Schuler & Namioka, 1993). Across the data set, I selected any open-ended questions, those that begin with operators such as "how", "what", or "why," that appeared in grant report, in presentations, asked in listening sessions, and recorded in listening conversations with practitioners. I then assemble a chronology of questions to analyze how the questions were changing through listening. The specificity of the question was indicated by the level of openness in possible answers (Halverson, 2002). Second, these questions elicited responses that allowed the initiation team to gather information and this information is inextricably linked to the people that we listened to. In the context of selecting a problem of practice, I examine how information from listening emerged in relationship to the people we hope to recruit to justify the selection of the problem.

Positionality

I both managed the collection of the data and use of the data in the initiation process. My investment in the success of PiPNIC may bias my analysis and interpretation of the data. It is not

my goal to eliminate my role, but rather to examine my own position in conducting this research through an awareness of my own goals and my personal connections to the work (Maxwell, 2013). The data that I draw on in this paper is largely from records that I created and managed, thus the analysis that is intertwined with my own actions, beliefs, and understandings that also evolved continuously with the project. The risk, then, is telling a "just-so" story, which has been a critique of overly optimistic design narratives that are fit to the data (Collins, 1992; Shavelson, et al., 2003). I mitigate this bias in a few ways. First, during the design process, the partnership documents that I created (Expert Convening Report, Research Group Meeting Presentation and Meeting Summary, Partnership Memo) were all shared and collaboratively edited by the initiation team. Thus their final form reflects their input as well. Second, grounding my analysis in the data collected along the way supports the identification of features and outcomes, reviving what was being considered at the time, and during the analysis for this paper, two members of the PiPNIC team provided significant feedback on my reconstruction of the events and interpretations of the moves that were made.

Findings

In this section, I present (1) descriptions of the features of the two primary activities that were designed to construct the problem-solution space, (2) the sequence of open-ended questions that were asked in these activities, and (3) a description of the initiation team's evaluation of each potential problem and eventual selection of one problem (Summarized in Table 2-4).

Activities	How: Features of the Process	Who: People Involved in the Activity	What: Contribution to Problem Identification	Relationships
Expert Convening	Invited a range of experts, open-ended questions, facilitated interactions, opportunity for everyone to share	23 People Total 12 University-based: 1 PI - University Faculty 1 Project director 2 Researchers 7 Graduate students 1 Partnerships Director 6 School-based: 1 Superintendent 1 District Administrator 2 Principals 1 Instructional coach 1 Classroom teacher 5 Intermediary Organizations: 2 Department of Public Instruction 2 Research Alliance partners 1 Professional Organization	High level insights into the problem-solution space, educators asked questions of us Producing "good students" vs. "competent learners" Linear vs. iterative learning systems Measurement tools and practices	Affirming relationships with PiP alliance partners New connections to others doing improvement science Principals and teacher from two schools that would eventually be recruited for participation
Statewide Listening	Phone calls, school visits, conferences Tapped people from our social network but also googled school districts Talked to educational leaders at all levels	7 People on Initiation team 3 Other PiP team researchers Interaction by phone: Educators at 49 schools across the state, 10 leaders from the CESAs (cooperative educational service agencies) and DPI (Department of Public Instruction), 1 school board member Visits: 11 schools, which included educators and students	Iterative refinement of questions, gathering of information	New, reactivated, or affirmed ties Built a history of relationships amongst the research team Provided an opportunity for informal conversations with potential partners to recruit
Problem Selection	Proposed three potential problems of practice to an audience of researchers Time for conversation about which problem to choose Selected #3, the development of protocols for conferring	7 People on the Initiation team 4 PiP team researchers 4 UW Researchers	Three potential problems: (1) Development of a survey of validated measures of non-cognitive learning (2) Redesign of the student personalized learning plan (PLP) to incorporate state and local data. (3) Development of a protocol for data-driven conversations with students (conferring)	Criteria included known interest in educators in participating, educators would be able to participate actively in the design

Table 2-4. Summary of participation in activities broken down by how, who, what, and relationships.

Constructing the Problem-solution Space

Listening Activity #1: Expert Convening

How. During the summer of 2016, the PiP research team convened a group of 23 experts, including partners from the IPL and DPI, as well as educators, principals, district and state administrators, regional leaders, and UW-Madison faculty, graduate students, and staff, for a day-long meeting in August. At this event, the initiation team facilitated a process for attendees to share their current perceptions of needs and opportunities in Personalized Learning across the state. In our meeting notes in the days planning for this event, we wrote, "instead of beginning with designs to test, [let's] begin with listening to what people are doing and **what they know**" [bold original].

The PI framed the intention for the day: to facilitate conversations amongst attendees, explore the opportunities of a NIC, and share current knowledge of practices in personalized learning. The PI asked two questions: "How do teachers know when students are learning?" and "What are the design opportunities for schools to improve their ability to know that students are learning?" The initiation team then facilitated small group discussions and whole group reflections, providing multiple opportunities for exchange amongst participants. The focus was on sparking discussion amongst attendees, not gathering information from them or telling them what the research team thought.

Who. The initiation team invited a range of people involved in education across the state, including educators currently working in schools and districts, university-based staff, leaders from intermediary organizations like service agencies, and policymakers from the Department of Public Instruction. Invitees were identified for their experience in personalized learning environments, improvement methods, professional learning, and/or district policies and selected by nomination in consultation with the PiP research team, research alliance partners at the

Institute for Personalized Learning, and grant collaborators from the Wisconsin Department of Public Instruction.

Not all attendees were supporters of personalized learning, and during the day we were challenged to think about why we were focused on personalized learning. One attendee was skeptical that personalized learning really allowed students to bring their own interests and strengths, wondering whether all voices would truly be honored in an authentic and genuine way rather than co-opted into an already existing agenda. Another attendee, a superintendent with expertise in improvement science, questioned why we were talking personalized learning, when we should be asking questions aimed at improving organizational processes, not a content-focused approach like personalized learning. What is important about these two critiques of our focus is that we created an interaction environment that allowed these critiques to be shared and listening openly for how they could inform our work going forward.

What. The conversations yielded two insights that would shape the PiP team's problem-identification process going forward. The first insight was about the need for different measures for the outcomes of personalized learning programs. Attendees made the contrast between "good students" and "competent learners." Good students comply with traditional instruction, study, and perform well on standardized assessments. In contrast, educators described the goal of PL to support students in becoming competent learners. A competent learner directs their own learning, is aware and can act on their strengths and needs as a learner, and develops the non-cognitive skills[3] for success past school. Looking for specific measures of competent learners, one participant asked, "What kinds of data, systems, and tools should be included in a SLDS?"

[3] Noncognitive here refers to skills that are not specifically rooted in academic disciplines, such as collaboration, communication, problem-solving, leadership, strategic thinking, among others. (Rutledge, 2017).

The second insight was about what information educators needed to improve personalized learning. Attendees drew a distinction between the information needed to guide personalized instructional decisions and the development of practices to use the information. To support personalized learning pathways, practitioners wanted accurate, up-to-date information on each student's needs and interests; they needed this information for personalized, data-driven instruction. One attendee asked, "What are current data practices?", highlighting the need to understand the data practices to use the data, systems, and tools available to educators.

Listening Activity #2: Statewide Conversations with Educational Leaders

How. After the expert convening, the initiation team decided that we needed to continue to refine the problem-solution space and began a process of statewide conversations with educational leaders through phone calls and visits with educators and leaders across the state.

Initially, one member suggested we create a survey to collect this information. The team considered the benefit of a survey, which would likely be faster and cheaper and would structure the feedback into answers to the specific questions we would ask. But the team decided instead to go with in-person phone calls and visits for a few reasons. One, it kept the majority of the work on our end, so that educators would make the time, but did not have to spend hours filling out a survey. Two, we were more likely to get responses. There was a concern that a survey is much easier to ignore than visiting in person. Three, in-person phone calls and visits allowed us to keep the questions open-ended and go with what they talked about and ask probing questions. Four, meeting the people in person, especially through visits, was already recognized as important for building relationships for potentially recruiting participants in the NIC. And five, it allowed for an iterative listening process. As the initiation team identified an interesting idea, we would bring up that idea at our next visit and see whether it resonate with others.

The first questions was, “What kinds of things are you excited about in terms of student learning this fall?” One team member, who had a more traditional research training, questioned why we would include an open-ended question like this, commenting on one version of the protocol document, “I don’t think this first question is necessary.” Indeed, the responses to this question were varied, and not always related to data-driven instructional tools or practices. What it did do was express interest and openness in opening the conversation.

The other questions included, “Tell us about the kinds of information your school collects to document student learning?” and, if they needed probing, “Is this how / How does your team define student learning in your school?” We also asked, “What role do students play in those discussions of data? How do students have an opportunity to show what they know?” (For the complete listening protocol, see Appendix 2-A).

Who. The initiation team spoke with educators at 49 schools across the state, visited 11 schools, had conversations with 10 CESA (cooperative educational service agencies), DPI administrators, and informally consulted with researchers at UW-Madison (See Figure 2-2). This sample represented a range of practitioners, including teachers and principals at large traditional high schools, teacher-leaders at project-based district charter schools, coaches in professional development organizations, and even a school board member.

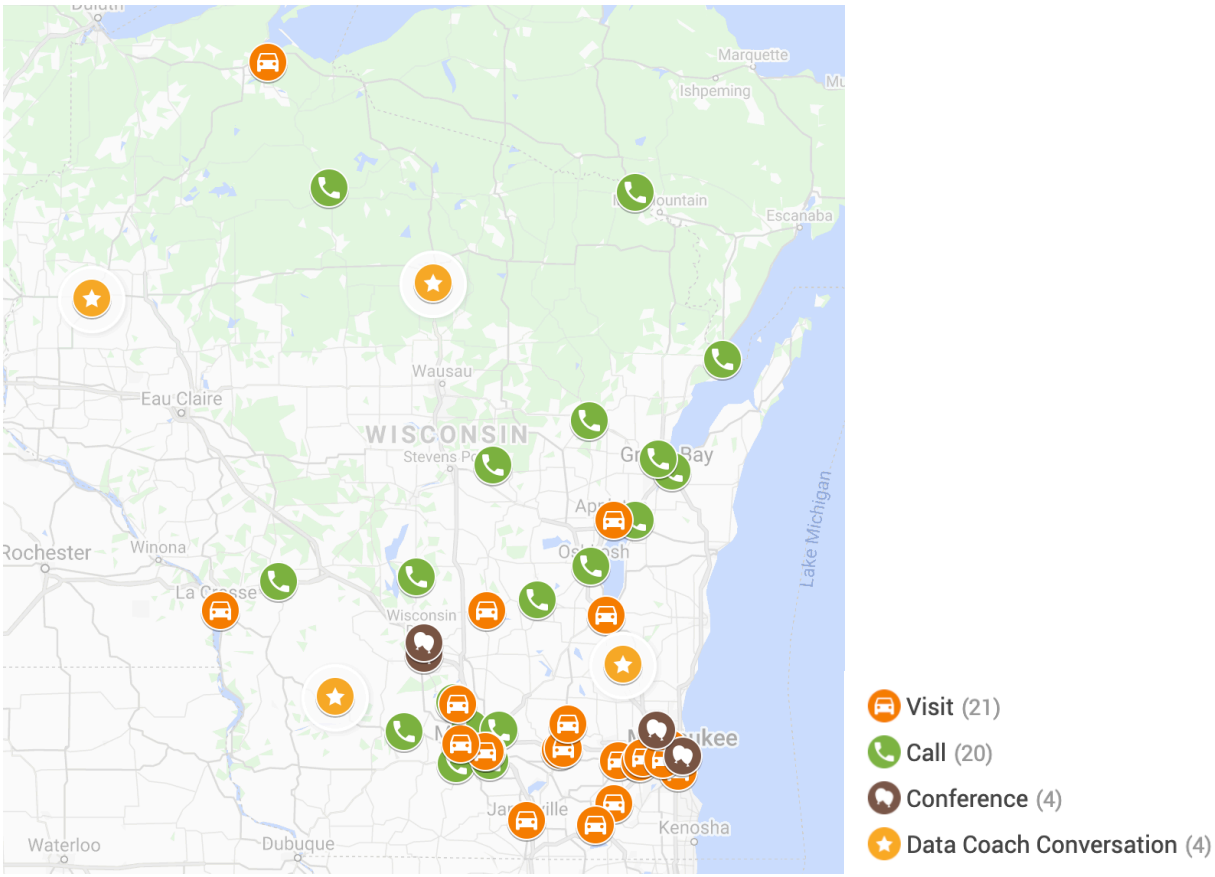

Figure 2-2. Map of listening conversations: phone calls (green phones), conversation with data coach (yellow balloons), visits (orange cars), and conferences (brown balloons).

The listening conversations build a social infrastructure that would eventually support the selection of a problem of practice and recruitment. The phone calls and visits created new ties, reactivated old ties, or did both. For example, some visits affirmed relationships with PiP alliance partners as initiation team members returned to PiP schools. Other visits were crucial in gauging the potential interest of educators to participate in a NIC. For example, one initiation team member had done her student teaching at a school that had an international reputation for its personalized- and project-based teaching and learning. She organized a listening visit with a group of 5 initiation team members to visit. Educators from this school would eventually become participants in the NIC.

Throughout this listening process, the initiation team was also getting to know each other and recruiting more members. By December, the initiation team had grown from 7 to 10 members. We had also developed a biweekly meeting routine that focused on making sense of the information that was being collected in the listening sessions.

What. The sequence of open-ended questions shows an iterative refinement of the problem-solution space (Table 2-5).

Date	Source	Question	Operator	Word Count
0607 2016	Initiation Team Meeting Notes	"How do *teachers* know when students are learning?"	How	8
		"What are the design opportunities for *schools* to improve their ability to know that students are learning?"	What	17
0729 2016	Presentation slides	"What kinds of data, systems, and tools should be included in a SLDS?"	What	13
		"What are current data practices?"	What	5
0819 2016	Listening survey questions	"What kinds of things are *you* excited about in terms of student learning this fall?"	What	15
		"Tell us about the kinds of information *your school* collects to document student learning?"	Tell us about	14
		"How does your team define student learning in *your school*?"	How	10
		"What role do *students* play in those discussions of data?"	What	10
		"How do *students* have an opportunity to show what they know?"	How	11
0912 2016	Initiation Team Meeting Notes	"What kinds of *schools* take the leap to helping *students* use data to guide their own learning?"	What	16
		"What data do *teachers* collect about student learning and how are *students* using their own learning data?"	What and how	17
1107 2016	Initiation Team Meeting Notes	"What are the micropieces that [*teachers*] are already assessing in their goal setting/initial conversations, check in conversations, and project finalization meetings?"	What	22

Table 2-5. Sequence of questions that the initiation team asked in conversations with educators and in conversation with each other. Underlines indicate reference to data or data practices. Italics indicate schools/teachers or students.

The first recorded questions was, “How do teachers know when students are learning?” [06072016] and, five months later, “What are the micropieces that [teachers] are already assessing in their goal setting/initial conversations, check in conversations, and project finalization meetings?” [11072016], showing that the team had identified specific assessment conversations that educators were already having with their students. By integrating what was learned in dialogue with practitioners into subsequent questions. Through the listening sessions, there was greater specificity in the questions that the team was asking, indicating a narrowing of the problem-solution space (Halverson, 2002).

The chronology of open-ended questions shows how the initiation team is probing the problem-solution space, which is coming to be defined by the intersection of the people involved (educators and students), the processes (practices), and outcomes (learning). The consistent inclusion of “teachers” in the questions demonstrates the commitment of the initiation team to framing this at the level of instructional practice. By August, the role students play has been added to the questions, suggesting that we had heard about the importance of students engaging in these data conversations as well.

We referred often to the “data,” which seemed to represent some measure of learning that was different from traditional measures of academic achievement. For example, this is in the questions, “Tell us the kinds of information...” and “How do students have the opportunity to show what they know?” The construction of these questions is an iterative attempt to relate the people, the measures, and/or use of the measure.

Finally, the last question provides the most specifics that we were in fact interested in the discrete pieces of information that educators collect, and that this happens in different types of meetings. This question shows how our understanding of the problem-solution space had moved

from a vague process of how do teachers know to what specific pieces of information do they get at these three specific times.

Selecting the Problem of Practice

How. In December of 2016, the initiation team prepared a presentation that articulated three potential problems of practice. While the initial NIC grant application had described the problem of accurate measures of learning, in this meeting, the initiation team shifted to select a problem that had emerged in the listening activities. The shift from conversations with educators to generating ideas for selection happened during the fall (Figure 2-3). During October and November in which there were a mixture of new open questions and potential ideas. For example, on October 10, 2016, the first proposal to create conferring protocols was suggested.

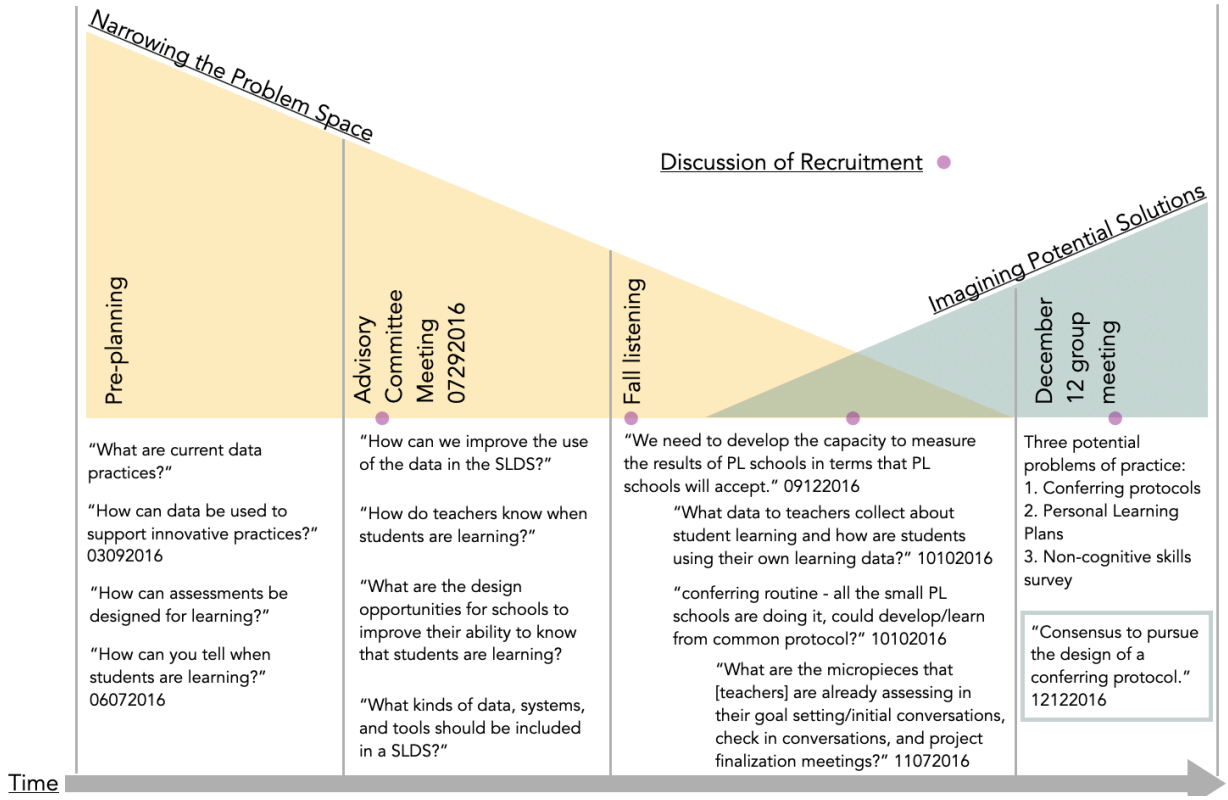

Figure 2-3. Diagram of the narrowing the problem space and imaging potential solutions that demonstrates the shift from open questions to proposing three problems of practice. Purple dots note references to the educators that the researchers were building relationships with for potential recruitment.

Who. The final selection of the problem of practice that would become the focus of the NIC was done by the initiation team after presenting three possible options to a small group of research colleagues. People who were present in person included the 7 people of the initiation team, 4 researchers from the PiP group, and 4 researchers who were funded on the same grant and were working on data-driven practices in another context and also had experience in personalized learning. Because this meeting was still prior to formal NIC initiation, we had not yet recruited partners to participate in the NIC, therefore no eventual partners were present at this meeting.

What. Three problems of practice were proposed and conversation ensued regarding the possibilities and limitations of each selection (Table 2-6). The following paragraphs were taken and edited lightly from a meeting summary that I wrote up immediately following the meeting. The conversation was a negotiation of initial directions from the grant application, what we had heard educators say during listening sessions, and our own interests. The conversation demonstrates the deep contextual knowledge that the initiation team had built through the listening activities.

Possible Problem of Practice	Reasons For	Reasons Against
Development of a survey of validated measures of non-cognitive learning	Initial grant focus Lack of measures was prohibiting broader adoption of personalized learning High researcher and policymaker interest	Educators were hesitant about the validity of quantifying non-cognitive learning Need to recruit different NIC team members Low participation by educators in the design process
Redesign of the student personalized learning plan (PLP) to incorporate state and local data.	Central artifact in the implementation of personalized learning Clear focus for design	Unsure whether educators would have the autonomy or willingness to change mid-year
Development of a common protocol for data-driven conversations with students	High involvement of educators in the design process Common, high-leverage practice Known interest in educators who would be interested to participate in the NIC Applicability beyond personalized learning	Unsure what would be designed Unclear connection to grant funding

Table 2-6. Describes the reasons for and against the selection of each of the proposed problems of practice.

Possible Problem of Practice #1. Development of a survey of validated measures of non-cognitive learning.

A validated survey would measure the non-cognitive skills that personalized learning educators valued as outcomes of their programs. A survey to measure non-cognitive skills had been identified as early as the expert convening because leaders in personalized learning environments characterized the desired outcomes of their programs as learner-focused, specifically dedicating time for students to develop agency and capacity to direct their own learning, yet had no way to reliably capture these to compete with traditional, standardized test scores. Educators had shared throughout the listening sessions that the lack of these measures limited their ability to report the true results of personalized learning in their schools. We also knew that the research community was working on this challenge and would be interested. Developing validated measures for integration into the statewide data system seemed like an excellent challenge in this problem-solution space.

However, the PiP initiation team identified several key barriers to this challenge. During the listening process, we found that educators were hesitant to quantify non-cognitive skills (Rutledge, 2017). Also, many educational organizations had already attempted to develop surveys, rubrics, and self-tests for various measures, but almost all had issues with reliability of implementation, cultural bias, and reference bias (Duckworth & Yeager, 2015). If the team went with the task of using previously developed measures, then the work would focus on testing and validating measures in the context of personalized learning, and it was unclear how educators would participate beyond giving the test. In addition, the task of building reliable skills measures is an emerging area of psychometric and research expertise that was beyond the range of the current PiP initiating and research team. Pursuing this direction would mean the likely departure of several current people, as well as the need to recruit others with this expertise. This would have delayed initiation and impacted the relationships that had already been built.

Possible Problem of Practice #2. Redesign of the student personalized learning plan (PLP) to incorporate state and local data.

A common PLP would create a learner-facing dashboard for educators and students to monitor and support personalized pathways. The PLP document is a central component of personalized learning programs, referenced in almost all PL models (Koufman-Frederick et al., 2017). The educators we spoke with in the listening sessions shared that the PLP was in some cases a central and dynamic document; for others, it lacked integration with other systems and quickly became outdated. The initiation team envisioned developing a PLP that would articulate a customized learning program for every student based on measures of student strengths and needs. The position of the PLP as central to supporting learning pathways and potential to support the integration of data into instructional decisions made this an attractive option for the NIC.

If the NIC chose to focus on the PLP, there were several aspects that could be redesigned. First, the data that was included in PLPs varied across schools, and even among teachers within schools. For example, some PLPs included student-created goals, whereas others were exclusively standards selected for students. Second, another challenge would be the PLP format: some programs used binders while others worked with sophisticated learning relation management systems, and still others cobbled together several different tools then integrated them with Google documents or sites. Third, the role of the PLP in the instructional system was not clear, whether it was a way to share student artifacts demonstrating competencies, like a portfolio, or a way to track progress, like a list of completed competencies. These issues provided an interesting design challenge because the PLP could be built to generate outcome data that would provide individualized information on student learning progress, with the goal of providing alignment across programs for both supporting instructional data use and aggregating learning data across classrooms.

The initiation team evaluated the selection of the PLP. At first, this seemed like an obvious choice, but the conversation turned back to the tension identified at the expert convening between developing tools versus practices. Because it was unclear how educators currently use the PLP, the team was concerned that building the tool would be disconnected from practice and limited in impact. Another reservation was whether educators would have the autonomy to change their PLP and implement new designs, especially if the educators we recruited were part of a larger district. Likewise, there may not be room for iterative testing, because educators would rely on a stable version to then develop their practice of how to use it. This suggested that the redesign of the PLP might not be good for an initial design challenge with this group.

Possible Problem of Practice #3. Development of a common protocol for data-driven conversations with students.

Conferring is a regular, one-on-one conversation between educator and learner that focuses on learning pathways, processes, or products. Conferring had been initially described in the PiP study (Authors, 2017) and came to the fore again in the regional listening process. Educators in personalized learning rated conferring as having the highest utility amongst all their teaching practices (Rutledge, 2017), and educators were using conferring as a data-driven instructional strategy. The initiation team agreed that designing protocols for conferring provided an opportunity to engage with data-driven instructional practices in personalized learning. Conferring was also a process that happened regularly and could be iteratively improved with multiple design cycles and opportunities for improvement.

What the PiP team had learned about conferring in the listening process was that there was little consensus around definition or logistics, but educators claimed it as central to their teaching. Some educators pointed to the Reading and Writing Workshop model, where teachers engage in targeted mini-lessons on specific skills, gradually releasing students to experiment, then provide guided practice opportunities (Calkins & Harwayne, 1991; Fisher & Frey, 2010). We also saw examples of conferring that focused on students reflecting on their learning process. The level of formality also varied, with some considering conferring more like an Individualized Educational Program (IEP) meeting, whereas others were more informal individual and group check-ins with students. The lack of a shared definition for conferring, paired with near universal demand and existing practices of incorporating student learning data, provided an excellent opportunity for design in the context of initiating PiPNIC. The research team also knew that several schools that we were interested to partner with would be interested in working on conferring.

We found some educators for whom data-informed instruction as something exclusively adults did, whereas others were beginning to think about how students might use their own data, and other schools who had explicit conversations with students about their learning data. There were data coaches who said that they were not able to involve students in conversations about data yet because of logistics or other programmatic barriers, even though they agreed that it would be a powerful way to engage students in their own learning. Even the most traditional high schools wanted to do more in terms of having students set their own goals and/or getting more feedback on their progress.

The Selection of Conferring

A common protocol for data-driven conversations with students, or conferring, was ultimately selected for the reasons given above: it was clear that educators felt it was a high leverage practice, it had strong connections to culturally responsive pedagogies and data-driven instruction, multiple design iterations would be possible in a short period of time, and this was a practice that educators were the experts in. From a problem-identification process perspective, the initiation team's reasons for selecting it focused primarily on supporting the participation of educators. In selecting a problem that educators would be interested, willing, and able to participate in solving, the initiation team demonstrates that the selection criteria foregrounded the relationships that had been built with educators. The selection of this problem was a pivot from the initial grant description, which focused primarily on measures of learning and is a pivot from a tool to a practice is reflected in a distinction made in the expert convening.

Discussion

The findings presented the features of the problem-identification process, who was involved, and what the results were from that activity. The sequence of open-ended questions

showed the iterative construction of the problem-solution space, and the selection of conferring demonstrated the application of this knowledge. In the next paragraphs, I look at the way radical listening came through in the design of the problem-identification process. Again, I define radical listening as an approach to conversation across research and practice that positions the practitioner to share their expertise openly and honestly and that builds positive relationships with interests to continue to work together.

Radical listening as a practical strategy

Radical listening was a practical strategy to start with insights into problems and solutions already exist in the system (Gawande, 2007; Pascale & Monique, 2010). We had the belief that some educators have already found ways to know whether their students are learning, and that we could gather them together to learn from them and use a NIC model to build the infrastructure to scale these good ideas. However in many ways, involving educators added complexity to the work of initiating a NIC and might seem unnecessarily complicating things. As the eventual NIC hub, we could have just recruited educators to a predetermined problem. Or could we? If we had stayed with the development of a validated survey of non-cognitive skills, which was of high interest to the research community, practitioners may have rejected participation and nixed the project completely.

Radical listening linked the interests of researchers and practitioners in the way it supported the emergence of other problems, in the consideration of options, and in the selection of conferring. The problem-solution space was constructed with the expertise and participation of educators was through open-ended questions. The open-ended questions surfaced two problems that had not been considered initially, the redesign of the PLP and the development of conferring protocols, the latter of which was ultimately selected. If we had asked the questions as

a survey or even if we had only asked about which non-cognitive skills they thought students were developing, we may not have surfaced these other problems.

The problem selection process also showed the rich contextual understanding that the initiation team had built by the end of the eight months. Being able to select a problem and debate the selection and weigh the interest and perspectives of educators demonstrates the depth and care to which the initiation team had done the listening. This goes beyond a tally of how many schools would be interested to work on whatever problem we picked, but rather a rigorously debated decision. Our team's deliberation provides insight into the serious commitment to selecting a problem that would address a real issue that educators would be interested to solve and that would feel valuable to them.

Radical listening was therefore also in the problem that was selected. The selection of conferring, rather than a non-cognitive skill survey, was a shift from the initial grant funding. This is a departure from how grants are typically funded, where the research writes a plan for what will be done and delivers on this plan, regardless of what is learned from users in the process. This shift provides evidence that the initiation team was willing to take educators seriously enough at their unwillingness to quantify non-cognitive skills and their interest in the conferring protocols to select the latter.

Radical listening as a participatory stance

Radical listening as a participatory stance asks to us to examine the NIC question of "What problems are we trying to solve?", alongside "Whose problems?" and "Problems for whom?" As traditional R&D activities are reorganized, this needs to include a consideration of what and whose problems are addressed. Retroactively labeling this process *radical listening* allows us to examine the work that happens prior to NICs from a participatory stance, asking

who was involved and how. Educators have historically been marginalized in their participation in school reform, but the success of the NIC reorganization depends on feedback from all points of the system to enact the systems-level approach to solving a complex problem. Explicit consideration of who is involved and how draws out assumptions about who has the knowledge and insight to select a problem worthy of a NIC.

In including problem identification as part of NIC initiation, radical listening offers a practical strategy and participatory stance that holds the tension between the desire to systematize and organize all aspects of a partnership while keeping the questions open and reflective. Critical research demands that researchers continually ask these questions of themselves and their process: any "how" question is necessarily intertwined with for what, for whom, with whom (Phillip, Bang, & Jackson, 2018). These questions call up a theoretical and methodological diversity that are a strength for building the diverse colleagueship of expertise needed for successful NICs and equitable improvement.

Radical listening as a strategy for problem-identification locates expertise in the interactions with practitioners. Listening was not solely about information gathering. Listening was the construction of possibility, and the problem-identification process was a way to orchestrate the conditions for the construction to happen. The working model of expertise in our process was more than an excavation model of gathering discrete "chunks" of information to be accumulated (LaFrance, 1997). While we were having conversations with educators that returned discrete information that was considered, there was a constructivist component of expertise that had practical bearing on how the process was designed. The focus in the process on facilitated conversations that allowed others to ask questions and share their experience made this process radical and participatory in that they shared their expertise through the interaction. Their

expertise was constructed in the interactions, sparked by the questions, and documented in the conversations and designs that resulted: the problem and people were intertwined. When we asked educators to join the NIC in the spring of 2017, they were all educators that we had connected with during the listening process. Recruitment was not an isolated event from the listening sessions, but rather an extension of the interactions that in some cases had been new ties, old reactivated ties, or affirmed ties.

Radical listening might support sensemaking of the shift in roles that NICs demand (Cannata, Cohen-Vogel, & Sorum, 2017). In participatory design, designers bring expertise in facilitating the process and representing ideas and users are the expert in their experience and use; they retain different roles in the process. Radical listening is not about shifting the work of the partnership to participants. At several points in our project, someone on the team would suggest just asking educators what problem they wanted to work on. While this seemed like listening, it was actually the researchers not knowing what to do and shifting the decision and responsibility onto the participants. Instead, we would generate ideas, prototype and test them out amongst ourselves, and then share them with our participants so they could focus on the task and give us feedback, rather than having to frame their own task.

Critiquing the PiPNIC approach to radical listening

The use of the term, "radical listening," in this paper contributes to and departs from the way radical listening is defined in critical pedagogy, feminist theory, and participatory design. For instance, many of the theoretical foundations that I draw on in defining radical listening are from primarily theory-driven research methods, such as Gilligan (2005), whereas in initiating a NIC, there is an organizational mandate to define a problem.

Another aspect of the PiPNIC process is the scale at which this took place. Whereas much of the background literature on radical listening draws smaller samples, with studies usually led by a researcher or possibly a small team, PiPNIC was ambitious in the aim for the 8 people on the team to talk as we could. As a result, there was a design tradeoff that meant that the overall dialogue was distributed across a large team and a large number of educators.

Limitations

Using radical listening to examine the problem-identification process in the initiation of PiPNIC is about broadening participation in the reorganization of R&D and assembling a diverse colleagueship of expertise. The analysis in this paper is not meant to say that radical listening as it was operationalized here is perfect or an example of fully realized participation. Every adoption of the NIC model in a new context is a design experiment, and the variation in each adoption, through the disciplined inquiry of research, can provide insight into how the model itself can be improved.

PiPNIC was a successful case in which our initiation team identified a problem, recruited participants, and initiated the NIC in the spring of 2017. There is much to be learned from successful cases through the identification of organizing principles (Fuller, 2015). However the scale of PiPNIC is much smaller than most networks or NICs that have been used as instrumental cases (e.g. Russell et al., 2017). Instead, I aim to use this smaller, more agile case study as a way to "learn fast" to understand NICs as a model for reorganizing educational R&D.

Conclusion

In this paper, I present an analysis of a university-based team's problem-identification process in the eight months prior to the initiation of a Networked Improvement Community. I document the features of the process that demonstrate how, who, and what was involved in the

construction of the problem-solution space and the selection of a problem. Radical listening demonstrates how the significant and impactful work that happens prior to NIC initiation can contribute to shifting the traditional organization of dialogue across research and practice. These findings contribute to needed research on how NICs are implemented in a range of contexts provides a way to improve the model itself through the interrogation of the design of a problem-centered approach.

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Appendix 2-A: Phone Interview Protocol

1. Who is the phone call with? Please give name, position, and school/program.
2. What kinds of things are you excited about in terms of student learning this fall?
3. Tell us about the kinds of information your school collects to document student learning? If needed for probing: Is this how / How does your team define student learning in your school?
4. What role do students play in those discussions of data? How do students have an opportunity to show what they know?
5. Blank space as a place for any other notes
6. Overall, rate your enthusiasm for this connection: 1 to 5
7. Should this connection be considered for a follow up visit? Yes/Maybe/No
8. Should this connection be considered for the NIC? Yes/Maybe/No
9. Explain the above ratings:

Chapter 3, Article 2: Accessing Educators' Problem-based Expertise: An analysis of the improvement infrastructure of the early stages of a Networked Improvement Community

Abstract

This paper examines how the activities of a Networked Improvement Community can be organized to create the conditions to transform problem-based expertise into a resource for improvement. NICs are an increasingly popular model of a research-practice partnership that create an improvement infrastructure that brings people together from different contexts around a common problem. Therefore, understanding how the improvement infrastructure supports the sharing of problem-based expertise across the NIC is critical to success. To examine the connection between a NIC's improvement infrastructure and the sharing of problem-based expertise, I draw on a range of qualitative data from the improvement work of a team of five educators from Irving School District that participated in PiPNIC (the Personalization in Practice-NIC). The findings trace their participation in three activities - a modified video club, improvement pitch, and user-testing - focusing on when, where, and by whom improvement ideas were generated and selected. The analysis connects the features of the activities with the generation and selection of ideas to yield network-level insights about the improvement infrastructure. I use this evidence to argue that a prominent network-level feature of the improvement infrastructure is the coupling the networked and team configuration of activities. This infrastructure provided access to educators' problem-based expertise to generate, select, and integrate improvement ideas into the teams' proposed solutions. In this way, this paper extends the understanding of how NIC leaders can design an improvement infrastructure to reorganize educational improvement around common problems in order to both generate new ideas and get them into action.

Problem Statement

Networked Improvement Communities (NICs) are a type of research-practice partnership that bring practitioners and experts together to solve a common problem (Coburn, Penuel, & Geil, 2013). Douglas Engelbart (1992) proposed the idea of a "networked improvement community" to describe the intentional infrastructure that would allow local problem solving to accrue across an organization and network. He described A-level as the core work of the organization, B-level as work that improves A, and C-level is work that improves B-level work. The A, B, and C levels provide an improvement infrastructure that supports the NICs problem-solving tasks. Through this improvement infrastructure, NICs can leverage a diverse colleagueship of expertise and the iterative testing and scaling of interventions to identify what works, for whom, and under what conditions (Bryk et al., 2015).

How NICs are designed to leverage the diverse expertise of their participants is a critical question for NIC researchers and leaders. NICs demand a "reconsideration of when and how in the arc of problem solving this diversity of expertise is best exploited" (Bryk, Gomez, & Grunow, 2011, p.4). Therefore the question this paper takes up is, *how can the activities of a NIC be organized to create the conditions to transform problem-based expertise into a resource for improvement?*

To examine the connection between a NIC's improvement infrastructure and the sharing of problem-based expertise, I draw on a range of qualitative data from the improvement work of a team of five educators from Irving School District that participated in PiPNIC (the Personalization in Practice-NIC). PiPNIC grew out of PiP, an existing research alliance studying the emerging practices of personalized learning. Personalized learning is a student-centered approach to co-construct learning pathways with students, particularly through one-on-one "conferring" meetings (Halverson et al., 2015). As an instructional innovation, conferring was

deeply rooted in local context, limiting the scalability of the practice (Penuel, Fishman, Cheng, & Sabelli, 2011). The PiP team took up the challenge to scale conferring by adopting a NIC approach and recruiting five schools from diverse contexts to engage in a problem-based design challenge.

Thus in the context of PiPNIC and the problem of scaling conferring, conferring is an A-level activity. Conferring is an A-level activity because it a practice through which the core work of the school – teaching and learning – is carried out. B-level activity is process by which the school improves conferring, and C-level activity is the work to improve how the schools improve conferring. Because the design challenge centered on understanding and improving conferring, educators were the problem-based experts in PiPNIC. Therefore the improvement infrastructure of PiPNIC aimed at accessing educators' problem-based expertise as a pathway to scale.

To examine the connection between a NIC's improvement infrastructure and the sharing of problem-based expertise, I draw on a range of qualitative data from the improvement work of a team of five educators from Irving School District that participated in PiPNIC. The findings trace their participation in three activities - a modified video club, improvement pitch, and user-testing - focusing on when, where, and by whom improvement ideas were generated and selected. The analysis connects the features of the activities with the generation and selection of ideas to yield network-level insights about the improvement infrastructure.

I use this evidence to argue that a prominent network-level features of the improvement infrastructure is the coupling the networked and team configuration of activities. This infrastructure provided access to educators' problem-based expertise to generate, select, and integrate improvement ideas into the teams' proposed solutions. These findings affirm the improvement science principle of gaining a deep understanding of local practice and conditions

to motivate systems level change (Bryk et al., 2015) and suggest that attending to the sequence of activities of a NIC is itself a critical feature of the reorganization of the problem-solving process.

I begin this paper with a background on participatory design and problem-based expertise. I present a theoretical framework of studying artifacts of a design process to trace the generation, selection, and integration of ideas. I then describe the partnership context and the three primary activities that educators engaged in: a modified video club, improvement pitch, and user-testing. The research design details the data collected and analyzed. In the findings, I focus on the improvement work of the educators from the Irving School District to examine deeply when, where, and by whom ideas were generated and selected in the construction of their conferring protocol. In the analysis, I connect the features of the activities with the generation and selection of ideas to yield network-level insights, arguing that a prominent network-level feature of the improvement infrastructure is the coupling of the networked and team configuration of activities. This infrastructure provided access to educators' problem-based expertise to generate, select, and integrate improvement ideas into the teams' proposed solutions. Finally, I discuss the findings, exploring more broadly the implications for NIC leadership and design.

Background

Networked Improvement Communities represent a multi-level, multi-faceted model to solving seemingly intractable problems. Because NICs are an innovation from within the system, they are unavoidably a product and amalgamation of other efforts at improving educational systems. For instance, the Carnegie Foundation for the Advancement of Teaching and Learning, which has led the development of the NIC model, has been involved in education reform for over a century. In the context of understanding how practitioner expertise is accessed and shared

throughout the network, I look at NICs as the latest in a series of designs to improve teacher capacity.

One specific challenge of the work of reorganization is that the adoption of the model becomes a technical project, in which "doing a NIC" becomes a checklist. The risk of a technical adoption is that one critical resource for NIC success - practitioner expertise - may remain inaccessible. The NIC model is predicated on practitioners sharing their expertise across the network (LeMahieu et al., 2017). Because the NIC model is relatively new, there are few researched examples of failed cases, therefore in this literature review, I draw on three adjacent literatures that have all focused in some way on creating the conditions for educators to share their expertise: traditional professional development, instructional coaching, and professional learning communities (See Table 3-1 for a summary). First, however, I begin with a definition of problem-based expertise as a way to evaluate what can be gleaned for NICs from these alternative approaches to improving teaching and learning.

Solving problems requires expertise (Newell and Simon, 1972). Expertise enables the participant to assess conditions, frame the problem, identify what is needed, and design a solution to test. Being able to do this is a combination of knowledge, skills, and experience. Expertise is often conceptualized in a limited way, as a "thing" that can be possessed, excavated, and given (Feltovich, Ford, & Hoffman, 1995). However there is also expertise that emerges through interaction, where the expertise lies "not simply within a single individual, but is situated in the relationships between practitioner, task, environment, and the organizational characteristics that direct and constrain practice in the domain" (Roesler & Woods, 2007, p.222). Thus solving problems is not only a matter of getting the experts together, but is also about building structures that allow sharing expertise through situated interaction.

	Strategy to Access Expertise	Remedial/ Capacity-building	Location of Problem Solving	Scope	Related Literature
Traditional Delivery Models	Sharing of external expertise via transmission, such as through speakers or materials	Remedial	External	Broad, organizational aim	Garet et al., 2001 Randel et al. 2017 Desimone, 2009 Darling-Hammond et al., 2017
Instructional Coaching	Inquiry cycles of setting goals, observations, and reflection	Remedial	Local, Dyadic	Specific, individual aim	Desimone & Pak, 2017 Gallucci et al., 2010 Kraft et al., 2018
Professional Learning Communities	Collaborative and collective effort focused on student learning	Capacity-building	Local, Communal	Specific, collective team aim	DuFour & DuFour, 2010 Stoll et al., 2006
Networked Improvement Communities	Systems-aligned, collective effort focused on common aim	Capacity-building	Local, Networked	Specific, collective network aim	Bryk et al., 2011 Bryk et al., 2015 LeMahieu et al., 2017

Table 3-1: Summary of professional development literature.

Professional development is often a central focus in improving student outcomes, because educators are the mediators of implementing new policies and programs. Professional development broadly is aimed at changing instructional practices to support improved student learning (Darling-Hammond et al., 2017). Sharing practitioner knowledge, however, which is rooted in the particulars of practice, can be difficult to make public, share across contexts, and verify and improve (Hiebert, Gallimore, & Stigler, 2002). Traditional PD, such as speakers, conferences, or materials, are primarily transmission activities and are largely ineffective (e.g. Randel et al., 2017). Significant work has happened in the last three decades to study professional development in terms of its design and outcomes. Professional development that shows positive impact on student outcomes includes five elements: content focus, active learning, sustained duration, coherence, and collective participation (Garet et al., 2001).

Instructional coaching is often described as an example of high quality professional development (Desimone & Pak, 2017). Organizational models and implementations vary: an

instructional coach might be someone internal or external to the building or district and the coach might work directly with one educator or might facilitate a group. Coaches themselves are also learners whose expertise grows with their experience and conceptual development about instruction grows (Gallucci et al., 2010). The majority of studies of coaching have focused on supporting elementary age reading interventions, and the key challenge has been maintaining quality in implementing coaching at scale (Kraft et al., 2018). In contrast with professional development, where all the meaningful problem solving has already happened and it is primarily the results that are being transmitted, coaching brings the problem solving into the conversation between educator and coach.

Another type of high quality professional development is the professional learning community (or PLC) that creates spaces for educators to work collectively and collaboratively (DuFour & DuFour, 2010). In a PLC, educators ideally share evidence of student learning, engage in evidence-based discussions, and generate ideas for ways to improve. PLCs both support educators in solving problems of practice together and build individual and collective capacity to sustain learning (Stoll et al., 2006). In these ways, PLCs provide perhaps the most important professional learning analog to NICs; however, they are distinct in that PLCs generally decide their own focus whereas a NIC is explicitly focused on a common aim and evidence-based conversations include improvement data.

There is a stark contrast between educators in traditional professional development session in which externally constructed knowledge is transmitted to them versus educators participation in a NIC generating new knowledge to solve a local problem. Coaching and PLCs offer potential organizing design principles of how local problems are tackled. In coaching, the configuration is usually one-on-one, where a designated coach provides remedial and reliable

support for educators to improve their practice, with the goal of eventually building that individual's capacity to continue to learn. In PLCs, there is a higher level of expectation for educators' capacity to self-organize a collaborative learning process and generate insights into problems. The reliance of educators to self-organize can create higher levels of autonomy as well as higher variation in success.

In the context of NICs, there is a "need to engage people in purposefully structured learning so as to generate new knowledge to improve the system" (LeMahieu et al., 2017, p.8). The new knowledge, however, needs to be specific to the problem and is likely to be generated in the context of the problem-solving task. Therefore the professional learning task for NICs is to create the conditions for educators to generate, select, and integrate improvement ideas as a way to access the problem-based knowledge participants have to contribute.

Partnership Context

PiPNIC grew out of an existing partnership, the Personalization in Practice (PiP) Research Alliance (Figure 3-1). PiP was formed in 2014 to study how public schools design and implement personalized learning (PL) strategies in K-12 schools, where personalized learning represents a range of approaches to redesign learning around student interests, strengths, and needs (Rickabaugh, 2016). As a partnership between education researchers at the University of Wisconsin-Madison and practitioners at the Institute for Personalized Learning (IPL) at Cooperative Educational Service Agency (CESA) #1 and the Wisconsin Department of Public Instruction (DPI), PiP meets the definition of a research alliance as a long-term, co-organized partnership between a research university and practice-focused organizations (Coburn & Penuel, 2016).

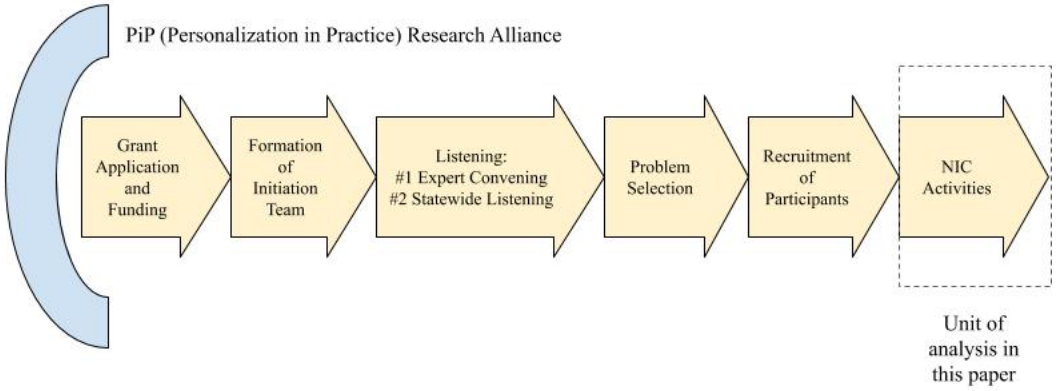

Figure 3-1: Diagram of partnership transition from research alliance to NIC initiation.

Personalized learning is a instructional approach that combines new technologies and student-led learning by building flexible learning pathways around learners' interests, goals, strengths, and needs (Rickabaugh, 2016). Educators support these flexible learning pathways through a practice called "conferring." Conferring is a regular, data-informed conversation between an educator and student, during which educators capture information about student learning, record and document progress, and co-construct a pathway with the student (Halverson et al., 2015).

Building on PiP research and an extensive problem-identification process (Kallio, under review), the PiPNIC team selected the design and testing of conferring protocols as a common problem of practice around which to initiate a NIC. At the time of initiation, conferring had no common definition and educators had limited knowledge of conferring use and implementation in other contexts. Educators in personalized learning rated conferring as having the highest utility amongst all their teaching practices (Rutledge, 2017), and educators were using conferring as a data-driven instructional strategy. The PIPNIC team therefore faced the design challenge of bringing together educators who all practice and valued conferring, lacked common understanding of each other's practices, and did not recognize each other's' practices as

conferring. The PiPNIC leadership was thus tasked with creating an improvement infrastructure to support educators in sharing their expertise in conferring.

At initiation, the PiPNIC team included 1 faculty principal investigator (PI), two university-based research staff, and six graduate students. The team had longstanding ties to educators in the state, experience with leading participatory design with educators, and most team members had prior experience as educators themselves.

The PiPNIC team recruited 21 educators from five schools. All programs had well-established personalized learning programs with conferring as a central feature. The schools were selected for the range of age levels (elementary through high school), locale (urban, suburban, and rural), and program size (whole district, neighborhood school, small district charter) (For a full description of each, see the research design section). While some of the schools were relatively new connections for the PiP team, some had long-standing relationships in the original PiP study or personal connections to members of the PiP team.

The PiPNIC team created and facilitated NIC activities, taking on the role of network designers, responding to and guiding the NIC as it emerged (Goldsmith & Eggers, 2005). The PiPNIC team took on the tasks of macro-level organizational design and detailed logistics of each meeting. One PiPNIC team member was assigned as the primary liaison, or "site captain," to each school and worked with that school throughout the project (Figure 3-2).

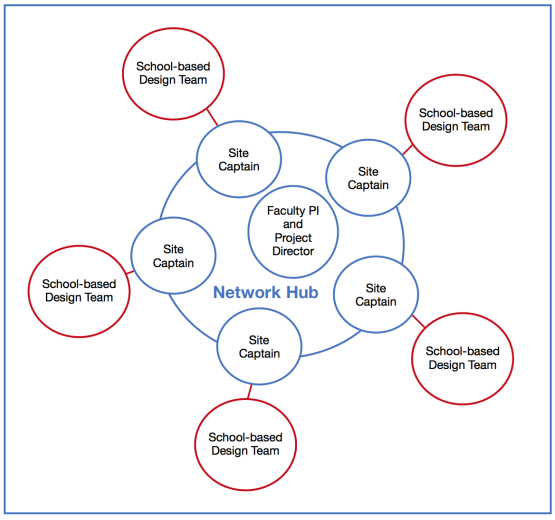

Figure 3-2: Organizational diagram of PiPNIC.

The guiding structure for NIC activities was the 90-day cycle (Park & Takahashi, 2013). The 90-day cycle was comprised primarily of three collaborative design activities: modified video club activity to share current practices and spark ideas for improvement, a design pitch to plan for improvement, and user-testing of conferring protocol prototypes. These three collaborative design activities are the unit of analysis for this paper (Figure 3-3).

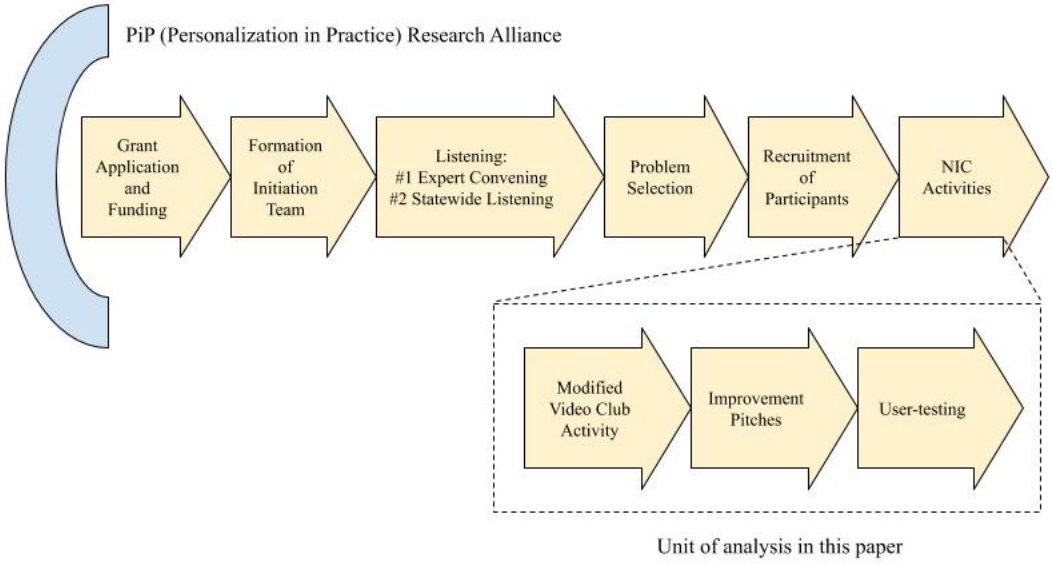

Figure 3-3: Focus of this paper on NIC activities.

At the end of the 90-day cycle, a report published the conferring protocols as well as a partnership narrative (Kallio & Halverson, 2017). These protocols were subsequently shared widely through Department of Public Instruction, as well as at multiple local and national conferences in partnership with participating educators. This paper takes up specifically how the features of NIC activities supported the generation, selection, and integration of new ideas for improvement.

Research Design

This paper draws on a range of data to explore how the activities of a NIC can be organized to create the conditions to transform problem-based expertise into a resource for improvement. Methodologically, this study, like much design-based research, draws on a complex array of qualitative data sources to analyze this project (Cobb et al., 2003). I likewise draw on case study approaches to consider how to write a rich description of a phenomenon for readers unfamiliar with the project to be able to adequately and critically interpret my analysis (e.g. Stake, 1995).

In this section, I describe the schools that participated in PiPNIC, including their recruitment and diversity, and the selection of Irving as an illustrative improvement case. Next I describe the data that was collected throughout the project and the analytic approach I take in reconstructing the Irving improvement work and examining the features of the NIC activities. Finally, I describe my own positionality as leader and participant observer in the NIC.

Participating Schools

Educators from five schools participated in PiPNIC. These schools were recruited from prior PiP alliance connections and new ties sparked through the listening phase. All schools were

actively using conferring and interested to collaborate. Each school had a well-established program and district leadership support, and all teachers had been teaching in their program for several years. The schools provided a range of rural, suburban, and urban; kindergarten through high school, and charter and traditional neighborhood schools. Three were small, teacher-led district charter schools; two were larger neighborhood schools. There were two secondary schools and three elementary schools; two rural, one suburban, and two urban.

1. **Jackson High School** is a public, district charter serving grades 9-12. They currently have just under 100 students and 9 teachers. Initially designed as a district alternative high school, they serve a high proportion of students identified for special education. The school was founded by local educators, community members, students and families interested in creating a school directed at educational innovation. Their vision is to be a leader in democratic, place-based, and personalized education by facilitating inspirational and authentic learning experiences for their students.
2. **Irving School District** serves approximately 650 students in grades K-12 in a rural community. As a district, they have been moving toward personalized learning, starting at the elementary and middle levels. Personalized learning is marked by students spending part of their day in a multi-age classroom with others that are at or around their same academic readiness level in language arts and math. They have created a Student Proficiency Profile system by which students work on individual common core learning standards in sequence, progressing as they are able to demonstrate proficiency. Learning is tracked by standards-based progressions that are recorded in a Student Proficiency Profile (SPP) and guided by student written goals in the Learner Continuum (LC), both of which are Google spreadsheets.

3. **Franklin Elementary** is a public, district charter for grades 3-5, located in a rural community and co-led by 4 teachers. The school currently enrolls just under 100 students. The school was founded with a common vision for personalized, project-based, and place-based learning. Students choose projects that fit into a common theme, and the teachers work with students to align their interest-based projects with disciplinary standards, all with a focus on building a learning community.
4. **Grant Elementary School** is a public, neighborhood school an urban district, enrolling approximately 450 students in grades 4K-5. The school serves more than 70% of students designated as economically disadvantaged and is racially and ethnically diverse, with approximately 40% identifying as Hispanic/Latino, 27% white, and 15% African American. The school's path towards personalization is starting with a team of teachers working to combine classes, co-teach, develop learning plans around student interests, and use digital learning technologies to support learning.
5. **The Lewis School** is a public, district charter serving grades 7-12. The school is co-led by four teachers and serves around 75 students in a mixed-age, open space learning environment. The core curriculum is designed around projects of varying lengths and student interests. Students set their schedule and work independently with the support of daily group advisory meetings, weekly advisor meetings, and optional daily seminar offerings. Students present their work through event and speech nights, project meetings, and online portfolios.

In this study, I focus primarily on the trajectory of the Irving team through the NIC activities. The Irving team was chosen as an illustrative example because it had the most complete data from initial ideas through final protocol. Their site captain fastidiously

documented their process and kept careful record of various drafts of artifacts. Because of this record, Irving's improvement work provides an adequate level of detail. While not representative of the experience of all five teams, Irving provides an existence proof of what is possible. Furthermore, the focus on design features of the NIC in analyzing the Irving work aims to identify how particular kinds of actions were encouraged, not determined.

Data Collection and Analytic Approach

The PiP researchers collected a wide range of data throughout PiPNIC. For this paper, I selected a subset of artifacts to focus on the video club, improvement pitches, and user-testing activities, as well as partnership documentation to understand the design of the improvement infrastructure (Table 3-2). Each PiP researcher wrote a memo (average was 17 pages) for their school and the project manager wrote a memo (10 pages) for the network. The memos drew on the artifacts that are included in this analysis as well as many more. These memos were then cross-checked with other researchers at a group meeting, where each researcher (or pair of researchers) presented their memo to the group. As a team, the group then read through and wrote comments on each memo, with particular attention to what might have been missed or other perspectives. Additionally, researchers and educator participants co-presented various aspects of this work together at three regional conferences with at least one representative from each school presented at one of the conferences, providing a source of member checking.

Activity	Type of Data
Modified Video Club	Video Scripts (131 pages of scripts, about 20 pages per school, generated in the video club activity) Researcher notes on the mixed-group, facilitated discussion (20 pages, 4 per school) Subsequent school team meeting, artifacts (5 pages, 1 per school)
Improvement Pitch	Researcher notes on the team discussion (5 pages, 1 per school) Reflections after the day (Survey, 11 responses) Slides (5, 1 per school) Pitch Feedback (21 pages for Lewis; 16 pages for Grant; 22 pages for Franklin; 18 pages for Jackson; 18 pages for Irving)
User-testing	First drafts (5 pages, 1 per school) Comments (15 pages, 3 per school) Debrief after user-testing meetings (150 minutes of transcribed focus group audio, approx. 30 minutes per school) Final presentation (39 pages of presentation transcript)
Partnership Documentation	82 pages of PiP team meeting notes 95 pages of case memos (1 for each school and 1 for PiPNIC) that were written at the conclusion of the 90-day cycle, at which time they were cross-checked with members of the research team

Table 3-2. Summary of data that was collected by activity and type.

The analysis looks at this subset of artifacts from two perspectives: locating the generation, selection, and integration of ideas about conferring and identifying the features of the design of NIC activities. First, for the ideas, I used inductive coding of the video scripts, improvement pitches, and user-testing protocols to identify what aspects educators noticed about other schools' conferring videos and triangulated this with what the researcher documented of the discussion. Locating the generation of ideas in the scripts provides evidence that the ideas were generated in the context of the activity. The exchange of ideas can be traced through the features of the artifacts that are created as feedback is collected and integrated into subsequent versions (Downing-Wilson, Lecusay, & Cole, 2011).

Second, for the features of the NIC activities, I attended to structures that impacted who participated, when, how, and to what effect. The first step was to identify the primary activities of the NIC and categorize these as either networked or team based on the people and task of the

session. The session was categorized as networked if the task was to support the school team in improving their conferring protocols. This includes watching the conferring videos, giving feedback on the pitches, and user-testing. The session was categorized as team if the task was focused on designing improvements to conferring itself. This includes creating the pitch slides, creating the protocol, and presenting the final version of the protocol. I then describe the features from the description of the activity and function as it related to the overarching NIC problem-solving process.

Positionality

Inextricable from these design features is that I both co-led the organization of NIC activities and managed the data collection during the partnership. My investment in the success of PiPNIC may bias my analysis and interpretation of the data. It is not my goal to eliminate my role, but rather to examine my own position in conducting this research through an awareness of my own goals and my personal connections to the work (Maxwell, 2013). The risk is telling a "just-so" story, which has been a critique of overly optimistic design narratives that are fit to the data (Collins, 1992; Shavelson, et al., 2003). One way that I mitigate this bias is grounding my analysis in the artifacts generated by participating educators and researchers and interpretations in the theories of improvement infrastructure and design.

Findings

Features of the NIC Activities

In this section, I describe the three primary NIC activities - the modified video club, improvement pitch, and user-testing - with a focus on their configuration, features, and function (Table 3-3).

	Configuration	Features	Function
Modified Video Club	Networked	Educators from other schools watching videos of current conferring practice	Share current conferring practice public to ground future improvements
	Team	Meet with team and site captain	Make sense of what was learned about own and others' practices and think about what to improve
Improvement Pitch	Networked	Describe idea for improvement to same educators from others schools	Share ideas for improvement and measurement of improvement
	Team	Meet with team and site captain to discuss pitch feedback	Implement plan and draft a protocol
User-testing	Networked	Have same educators take the draft protocol, test it in their own context, and give feedback	Share draft protocol nad see how it functions in other context
	Team	Meet with team and site captain	Revise protocol from feedback

Table 3-3: Three NIC Activities by their configuration, features, and function.

1. Modified Video Club Activity

The modified video club activity took place on the first day of PiPNIC, immediately following the introduction and welcome from the PI. Participants were broken out into small groups to watch videos of each other's' current conferring practices. This was organized as a video club, where participants watched one video of conferring from each of the five schools then discussed what they saw. Video clubs are a type of professional learning activity in which educators share recent videos of their practice then discuss what they notice (Sherin & van Es, 2009), building a shared language of practice as a pathway to improvement (Frederiksen et al., 1998). A core premise of a video club is that learning happens when educators view and discuss practice. Video clubs focused on mathematics teaching have been shown to support teacher learning, particularly in what they notice about students' thinking (van Es & Sherin, 2008). Where most video clubs focus bring together colleagues from the same school, we hypothesized

that a networked video club design would provide a pathway for educators to learn from other participants in the NIC as they worked to improve the collective impact of conferring.

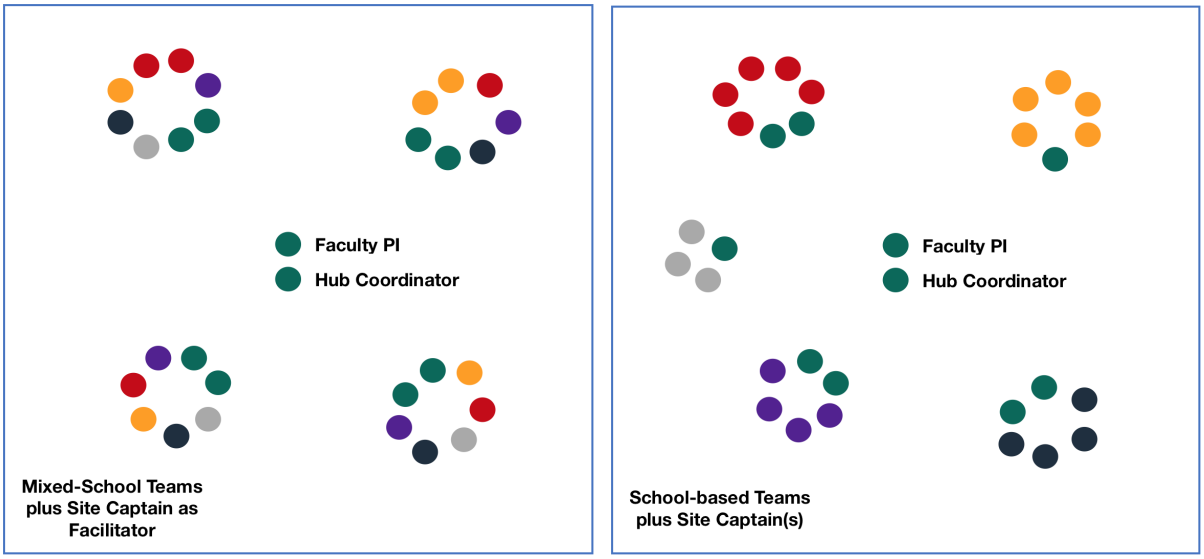

Figure 3-4: Networked and Team Configurations of Activities. Each circle indicates one participant, with different colors for each school in order to demonstrate the mixed-school configuration. Teal circles are members of the research team.

The small groups included only one educator from each school and one researcher (Figure 3-4, Networked). Having one person from each school in each group was meant to foster cross-school interactions and prevent one person from becoming the de facto spokesperson for their school. One researcher facilitated each group through two parts for each video. First, participants were asked to script the conferring session by writing down what they saw happen, second-by-second, in the conferring meeting. The researcher prompted participants to observe, rather than interpret, what they saw in the video. Researchers then guided subsequent discussion with two open-ended questions: (1) What is the goal of this session? (2) What are the parts of this session, and how long did each part last? The researchers recorded the answers to these questions on their facilitator's sheet. The observers' scripts and facilitator sheets were passed on to the school team to support the following design activity.

Following the mixed-school small groups, school teams got back together with their researcher and debriefed what they had heard (Figure 3-4, Team). They brought with them the notes the facilitating research had taken during the conversation. The site captain facilitated a conversation with the following questions and recorded the discussion in a facilitator sheet: 1) What did we learn from others observing us? 2) What did we learn from observing others' videos? 3) What would we like to do to improve? These conversations brought the team together to think about what their next steps in improvement would be.

2. Improvement Pitch

In the second activity, which took place on the next Saturday meeting, school teams pitched their improvement idea to the other schools. A design "pitch" is a format for a presentation meant to be an opportunity to get feedback prior to implementing any tests. The pitch required the team to select a change idea and create a concrete plan that they could implement. The pitch as a genre of activity is a type of "mock-up," which support the quick building of something tangible for participants to think with (Brandt, 2007; Bodker et al., 1993).

The format of the pitch was three sections: plan, build, and measure. The plan asked teams to specify "What are you going to build?", which included a protocol and a plan to track the process or results. The build asked teams to "Mock it up" as a way to think specifically about what teachers and students would say and do. Finally, the last slide asked for a plan to collect data on the design and implementation. Each school team created a slideshow with their researcher that addressed these three sections, and all schools also included the researcher's visual representation of conferring as an impetus for change.

After creating their design pitches, the educators broke up into the same mixed-group teams they had been with for watching the conferring videos. The same groups were used so that

the participants began to develop relationships through repeated interactions. Again, there was only 1 or 2 educators from each school so that they were each responsible for the pitch and no one person took over as the primary voice for the team. And again, a researcher facilitated the process. This time as an educator gave their pitch, each person filled out a feedback form, with the directions to give two responses for each of the questions, (1) What suggestions do you have about their plan? (2) What suggestions do you have about their build? (3) What suggestions do you have about their measure? Overall, 95 sheets were filled out with most completely filled out, generating a substantial list of ideas for each team.

The pitch, and the feedback they got, guided each schools' work for the next two weeks as they implemented their change idea. Researchers noted during the pitch process that meaningful connections were being built between schools, observing that conversations were focused on practice and not taken personally, even when educators were being challenged by feedback or suggestions.

3. User-testing Protocols

The next design task was for teams to create a prototype of their conferring protocol. The format of a "protocol" was chosen because it conveyed more structure than a guide of suggested practices, but less directive than a script. The research team created a Google document template for the first versions of the protocols to begin to standardize across school teams so that the protocols would be recognizable as variations on a practice, rather than five different practices. Using a shared Google document was used so that multiple people on the team could contribute, and then the prototypes could be shared easily across the network for user-testing.

Prior to the Saturday meeting when teams would work on the prototype, the research team did mock ups of what they thought each protocol might look like. This generated a proof of

concept prior to asking teams and prepared researchers to facilitate the educators in doing this activity.

To create the prototype, teams worked with their researcher to write a description of the context in which conferring happens at their school (or the context specifically for this version of conferring), the basic sequence of the meeting, and then any documentation that happens during the meeting. These three parts were selected as what had emerged as the basic descriptors needed to understand the practice.

The prototypes were then shared with other schools through pairs of educators from different schools to be used in user-testing. User-testing is a design strategy for someone to take a prototype and test it out in their context. The goal of this activity was twofold: first, generate ideas for improving conferring by getting feedback on what happened in a different context, and second, provide feedback on how well the prototype communicated the practice so that educators beyond the NIC would be able to take it up and use it in their own context.

Step 1: For user-testing, educators were put into pairs with someone they had already worked with in their previous mixed groups, with special attention to collaborative relationships that had been developing. This was done to build on relationships. In this sharing session, each educator presented their protocol draft to their partner, answered any questions, and made any needed changes. The pairs then made a plan for user-testing.

Step 2: User-testing then happened over the course of the next two weeks. When the educators had an opportunity to test out the protocol, they then put comments on the shared Google document below the prototype. Feedback was structured with four questions: (1) What was the context and situation in which the protocol was tested? (2) What worked well about the protocol? (3) What suggestions do you have to improve the protocol?, and (4) What potential do

you see in your context for using this protocol and/or how might you adapt it? Again, these questions prompted an inquiry stance. Overall, every participant followed through on writing comments for their pair, with some educators even testing several prototypes and adding their comments. Each protocol received at least three pages of feedback (See Appendix 3-A).

The Example of the Irving Team

The findings describe the Irving team's pathway from the generation of improvement ideas in the modified video activity to their final protocol designs. The findings focus on connecting the features of the NIC activity to the generation and selection of improvement ideas. Again, Irving serves as an illustrative example because it had the most complete data set from initial ideas through final protocol. This example is not meant to be representative of the experience of all five teams. Rather, Irving provides a test case to explore the conditions for sharing problem-expertise. In the following section, I first describe the Irving context and present their final protocol design. I then trace elements of their protocol to specific moments in the NIC activities to identify when, by whom, and how new change ideas were generated.

Context

The Irving School District is a small, rural district where personalized learning is district-wide, standards-driven reform. The move to personalized learning is relatively recent and grew out of data-driven instructional practices. They characterize their existing conferring practices as performance assessments, where students demonstrate that they have met a standard before moving ahead. Prior to their participation in PiPNIC, Irving educators had an established practice of conferring with students. Their approach to conferring was teacher-led and focused on performance assessments of standards. Through their participation in PiPNIC, they got ideas

about how to shift their practices toward more student ownership, selected ideas for how this could be structured, and designed interventions to support this.

Irving School District is a rural district that serves approximately 650 students in grades K-12. They began moving towards district-wide personalized learning in 2011, primarily in the elementary grades. In personalized learning in Irving, students spend part of their day in a multi-age classroom with others that are at or around their same academic readiness level in literacy and mathematics. Learning is tracked by standards-based progressions that are recorded in a Student Proficiency Profile (SPP) and guided by student written goals in the Learner Continuum (LC), both of which are Google spreadsheets.

Conferring in this context, prior to participation in PiPNIC, was an instructional strategy that had three different purposes. First, conferring with younger students focused on demonstrations of mastery of a concept and updating their SPP. For example, for the standard of sounding out words, a teacher would listen to the student sound out each syllable from a list of words, then mark a P if they student is able to complete the task. Second, conferring was a time to update the student's Learning Continuum, discuss academic progress, and determine next steps. Third, conferring is used as in an intervention model, where students who need more confer more often as a way to provide individually tailored instruction specifically and address any specific issues.

Prior to the work with PiPNIC, Irving educators had no system for tracking conferring as a practice, such as frequency, whether the meeting was student or educator initiated, or what was discussed. As Irving educators began to work on their identified goal of developing student ownership of the conferring process, they developed indicators of ownership, such as how often

students initiated the meeting, what students asked to meet about, and whether students were prepared for the meeting.

Also important to note that while the participating Irving educators all had commonalities in the goals they had for conferring, this was a group of educators that did not work together on a daily basis and had limited understanding of each other's practices. The educators who participated in PiPNIC were the district director of curriculum and instruction, a kindergarten teacher, a 2-4th grade math specialist, a 6th grade literacy educator, and a middle school humanities specialist.

Irving Educators and the Modified Video Club Activity

The modified video club activity produced ideas in a few different ways: Irving educators watching the videos from other schools, educators from other schools watching the Irving video, and the discussions that took place in the networked configuration and in the team debrief immediately following (Table 3-4).

A-level insights that were generated by viewing other's videos	A-level insights that were generated by viewing their own videos	A-level insights that were generated by others viewing their videos	Possible ideas for improvement that emerged
Franklin: Educators talking too much Lewis: Students directing the conversation Jackson: Focus on reflection with students, really digging deeper into students' thoughts	Teacher-initiated prompts for younger students, but student-initiated for middle school	Focus on standards and that conferring was being used as an assessment Teachers "taking over" or interrupting students	Make conferring a more reflective process that includes metacognition, such as students assessing themselves as a learner Have students take more ownership of conferring, such as older students setting the agenda for conferring and younger students identifying what they want to work on

Table 3-4: How and by whom insights were generated about the current Irving practices in the modified video club activity.

When watching the Franklin video, Irving teachers along with others noticed that the teachers spoke more than the students. This became a topic of conversation across all groups. When watching the Lewis video, Irving teachers described how the high school student directed the conversation the meeting, with the Lewis educators asking probing questions. From watching their own videos, Irving teachers noticed that the teacher initiated the prompts in the kindergarten and third grade conferring meetings, but in their middle school example, the student was identifying her own areas of struggle and asking for feedback from the teacher.

Educators from other schools noticed that conferring at Irving was driven by standards-based performance assessments and that teachers dominated the initiation and structure of the meeting. Some of the discussion they had heard in the video session was that they could "help guide students to discovery," rather than provide answers; that the students should do more of the talking because other educators had noticed that the Irving teachers would occasionally interrupt the students, or answer the questions for the students; and that the teachers should not "take over" the conversations. The Irving teachers noticed that this was in contrast with, for example, Jackson High School's focus on reflection with their students, asking questions about the student, and other educators that use conferring for getting to know the students' interests. In these ways, the sharing session resulted in the generation of ideas for the Irving team to think about their current practice.

In the subsequent Irving team debrief, the team discussed what they would be interested to improve, several different ideas emerged: older students could create their own agenda for conferring; younger students could identify what they wanted to confer about or what came next in their Learning Continuum; educators for upper elementary and middle school students could integrate reflective questions about the learning process. They wanted to spend more time

"digging deeper into student's thoughts," as one educator described. They began to tie these ideas together around a common thread of student ownership of learning, and that as they got older, they should be increasingly capable of making decisions about their learning trajectory and have agency over the content and purpose of conferring sessions.

Irving Educators and the Improvement Pitch

At the next Saturday meeting, the Irving team was tasked with pitching an improvement idea and chose to focus on two specific areas where they had gotten feedback: the different levels of student ownership in theirs and other schools' conferring videos and the balance between academic and personal content in the conversation. During this task, Irving educators envisioned a goal of a K-12 continuum of conferring, where students would have more voice and choice as they got to high school. This was an adoption of some of the ideas about student participation in conferring from Lewis and Jackson schools, and it was also evident that they were shifting how they thought about personalized learning as more than meeting standards.

The Irving pitch included three slides (Figure 3-5) that detailed their plan, what they would build, and how they would measure the change. Already by this stage the Irving team shows evidence that they had decided on a common goal (students initiating conferring sessions), but were creating different designs for different grades. The plan to track students initiating conferring was at first a design to get evidence that students were initiating conferring, but ultimately became part of their protocol and was eventually tested and adopted by other schools. At this point, they still identify students by the grades that they are in (K, 3rd, 6-8), whereas later they will adopt language from the Lewis School based on a progression (Beginning, Intermediate, and Independent Learners) (Figure 3-5).

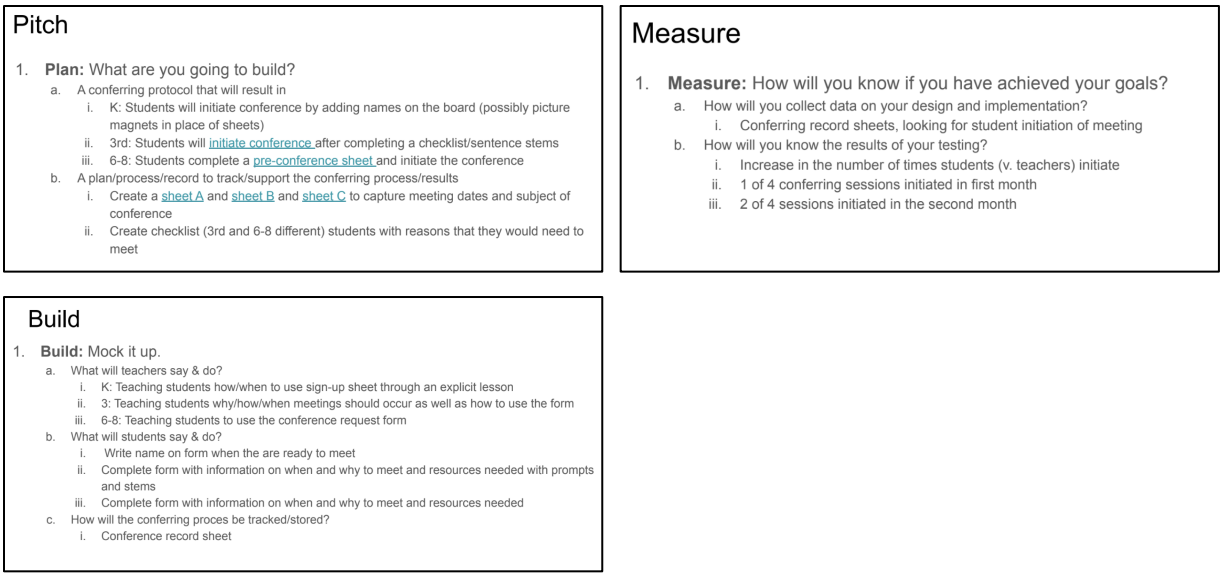

Figure 3-5: Irving Improvement Pitch Slides

Pitches were given in the same mixed-school groups as the modified video club and a researcher facilitated a noticing process guided by two questions: (1) What suggestions do you have about their plan? (2) What suggestions do you have about their build? (3) What suggestions do you have about their measure? From the answers to these questions, the Irving team got feedback on their design (Table 3-5).

	Feedback on the Improvement Pitch
Feedback on the features of the student forms	"I like the idea of more student initiation," "being specific about what expectations are," and "how the process was differentiated by grades." "Love the goal of having students initiate the conference and the progression with age." Add space on the form for "student reflections or goals on meeting requests," such as "What else have I done to solve this issue" or "Anything I need to complete by next [meeting]." Suggestion for form: "use Excel" or make a Google form. Another suggestion was for educators to have their own slips and checklists for when they wanted to meet with a student. Could students even create the slip itself to support engagement? For example, one Irving educator stated that she was excited about one suggestion, "I was given the suggestion to make a flow chart with students as to when they have a problem, solutions such as ask a teacher, research the answer on your own, ask a peer!"

Feedback on the tracking sheet	For the meeting tracking sheet, there were suggestions of other measures, such as asking students to track their own process or times they initiated a conferring session, what types of conferences students requested, and the quality of the conferring session. Finally, one person gave the feedback that got to the heart of why conferring what happening in the first place by asking, "Conferring to what end? … How will [conferring] aid in student agency? … Understanding the 'why' of the conferring." "Could kids keep track of how often they met?"
Overall	"Th[is] system will likely train students to confer... Does it really track ownership?"

Table 3-5: Feedback for Irving on the Improvement Pitch

Irving Educators and User-testing Protocols

Following their improvement pitch, the Irving team implemented their plan then created a draft of a protocol. The protocol included the different ways to support students initiating conferring and a tracking system for educators to record who they had conferred with, from magnets for kindergarteners to slips of paper for middle schoolers (Figure 3-5). The goal of the Irving protocol was to prompt students to prepare for conferring. They operationalized "ownership" of the conferring session as the student initiates the conversation, the student comes to the meeting prepared, and that the student does the majority of the talking.

As noted before, at this stage of the design, the Irving team moved from targeting grade levels to progressions (Beginning, Intermediate, Independent), which was language used from the pitch feedback "the progression with age." Supporting students at their readiness was definitely a focus of the personalized learning program at Irving, as well as the other schools that participated.

An important feature about the final protocol is the first line of the description that describes conferring as a way for students to demonstrate their ownership of the learning progress. This description of conferring contrasts with their initial conferring video that they shared in the video club, which was primarily a standards-based performance assessment. The

language used in this final protocol suggests an important shift in the focus of their practice of conferring from solely assessment to an integral part of developing as a learner.

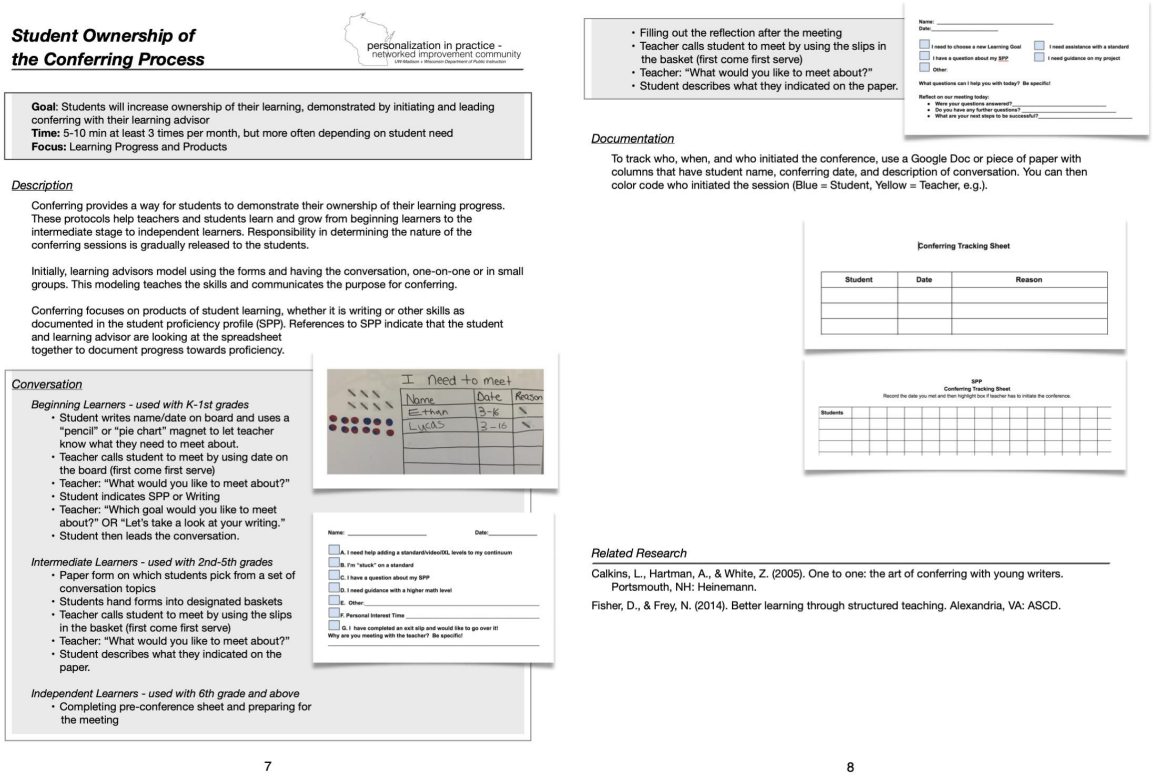

Figure 3-5: Irving protocols in the final produced report.

In between the third and fourth Saturday meetings, educators from different schools user-tested each other's protocols. Four educators tested the Irving protocols with their students who ranged in age from elementary through high school. The comments from the testers showed evidence that educators from other schools generated ideas from testing the protocol and suggested new ideas for the Irving team (Table 3-6). One way that Irving took up this feedback is in their final protocol, they moved on of the conferring prep forms to an online form, which was suggested by the educators at Jackson and Lewis schools.

	Comments from the Google Document
Feedback aligned with Irving goals, such as improving logistics and communication with students and increasing student ownership	"What I like most about the protocol is that I didn't have to run around each day checking in with each group. If a group had not requested a conference, I typically trusted that their project was going as planned and would wait to check in with them at the end of the week." "I'm using a google sheet to track it and those kids that might have flown under the radar or who like to be there, can't do that anymore. … It's really having those discussions with them about that too." "The form made it clearer that the onus was on them [the student]." "The students needed a lot of modeling initially, but they were overall excited to have a form they could fill out to request a conferring time with a teacher."
Feedback that generated new ideas for Irving and for user-testers	The forms required a "large amount of paper and the struggle with keeping track of all of the papers." and "I found trying to 'give' and 'receive' the form a bit cumbersome in a high school environment in a paper format. It worked better to create a google form that I emailed out to my advisees." "It was helpful to have a place to record topics that were discussed or tasks that were accomplished…. Space on the form, however, is limited…. If I continued to use a printed version of the form, I would expand the boxes." "I ran into the hurdle of some students constantly requesting meetings and others never requesting meetings or having 'nothing to talk about' (this is when the [Jackson High School] Learning Profile came in handy!). I have to keep thinking about how to build the instructional framework around the 'form' to help all of our learners (ie scaffolds for those not independent enough to 'pursue' a meeting to solid structures and processes for those who 'feel like they cannot do anything without meeting'. Perhaps some sort of decision-making criteria or lessons around 'when' to meet could help. I can even imagine some sort of info-graphic that could help a student self-determine what they can do independently versus needing to request a meeting.)" "[I made my] own sheet and chose to give the sheet to students."

Table 3-6: Comments from educators at other schools after user-testing

Irving Educators and Their Final Reflections

At the end of the project, all participating educators presented their protocols to the members of PiPNIC and a few additional invitees from the community. An Irving educator describes the profound shift in team's approach to conferring, where she uses "we" to refer to her whole team:

> So we just want to say that we think conferring is critical to personalized learning, *really getting to know your students*, and this whole conferring protocol that we have and students taking ownership of it has really helped us get to know our students. I told them before that I didn't

> think my 5 year olds would be able to do this and they have proved me wrong, everyday. After the first time I was so happy with what they could tell me and we're trying to do now is get them to do more of the talking and not so much teacher talking but 'what did you do to meet this goal?' (Italics added for emphasis)

That an educator from Irving equated conferring as how you get to know your students is rooted in the very first observations and comments of the modified video club. This quote is evidence that educators were sharing and integrating ideas about how they understood the function of conferring as building relationships between teachers and students. This was not part of how the Irving educators described it prior to their participation in PiPNIC; rather, this was something the Lewis and Jackson school educators described.

Analysis

In this section, I analyze the improvement infrastructure, specifically connecting the preceding description of the features of the NIC activities and improvement ideas that were generated, selected, and integrated as illustrated in the Irving example. I use this evidence to argue that a prominent network-level features of the improvement infrastructure is the coupling the networked and team configuration of activities. These two features provided access to educators' problem-based expertise to generate, select, and integrate improvement ideas into the teams' proposed solutions.

The coupling of the networked and team configurations of NIC activities provided the improvement infrastructure to create specific time and place for ideas to be generated, selected, and integrated into conferring protocols. The generation, selection, and integration of improvement ideas provide a way to track problem-based expertise. For example, the conferring protocol that the Irving team constructed (Figure 5) is a representation of this problem-based expertise, and each feature came from different places in the problem-solving process of the NIC activities (Table 3-7).

Protocol Feature	When	By Whom	How
Focus on student ownership	Modified video club	Irving Team	Noticing how students at other schools made more of the conversational moves
Teacher question, "What would you like to meet about?"	Modified video club	Irving Team	Noticing how the Lewis teachers asked their students open-ended questions during conferring
"F. Personal Interest Time _____"	Improvement pitch	Educator from Jackson	Suggested integrating something about student interest as a way to encourage reluctant students to engage
Use a Google doc	User-testing activity	Educators from Jackson and Lewis	Educators from Jackson created one with the prompts to be able to send it to their students ahead of meeting

Table 3-7. Summary of protocol features analyzed with when, by whom, and how the ideas were generated.

For example, the Irving team began to envision the goal of a K-12 continuum of conferring, where students would have more voice and choice as they got to high school, after the modified video club. This vision combined with their preexisting district movement towards alignment from data-driven instructional reforms along with the observation of conferring at Lewis and Jackson schools. When Irving educators decided they wanted to spend more time with the students, "digging deeper into student's thoughts," and created features in their protocols that would increase student ownership as they got older, such as asking students what they were interested to talk about, is a way that the improvement ideas were embedded into features of the protocol. Older students could create their own agenda for conferring; younger students could identify what they wanted to confer about or what came next in their Learning Continuum; educators for upper elementary and middle school students could integrate reflective questions about the learning process. The team began to tie these ideas together around a common thread of student ownership of learning, and that as they got older, they should be increasingly capable of making decisions about their learning trajectory and have agency over the content and purpose of conferring sessions.

While improvement ideas were primarily generated in the networked configurations, team configurations provided a space for schools to make sense of the feedback and select which ideas they would integrate. The integration of ideas from across the network into individual schools' designs legitimates that the insights that were generated were valued as expertise. In this way, the coupling of the activities leveraged the improvement infrastructure to generate problem-based expertise as a material resource for improvement.

In examining how the activities were coupled, an additional feature of the improvement infrastructure emerges: the brokering activity of the site captains. The site captains were in both the team and networked activities, and served an important continuity and information functions. As the educators moved between activities, there was always a researcher - whether their site captain or another - that provided the sheets to be filled out, confirmed who was supposed to be where, or answered clarifying questions. There was significant sensemaking activity amongst the researchers to support the site captains in acting in this capacity.

Conclusion

Through the literature review, I identified that one professional learning challenge to NICs is to create the conditions for educators to generate, select, and integrate improvement ideas in the context of their participation as a way to draw out the problem-based knowledge they have to contribute. Through an analysis of the improvement infrastructure of PiPNIC and the illustrative example of the Irving School team, I showed that the NIC created the conditions for ideas to be generated, selected, and integrated through the coupling of network and team activities and authentic design tasks. This analysis of NIC features and problem-based expertise has implications for the study and design of NICs. The use of a networked video club activity, improvement pitch, and user-testing provide examples of strategies to generate problem-based

insights; however, I argue was the coupling of the networked and team configuration that supported participants in generating, selecting, and integrating this expertise into their designs. This suggests that attending to the sequence of activities of a NIC is itself a critical feature of the reorganization of the problem-solving process.

A future question to consider is how problem solving in NICs relies on the interactions of participants from different contexts. Whereas some NICs have been formed with educators from a single district, the analysis here suggests that the networked dimension of the video club with educators from different districts was critical for generating new perspectives on current practices. How different their contexts need to be is a question that could be examined.

The question this paper addressed is, *how can NIC activities be organized to create the conditions that transform problem-based expertise into a resource for improvement?* By analyzing when, by whom, and how new change ideas were generated, selected, and integrated into proposed solutions, the paper extends understandings of how NIC leaders design an improvement infrastructure in order to both generate new ideas and get them into action.

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Appendix 3-A

Please post your feedback below:

- What was the context and situation in which the protocol was tested?
- What worked well about the protocol?
- What suggestions do you have to improve the protocol?
- What potential do you see in your context for using this protocol and/or how might you adapt it?

From Jackson School teacher:

My advisory students were given an adjusted form to use to pre-think or pre-consider topics for our advisory discussion. They could also send me the form to indicate their need to meet on a particular topic.

I found trying to 'give' and 'receive' the form a bit cumbersome in a high school environment in a paper format. It worked better to create a google form that I emailed out to my advisees. This gave them ongoing and easy access to the form and helped me keep track of materials. It was also easy to pull up the form during our PLP meeting time, and to keep track of post- meeting reflections and questions to follow up.

I ran into the hurdle of some students constantly requesting meetings and others never requesting meetings or having 'nothing to talk about' (this is when the [Jackson School] Learning Profile came in handy!). I have to keep thinking about how to build the instructional framework around the 'form' to help all of our learners (ie scaffolds for those not independent enough to 'pursue' a meeting to solid structures and processes for those who 'feel like they cannot do anything without meeting'. Perhaps some sort of decision-making criteria or lessons around 'when' to meet could help. I can even imagine some sort of info-graphic that could help a student self-determine what they can do independently versus needing to request a meeting.)

I think it would be worth considering how to adjust the content of the forms so they are less specific to [Irving]'s SPPs and standards etc. as I think there is universal appeal in the process of learning how to 'request a meeting' and 'pre-thinking' the content of that meeting beforehand.

I will definitely continue to use the form with my advisees in a Google Form format. I think it worked as a great communication tool and it definitely empowered students to guide our conversations as they had 'done the thinking' before we sat down to chat. For those students not quite independent enough to use the form, even having access to a process for connecting or requesting a meeting, indicated a level of responsibility on their part to shape the conversation rather than feeling like PLP meetings are for teachers to 'check in' and 'keep track of you'. The form made it clearer that the onus was on them. I also think having some sort of decision-making infographic that helps a student determine when to meet and when they can 'figure it out on their own' is important. I think this 'pre-meeting' form is a great compliment to the {Jackson School] Learning Profile protocol. I might consider using some of our [Jackson] Learning Profile type questions on the future 'pre-meeting' form.

From Jennifer (pseudonym), a teacher at Franklin Elementary School, written down in conversation with her site captain:

[Jennifer] made her own sheet and chose to give the sheet to students who don't come to her at all or students that come too much. She found that her students didn't use them very much, but this might be because it is so late in the school year and they already have patterns they have followed all year in terms of requesting time to meet with their advisors.

There was one student, in particular, who often visits [Jennifer] to ask questions and check on progress. [Jennifer] found the conferring sheet to be particularly helpful for this student. After each meeting with the student, [Jennifer] wrote comments on the bottom in terms of next steps and areas for the student to work on. She could then as the student if she had completed the work on the bottom of the sheet and the sheet could then serve as a constant

reminder of what the student needed to complete. [Jennifer] could also use her notes as a guide to assess students' progress.

[Jennifer] commented on the large amount of paper and the struggle with keeping a track of all of the papers. I asked if a Google Form or Doc would work better, but she said that the paper was actually more useful as its presence on students' desk worked to help students remember their tasks.

[Jennifer] concluded that this protocol worked really well for students who struggle in finding agency as it aids students in becoming advocates for themselves.

FEEDBACK FROM the Lewis School (5/5/17)

For the purpose of this trial, and since I work with learners in grades 7-12, from beginning to independent, I chose to use Irving's "Conferring Tracking Sheet for Intermediate Learners." I modified the form by adding my advisees' names in the "Students" column and dates for the start of each week at the top of each following column. The printed copy of this form was then brought with me to each Advisor-Advisee meeting.

On the first Monday morning of the trial, we followed our usual protocol of reviewing the next two weeks on our calendars and scheduling an individual 45-minute meeting for each Advisee. Students and Advisor noted the dates and times in their planners (some paper, some electronic), and the full schedule was posted on dry-erase boards in our Advisory area. I explained that I would be recording whether they took initiative to ensure the meeting started on time and what we discussed.

Please see the Conferring Tracking Sheet to date: [Linked Google document]
Having a form on which to track Advisor-Advisee meetings proved useful. It was helpful to have a place to record topics that were discussed or tasks that were accomplished, so that Advisor and Advisee could easily pick up at the next conferring session/bi-weekly meeting where they had left off, especially if the Advisee did not prepare an agenda for the meeting. Highlighting the box when a student did not take initiative to have the meeting (e.g., scheduled the meeting in conflict with another appointment, left the building for another activity) was an easily visible way to note over time who has missed or is avoiding meetings. This aspect of the document is particularly useful evidence when speaking with both the student and his/her parents about the student's lack of initiative and strategizing for development of this skill.

Space on the form, however, is limited. It was difficult to fully document what was covered at each meeting due to the small boxes. If I continued to use a printed version of the form, I would expand the boxes by putting only two weeks/one meeting cycle on each sheet. This would allow for more detailed documentation of each conferring session, and, if kept over time, the sheets would still reveal trends in student initiative. Alternatively, an electronic version of the form (a table or spreadsheet) with text-wrapping would allow each box to expand as necessary as the Advisor took notes. A new sheet within the larger document could be opened at the beginning of each meeting cycle.

I will continue to track student initiative in scheduling and upholding meeting times as well as document what was accomplished at each meeting. Documentation of student follow-through with scheduled meeting times will continue to be tracked by highlighting the name/time on my planner. Meeting notes, however, will be made more effective. While I enjoyed having all of the information on one compact sheet, I found that I often wanted to share my meeting notes with the students, especially less experienced learners (advanced learners were taking their own notes). They saw me model the skill of taking meeting notes, but they did not have access to the actual notes after the meeting. Utilizing a shared, electronic document would solve this problem, promoting student engagement in and ownership of their learning.

Feedback from Grant Elementary:

We started a new round of project based learning two weeks ago, so we just recently were able to start testing the protocol. The form was overall helpful in an elementary school setting. We used a modified version of the intermediate form in a third grade classroom. The students needed a lot of modeling initially, but they were overall excited to have a form they could fill out to request a conferring time with a teacher.

Initially students were still coming up to the teacher to ask for help, but after a few days of reminding them about the form, they started to fill it out and use it to request help. In an elementary school setting, students can be accustomed to asking for help constantly, so the form was a nice way to let them know that help was available, but not always in that immediate moment. What I like most about the protocol is that I didn't have to run around each day checking in with each group. If a group had not requested a conference, I typically trusted that their project was going as planned and would wait to check in with them at the end of the week. The concept of ownership is still being developed, but this is a step in that direction and I appreciate that this system encourages student initiative.

Although I really like the idea of tracking the conferences and noting conversation topics as well as who initiated the conference, it was difficult for me personally to record all of the conferences on the tracking sheet. I found myself wanting to just conference with the students without having to record what we talked about. It is probably just a transition I need to make because I believe it would be worthwhile to have this information, but in the elementary setting, it felt overwhelming for me to keep track of all of the conversations I was having with students. For the rest of the year I might have days where I have quick check-ins with students and then have two days a week that are more formal conferring days where I rely on the forms to decide who I meet with and then I could try using the tracking form on just those days.

Chapter 4, Article 3: Designing for Trust-building Interactions in the Initiation of a Networked Improvement Community

Abstract

Networked Improvement Community (NICs) are increasingly recognized as a social innovation for orchestrating sustained change in education. NICs are one type of a research-practice partnership that provides a model for researchers and educators to bring insights about what works locally to scale. A critical aspect of NIC success is the emergence of relational trust across the participant network. At initiation, therefore, NIC leaders must create the conditions for long-term development of relational trust, which can be operationalized to be the existence of reciprocated, help-based interactions. To understand how NIC leaders foster these reciprocated, help-based interactions, this paper leverages social network and qualitative data to explore how the core activities of a NIC might foster help-based interactions amongst participants.

This paper is a case study of how social network and qualitative data analysis might be applied to the design and development of NICs, and social innovation more broadly. We apply social network and qualitative data analysis in the context of the Personalization in Practice - Networked Improvement Community, which brought together 21 educators from five schools around a common challenge. Focusing on the initial activities that took place over three months, we use social network analysis to connect the patterns and progressions of interactions with design activities and qualitative data to examine the quality of those interactions. Our paper highlights how collaborative design activities created the three conditions for relational trust to emerge: sparking interactions around shared practices, creating situations for participants to ask for help, and encouraging reciprocated, help-based interactions. The application of social network and qualitative data allows us to capture (1) the creation of meaningful ties amongst educators across schools and strengthening of ties between same-school colleagues, and (2)

instances of reciprocated, help-based researcher-educator and educator-educator interactions. These findings demonstrate how specific collaborative design activities can foster the kinds of trust-building networks necessary for NIC success.

This paper presents an applied case of using analytic research methods for the design of social innovation. The triangulation of social network and qualitative data provided insight into the internal dynamics of the partnership and has implications for development measures of network health. We found that the social network data described *that* interaction changed, but did not indicate which activities led to these changes. Triangulation with qualitative data was necessary to understand the quality of the interactions that were possible as the social network emerged.

This case contributes to emerging research on how to measure the effects Networked Improvement Communities on participants and their practices. In doing so, we demonstrate, on a practical level, how social network and qualitative data might be used to generate network-level data for improvement, and we contribute theoretical insight into the way collaborative design creates the conditions for the long-term development of relational trust.

Introduction

Solving the complex problems of educational systems requires rethinking how researchers and educators work together. For many years, education researchers and policy makers devised technical innovations to improve learning at scale, and formulated processes to ensure the appropriate implementation of these programs (Slavin, 2002). In recent years, however, the education policy and research community has come to realize the promise of social innovations, particularly through including educators in the change process (Cohen-Vogel et al., 2015). This realization is seen in the emergence of research-practice partnerships as a promising pathway to engage in systems-level change (Coburn & Stein, 2010).

One type of research-practice partnership is the Networked Improvement Community (NIC). NICs are a social reorganization of traditional research and development activities that leverage data-informed, collective action for social innovation (Bryk, Gomez, & Grunow, 2011). When the first NICs achieved outsized success, NICs became an increasingly popular model for reform (Bryk et al., 2015). Toward this end, research on models for NIC initiation (Russell et al., 2017) and execution (LeMahieu et al., 2017) have focused primarily on identifying the organizational structures, methods, and tools that support NIC progress. What is less clear is how NICs foster the social capacities, such as relational trust, that are needed for sustained reform.

This paper focuses on designing for interactions that build social capacities for sustained reform. Relational trust describes the capacity for successful, professional interaction (Bryk & Schneider, 2002) and has been promoted as an indicator of research-practice partnership effectiveness (Henrick et al., 2017). Relational trust springs from recurrent, reciprocal help-based interactions that, over time, build communities of practice where participants can take risks together and experiment with new practices. If relational trust is a key capacity for long-term

change, then how can a NIC act as a catalyst to move practitioners toward the kinds of interactions that can spark relational trust?

To this end, this paper answers the question, *how do NIC collaborative design activities foster reciprocated, help-based interactions?* Focusing on the first three months of NIC initiation, we illustrate how the collaborative design activities sparked help-based interactions among NIC participants. The paper begins with a review of collaborative design, relational trust, and social network theory. We then provide a narrative of the early stages of PiPNIC, a NIC with educators around the challenges of implementing personalized learning. Next, we detail the applied research design. The findings trace (1) the creation of meaningful ties amongst educators across schools and strengthening of ties between same-school colleagues, and (2) instances of reciprocated, help-based researcher-educator and educator-educator interactions. The paper concludes with an exploration of how the findings from this analysis inform an understanding of designing NIC initiation and the use of social network and qualitative data to inform the development of social innovation efforts.

Collaborative Design

Collaborative design[4] is a user-centered problem-solving approach that emphasizes the inclusion of users in both what problems to solve and how they will be solved (Schuler & Namioka, 1993; Muller, 2003). NICs appropriate many collaborative design ideas, such as problem-identification, iterative testing, and reflection cycles (Bryk & Gomez, 2008). NICs begin with identifying a common problem of practice important to the educator participants and leverage collaborative design as a core interaction mechanism (Dolle, Gomez, Russell & Bryk,

[4] Co-, collaborative, and participatory design all have their roots in Scandinavian tradition (Sanders & Stappers, 2007). We choose to use collaborative design as a term that is more commonly used in education research in the United States.

2013). Through collaborative design, a NIC invites practitioners to examine how problems occur in local contexts and identify measurable goals, develop robust data pathways to iteratively inform design process and outcomes, build and test solutions, and create a theory of action that reveals the problem and possible solution paths (LeMahieu et al., 2017).

Successful collaborative design requires help from other people. In a successful NIC, problems are solved when researchers ask for design help from educators, and educators are open to research precedents and design options. The perspectives of researchers and practitioners are then integrated into the collaborative design of an artifact that addresses the problem of practice. As a result, participants feel mutual ownership over the process and product, and recognize why each kind of expertise included in the design was necessary for the resulting solution.

While the design process is aimed at creating a useful solution to a shared problem, collaborative design research also focuses on how interaction is coordinated to support authentic participation (Ehn, 2008). The connection between the collaborative design activities and interactions is labeled *infrastructuring* (Penuel, 2019). Infrastructuring describes the "network of tools, relationships, standards, and protocols on which an individual or group relies to carry out day to day tasks and accomplish particular goals" (Penuel, 2015, p.5). From a social perspective, NIC initiation is infrastructuring, where the collaborative design activities foster the kinds of social capacities that will support long-term partnership success.

Relational Trust

Relational trust is a specific form of social capacity that has been studied extensively in organizational theory (Mayer et al., 1995) and education (Tshannen-Moran, 2008) and associated with successful school reform (Bryk & Schneider, 2002). Relational trust is a critical resource for

solving organizational problems as it supports asking and answering hard questions, risk taking, and the collaborative vetting of proposed solutions (Levin & Cross, 2004).

Bryk & Schneider (2002) defined the concept of "relational trust" as a form of social trust[5] that is built through the interactions amongst educators over time within a community. Relational trust develops between two individuals when they ask each other for help, and the bid for help is fulfilled by the other, repeatedly, over time. When people ask for and receive help from one another across an organization (or a partnership), trust networks begin to form that can support participants to engage in tasks that require more risk (Mayer et al, 1995; Halverson and Kelley, 2017). Distributed relational trust emerges when there are redundant, reciprocal trust-networks develop in an organization around key professional tasks. Tracing the development of a network of reciprocated, help-based interactions across the participant community operationalizes the conditions for relational trust to emerge in the long term.

The role of trust in building successful research-practice partnerships is well-known. Henrick and colleagues (2017), for example, propose five indicators under the category of "building trust and cultivating relationships": researchers and practitioners (1) routinely work together, (2) establish routines that promote collaborative decision making and guard against power imbalances, (3) establish norms of interaction that support collaborative decision making and equitable participation in all phases of the work, (4) recognize and respect one another's perspectives and diverse forms of expertise, and (5) decide partnership goals that take into account team members' work demands and roles in their respective organizations. Identifying these indicators is an important feature of partnership research. The next step in partnership

[5] There are other many other dimensions and factors of trust that may impact long-term development of relational trust, such as perceived trust/mistrust of research organizations, universities, schools, parent groups, or individual propensity to trust others, especially those of the same profession, etc., however these dimensions of institutional,, and individual trust are beyond the scope of this investigation.

research is then to identify the kinds of activities that promote collaborative decision-making and the strategies leaders use to build capacity for participants to recognize and respect one another's perspectives. This paper is aimed making this connection between NIC activities and the patterns and progressions of interactions that might yield these indicators of long-term development of trust.

Social Network Theory

The patterns and progressions of interactions during NIC initiation can be traced by social network analysis tools, which are built from social network theory. Social network theory provides a method to track the patterns and progressions of interactions amongst members of a group (Daly, 2010). Social network theory foregrounds the overall structure of the group, the ties between actors, and the quality of the ties as important factors in understanding actor and network outcomes (Borgatti, Brass, & Halgin, 2014; Lin, 2002).

Networks and trust have been studied extensively, with higher network density associated with greater network cohesion, trust, and capacity for change (Mohrman, Tenkasi, & Mohrman, 2003; Moolenaar & Sleegers, 2010). Strong ties are correlated with benevolence-based trust (Currall and Judge 1995) and with trust and trustworthiness (Glaeser et al. 2000). (See Table 4-1 for a summary.) Trust is typically examined for its impact on interactions, rather than as an outcome of interactions (Liou & Daly, 2014).

In education, social network theory has been used to explicate how ties among network members evolve during reform efforts (Daly & Finnegan, 2010), mediate professional learning (Penuel, Frank, & Krause, 2012), and support principal innovation (Moolenaar & Sleegers, 2010). Recent work to apply social network methods to NICs has examined how knowledge is

transferred across the network (Cannata et al., 2017) and how organizational positions affect NIC participation (Sherer & Feldstein, 2018).

Social network theory allows for collecting data on the shape and intensity of the network of help-based interactions that characterize a successful NIC. NIC initiation typically brings together people who have limited prior connections. Limited prior connections is part of the NIC strategy to learn from implementations across contexts of practice. The lack of relational trust between people who have few shared connections could limit participation in NIC activities. In this scenario, interaction may be centralized among the small number of actors who had prior connections, which could result in a one-way network where certain actors provided help to a large number of participants. Even though the NIC may be organized around shared design activities, the patterns of help-based interactions may come to be unevenly distributed across participants. The application of social network and qualitative analytic tools to examine the network as it is forming can be used to provide insight into the patterns and progressions of emerging connections among participants.

Aspect of Help-based Interactions	Facets of Trust	Theory
Asking for and receiving help	Willingness to be vulnerable, honesty, openness, benevolence	Teacher collaboration and trust (Moolenaar & Sleegers, 2010; Penuel, Frank, & Krause, 2006) Helping (Nadler, 2012)
Quality of interaction	Competence	Knowledge transfer through weak ties (Granovetter, 1973; Levin & Cross, 2004) Social capital (Coleman, 1988) Quality of ties (Borgatti et al., 2014; Lin, 2002) Structural holes (Burt, 2017)
Reciprocation over time	Reliability, Integrity	Positive history of experiences (Tschannen-Moran, 2001)

Table 4-1: Theoretical connection between help-based interactions, the facet of trust they align with, and related research.

In the next section we provide a narrative of the larger research and practice context for the NIC presented in this paper.

A Networked Improvement Community around Personalized Learning

The Personalization in Practice (PiP) research group was formed in 2014 to study school-wide efforts to design and implement personalized learning strategies in K-12 schools (Authors, et al., 2015). PiP is a research alliance between the University of Wisconsin-Madison School of Education, the CESA 1 Institute for Personalized Learning (IPL), and the Wisconsin Department of Public Instruction. The partnership is supported by the Joyce Foundation and by the US Department of Education Institute of Education Sciences. The goal of PiP was to document how public schools engage in personalized learning, then transform these insights into opportunities for professional learning for interested educators through a NIC.

There is a strong and growing network of personalized learning schools in Wisconsin, and IPL has been a regional and national leader in designing, supporting, and scaling this grass-roots movement since 2009 (CESA1, 2011). IPL defines personalized learning as,

> an approach to learning and instruction that is designed around individual learner readiness, strengths, needs and interests. Learners are active participants in setting goals, planning learning paths, tracking progress and determining how learning will be demonstrated.

The PiP research team conducted ethnographic studies of 20 IPL schools engaged in personalized learning. They identified three key personalized learning practices:

- educators designed *cultures of agency* to engage students as active participants in their learning;
- Educators acted as facilitators of learning by regular *conferring* with students to construct learning pathways and set learning goals; and
- schools developed *socio-technical ecologies* of digital tools, such as productivity tools, learning management systems, computer adaptive testing and curriculum tools, and digital media and design tools to coordinate instructional, assessment and learning tasks. (Authors et al., 2015)

In the fall of 2016, the Personalization in Practice - Networked Improvement Community (PiPNIC) was launched to bring together expert educators to identify, document, and improve core personalized learning practices. PiPNIC sought to engage expert practitioners and researchers in collaborative design around common, meaningful problems of practice that would produce practical and theoretical knowledge about cutting-edge personalized learning practices. The PiPNIC theory of action was that engaged practitioners and researchers in collaborative design would spark help-based interactions, which would in turn generate solutions to the problem of practice and develop the capacity to support further improvement.

A network hub was established, led by the two authors of this paper, and the formation of a Networked Improvement Community was conceptualized as three stages: problem identification, participant recruitment, and a 90-day collaborative design cycle.[6]

Stage 1: Problem identification

This stage involved contacting and interviewing schools across the state to identify shared problems of practice in personalized learning. Identifying a problem of practice from the field established the interdependence and authenticity of the partnership from the start as researchers would have to rely on the practice-based knowledge of educators, while educators would have to rely on the researchers to structure the common inquiry. To do this, our network initiation team drew on Gawande's (2007) idea of listening to those closest and most knowledge about the work in order to identify meaningful insights and challenges. Through phone calls, visits, and discussions at conferences, over 60 educators were consulted from traditional public, charter and private school communities. Schools were nominated through the PiP researchers'

[6] In this paper, we focus on stage 3, the collaborative design cycle. For more detail on the first two stages of the process, please see Kallio & Halverson (2017).

existing connections for their expertise in personalized learning. In this way, the research team leveraged its existing social capital to better understand the challenges faced by personalized learning educators and leaders.

We identified *conferring* as central, shared problem of practice on the frontier of personalized learning. When personalized learning educators ranked their practices, conferring emerged as the practice that had the highest utility for their work (Rutledge, 2017). Conferring came to be defined as the regular one-on-one conversations between an educator and student. For example, in a project-based learning school, a student might sign up to meet with their teacher to discuss their ideas for an interest-based project. In a competency-based school, a student and teacher might meet to look at their progress on a computer adaptive platform and discuss next steps. Educators from different contexts described the purpose of conferring as developing learning relationships, individualizing learning, and/or capturing evidence about learning. While the instructional origins of conferring are found in other pedagogies (e.g. Calkins & Harwayne, 1991), it also roots in the individualized educational program meetings of special education. Despite near universal agreement that conferring was a core practice, teachers reported little consensus on process documentation or evidence of impact. This made conferring an excellent problem of practice for NIC design.

Stage 2: Participant Recruitment

The Stage 1 listening effort resulted in a long list of potential NIC educator participants. We narrowed this list by identifying practitioners who had well-established conferring practices, district leadership support, and the capacity to engage in the project. We also sought to recruit educators from a range of schools in terms of student age (kindergarten through 12th grade) and context (school size, locale, age of program). We ultimately invited 21 educators from five K-12

public schools based on their expressed expertise in conferring and their willingness to spend four Saturdays over the course of three months working on a collaborative design project. Each participant received a stipend and the option of continuing education credit. Ten UW researchers agreed to help coordinate the collaborative design process.

Stage 3: 90-Day Design Cycle

In the spring of 2017, 10 UW researchers, including the authors, and 21 educators from five schools (see Appendix A for school descriptions) came together to participate in collaborative design activities. The collaborative design activities were organized by the 90-day design cycle (Park & Takahashi, 2013), a way to prototype an innovation through leveraging knowledge of those within and outside of the field associated with the topic; coordinating the development and "testing" of a product by at least one of several means; begin and conclude within a span of 90 days … [and] deliver needed knowledge in a timely fashion (Park & Takahashi, 2013, p. 6-7). The 90-day cycle also provided a strategy to synchronize the work of participants from different organizations, a key challenge of RPP (Coburn & Penuel, 2016). The outcome of the design task was to develop and validate conferring protocols that could be used across the schools. Each school team that participated ultimately produced a protocol to guide their local conferring practice, and all protocols were published in a final 90-day report (Authors, 2017). Meetings were held on four Saturdays, hosted by participant schools.

The research team developed a series of five key activities to engage participants in collaborative design. Each school team of educators:

1. created videos of their own practices to share current conferring strategies;
2. pitched a plan for the improvement of conferring to the whole group;
3. developed protocols that described the context, conversation, and documentation strategies for their desired conferring practices;

4. engaged in a user-testing cycle where each educator tried out their school's protocol and experimented with protocols from other schools; and
5. contributed to a final report and community discussion where experts in personalized learning and student-focused instruction commented on the presentation of new practices.

To facilitate these activities, each PiP research team member was assigned as a liaison, or "site captain," as primary points of contact for each school. PiP site captains visited participant schools prior to and throughout to support design activities.

The NIC collaborative design activities were held during the Saturday whole-group meetings. Each activity included (1) *sharing activities* in mixed-school groups and (2) *reflecting, planning, and testing* activities within same-school teams. (See Table 4-2 for a summary.)

In *sharing activities*, participants presented representations of their conferring practice or plans for improvement to participants from other schools. The goal of these structured sharing activities with mixed-school groups was (1) to maximize opportunities for each participant to ask for and receive help from educators from other schools and to minimize the possibility of one person serving as the de facto spokesperson for the school, and (2) to require participants to take a risk in sharing their practice publicly and allowing others to comment on it. These kinds of sharing activities were repeated each week as school teams refined their representations of conferring, created and executed improvement plans that incorporated feedback, and ultimately user-tested each other's conferring protocols. This repetition built a history of interactions between educators from different schools and with researchers.

In *reflecting, planning, and testing* activities, participants from the same school plus their site captain had time to make sense of their feedback. Participants then negotiated how they would incorporate individually-received feedback into future collective action. The repetition of these activities also provided opportunities for same school colleagues to build a history of interactions with each other and with their site captain.

Collaborative Design Activity		Modes of Interactions		Who	
		Reflecting, Planning, and Testing	Sharing Representations of Practice	Within Teams	Mixed-Groups
1*	Watch videos of current conferring practices		x		x
	Reflect on feedback and plan for improvement	x		x	
2	Create a pitch to share improvement plan	x		x	
	Present pitch		x		x
	Refine pitch into action plan	x		x	
3	Discuss action plan data, Write conferring protocol	x		x	
	Share protocol		x		x
	Finalize protocol	x		x	
4**	User test protocol from another school	x		x	
	Add user testing feedback to protocol		x		x
	Meet with user testing partner		x		x
	Reflect on feedback	x		x	
5	Share protocols		x		x
*Example 1; **Example 2					

Table 4-2: Collaborative design activity sequence during the 90-day design cycle.

The conferring protocols that resulted from the NIC process have since been shared through the state Department of Public Instruction, as well as presented by participants and researchers at state-wide educator conferences. There has also been follow up between researchers and schools as part of a continuation of the Personalization in Practice study, specifically focused on the implementation of the conferring protocols and the instructional systems that support it. The remainder of the paper focuses on the interaction structures and emerging network in Stage 3.

Research Design

This study uses a mixed methods approach that draws on social network and qualitative data to answer our qualitative research question (Plano Clark & Ivankova, 2016): *how do NIC collaborative design activities foster reciprocated, help-based interactions?* We collected social network and qualitative data to determine the patterns and progressions of these interactions, and connect these to the design of the initiating activities of the NIC. We operationalized relational trust with a survey that allowed participants to identify who they valued in the NIC process, then explored key design tasks for evidence of reciprocated, help-based interactions. While all members of the research team engaged in data collection, the two authors of this paper were primarily responsible for both the design of the NIC activities and the collection of data.

Social Network Data Collection and Analysis

The research team developed a social network survey to collect data about participant interaction. The survey was given at the conclusion of the 90-day cycle, to all participants (n=31, 21 educators and 10 researchers), built and delivered through Qualtrics (Appendix 4-B). To ensure 100% response rate, participants were given time during the final meeting to complete the

survey, and the network coordinator verified that each person had submitted it before the meeting concluded.

Participants indicated who they had interacted with about conferring prior to participation and who they interacted with during. We used a roster with the names of all the participants as a feature of the survey. They then rated how important that person was to their "learning about conferring". The question was phrased as "learning" to capture the range of interactions across the different design activities but rooted in collaborative and professional interactions. Because relational trust is a condition for learning with someone in the context of a professional learning community (Louis, 2006) and other studies have used tie strength as a proxy for trust (Gulati, 1994), we interpreted higher "important to my learning" as a valued interaction.

In the analysis of social network data, we use whole network and dyadic characteristics (Borgatti et al., 2013). Responses from the social network survey[7] were imported into Excel, anonymized, and uploaded into UCINET (Borgatti, Everett, & Freeman, 2002). Operationalizing what the tie represents is critical for interpretation. The ties we capture indicated who an individual interacted with and how that interaction was valued. This provides insight into the distribution and quality of ties across the network and situates qualitative observations, providing evidence about the ways in which participants relied on one another for help in the design activities.

[7] For understanding the structure of the network during implementation, we omitted the ties between researchers. The reason for this was twofold: we wanted to see the structure of the network around the design work as the educators experienced it and the interactions amongst researchers were primarily focused on the organizational design of the network.

Qualitative Data Collection and Analysis

We also collected data to capture the emergence of help-based interactions in the collaborative design activities. A number of written documents served as data sources, including the initial grant application, an advisory committee report, a research group presentation, meeting agendas, and a final report. During the listening sessions, the research team had a Google form that team members filled out with the answers from their calls. We collected planning documents and agendas, with notations for how meetings were modified in the moment, as well as email communications, internal and external presentations. Observation data was recorded by research team members as they participated in and/or facilitated activities related to the project, including notes and participant reflections from all collaborative design meetings.

We also collected direct feedback from participants. We asked participants for feedback about the activities, their thinking about conferring and personalized learning, and what each individual was interested to improve. After the second meeting, participants emailed one thing that they found to be the most meaningful during the morning's activities. On the last Saturday, we had teams do a focus group debrief of the user testing process and reflect on their progress up until then. The audio from these focus groups was transcribed.

Finally, we used the qualitative data to write detailed design narratives for each site and the NIC as a whole. The site narratives were semi-structured, describing each school's context and participating team members, what conferring and personalized learning looked like prior to PiPNIC, then a chronology of actions and design moves during the 90-day cycle. The network narrative focused on the meta-design of the processes that brought this work together. At a research meeting, these narratives were cross-checked with other members of the research team. The narratives were also presented with participating educators at a conference.

The analysis in this paper began with the social network then qualitative data. The social network analysis was used to identify patterns in interactions, then the qualitative data provided the quality of the interactions. For example, when the network analysis showed that participation in PiPNIC created interactions between participants from different schools, we turned to the qualitative data to understand the progression and function of those interactions. This led us to identify a pattern of authentic requests for help between educators and researchers and amongst educators. Our attention was drawn to examples of participant interaction that could illustrate the kinds of help-based interactions indicated by the social network analyses. In our discussion (below), we consider the explanatory relation between the activities and the social network data as part of a larger argument about designing for relational trust.

In this way, the social network data provided selection criteria for the qualitative data, though not all of the qualitative data demonstrated the existence of help-based interaction. Many of the fieldnotes, for example, described information presentation activities, or documented participants involved in discussions or non-project related interactions. Our attention was drawn to examples of participant interaction that could illustrate the kinds of help-based interactions indicated by the social network analyses. In our discussion (below), we consider the explanatory relation between the activities and the social network data as part of a larger argument about designing for relational trust.

Because of the focus of this case on a context that includes educators as partners in social innovation, we constrain the analysis in this paper to educator-researcher and educator-educator interactions. While the researchers had some previous connections with each other, their pattern of interactions would have been confounded by other meetings beyond the collaborative design

activities. Future analyses could examine how the ties between the researchers changed, but that is beyond the scope of this case.

Findings

Our findings focus on identifying the emergence of help-based interactions through the PiPNIC collaborative design activities, then on describing the conditions that sparked these interactions. We present three kinds of collaborative design activities that produced the observed help-based interactions: (1) activities that created *meaningful cross-school connections* among educators and activities that strengthened ties between *same-school colleagues* and between *researchers and educators*; and (2) *activities to build reciprocal interactions across the network*.

1) Meaningful cross-school connections

The first kind of activity we highlight is the process of bringing together educators from different schools and school contexts interested in shared problems of practice to spark new professional interactions. Bringing together a group of weakly-connected educators and researchers can be a source of new ideas and resources for the NIC (Granovetter, 1973; Johnson, 2011), and it is integral to the process of finding what works, for whom, and under what conditions (Bryk et al., 2011). However, the lack of existing ties between educators from different schools and the differences in their school contexts can also produce barriers to collaborative problem solving if they perceive that other people's practices would not apply[8].

In PiPNIC, recruitment began with researchers who had existing ties with potential partners. Recruitment via existing ties has implications for the initial structure of the relational network, how new ties might be created, and the function of these new ties in terms of building

[8] When educators encounter new ideas for practice, such as from research, they are likely to use their context as a primary filter for whether that new information will fit (Tseng, 2012).

the relational resources for innovation. Once a school indicated they were interested in participating, the school leader and the PiP team worked together to invite other educators from the school. Asking the school leader to identify someone meant that the educator might have a strong connection to their own school colleagues, but probably would not have a direct connection to the research team. This created a situation where one person from each school was connected to the PiP team, but most of the educators did not have prior connections with the PiP researchers or with other school educators.

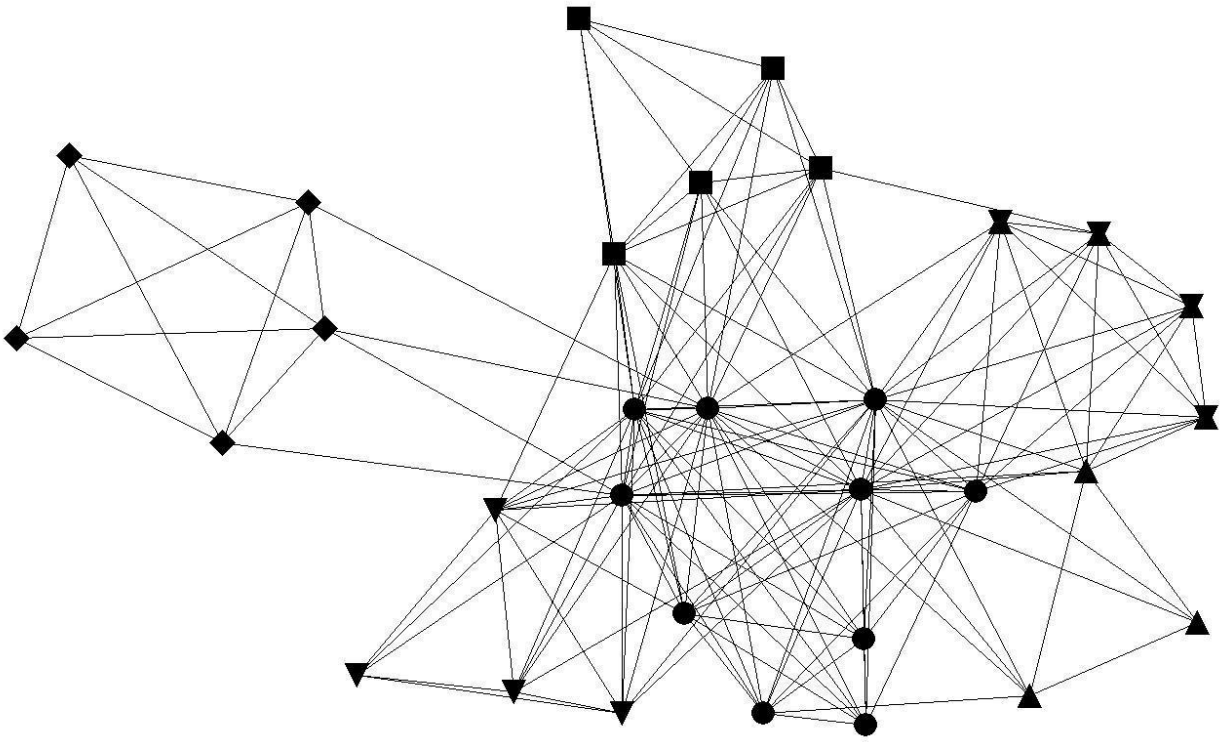

Figure 4-1. This graph shows the network prior to the 90-day cycle. Participants answered the survey question, "Who did you know prior to PiPNIC?". The graph, constructed in UCINET, includes all participants (n=31). The non-circle nodes are educators, circles are researchers, and the shape indicates organizational affiliation. More highly connected nodes are moved to the center, while people with fewer connections are moved to the periphery.

Our social network data reflected this initial condition. The social network survey asked participants to identify who they knew prior to PiPNIC.[9] Ties prior to participation show a weakly-connected researcher-practitioner network with six subgroups: the five school teams and the research team (Figure 4-1). Researchers were central and densely connected to each other with ties to a few educators, but educators were not connected to each other (with a few exceptions). The ties between researchers and educators are characterized as weak because the average importance rating of the research team prior was 2.83/5 whereas the average importance rating of educators to their own colleagues at each school was 3.64/5 (Table 4-3).

	Average Importance Rating		
In-Group (i.e. between colleagues)	3.9	4.5	+0.6
Out-Group (i.e. between educators at different schools)	1.3	3.3	+2.0
Educator-Researcher	3.1	4.0	+0.9
Educator-Site Captain	3.0	4.4	+1.4

Table 4-3. This table shows the average importance rating for different types of ties. Participants answered the survey question, "During PiPNIC, how important was this person to your learning about the conferring process?"

A weakly-connected researcher-practitioner network is an important initiating condition for many NICs. The research team recognized we would need to initiate meaningful interactions across school groups early in the process by creating stable mixed-groups of educators from across schools. We intentionally created stable mixed-groups so that educators would come to know one another and have opportunities to consult each other over time.

The first mixed-group activity was sharing videos of their current conferring practice. Prior to the first Saturday meeting, PiP site captains had met with educators at each school to

[9] The accuracy of their recall was corroborated with what members of the research team knew as well. We knew there were very few ties across schools, but we did know about a few preexisting cross school connections and those were accurately reported. Likewise, we compared whether participants indicated interaction with their site captain, and this was consistent with what we knew, providing an external measure of accuracy that participant responses match observed interactions (Kashy & Kenny, 1990).

video the existing local classroom conferring practice of most teachers. Site captains worked with educators to shoot and edit the video to present at the first group meeting. Then on the first Saturday, each educator in the mixed-group shared their video of the school's conferring practice. A PiP Site Captain facilitated the discussion process. This activity allowed each educator to see how their conferring expertise compared with the other school's educators. Each educator could ask about the practices of the other schools and serve as an expert for the practices represented in their school videos.

Researchers noticed that this first look into each other's practices sparked discussion about the similarities and opportunities they saw in how conferring happened in other schools, rather than focusing on the differences in their contexts. One participant observed how remarkably similar the goals of conferring were, despite the variation in the implementation, age levels, pedagogical models, or student populations.

These mixed groups met again on the second Saturday where educators "pitched" their plans to improve their conferring practices, again facilitated by a researcher. Participation in these activities meant they needed to interact with participants from other schools to complete the design task, and next we show how we know these interactions were meaningful.

At the end of the 90-day NIC design activities, we saw changes in number of meaningful connections that each participant reported with others. The density of the network[10] increased from 0.28 to 0.44. This increase in density indicates the creation of new ties amongst the same number of nodes. The structure of the resulting network showed a distributed network of interactions (Figure 4-2). Educators became more centrally located in the network, whereas most of the PiP researchers had moved to the periphery, which confirmed our intention to design

[10] Network density is calculated by the number of indicated ties divided by the total number of possible ties.

activities that would foster help-based interactions amongst participating educators. The network graph illustrates how educators were creating new connections with educators from other schools and with researchers. This creation of interactions across school groups reflects research on how networks can close structural holes and create access pathways to the ideas and resources of the other actors (Burt, 2017).

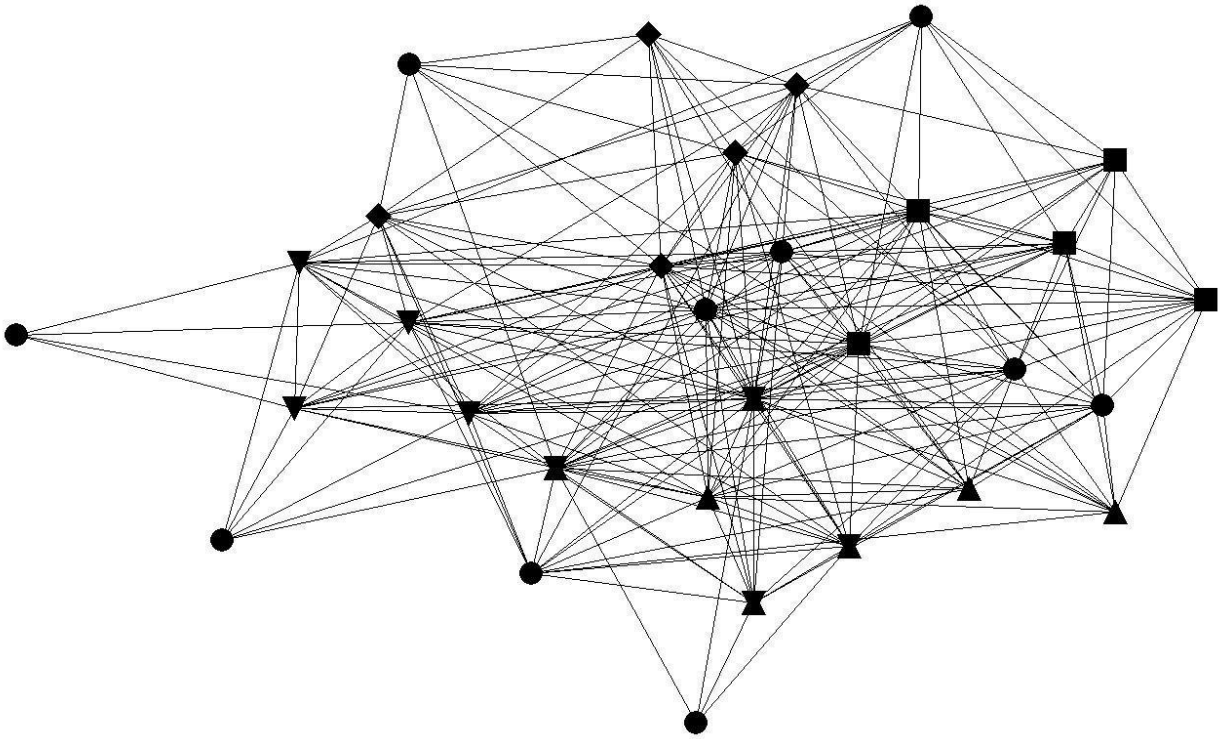

Figure 4-2. This graph shows the network during to the 90-day cycle. Participants answered the survey question, "During PiPNIC, who was important to your learning about conferring?". The graph, constructed in UCINET, includes all participants (n=31). The circles are researchers, non-circles are educators, and the shape indicates the different schools. More highly connected nodes are moved to the center, while people with fewer connections are moved to the periphery.

We also observed that the new ties that were created were valued by participants. Half (12/21) of the educators indicated that "interactions with innovative educators from other schools" was the most important aspect of their participation. Participating educators shared the following reflections on their most meaningful moments:

- "The process of sharing with others who have similar missions but very different contexts and different practices around a common question has been even more powerful and effective than I imagined it would be. I have greatly enjoyed this experience and feel as if I am gaining a lot."
- "I think the most meaningful part of the PiPNIC was when we were partnered with one person from a different school to share our protocol and talk through it with them so that they could try it in their context."
- "Meeting with different age levels teachers to see the connection with what is happening in my classroom"
- "The most meaningful part of the PiPNIC process was the interaction and conversations amongst the different schools."
- "The connections, stories and experiences shared from other professionals. The honest and open vulnerability everyone had through the process."

Every educator reported meaningful interactions with at least three educators from other schools. The number of meaningful interactions that each person receives is called *in-degree centrality*, and is often used as a measure of status in a network (Siciliano, 2016). This is because a person with more nominations from others has an influential position (Moolenaar, 2012). We considered a rating of 3 or higher (5 being the highest possible) for the question, "During PiPNIC, how important was this person to your learning about conferring?" That each person developed meaningful connections with educators from other schools is significant in establishing the conditions that support help-based interactions, as similar levels of status support the development of relational trust (Tschannen-Moran & Hoy, 2000).

2) Strengthening ties between same-school colleagues and between researchers and educators

Sparking new ties among new colleagues is an initial challenge for the NIC process, but strong ties within schools, and with network initiators, are needed for innovation to take root in practice (Coburn & Russell, 2008). In many ways, it is not surprising that time spent together increased tie strength. A quarter of the educators responded that spending time working with their colleagues and other educators was meaningful. In this part of the analysis, however, we consider how the quality of interactions across the network strengthened ties within schools and ties with researchers.

The NIC leaders designed activities to foster help-based interactions amongst same-school colleagues. Saturdays began with an hour for school teams and their site captains to meet and prepare for the mixed-group session and concluded with an hour for them to prepare for their work going forward. Providing teams with this time was at first a way to reduce the demand for their participation on time outside of NIC activities, but it also gave them designated time to complete collaborative tasks. For example, one school recognized that it had two approaches to conferring. They had to come to a consensus as to which version they would focus on or whether they would try to blend the two. The interactions to complete this task required a willingness to be vulnerable by sharing one's own practice, being open to change based on new information, and acknowledging each other's competence and expertise. The site captains noted that the team ultimately decided to go with one protocol, citing that "they saw themselves as one school." In this way, this design task forged a sense of shared commitment to this direction and engagement in the collaborative design process.

Other educators shared how important it was to have the time to work with their colleagues, including the drive to and from the meetings. One educator shared that the best part

Saturday was “The ability to sit with my team, free of distractions, and have a conversation. Coming up with conferencing/project protocols has been on our to-do list for far too long. Often we are just going full speed and have little time to stop and just do ONE thing. I also appreciate seeing and hearing about what others are doing with their students. The experience is encouraging us to keep moving forward.”

Looking across the network at the change in tie strength, participation in NIC activities strengthened all types of ties and ties across schools increased the most, but same-school ties were the most important (Table 4-3). The survey asked participants to indicate how important the person was to their learning about conferring. “More important” here indicated that the interaction supported them in the task they were trying to accomplish and suggests that the person was judged as competent in helping the respondent learn. The deepening of ties amongst colleagues is an important indicator that the NIC process sparked meaningful interactions among educators from the same schools.

Because the goal of NICs is to work across research and practice boundaries, the ties between a school group and their site captain provides an examination of a particularly important type of interaction in the context of the NIC. During design activities, site captains were included in the same-school groups, often helping participants clarify of the task or make sense of feedback, as we draw out in more detail later in the paper. All participants indicated that they had meaningful interactions with their site captains. The average importance rating of the tie between the school members and their site captain was 4.4/5, on par with their ratings for their own colleagues. The importance of the educator-researcher relationship and the deepening of ties across all subgroups suggests that the strong ties that were created represent meaningful, distributed interactions where help could be sought and received.

3) Activities to build reciprocal interactions across the network

The social network and qualitative analysis presented provides insight into the patterns of interactions across the network. In the next section, we look at progressions of interactions. We highlight examples from the first NIC activity (sharing the video of current conferring practices in mixed-groups and deciding on a conferring improvement focus) and the fourth NIC activity (user-testing each other's conferring protocols). Though there were other examples of help-based actions, these two examples were the richest in participant perspective and provide examples of what was possible in the context of the activities.

The first example illustrates how researchers and educators began to ask for help from one another in developing representations of conferring practice. As described earlier, prior to the first meeting, PiP site captains had met with their school to help record and edit a representation of how conferring happens in each educator's school. These videos were then discussed at the first meeting's mixed-group sharing session. This session presented a moment of high vulnerability for educators who had just met each other. The interactions in the video, one-on-one conversations between a teacher and student, are perhaps the most intimate part of a teacher's practice. The researchers sought to create a safe space by prompting participants to notice, rather than evaluate, each other's practices. For example, the activity encouraged participants to describe carefully what they saw in each other's practice rather than making suggestions about how practice might be improved.

The educators from Franklin Elementary School recorded a conferring session in which two teachers met with one student to talk about her idea for an interest-based project. After presenting the video in the mixed-school groups, the Franklin educators reconvened with their site captain to make sense of the feedback they had gotten from educators at other schools. They discussed that other educators had noticed a lack of structure in their conferring process and that

the teachers did most of the talking. Their site captain wrote down that their main takeaway from this discussion was that "We talk too much. We need to do something that helps students find their voice." This design task facilitated their ability to get feedback on their practice, then make sense of the feedback with their colleagues. At the conclusion of the first Saturday, the teachers decided to develop a conferring protocol that would structure conferring around interest-based projects, hoping that the structure would provide the scaffolding for students to speak more.

Before the second Saturday NIC meeting, the PiP site captain analyzed the Franklin conferring video and created a representation of the turn-taking between teachers and students (Figure 4-3). This visualization affirmed what had been observed the previous meeting and prompted continued conversation among the Franklin teachers about student ownership of the learning process. The team agreed that their conferring sessions were too teacher-led, and they decided to focus their conferring improvement efforts on supporting student-led conversations.

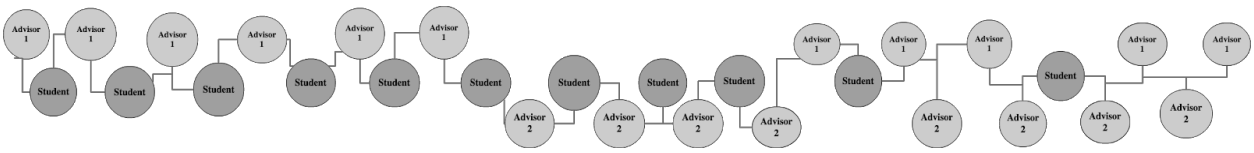

Figure 4-3: Visualization of the Franklin conferring process created by the site captain. This figure represents the conferring process of one advisory session with two advisors and one student. In this instance, the student mostly responded to questions from the advisors and the student spoke less often toward the end of the meeting.

Notably, the interaction between the Franklin teachers and the PiP site captain lacked any signs of defensiveness that could limit reciprocal learning (Argyris, 2000). At the end of this second Saturday, one Franklin teacher shared in an email that she was thankful for "having the chance and opportunity to chat with my colleagues and hash out the details of our project process, having [our site captain] organize our thoughts and make sense of them, and creating meaningful project/conferring opportunities for the students we serve."

This example illustrates the PiPNIC collaborative design strategy. First, participants engaged in activities grounded in their current practices. Then they received feedback from other schools and from their site captain, and were able to reflect on how to integrate feedback into their own protocol design process. Help was requested and received by educators and researchers alike in an effort to design a solution to the problem of practice.

The second example spans the third and fourth NIC Saturdays to show how the collaborative design activity of user-testing sparked authentic, help-based interactions between educators from two different schools. At this point, each school had a rough draft of their conferring protocol. The PiP team developed a user-testing activity for school teams to test and give feedback on each other's protocols. Each participant was paired with an educator from their mixed-school group in order to continue to build on their history of interactions. Pairs traded protocols, tested each other's designs with students in their own classrooms, then wrote feedback on the protocol. They then discussed their feedback in person at the final meeting.

One pair included Allison, an educator from Jackson High School, and David, an educator from Grant Elementary. Allison had ten years of experience working in an alternative high school, and David was in the first year of creating a personalized program within his elementary school for disengaged students. Allison and David were assigned to work together because one of the research team members had noticed that they had often engaged each other in conversation during the mixed-group activities. The focus of their protocols, however, was different: Allison's school team had focused on protocol questions to elicit evidence of student growth, whereas David's school team focused on questions to guide the development of interest-based projects with students.

On the third NIC Saturday, tasked with exchanging protocols and making a plan for user-testing, their conversation started with the context and logistics of using the protocol, but soon turned to probing each other's expertise. David asked Allison for help thinking about two questions when she was testing his protocol: "Are there questions that are better predictors of student success?" and "Are there questions that lead to student self-awareness and potential for success on a project?" Allison noted these on her planning document.

A few weeks later, when Allison made comments on David's protocol (via Google documents), she wrote that two of the questions from his protocol, "Who is your audience?" and "How will you measure the quality of your work?", elicited the response from her students, so she suggested that the two questions could either be combined or one of them eliminated. To David's question about student success with the project, Allison challenged him to define his criteria for success better, noting that his use of the term "reasonable" could be interpreted in different ways. In her feedback, Allison responds to David's request for help and shares her expertise with David through a high level of specificity in her feedback combined with recommendations for improvement.

This help was reciprocated by David. He wrote a page of comments on Allison's protocol about his testing process. The goal of Allison's protocol was to develop the relationship between teacher and student through questions about the student as a learner. David described how his conversation with a fourth grader went and that through the protocol, he "learned a lot of new information about the student as a person and learner and think that this protocol … could really strengthen the relationship between the teacher and the student." This reflection provides evidence of mutual appropriation, where David is adopting some of Allison's perspectives on the goal of conferring.

On the final NIC Saturday, Allison and David met to discuss each other's feedback. They engaged in 45 minutes of animated conversation, sharing their experience with testing out each other's protocols. David later shared this reflection with his colleagues, "This whole idea of knowing your students better … we were talking about [this as] the key to creating robust personalized learning projects because they are so connected to who the students are as people." This quote shows a converging understanding of ideas that can be traced through the series of interactions that were set up by these collaborative design activities. Additionally, on the social network survey, Allison and David both indicated higher than average importance ratings for each other. This supports that David and Allison asked each other for help, reliably received help, and valued the quality of the help they received.

These two examples illustrate the progression of interactions that was possible within the 90-day cycle. As the cycle progressed, participants increasing relied on the authenticity of their colleagues' expertise as designers in similar situations to guide their actions. The NIC process created the conditions for building a distributed network of expertise where help-seeking interactions happened across participants.

Discussion

Networked Improvement Communities and other social innovation approaches require educators and researchers to work together to solve complex problems. We explore how collaborative design could serve as the interaction structure at the heart of a NIC process. This case study is a first effort to test using social network and qualitative data analytic techniques to understand the network of relationships that were fostered through the initiating NIC activities. Our research question, *how do NIC collaborative design activities foster reciprocated, help-based interactions?,* helps us understand how social network and qualitative data might be

applied to explore the development of network ties amongst participants. We use the idea of reciprocated, help-based interactions as an indicator to point toward how NIC activities could lead to the development of relational trust. Tracing the patterns and progressions of reciprocated, help-based interactions opens a window into the capacity that emerges from NIC collaborative design activities.

Answering this question leads us to explore how we could use social network tools and qualitative data to trace the emergence of help-based interactions across the participant network in order to contribute to the growing literature on the effects of NICs on research-practice partnerships, and social innovation more broadly. The NIC initiation framework described by Russell and colleagues (2017) states that "coordinated action among the partners should align with the core design activities and that the development of social infrastructure, such as the "culture, norms, and identity" (p.5) is a desired outcome. We find Penuel's (2019) insight that infrastructuring establishes the "configurations of conditions needed" (p.2), a helpful way to think about the role of NIC design in sparking emergent relational trust networks. The social infrastructure of PiPNIC emerged from the strategic action of the initiation team to create a sequence of help-based interactions across participants.

Leveraging social network and qualitative data illustrates the path from configuration conditions to the emergence of the PiPNIC social infrastructure. The mixed-group assignments provided proximity for interaction. An early task, watching and annotating other participants' conferring videos, created an initial condition for asking for and receiving feedback from other educators. The grouping strategies built a history of professional interactions over time and a network structure that positioned educators to connect with each other within and across schools.

The social network data showed that researchers moved to the periphery during implementation. A peripheral position for a researcher is different from a traditional research-practice model of researcher as source of knowledge. The peripheral position instead aligns with more collaborative design approaches that center the user (the educator, in this case). Positioning the researcher this way may suggest a structural component to the shift in researcher role in the context of research-practice partnerships that are described (e.g. Cohen-Vogel et al., 2015). This insight presents an important follow up investigation of the networked position of the researcher.

The triangulation of social network and qualitative data was crucial in our study. The social network data helped trace how the patterns of interaction emerged. Our argument suggests that social network analysis can serve as a valuable indicator and as a strategy for how NIC designers might measure emergent network capacities. While the social network analysis demonstrated *that* relational ties were being developed, we needed the qualitative data to understand how and why help-based interactions occurred. We find that the feedback on which activities mattered, and why, called for qualitative information about participants, designers and the work produced. Together, the social network analysis and qualitative data provided feedback to PiPNIC designers on how and why the planned activities worked, and gave voice to the participants on the effects of the activities on the growth of their knowledge and skills.

Attention to the social infrastructure is not meant to replace measuring the targeted outcome of the NIC. The key outcome for a successful NIC, of course, is a change in the targeted behavior highlighted in the core problem of practice. If the NIC is organized around collaboratively designed solutions to improve student outcomes, then evaluation should be focused on how the solutions change the outcomes. Our work here is meant to investigate the

social dynamics during initiation and propose how interactions might be seen in terms of fostering long-term relational trust networks.

We would like to note several limitations of this paper. First, there are limitations in terms of how we operationalized relational trust, and more work is needed to establish a causal link between reciprocated, help-based interactions and the development of relational trust over time. Initially, we aimed at a NIC strategy that would create relational trust among participants. Careful reflection led us to understand that relational trust emerges as a result of long-term engagement in help-based interactions, and that the 90-Day NIC cycle may not create enough opportunities to create relational trust. Although our paper emphasizes the role that the design of help-based interactions can plan in shaping professional interaction, we would need to continue the study by returning to the daily practices of educators in order to document whether the PiPNIC spark sustained into professional interaction in their schools.

Second, because the study was limited to documenting the PiPNIC 90-day cycle, we are also unable to answer the ultimate question of the PiPNIC process of whether everyday conferring practices changes in the participant school communities. The goal of a NIC is to change everyday practices, and the design of this study, which focused on the NIC process itself, did not allow us to subsequently track the effects of PiPNIC into participant classrooms. Anecdotally, we have checked in with each participant group since the PiPNIC experience. We found that each team experimented with new conferring practices in some way, ranging from formalizing all conferring practices across the school to trying new kinds of conferring (project-based, or interest-driven) protocols in everyday practice. Still, without a systematic study of post-NIC outcomes, we are unable to make claims about the impact of the NIC on practitioner work.

Third, there was a significant limitation to the social network data we collected. We were only able to give the survey near the end of the PiPNIC process (rather than at the beginning and at the end). Thus, the data that we report about the network at the outset was based largely on the recollection of participants near the end of the PiPNIC process (as well as on interview data collected near the beginning of PiPNIC). It would have been better for us to have surveyed people several times throughout to indicate where and how interactions were happening and to have asked specifically about who they were getting help from.

A final limitation of our study is the positionality of the designers. The authors of this paper also acted as the designers of the PiPNIC process. While this situation provided a unique perspective on the design process, it also limited our ability to see beyond the design choices that appeared obvious to us. Our use of interview, observation and social network data helped to triangulate our positionality, but did not remove our role in the design process as a factor in the analysis. In future studies, we would use the social network and qualitative inquiry models to study other NIC implementations to create a distance between the actors interested in the success of the NIC and those interested in measuring its results.

In this paper, we use social network analysis and qualitative data analysis to trace how the collaborative design activities of a Networked Improvement Community create the capacity for participants to work together to solve their common problem of practice. The PiPNIC project used a NIC model to create an RPP around the emerging challenges in personalized learning, bringing together 31 participants from five schools and a university for a 90-day collaborative design cycle. In our findings, we document the emergence of network interactions across participants, as well as examples of the kinds of help asked for and received within and across participant groups. We showed that when help-based interactions are reciprocated, the emerging

relationships allow the necessary risk-taking required for the kind of experimentation with practices characteristic of successful research-practice partnerships.

With increasing interest in using social network analysis as a form of network-level data to assess the health or effectiveness of a research-practice partnership, we conclude that the social network data alone described *that* interaction changed, but qualitative data supported a stronger connection with the design activities. The aim of this study is to contribute to emerging ideas of how to use social network analysis to understand how Networked Improvement Communities, and social innovations more generally, are initiated and developed. In doing so, we demonstrate, on a practical level, how social network and qualitative data might be used to generate network-level data for improvement, and we contribute theoretical insight into the way collaborative design creates the conditions for the kinds of interactions associated with long-term development of relational trust.

Social innovation requires attention to interactions. Collaborative design provided a helpful guide to developing activities that lead participants to ask for and to receive help from one another. Network designers can use collaborative design to create opportunities for participants to make their own practice public, engage in collaborative revision of their practices, try out each other's solutions, and create dissemination networks for resulting insights. Our efforts to trace the emergence of help-based networks across participants, and to use qualitative data to illustrate important occasions for interaction, provided insight on how the conditions for relational trust started to emerge in PiPNIC. We hope that our study of how participants helped each other design and test solutions to a shared problem of practice can provide an example for NIC leaders on network design, and for NIC researchers on network evaluation and guidance. More broadly, understanding how collaborative design activities can create these characteristics

suggests that, by attending to how people come together, social capacity for innovation can be built in and through orchestrating meaningful help-based interactions among professionals.

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Appendix 4-A: School profiles

We invited 5 school teams with 3-5 participants each. The schools span a variety of locations (urban/rural), enrollment, grade levels, and racial, economic, and student demographics. We also considered the stability of the program and the support from district leadership. Most importantly, we purposefully sought out expert teachers and leaders to establish a learning community with the capacity and confidence to experiment with their practice.

- **Jackson High School** is a public, district charter serving grades 9-12. They currently have just under 100 students and 9 teachers. Initially designed as a district alternative high school, they serve a high proportion of students identified for special education. The school was founded by local educators, community members, students and families interested in creating a school directed at educational innovation. Their vision is to be a leader in democratic, place-based, and personalized education by facilitating inspirational and authentic learning experiences for their students.
- **Irving School District** serves approximately 650 students in grades K-12 in a rural community. As a district, they have been moving toward personalized learning, starting at the elementary and middle levels. Personalized learning is marked by students spending part of their day in a multi-age classroom with others that are at or around their same academic readiness level in language arts and math. They have created a Student Proficiency Profile system by which students work on individual common core learning standards in sequence, progressing as they are able to demonstrate proficiency.
- **Franklin Elementary** is a public, district charter for grades 3-5, located in a rural community and co-led by 4 teachers. The school currently enrolls just under 100 students. The school was founded with a common vision for personalized, project-based, and place-based learning. Students choose projects that fit into a common theme, and the teachers work with students to align their interest-based projects with disciplinary standards, all with a focus on building a learning community.
- **Grant Elementary School** is a public, neighborhood school an urban district, enrolling approximately 450 students in grades 4K-5. The school serves more than 70% students designated as economically disadvantaged and is racially and ethnically diverse, with approximately 40% identifying as Hispanic/Latino, 27% white, and 15% African American. The school's path towards personalization is starting with a team of teachers working to combine classes, co-teach, develop learning plans around student interests, and use digital learning technologies to support learning.
- **The Lewis School** is a public, district charter serving grades 7-12. The school is co-led by four teachers and serves around 75 students in a mixed-age, open space learning environment. The core curriculum is designed around projects of varying lengths and student interests. Students set their schedule and work independently with the support of daily group advisory meetings, weekly advisor meetings, and optional daily seminar offerings. Students present their work through event and speech nights, project meetings, and online portfolios.

Appendix 4-B

Thank you for taking the time to help us understand more about PiPNIC. Please answer the following questions to the best of your knowledge and recollection. While there are names on this survey, at the point of analyzing the data, all names and identifiable information will be removed to preserve anonymity.

What is your name? o [List of Participant Names]

Who did you know prior to PiPNIC? i.e. knew their name, had met them, or interacted with them. o [List of Participant Names]

Prior to PiPNIC, how important was this person to your learning about the conferring process?

					More important
[List of Names Selected in the Prior Question]	◯	◯	◯	◯	◯

During PiPNIC, who did you interact with about conferring? o [List of Participant Names]

During PiPNIC, how important was this person to your learning about conferring?

					More important
[List of Names Selected in the Prior Question]	◯	◯	◯	◯	◯

Choose up to three people you would like to continue to interact with about conferring. o [List of Participant Names]

Of the Hub Team, who did you know prior to PiPNIC? i.e. knew their name, had met them or interacted with them. o [List of Hub Team Names]

Prior to PiPNIC, how important was this person to your learning about the conferring process?

					More important
[List of Names Selected in the Prior Question]	◯	◯	◯	◯	◯

During PiPNIC, who was important to your learning about conferring? o [List of Hub Team Names]

During PiPNIC, how important was this person to your learning about conferring?

					More important
[List of Hub Team Names]	◯	◯	◯	◯	◯

From the list below of Hub Team members, choose up to three people you would like to continue to interact with about conferring. o [List of Hub Team Names]

Thank you for completing these questions. Your responses are greatly valued and will help us understand and build on the work we've done together this spring.

Chapter 5: Summary, Limitations, and Future Research

In this final chapter, I summarize my findings across the three articles of my dissertation, describe limitations, and suggest potential avenues for future research.

Summary

This three-article dissertation is an instrumental case study of the Personalization in Practice - Networked Improvement Community. The instrumental part of the case study is to contribute practical and theoretical knowledge related to the viability of NICs as a model for improving educational systems. Instrumental cases allow the in-depth study of one instantiation of a phenomenon. In this case, I use PiPNIC as an instantiation of NIC initiation to understand more deeply how the structures of a NIC can facilitate participation.

The overarching question driving this dissertation was, *How do members of a Networked Improvement Community come together to solve problems of practice?* Across the three articles, I have focused on the design of the structures of a NIC and their connection with the observed patterns of problem-solving interactions of the participants (See summary table 1-1 from the introduction). Each article takes up an element of NIC initiation (Figure 5-1): identifying a problem of practice; leading, organizing, and operating the network; and fostering the emergence of culture, norms, and identity consistent with network aims. In the first article, a participatory problem-identification process supported the interaction of researchers and educators to select a meaningful problem of practice. In the second article, the coupling of networked and team design tasks created the conditions for participants to share improvement ideas across the network. In the third article, the co-design activities sparked the kinds of help-based interactions needed to build relational trust. Focusing my analyses on how PiPNIC created the conditions for

participation operationalizes NICs as a human-centered, systems-informed approach to change at scale.

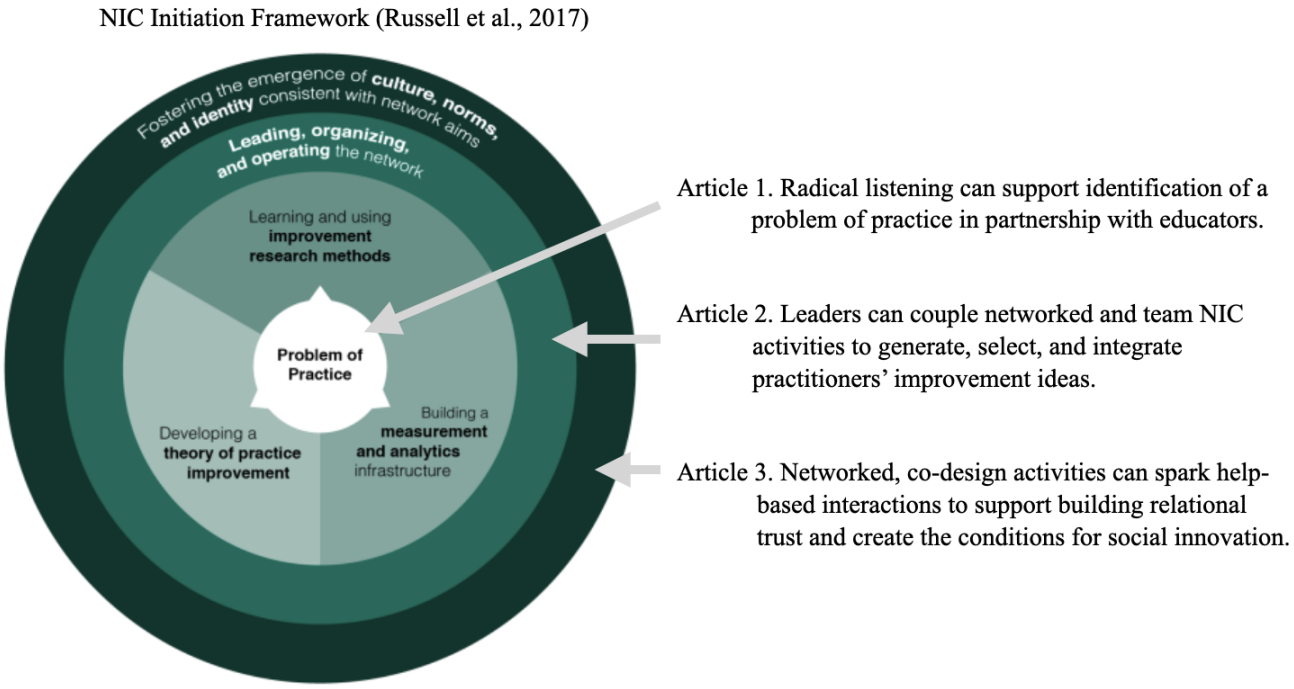

Figure 5-1: Alignment of research findings with the NIC initiation framework.

In the next few paragraphs, I draw out what this instrumental case study of PiPNIC to understand building relationships before and throughout NIC initiation, NIC leadership during initiation, about the role of networks in NICs, and about central role of educator participation.

PiPNIC grew out of a preexisting research alliance. During that time, the PiP research team had begun relationships with personalized learning educators across the state. As a preexisting condition, the existence of these relationships are an important factor in understanding the work to identify a problem of practice, recruit educators for participation, and initiate the NIC. When the educators from the five schools were recruited, the PiP team was already within their network of weak ties. Within this weak-tie environment, we designed our

processes to take an asset-based approach, as has been detailed in the second two articles, aiming to position educators as experts in their own practice. This asset-based approach provided an entry into much deeper understanding of the personalized learning instructional systems that were in place these five schools and the development of trusting and motivating relationships with educators. This asset-based approach to initiation contrasts with the partnership narratives of many NIC initiations, which is the identification of a system-level failure, such as dire community college graduate rates, far removed from individual educators.

To be clear, redressing system-level failures is the goal of NICs. What I argue here is that taking an asset-based approach in PiPNIC allowed the PiP team to begin to build the relationships and knowledge of the system that would be needed later on. Had PiPNIC continued, there may have been opportunity to define a common aim, related to improving a system-level desired outcome, but the identification of a common aim would come after we had become part of the system. Learning about the system through interacting with the system is a common design-based research approach, and doing so in a weak-tie environment led us to take this asset-based approach.

A central argument of this dissertation is the importance of attending high-quality interactions amongst participants. Designing for professional community is a central practice of educational leaders (Halverson & Kelley, 2017). In article 1, this was between researchers and education stakeholders, and in articles 2 and 3, this was amongst educators in the NIC activities. These interactions have consequences for building the capacity to initiate a NIC. Designing for how people come together is a leadership task, though one that has not been articulated in the NIC literature. Different leadership tasks are referred to across the NIC literature, such as the

role of an evangelizing leader (Bryk et al., 2011), but a attention at this level of detail to the interaction structures is absent.

Second, the role of networks across multiple contexts is another theme that came through the articles. In article 1, listening to educators across multiple contexts constructed a rich problem space with more possibilities than would have been otherwise. In article 2, the networked configuration of activities provided conditions for educators to present their ideas and get feedback, generating new insights into their design task. In article 3, the focus was on how the patterns of interactions provide evidence for the kinds of interactions that need to take place to build relational trust and support the conditions for social innovation. Networks provide access to the adjacent possible, or the innovative space that lies just one move away (Johnson, 2011).

An ongoing question in the community of people working on and in NICs is how networked a NIC needs to be. Many NICs exist with one district, and may instead call themselves an Improvement Community, because they may or may not have the kinds of contrasting contexts that allow for the distance between participants needed to generate new ideas.

Finally, The case study is framed by the three guiding questions of the NIC model: “First, what problem(s) are we trying to solve? Second, whose expertise is needed to solve these problems? And third, what are the social arrangements that will enable this work?” (Bryk et al., 2011, p.4). The case of PiPNIC explores these three questions through the participation of educators. Broadening participation for educators, in the case of PiPNIC, a way to identify authentic and meaningful problems, leverage their problem-based expertise toward developing solutions, and generate the kinds of help-based interactions that will support longer term collaboration.

Limitations

While each article addresses the limitation of that analysis, in this concluding chapter I will address limitations of the instrumental case study of PiPNIC. The three limitations include a lack of audio recordings,

Focus on educator participation, not student outcomes

In qualitative research, the goal is to be able to describe deeply a phenomenon and its context as a way to draw out how things work. In this dissertation, I focused on the phenomenon of how NICs can create the conditions for educators to participate in change. Some may feel that there is no point in focusing on educator participation prior to evidence that the protocols produced improvement in student learning outcomes. While I am certain that the conferring protocols had an impact educators' daily practice and their students' learning during and beyond the 90-day cycle, I did not evaluate their impact on student learning. I did not evaluate impact on student learning for the reason that I think that was beyond the timeframe that could be expected in these early stages of PiPNIC. Instead, I focused on participation as a necessary first condition for establishing a partnership and as a valuable outcome in and of itself.

Lack of audio recording of conversations or formal interviews

While our team collected a wide range of data at each stage of the partnership, collecting data was constantly in tension with the level of burden on participants. There were several moments in which we decided not to collect data, such as individual interviews with participants afterwards, because it placed a significant burden on participants and we felt that we were already asking a lot of them. This trade off likely improved their participation, while also reducing the data available to ask and answer research questions about the partnership itself. For example, we also decided not to do audio recording during listening conversations because we

did not want to slow down the process of getting out to talk to people or make them hesitant to talk to us before we had built up some trust. Again, this was a decision made to improve our ability to execute the partnership. Audio recording of listening conversations, of NIC initiation and research team meetings, and of mixed-group and school team conversations could have provided an additional layer of evidence of how the partnership was enacted and its impact on educators' understanding of conferring practices and experience of participation itself.

Critical analysis of PiPNIC, and NICs and design more broadly

Because of the novel nature of the NIC model, I focused my analyses on studying the design of PiPNIC and it supported participation, where participation included the sharing of insight, problem-based expertise, and meaningful interactions with other participants. I did not, however, engage specifically in examining whether or how power was shifted through these partnership design decisions. NICs and the participatory design processes at their core aim at shifting the power traditionally held by researchers to tell practitioners what and how they should teach. In proposing a reorganization of R&D, Bryk and colleagues (2011) make a political critique of the traditional R&D system. Likewise participatory design aims to shift power as users are engaged fully in framing and solving problems (Ehn, 1988). Again, the additional audio data described above may have provided the insight into participants' experiences, and their perception of their own participation. Broadly, designers and design studies research is beginning to think more critically about its own relationship to whiteness and colonialism, and bringing a critical lens to NICs is an important future direction in keeping the equity, social justice, and participatory ethos at the forefront of the work.

Future Directions for Research on NICs

Indicators of Participation

NICs, like research-practices partnerships, continue to increase in adoption as a strategy for change. In 2017, Henrick and colleagues released a report with proposed indicators of healthy RPPs, and Jenn Russell and colleagues are working to develop a survey to measure network health. This dissertation suggests three potential indicators of participation that could be integrated into future measures or surveys:

- Were participants involved in identifying the problem of practice? If so, how?
- Who created the partnership artifacts, particularly those that guide interventions?
- Who do participants interact with? What is the quality and pattern of these interactions?

As these questions are asked over time, there may be different phases from initiation to implementation to expansion of a NIC that might affect how these change, and this represents a key area for future research on participation in a NIC.

Another potential indicator of participation that was not explored in this dissertation is studying how partnerships create a discourse community. Looking for evidence of common understanding, relationships, mutual respect and trust, etc. in how people in a partnership talk to each other could provide evidence for what is working, similar to the way it is used…

Rethinking the Partnership Typology

In 2013, Coburn, Penuel, and Geil proposed a typology of RPPs that has shaped how partnerships are categorized: research alliances, design research, and networked improvement communities. In reality of course, these three exist on more of a continuum of configurations and approaches. On configurations, for example, PiPNIC grew out of a research alliance, thus transitioning between two types. This was also true for the Better Math Teaching Network (Gomez et al., 2016). Second, PiPNIC drew on elements of NICs, such as the networked

structure, 90-day cycle, and focus on common problem of practice, but the NIC activities were more heavily influenced by participatory/co-design approaches, rather than improvement science.

Future directions in this area of typologies or classification is thinking about the goals, design principles, and contexts of these models. For example, NICs seem to work when the goals of the system are given, and the task is to optimize the system. Networked improvement, with its tight coupling of measurements, leverages the networked configuration to generate ideas for improvement and test those ideas in a variety of contexts. Networked improvement is about creating reliability in interventions: to narrow the curve and shift the curve to the right. In contrast, DBIR (design-based implementation research) aims to create organizational space for new practices to be developed through design. DBIR does this through design-based research at the core, and implementation science to make the system sustain the changes. Both of these characterizations of NICs and DBIR are potentially oversimplifications, but distilling the goals, core design principles, and contexts of each approach allows for comparison and contrast.

In PiPNIC, we set out to build a NIC, but improvement science did not fit. We were working with educators at the cutting edge of implementing new school models, who were designing new practices to fit their vision of schooling. In the end, PiPNIC created a space for new practices to emerge and a network to generate and refine ideas, but it would more accurately be called a Networked Design Community. Perhaps this is a new type of RPP, or just another amalgamation, but naming it an NDC could allow design researchers more broadly to examine how they could leverage the power of networks to generate new ideas and to scale impact, particularly in these cutting edge environments.

Relevance to the Current Moment

I am writing these final words of my dissertation during a time in which the novel coronavirus, SARS-CoV-2 (or COVID-19), has created a global pandemic and resulted in a closing schools, universities, and childcare. On March 25th, Governor Tony Evers ordered a safer-at-home order, and we stayed home. My husband closed his business, and my second grader started morning meetings via zoom. Our lives looked very different, but we were healthy and safe. Then, two months later, on May 25th, a Minneapolis police officer murdered George Floyd, setting off a wave of protests against police brutality, against racism, against anti-blackness, and against the systemic injustices that are built into American institutions at every level. I stared at the pages of this dissertation, knowing that this last chapter needed to be written and feeling like none of it mattered.

In the midst of this, a colleague shared an article written in early April by Hugh Vasquez of the National Equity Project, titled, "What if We… Don't Return to School as Usual." The article called for K-12 educators to take action this summer to prepare for a different kind of schooling in the fall: a schooling that puts children at the center of learning. In an embedded video interview, Hugh Vasquez interviews Tony Smith, the former state superintendent of Illinois, who states, 'What we need is to 'generate new, deeper forms of belonging and participation, and young people and their learning need to be right at the center of that." Designing for belonging and participation. That is what PiPNIC was about.

The path forward for K-12 educators is uncertain and daunting. We recognize that the system is inadequate, harmful, and violent towards minoritized students, teachers, and communities. The coronavirus shut down schools, and the protests demand they be fundamentally different. Who will do this work, and how? As Vasquez said, "we do not have to go back to business as usual in our educational system, or any other system for that matter. We

just don't. The question confronting us at the moment is not *can* we prepare to come back differently but *will* we?"

To be sure, when you have a hammer, everything looks like a nail. But in this case, I really do think that NICs, with participatory design at its core, offer a way forward. Social justice happens in the details of practice, and perhaps what is most transformative about NICs is the primacy of local practices. The model of social reorganization NICs offer is about scaling practitioner wisdom: what works, for whom, and under what conditions. NICs offer strategies to get feedback on student, parent, educator, and community experiences in a time when this is desperately needed. Authentic design tasks require people to help each other, which can begin the slow process of building relational trust. There is a "bias toward doing," an ethos of starting small, and an embrace of "possibly wrong and definitely incomplete." As a whole, the NIC model represents a redefinition of research from the hegemonic and technocratic approach, epitomized by the What Works Clearinghouse, towards a social approach where the voices of practitioners is valued and local wisdom is the valued knowledge (Bryk, 2015).

NICs still provide a measure of public accountability, but these are measures defined by the NIC, which itself is made up of community members, and the measurements are for improvement, not evaluation. Apple (2006) writes, "An alternative to the external imposition of targets, performance criteria, and quantifiable outcomes - but ones that still takes the issue of public accountability seriously - needs to and can be built" (p.117). NICs have the potential to combine systemic approaches with real, identified needs and broaden participation in decision-making at every level.

What I have learned tacitly in building PiPNIC, and now explicitly in this writing, is that participatory design, combined with infrastructures for scale, might offer a way into, through,

and beyond this moment. PiPNIC was small in scale and imperfect, yet it was a meaningful attempt to build a community that could solve a problem together. And that is worth writing about.

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